

**CONTRIBUTION OF SUA TRAINING FOREST TO THE SOCIO-ECONOMIC  
DEVELOPMENT OF ADJACENT LOCAL COMMUNITIES AND FOREST  
PRODUCT CUSTOMERS AT OLMOTONYI, ARUSHA**

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**A DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE  
REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE IN  
ENVIRONMENTAL AND NATURAL RESOURCE ECONOMICS OF SOKOINE  
UNIVERSITY OF AGRICULTURE. MOROGORO, TANZANIA**

## ABSTRACT

The overall objective of the study was to assess the contribution of SUA Training Forest to adjacent local communities and forest product customers in Olmotonyi, Arusha. Purposive sampling was used to select two villages (Timbolo and Shiboro) with the longest boundary to the forest among the four villages. A cross-sectional survey design was employed where a total number of 90 respondents were randomly selected and interviewed using household questionnaire. Key informant's information was collected and two focus group discussions comprising of 16 discussants in both groups with Farmers and Livestock keepers from Shiboro Village. Data was analyzed by Gross Margin Analysis, Net Revenues and Stepwise Multiple Linear Regression model using the Statistical Package for Social Science 24.0 (SPSS) Software and Microsoft Excel. The findings revealed that, the farmers gained 4% of the overall profit of Forest interactions, the livestock keepers gained 55% and the traders had a gain of 41% of the overall gross profit from the socio-economic activities. Pesticides, Household size, Pasture loads collected, Access to markets and Fertilizer application were found to be significant factors influencing local communities depending on the Forest resource at a 5% probability level ( $p < 0.05$ ). The Social Cost to the households and forest product customers accounted for the conservation actions to the resource which was TZS 5 693 600/= per year. Moreover, 38% of the forest product customers preferred the *Pinus patula* species and 55% purchased timber from the SUA Training Forest for construction purposes. The SUA Training Forest Overall Net profit was TZS 540 501 089.90/= from the sales of the Forest products to the customers. Generally, the SUA Training Forest resources are of high benefit to both adjacent local communities and beyond. It is recommended that

modalities should be sought to capacitate sustainable utilization of the scarce and valuable resource.

**DECLARATION**

I, Elice Griffin Zakayo, do hereby declare to the Senate of Sokoine University of Agriculture that this dissertation is my own original work done within the period of registration and that it has neither been submitted nor being concurrently submitted in any other institution.

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**(MSc. ENAREC)**

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Date

The above declaration is confirmed by:

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**(Supervisor)**

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Date



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## **ACKNOWLEDGEMENTS**

First of all, I wish to thank the Almighty God for His grace, protection and blessings throughout the period of the study at Sokoine University of Agriculture.

I'm grateful to my supervisor, Prof. Gerald. C. Monela for his academic advice, personal commitments, and intensive supervision during the study until its completion, God bless him. I also extend my sincere gratitude to Prof. Yonika. M. Ngaga for his assistance, encouragement and constructive suggestions during the entire period of the study.

During the field work a number of people from the SUA Training Forest Olmotonyi provided the necessary support that facilitated the study. The SUA Training Forest Manager (Mr. Modest Mrecha), staff members and Village leaders at both villages Shiboro and Timbolo for their permission to reside and pursue the respective study, deserve a special mention.

Also, I would like to acknowledge the villagers of Shiboro and Timbolo villages especially those who participated in the household questionnaire and/or focus group discussion exercise for all the information and support they provided during the field work.

Thanks to friends, colleagues, and fellow students who in one way or another made the study a success. Indeed their co-operation and support made the academic wheel roll over smoothly.

Finally, I would like to express my deep gratitude to my family for their moral encouragement, prayers and willingness to accept the opportunity cost for me to attend Masters' studies. God bless them all.

**DEDICATION**

I dedicate this work to my family whose love and thirst for knowledge continues to inspire me till today, especially to My parents Mr. Griffin Allen Zakayo and Mrs. Eunice Matari Zakayo for opening my eyes to the world, and for instilling the importance of hard work and higher education;

My sisters (Winnie Griffin Zakayo and Caitlyn Griffin Zakayo) for their ongoing and endless prayers, inspiration and encouragement;

To them I say: “have faith in GOD and trust His process”.



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## LIST OF ABBREVIATIONS AND SYMBOLS

ANAPA	Arusha National Park
EC	External Cost
EMA	Environmental Management Act
FAO	Food and Agriculture Organization of the United Nations
FOFNC	Faculty of Forest and Nature Conservation
FMP	Forest Management Plan
FTI	Forestry Training Institute
GEF	Global Environmental Facility
GIS	Geographic Information System
GM	Gross Margin
GMA	Gross Margin Analysis
Kg	Kilogram
L	Litre
m <sup>3</sup>	Cubic metre
m <sup>2</sup>	Squared metre
m.a.s.l	Metres above sea level
NEMC	National Environment Management Council
NFP	National Forest Policy
No	Number
PC	Private Cost
PMT	Proxy Means Test
SC	Social Cost
SDG's	Sustainable Development Goals

SUA	Sokoine University of Agriculture
TANAPA	Tanzania National Parks
THCU	The Health Community Unit
TFS	Tanzania Forest Services Agency
TPDF	Tanzania Peoples' Defense Force
TR	Total Revenue
TVC	Total Variable Cost
TZS	Tanzanian shillings
UNSPF	United Nations Strategic Plan for Forests
USD	United States Dollar
URT	United Republic of Tanzania
VEO	Village Executive Officer
WBG	World Bank Group
yr	Year
ZOFOMO	Zonal Forestry Management Organization

## CHAPTER ONE

### 1.0 INTRODUCTION

#### 1.1 Background

Forests play a crucial role in many aspects of human life including the provision of food and medicinal products, timber for furniture and provision of water through the hydrological cycle (Razafindratsima *et al.*, 2018). The need for forest resources and benefits to people grow daily due to their identified significance and contribution (Sgroi, 2020). The contribution of forests is widely acknowledged to promote socio-economic development among individuals devoted to interactions and involvement of the resource (Rasmussen *et al.*, 2017). Most of the communities adjacent to the forests gain a lot of benefits from the forest resources since forests provide for their subsistence and cash income (Rasmussen *et al.*, 2017).

However, there is also great significance in altering the forestry's informal sector, through customers' involvement as an asset that ensures broader benefits economically, socially and in the environment (Rasmussen *et al.*, 2017). The prominence on stakeholders' inclusion in forestry decision-making processes and equitable distribution of costs and benefits is to emphasize improvement on the optimization of the forest resources (UNSPF, 2017). According to United Nations Strategic Plan for Forests (2017-2030), the Sustainable Forest Management effective implementation depends on the influence of all pertinent stakeholders. These stakeholders include small, medium and large forest-based enterprises, non-governmental organizations and philanthropic organizations of all levels (UNSPF, 2017).

The optimal utilization of the forest resources by the local communities and stakeholders increases the lifespan of the resource being managed, and influencing socio-economic development (Sgroi, 2020). Therefore, assessing the socio-economic contribution of the forest resources includes an account of the all relevant resource interactants benefiting from the respective resource.

## **1.2 Problem statement**

The contribution of a resource to individuals with interest is influenced by resource management of the respective resource. Sokoine University of Agriculture was given a mandate to manage 840 ha which is part of the Government owned Meru Forest Plantation on ten years renewable leasehold (SUA, 2017). This area has been divided into 667.8 ha as a plantation forest, 159.2 ha as a protection forest and 13 ha as non-forested area (SUA, 2017). The Sokoine University of Agriculture puts emphasis on full tree utilization through systematic forest management (SUA, 2017).

The SUA Training forest is also protected from illegal activities done by local communities and various customers. The activities that tend to risk the forest production include wood poaching, animal grazing, cultivation (Taungya system) and wildfires (SUA, 2018). This situation has provoked a supervision concern on economic activities associated with the forest hence, involving frequent patrols to be done by the forest guards to protect the forest (SUA, 2018).

Furthermore, among the training forest objectives, is to become an area for management of watershed conservation on the slopes of Mt Meru (SUA, 2018). As well as a source of forest products to various customers through controlled production of saw-logs, poles,

timber, lumber and other processed products (SUA, 2018). These objectives rely on conservation to make the area highly productive for such utilization. Moreover, noticeable socio-economic contribution of the forests to local communities and stakeholders' requires optimal utilization of the forest resources, to acquire socio-economic development.

Studies have reveal limited contributions of forests' to various beneficiaries, due to several environmental and socio-economic reasons including degradation of forest resources due to poverty and livelihood vulnerability (Jannat *et al.*, 2018), culture and norms invested on sacred Forests' (Mgaya, 2020) and conflicts over market based forest conservation (Scheba and Rakotonarivo, 2016).

However, the interactions of the local communities and customers with the SUA Training Forest appear limited due to the methods used to restrain uncontrolled utilization. In fear of uncontrolled illegal exploitation of the forest resources, the management gets involved (SUA, 2017). Illegal exploitation can be experienced due to increased population pressure on a resource of interest (Bradshaw and Di Minin, 2019). Population pressure is among the pertinent issues to consider while planning for socio-economic development (Bradshaw and Di Minin, 2019).

Hence, the question lies in identifying the extent of contribution that the SUA Training Forest has in promoting socio-economic welfare despite the unfolding limitations. Socio-economic development should ensure both material and non-material needs of individuals and societies are completely satisfied (Paradowska, 2017). This satisfactory progress achieved from the needs observed reveals a step to socio-economic development.

Moreover, due to improved techniques in capturing the extent of socio-economic development to peoples' livelihoods and increased technological improvement of the forest resource, less is known. Hence, limited knowledge exists on the contribution of SUA Training Forest to the adjacent local communities and customers, in Olmotonyi Arusha. Therefore, socio-economic benefits obtained from a forest should be motivated by sustainable exploitation of all actors utilizing the forest resource to promote development.

### **1.2.1 Justification of the study**

This study focuses on assessing how adequately conserved forest resources can contribute to the socio-economic welfare of the adjacent local communities and customers in Olmotonyi, Arusha. It is almost impossible to maintain forests long without local support since they are most concerned by the use of the resources. The study findings aim to improve the planning process by providing a broader room of choices regarding the options for the forest management.

The information acquired emphasizes on increasing awareness on the importance of freedom of dialogue and open communication between the forest users and the management in proposing real changes that influence development. Furthermore, the findings have aided in identifying the challenges of the services provided by the forest management and recommend solutions that satisfy both, the forest users and the management. Also, the methodology for assessing the benefits and costs embraced more comprehensive techniques (i.e. Proxy Means Test Questionnaires and Stepwise Multiple Linear Regression Model) to better capture them. Therefore, identifying the local community's and customers' flexibility in interacting with the forest resources is a benefit

to the forest management in promoting socio-economic development in the study area and beyond.

### **1.3 Objective**

#### **1.3.1 General objective**

The general objective of the study was a socio-economic assessment on the contribution of SUA-Training Forest to the development of adjacent local communities and forest product customers in Olmotonyi, Arusha.

#### **1.3.2 Specific objectives**

The specific objectives were to:

- a) Identify the socio-economic activities associated with the SUA-Training Forest
- b) Assess the financial revenue accrued from identified socio-economic activities associated with the SUA-Training Forest by the adjacent local communities' and customers in Olmotonyi
- c) Analyze the socio-economic factors influencing SUA –Training Forest's contribution to the adjacent local communities and customers in Olmotonyi
- d) Determine the Social Costs incurred from the socio-economic activities done by the local communities and customers in Olmotonyi associated with the SUA Training Forest

### **1.4 Research questions**

The study answered the following questions:

- What are the socio-economic activities associated with the SUA-Training Forest?

- What are the socio-economic factors that influence the contribution of the SUA –Training Forest to adjacent local communities and customers?
- To what extent the identified socio-economic activities associated with the SUA-Training Forest influence the financial revenue accrued by the adjacent local communities' and customers?
- What are other benefits accrued from SUA Training Forest?
- What are the Social Costs incurred from socio-economic activities done by the adjacent local communities and customers at the SUA Training Forest?

### **1.5 Conceptual framework of the study**

The study is based on assessing the SUA Training forest's influence on the community's and forest product customers' socioeconomic sustainability indicators (economy, society, and environment). Effective sustainability indicators provide awareness to individuals in identifying problems and revealing links between the individual's economy, society, and environment (Sattanno *et al.*, 2017). Socio-economic sustainability indicators are multidimensional since they reflect diverse realities that contain complex interactions and networks. Fig. 1 shows that the SUA Training Forest integrates various socio-economic indicators promoting sustainable development to the forest resource utilizers.

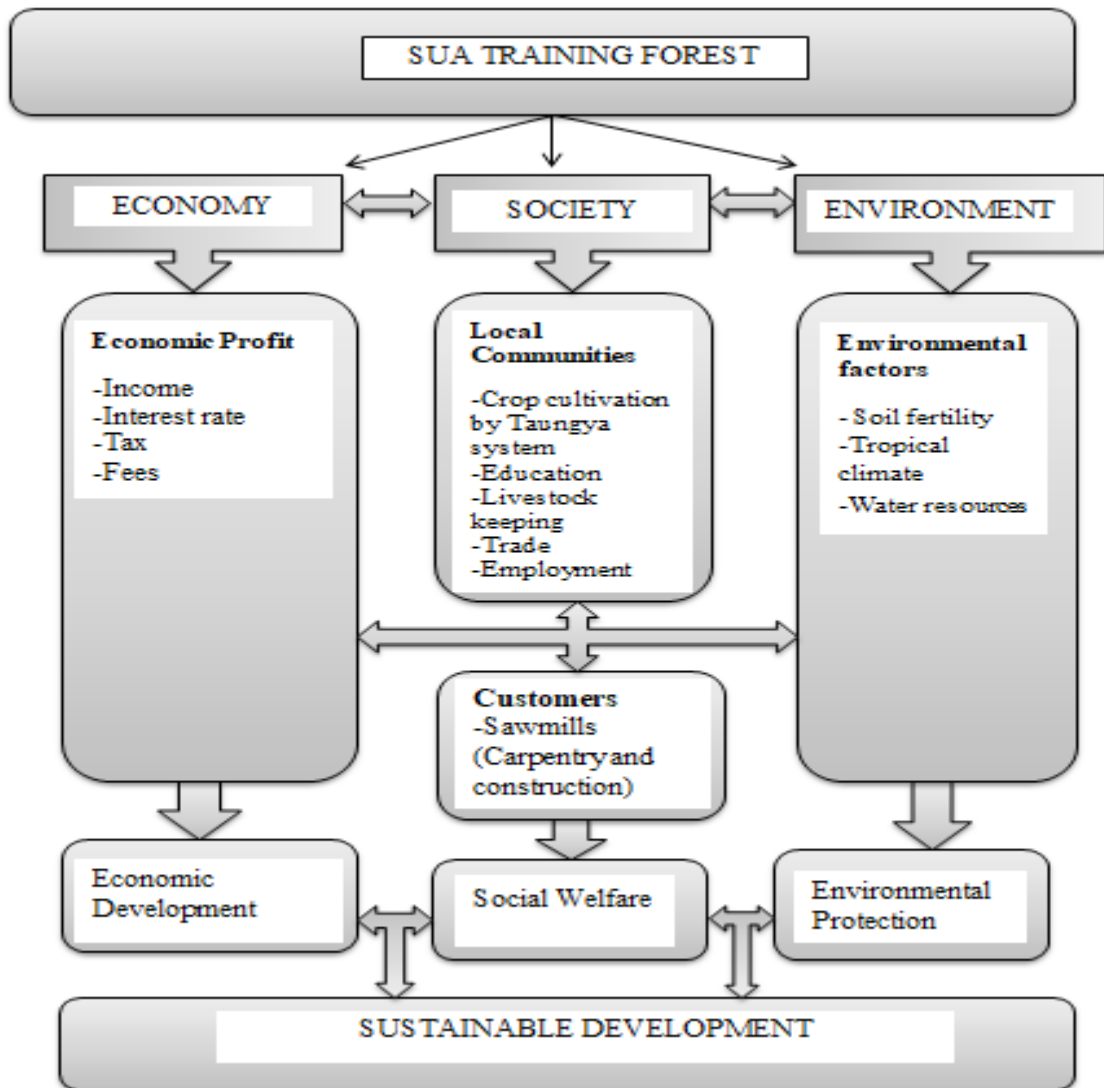
Forests conserve several other environmental resources within and around the resource including the water resources, tropical climate of the area and soil fertility influencing environmental protection. The Sustainable Development Goal 15 aligning to the Training Forest's objectives of forest conservation encourages protecting, restoring and promoting sustainable use of terrestrial ecosystems, by sustainably managing forests, to combat



desertification, reverse land degradation and halting biodiversity loss to improve livelihoods (De Jong *et al.*, 2018).

The economy is an indicator to improve livelihoods, revealed by economic profit obtained in the SUA Training forest causing increase in income, interest rate, tax and fees. The two socio-economic indicators of sustainability; economy and environment improve livelihoods by acting on the society as the essential beneficiary. The society is defined by various interactants utilizing the environmental resource. In the SUA Training forest the society is defined by the local communities and customers. These interactants enjoy economic profit, good quality environmental factors and equity among generations (Teodorescu, 2015). The society component requires an approach to inspire development. In relation to forest utilization according to De Jong *et al.* (2018) the SDG 8, that promotes sustainable economic growth, full and productive employment and decent work for all; inspires sustainable resource exploitation for livelihoods economic progress. As a result, local communities are utilized in the society to eradicate poverty and provide better living conditions through education (i.e. trainings, meetings and seminars), crop cultivation by Taungya system, livestock keeping, trade and employment. The customers engage in trade of wood products that are purchased and processed in saw-mills for carpentry, construction and further trade.

The multidimensional valence of sustainable development is a result of interaction of three indicators which are society, economy and environmental. These indicators act together to benefit the future living standard of the next generations (Teodorescu, 2015). Therefore, the integration of economic development, environmental protection and social welfare builds socioeconomic development of the community harmonizing the three main pillars of sustainable development.



**Figure 1: Conceptual framework summarizing SUA Training Forest's contribution in promoting sustainable development**

### 1.5.1 Hypotheses

In light of the conceptual framework the following hypothesis were tested:

$H_0$ : The SUA Training Forest has no contribution to the local communities adjacent to the forest resources and forest product customers in Olmotonyi, Arusha

H<sub>1</sub>: The SUA Training Forest has contribution to the local communities adjacent to the forest resources and forest product customers in Olmotonyi, Arusha

## **CHAPTER TWO**

### **2.0 LITERATURE REVIEW**

#### **2.1 Theoretical framework of the study**

##### **2.1.1 Sustainable forest management**

Humans have adapted to less rational ways of dealing with natural resources sustainably and have sought their personal benefits over environments safety. The Neoclassical Management Theory similarly upholds the human-oriented theory stressing primarily on individuals needs of behaviour, attitudes, time and motives (Kitana, 2016). The Theory focuses on social personal views, considering solely the social dimension of management (Kitana, 2016). This theory deliberates less rational perspectives on sustainable development reviews, since individuals should also consider supporting other higher authorities in preserving the future's portion (Kitana, 2016). The exploiters should strategize a modified behavior to prolong the benefits to further generations by managing natural resources sustainably. However, the Modern Management Theory firmly believes that no single managerial strategy can be applied at all times to initiate development (Kitana, 2016). The Theory encourages management's different views and many motives to vary between societies or organizations (Kitana, 2016). The objective of the theory aligns with the sustainable management perspectives that ensure managers apply different strategies at different times and for different individuals (Kitana, 2016). The Theory also

promotes use of managerial strategies that is important in complex scenarios while dealing with societies or organizations (Kitana, 2016).

Sustainable Management is a major concept with a goal of portraying sustainable development (Wang, 2004). The development process guarantees an optimal future for human societies stressing on three dimensions social, economic, and environment (Marchi *et al.*, 2018). Sustainable social management of a resource involves planning, surveillance, implementation and appraisal of activities and efforts that need support of both the users and non-governmental organizations with the objective of using, protecting and restoring the resource (Pokharel *et al.*, 2015). On the other hand, sustainable economic development of a resource includes reducing the reliance on the resource services as a means of livelihood by the present generation that compromises the needs of the future generations (Zandebasiri and Pavrin, 2012 cited by Savari *et al.*, 2020). Sustainable environment management of a resource promotes a safer health of the ecosystem that embraces protection and support of the resource against anthropogenic activities such as forest fire, land degradation and pollution (Marchi *et al.*, 2018).

Sustainable Forest Management refers to the ways and processes of managing forest resources to meet societies varied needs today and tomorrow without compromising the ecological capacity and renewal potential of forest base (Wang, 2004). Sustainable Forest Management sees through increasing the value of the standing forests and prioritizing the opportunity cost of deforestation. The primary goal of Sustainable Forest Management is to achieve sustainable development and goes hand in hand with people's participation especially those utilizing the forest resources. Participation is a premium policy for Sustainable Forest Management with a primary objective of creating commitment and responsibility for improvement of the users' motivation in adaption to the sustainable

practices (Savari *et al.*, 2020). The individuals' participation is also a management approach that enhances social adoption, equality, benefit distribution and protection of the forest during exploitation (Savari *et al.*, 2020). The factors influencing individual's participation on a particular economic activity in the forest or utilization of forest products vary in particular. The forest reliance is triggered by the demand at hand of the utilizer obtaining the forest benefits. The level of forest use and the degree of reliance on forest products in the local communities' differs across households. Households diversifying their income-generating activities other than depending on forest products their tendency to rely on forests are likely to decline (Okumu and Muchapondwa, 2020).

This slows down the economic pressure to extract products from the forest ensuring sustainability of the resource. Additionally, it promotes the use of alternative economic strategies in supporting their families, or generating resources that can be used to purchase inputs such as fertilizers; labour-saving technologies or investments in activities that promotes sustainable practices in natural resources exploitation. In the realm of sustainable forest management, an alternative of an economic source for a livelihood in the environment is a relief to the ecosystem and a development step to the society. Therefore, Fig. 2 reveals that the circle of sustainable forest management is a concept that never leaves behind the multidimensional context of sustainable development in promoting sustainable forest exploitation.



**Figure 2: Sustainable Forest Management Framework**

**Source:** GEF (2011)

### 2.1.2 Global economic value of forests

Forests are the most important global repositories covering 30% of the Earth's land area or approximately 4 billion hectares. The Forests importance to human wellbeing, sustainable development and the health of the planet has influenced the world governments to the gazette, that exceedingly 10% of large areas of the global land as protected areas (Kideghesho, 2015). Recently, the forest sector is more embedded in the global economy than ever due to the growing recognition of forest resources to the benefiting several actors (Kideghesho, 2015). The contribution is substantial to socio-economic development through the provision of several products and services that diversely provide for hundreds of millions of people in rural areas, including many of the world's poorest (FAO, 2018). In developing countries, forests provide around 20% of income for livelihoods rural households (FAO, 2018). Therefore, communities and customers utilizing forest resources realize that all ecological functions of forests are certainly economic functions that sustain their livelihoods.

### **2.1.3 Forests contribution to the socioeconomic development of Africa**

Africa's natural resources have gained global importance in exploitation and utilization done by global actors presenting development in their states. The continent's economy is highly dependent on natural resources, the ability to generate growth in the future and meet wider development priorities will depend on what happens to key resources like forests (Dwumfour and Ntow-Gyamfi, 2018). Forests are among the essential natural resources for sustainable growth in Africa, promoting economic, environmental and social implications to the continent (Fenta *et al.*, 2020). An ultimate transformation to a sustainable world for the forestry sector has to coordinate policies across governments. New markets for the forest ecosystem services emerge daily, the web of rights extending to biodiversity conservation, watershed protection and carbon sequestration has become more complex than ever to national and global communities (Kubiszewski *et al.*, 2017). In forestry, assessing which rights in the bundle are held by whom is complex, as it is often necessary to differentiate between rights to land versus forest, as well as to diversify forest products including the timber and non-timber forest products (German, 2010). Therefore, monitoring of the forestry processes should present policymakers with a strong rationale in linking forests and other land resources enhancing proper forest management.

### **2.1.4 Socioeconomic contribution of a conserved normal forest in Tanzania**

The SUA Training Forest is among the well-managed forest plantations and a typical example of a Normal Forest. A normal forest has a normal series of normally stocked age or size classes (Leslie, 1966). This type of forest specifically embraces homogeneous land quality, timber harvesting is even over time since the total land area is evenly allocated between the existing age classes, and in each period the oldest age-class is

clear-cut and replanted (Leslie, 1966). The main objective of a Normal Forest is to ensure that timber can be harvested each year guaranteeing sustainable forest management.

Fundamentally, the legal frameworks strengthen forest management to sustainable development of the forest resource by fortifying the private sector through stakeholders' engagement in pro-sustainability activities (FAO, 2018). Gradually, the forest decision-making processes evolve to reflect a broader base of stakeholders and more collaborative actors. The customers of the wood products at the SUA Training Forest play a major role in creating value and promoting new sales by linking other customers to the Training Forest. The SUA Training Forest also cooperates with other neighbouring stakeholders including Forestry Training Institute (FTI), Meru Forest Plantation, Tanzania National Park (TANAPA) and Zonal Forestry Management Organization (ZOFOMO) (SUA, 2017). The joint activities conducted include; protection of the forest, for example; by fire fighting, repairing access road from Ngaramtoni to Olmotonyi and maintenance of water storage at the Training Forest which is used by all these institutions.

This situation has secured the rights of both local communities and customers accessing these forests. Tanzania is the only country with exclusive rights granted to the local communities and stakeholders managing the forests (Duguma *et al.*, 2018). These local communities and customers are often given rights to access forest areas and withdraw forest products for their own consumption.

The SUA Training forest is surrounded by few ethnic groups, the most prominent one being the Waarusha (SUA, 2017). They are much involved in farming and livestock keeping as their main economic activities. The communities are also provided with free fodder fuel, water for irrigation and domestic utilization (SUA, 2018). The SUA Training



Forest cooperates socially by allocating plots to villagers in the communities for cultivation in clear-felled areas (SUA, 2018). Squatter farming “Taungya” system is practiced in the clear felled by the villagers, annual crops like maize, beans, Irish potatoes green vegetables and carrots are grown before tree canopy closure as shown in Plate 2. In fear of ‘tragedy of the commons’ on resources of interest, by the various actors, restriction grounds are laid for sustainable resource exploitation (Wulandari, 2018). The restriction on certain rights to transfer forest products to others through the sale is bound, through taxation or absolute prohibition most common for jointly managed protected areas (Duguma *et al.*, 2018). Therefore, sustainable forest exploitation is the main theme of a conserved normal forest, for proper forest management there has to be a higher priority on the long term forest management plans.

### **Environmental conservation schemes and activities in the SUA Training Forest**

Most of the forests in Tanzania are profoundly local, each one is unique and the use depends heavily upon specific environmental conservation contexts (Kideghesho, 2015). Environmental conservation is an essential role in forest management that ensures the production of forest products are not compromised in the Forest. The SUA Training Forest is among the plantations on the slopes of Mount Meru that have greatly invested in the environmental conservation (SUA, 2017).

Environmental conservation practices in the SUA Forest begin from the planting stage to harvesting stage of the Forest products. In all stages of growth of the trees the SUA Training Forest ensures no fire operations are conducted including the use of fire for farm cleaning. Frequent patrols are conducted throughout the growth season in the Forest area to ensure no harm derails the trees growth. The patrols are conducted to prohibit illegal

forest activities including illegal cutting, grazing in the forest, stealing of poles and forest fires. Moreover, raising awareness to the forest exploiters on sustainable forest exploitation through seminars, village meetings and workshops reduces risks on the forest's safety (Zhang *et al.*, 2020). Education is a form of involvement in decision making that enlightens the exploiters' on their limits of exploitation and responsibilities to take in conservation. One of the best examples the SUA Training Forest exemplifies is educating villagers around the forest about the need to reduce the number of livestock to shift from raising indigenous cattle to raising dairy cattle that are more productive (SUA, 2017).

On the other hand, reducing forest interactions sustains the forests safety (SUA, 2017). The scheme involves encouraging the villagers to practice planting fodder trees with agricultural crops (Agroforestry) around their homesteads by providing tree seedlings free of charge (SUA, 2017). The Training Forest also supplies water from the source in the Training Forest through water channels to the villagers' farm plots for irrigation and domestic use. Therefore, the villagers do not have to travel a long distance from their households to fetch water from the source for their daily use.

Furthermore, eco-tourism is also among the activities conducted free of charge with only a need of permits to explore the Training Forest as an aesthetical resource. Eco-tourism in forests is a motivation for maintaining a healthy and conserved ecosystem for both the forest and the inhabiting wildlife (Friess, 2017). Hiking is the tourism activity done in the forest's vicinity by both local communities surrounding the forest and customers (SUA, 2018). The activity is an eco-tourism experience for the hiker that includes observing of interesting life forms and good network from the forest trails (SUA, 2018). The forest aesthetics observed by interactants serve as an attraction to influence both the

local communities and customers on the significance of forest protection and conservation. Consequently, flourishing sustainable forest environments involve continued commitments by both utilizers and governing organizations during exploitation the forest resource.

### **2.1.5 Government's involvement in Forest Conservation**

Historically, Tanzanian's resource protection, management and utilization main authority was vested in the Central Government, particularly the President Office (Ponte *et al.*, 2020). The reforms on the governance were made in the past few decades with an overarching objective of assigning greater roles to the private sector and local communities rather than the state (Ponte *et al.*, 2020). However, the Central Government remains the custodian of National Policy and Legislation in the country, using the National Forest Policy and the Forest Act the forestry sector has been well structured. In 1998, the Tanzanian Government adopted the National Forest Policy mainly focusing on sustainable conservation of Forest resources (Mimiwasa and Shauri, 2001). The NFP's objectives are to:

- Ensure sustainable supply of forest products and services by maintaining sufficient forest area through an efficient management
- Increase employment and foreign exchange earnings through sustainable forest-based industrial development and trade
- Ensure ecosystem stability through conservation of forest biodiversity, water catchments and soil fertility
- Enhance the national capacity to manage and develop the forest sector in collaboration with other stakeholders

However, the policy still recognizes the existence of local government forest reserves, is to be managed by local authorities, specialized executive agencies or even by the private sector (Mimiwasa and Shauri, 2001). Furthermore, the NFP ensures equitable sharing of benefits amongst all stakeholders, appropriate joint agreements between the central government, specialized executive agencies, and organized local communities or other organizations of people living adjacent to the forest are promoted (Mimiwasa and Shauri, 2001).

On the other hand the Forest Act 2002 is also a tool enforcing the law in the Forestry sector by promoting protection of biodiversity and sustainable development of forest resources (Lovett, 2003). The objectives of the Forest act are to;

- (a) Promote, to enhance the contribution of the forest sector to the sustainable development
- (b) Encourage and facilitate the active participation of citizens in sustainable planning, management, use and conservation of forest resources to ensure ecosystem stability
- (d) Delegate responsibility for management of forest resources to the lowest possible level of local management consistent with the furtherance of national policies
- (e) Ensure the sustainable supply of forest products and services to all kinds of stakeholders
- (f) Enhance the quality and improve the marketability of forest products and regulate their export
- (g) Promote coordination and cooperation between the forest sector and other agencies

- (h) Facilitate greater public awareness of the cultural, economic and social benefits for conserving and increasing sustainable forest cover
- (i) Enable Tanzania to pay, fully in contributing towards and benefiting from international efforts and measures to protect and enhance global bio-diversity

The Central Government also uses the Tanzania Forest Services (TFS) as an Agency with Military Training to arrest illegal loggers through patrols and inspections at Check points (Ponte *et al.*, 2020). Tanzania's role of the Government in conservation of the forests also includes environmental policies, legislation, and law enforcement as a restraining bench mark to the users (Magalla, 2018). Environmental conservation in Tanzania began during the German occupation of East Africa (1884-1919) colonial conservation laws for the protection of game and forests were enacted, whereby restrictions were placed upon traditional indigenous activities such as hunting, firewood collecting, and cattle grazing (Goldstein, 2005). However, environmental conservation in relation to forestry is the responsibility of all the people and not simply that of government. Therefore, environmental conservation of a forest is a process that involves actors including the Governmental and Non-governmental Organizations from various forms of interest that invest to guarantee conservation of the forest resource. Tanzania is a signatory to a significant number of international environmental protection conventions including the Rio Declaration on Development and Environment 1992 and the Convention on Biological Diversity 1996 (Kashwan, 2017). The concerns for the environmental conservation include damaged to ecosystems and loss of habitat resulting from population growth, expansion of subsistence agriculture, pollution, timber extraction and significant use of timber as fuel. As a result a more broad-reaching effort to manage environmental issues at a national level has been achieved, through the establishment of the National Environment Management Council (NEMC) to enforce the Environmental

Management Act (Kashwan, 2017). The Environmental Management Act (EMA) provides a legal and institutional framework that promotes sustainable environment (Magalla, 2018). The Act branches out a hand of help to outline principles for management, impact and risk assessments, prevention and control of pollution, waste management, environmental quality standards, public participation, compliance and enforcement.

Therefore, the Government's involvement in a resources' conservation has inspired and ensured better management of forest and environmental resources which majority of the citizens are dependent on for their livelihoods.

#### **2.1.6 Proxy means test questionnaire**

Proxy Means Test Questionnaires enhances estimation of the income or consumption when precise measurements are unavailable or difficult to obtain (WBG, 2010). In most cases, it is not an easy task for the household members to remember the exact amount of the earnings or expenditure for every month off per year. Therefore, these detailed records can, however, be obtained by an informed guess made based on household characteristics (WBG, 2010). Observing *ceteris paribus* it is definite that the income capacity of a household using gas as a cooking source of energy will have a better livelihood compared to household using firewood. This simple line of distinction is our "proxy" because it provides an approximate value of the households' income or consumption. Practically, most PMT models use several different variables (WBG, 2010). The use of only one proxy value reduces the required estimates leading to imprecision since, the variability in incomes is still great, even between families living in brick-walled houses. Therefore, the use of several proxy variables is significant to obtain an accurate prediction of the welfare

from different households, with a set of variables and weights connected in the overall PMT model.

### **2.1.7 Application of gross margin analysis and net revenues in calculating financial revenue accrued from the socio-economic activities**

Gross margin analysis is mostly used to calculate the economic benefits in terms of gross profit. The farm gross margin is comprised of the accumulated revenue from the final products of different farm activities and farm subsidy payments, minus the cost incurred for inputs for the farming activities (Glenk, 2017). Such an approach is adopted because small-scale farmers/ enterprises do not often incur much of these costs and partly because such information is often difficult to obtain (MUVI-SIDO, 2012). Gross margin is useful in decision making because of the logical and systematic way of assessing each activity including inputs such as water, fertilizer, labour, and yields or market prices (MUVI-SIDO, 2012).

On the other hand, Net Revenues are used in calculating the Net Profit of the enterprises that expect higher values compared to the Gross Margin Analysis. When revenues exceed expenses, there is a net profit but when the expenses exceed revenues, there is a net loss. Net Profit is defined as a sum of sales revenue, the value of output consumed by the entrepreneur and the value of output given away from the total business and operating cost (Salia, 2016). The approach is adopted because larger enterprises such as sellers of the products of the trees do earn much more partly. Therefore, it will be more convenient for the tree products revenue to be accounted for by observing the net profit.

#### **2.1.7.1 Gross profit**

Gross Profit = Total Revenue - Total Variable Cost

$$i.e \text{ Gross Profit} = TR - TVCi \text{ (i = 1, 2 .....n.....)} \quad (i)$$

Where; Gross Profit (TZS/kg or TZS/Year)

$TR_i$  = Total Revenue (TZS/kg or TZS/Year)

$TVC_i$  = Total Variable Cost (TZS/kg or TZS/Year)

Total Variable Cost = (Operating expenses + Other expenses + Interest + Taxes)

### 2.1.7.2 Net Revenues of the tree crops

$$\text{Net Profit} = \text{Gross Profit} - \text{Expenses (TZS)} \dots\dots\dots (ii)$$

Where; Gross profit = Total Revenue – Cost of goods sold..... (a)

Expenses = (Operating expenses + Other expenses + Interest + Taxes)..... (b)

### 2.1.8 The social cost

The Social Cost works to determine the overall impact of an economic activity on the welfare of the society (Çelik *et al.*, 2017). During determination of the Social Cost, both fixed and variable costs must be included. The Fixed costs are values that do not fluctuate such as salaries, or startup costs. On the other hand variable costs experience change; a good example of a variable cost that changes from time to time is production quantity. The significance of the Social Cost is more apparent when it can be used by economists and legislators to develop an operating and production structure that invites institutions, organizations and corporations investing in a resource reducing the costs of their actions (Kenton, 2019). The Social Costs is calculated by;

$$\text{Social Cost} = \text{Private Cost} + \text{External Cost}.$$

The Social Costs are compared to the private cost to determine whether the externality is negative or positive. If the Social Costs are higher than the Private Costs, and the external



cost is positive but results in a negative externality; this situation indicates a negative effect on the environment (Bassi, 2015). This negative effect must be considered by the management to ensure maintenance is observed by encouraging integrity of social responsibility to the environmental resources utilized (Bassi, 2015). Observing social responsibility is highly vital since it shows the extent of resource management, especially to the operators seeking to invest in the environmental resource that provides long-term benefits for the welfare of society and the environment in general.

### **Social costs**

$$SC = PC + EC \dots\dots\dots (iii)$$

Where; SC= Social Cost (TZS/Kg or TZS/Year)

PC= Private Cost (TZS/Kg or TZS/Year)

EC=External Cost (TZS/Kg or TZS/Year)

When; PC= Cost of production

EC= Cost of fine and penalties

## **CHAPTER THREE**

### **3.0 MATERIALS AND METHODS**

#### **3.1 Study site description**

##### **3.1.1 History of the study area and Geographic location**

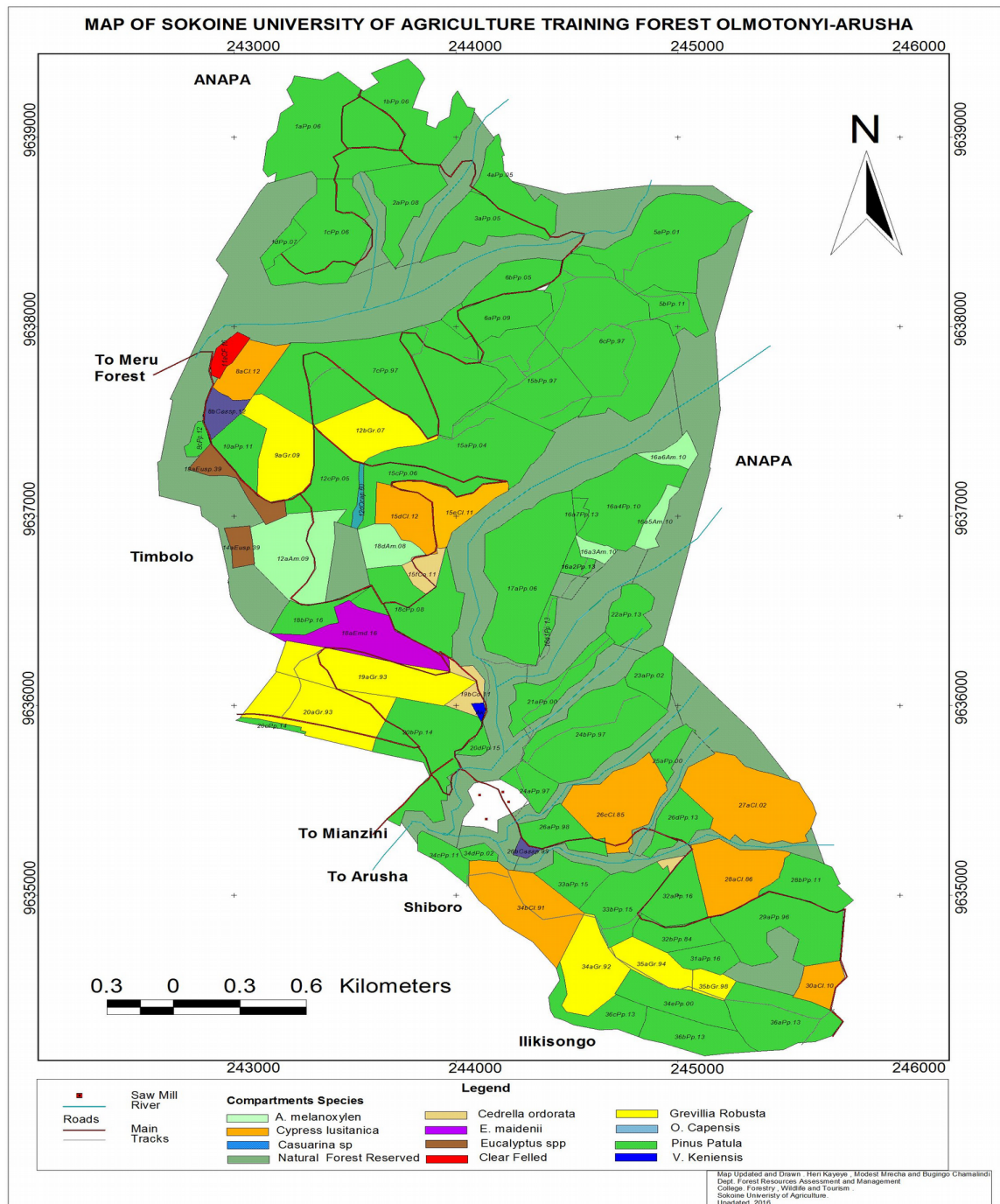
This study was conducted in the Olmotonyi area among the communities adjacent to the SUA Training forest and customers in Arusha as shown in Fig. 3.

Sokoine University of Agriculture, Training Forest (SUATF) Olmotonyi was established on 22<sup>nd</sup> February 1978 owned on a 99-years leasehold (SUA, 2017). At first SUA Training Forest was a part of the Meru Forest Project until when it was transferred to the University of Dar es Salaam for the purpose of research, training and production (SUA, 2017). In 1984 after the Act No. 6 of the Parliament that established the Sokoine University of Agriculture (SUA), the ownership of the Training forest was transferred to SUA on a 10 years renewable lease (SUA, 2017). Recently, the SUA Training Forest is owned by Faculty of Forest and Nature Conservation (FOFNC) of Sokoine University of Agriculture (SUA, 2017).

The Training Forest is located at the latitude of 360 42' E and longitude of 30 17'S and covers a total area of 840 hectares (SUA, 2017). Most parts of the Training Forest are mountainous (Plate 1), with slopes ranging from gentle to steep at an altitude of about 1,740 to 2320 metres above sea level (SUA, 2017). The SUA Training Forest is bordered by Meru Forest Plantation to the East and West, Arusha National Park (ANAPA) to the North, two village lands to the South (Shiboro and Ilikisongo) and two village lands to its very East (Sambasha and Timbolo) (SUA, 2017). Seliani and Engare-Narok are the main rivers flowing through the Training Forest throughout the year (SUA, 2017).



**Plate 1: A distant view of Mount Meru on which SUA Training Forest is situated**



**Figure 3:** Map of the study area

**Source:** Survey and GIS unit- Sokoine University of Agriculture.

### 3.1.2 Climate

The SUA Training Forest together with other forests on Mount Meru contributes enormously to the climatic condition of the region. The climate is typically tropical causing precipitation and cools the region's temperature leading to a bimodal rainfall pattern, with two rainy seasons (SUA, 2017). Therefore, many crops are planted twice a year. The first rainy season begins early in the months of March, April and May the forests influences reliable long “Masika” rains in Arusha region compared to its surrounding areas (SUA, 2017). The second rainy season is from November to December and all other months experience dry condition (SUA, 2017).

### 3.1.3 Topography and vegetation

The SUA Training Forest plantation in the Olmotonyi area lies within the ranges of 1600 to 2300 meters above sea level (SUA, 2017). About 80% of the total SUA Training Forest area is the artificial forest's plantation, and the remaining 20% is the natural forest (SUA, 2017). The common species of the forest plantations include *Pinus patula*, *Cuppressus lusitanica*, *Grevillea robusta*, *Eucalyptus maidemii*, *Casuarina montana*, *Olea capense*, *Accacia melanoxylon*, and *Cedrella odorata*. The common natural forest species include; *Syzygium guineense*, *Albizia gumifera*, *Albizia schimperana*, *Newtonia microcalyx*, *Croton megalocarpus*, *Juniperus procera*, *Hagenia abyssinica*, *Stoebe kilimandscharica*, *Rapanea rododenroides*, *Arundinaria alpina*, *Philipia trimera*, *Cordia abyssinica*, and *Myrianthus holstii*.

## **3.2 Method of data collection**

### **3.2.1 Research design**

This study used cross-sectional design where data collection was done at a specific point in time of three months being November, December and January. The employed study the design since it is suitable for a descriptive study and determines regressions among variables; however the design is also convenient where there are resource constraints such as money, time and labour (Namwata *et al.*, 2012).

### **3.2.2 Sampling procedure**

#### **3.2.2.1 Sampling design and intensity**

Bordering the SUA Training Forest are four villages located to the East and South of the forest. These four villages have a total of seven sub-villages bordering the forest. Purposive sampling was used to select two villages with the longest boundary. The selected villages had a total of five sub-villages, bordering the forest. The remaining two un-sampled villages bordering the forest comprised of only two sub-villages bordering the forest.

The stratified random sampling design was used to stratify respondents into categories based on their socio-economic activities: Farmers, livestock keepers and traders. Total enumeration technique was used to cover the 20 customers from distant areas that were involved in buying of sawn wood, poles and firewood from the SUA Training Forests. The technique is justifiable on a smaller population which is well defined and can be easily studied. Production of the forest products at SUA Training Forest is generally low hence; sale ended within two days. Therefore, the lower supply of the products,

results in lesser available customers to purchase the Training Forest's products. For each village, the updated list of households was selected as a sampling frame from the village registers by a simple random sampling procedure.

### **3.2.2.2 Sample size determination**

The sample size of this study comprised of ninety respondents that were selected from the stratified sample in order to include respondents from different types of farmers, livestock keepers and traders. The respondents for each stratum were randomly selected from the villages considering a sampling intensity of at least 5% to determine sample size of the households interviewed in each village as described by Kayunze (1998). Moreover, the sample size was not less than 30 per village. The 90 respondents selected as the sample size is based on Matata *et al.* (2001) that describes 80-120 respondents are adequate for most socio-economic studies in Sub-Saharan African households' statistical analysis to be carried out.

### **3.2.3 Data collection**

Primary and secondary data of the specific objectives in the study were collected from the study area, guided by the sampling designs. Data collection involved reconnaissance survey and the actual survey. A reconnaissance survey was conducted before the actual data collection.

#### **3.2.3.1 Reconnaissance survey**

This strategy enlightens the researcher on logical issues about data collection such as the study sites and units of analysis before actual data collection (Lupala, 2015). At this stage, the socio-economic data collection tools such as questionnaires were tested their

reliability, validity and hence, modified accordingly. Consequently, the Proxy Means Test structured household questionnaires had to be adjusted before conducting the actual data collection, by use of unstructured questionnaires. The unstructured Proxy Means Test questionnaires captured the cost and benefits of the socioeconomic activities conducted by the livestock keepers that couldn't be targeted by the structured questionnaires used to interview the farmers and traders.

### **3.2.3.2 Actual data collection**

The stage involved collection of both Primary data and Secondary data as the convenient sources of information in the study.

#### **3.2.3.2.1 Primary data**

Primary data of specific objectives in the study was collected through a Questionnaire survey (Appendix 1), Key informant interviews (Appendix 3), Customers interviews (Appendix 2), Focus group discussion interviews (Appendix 4) and Researcher's direct observations. A reconnaissance survey was carried out prior to actual data collection to provide a general picture of the research.

#### **Questionnaire survey**

Structured and unstructured questionnaires were used for data collection. The Structured questionnaire interviews included closed and open-ended questions as an instrument used to obtain quantitative data. The questionnaires were used to meet the specific objectives of the study by investigating the socio-economic activities conducted in the study area and the Social Costs caused by the socio-economic activities associated with the SUA Training Forest. The financial revenue accrued from the socio-economic activities associated with SUA Training Forest done by the local communities' and customers in



Olmotonyi, Arusha were assessed using of Proxy Means Tests questionnaire which was also part of the structured questionnaire interview. The Proxy Means Test questionnaires include the use of observable characteristics of the household or its members to estimate their incomes or consumption, when other income data (salary slips, tax returns) are unavailable or unreliable (WBG, 2010).

### **Key informants interviews**

Key informants interviews are qualitative comprehensive interviews done with people with detailed knowledge about the topic in question. These face to face interviews were addressed purposively to key informants in the SUA Training Forests area to provide information about the forest socio-economic activities done with local communities', the financial revenue accrued from the forest socio-economic activities and socio-economic factors influencing SUA Training Forest contribution. In this study, the interviews were conducted with the SUA Training Forest office (Manager and the five staff members), village leaders, and village executive officers' (VEO) and 20 customers.

### **Focus group discussion**

Focus group discussions (FGD) is a rapid assessment with semi-structured data gathered purposively for a selected set of participants to discuss issues based on key themes of the study (Kumar, 1987 as cited by Komba, 2016).

The Focus group discussions were conducted with a small but variable number of 10 to 12 discussants (THCU, 2002). Only two focus group discussions were conducted with a number of 16 discussants in both groups with the Farmers and Livestock keepers of similar background experiences (e.g. female, male and head of households) from the Shiboro Village adjacent to the SUA Training Forest. A questionnaire was prepared for the

investigation of the Focus Group discussants. The information obtained was on pertaining issues including the socio-economic activities conducted in the study area, socio-economic factors influencing SUA Training Forest contribution, financial revenue accrued from the socio-economic activities associated with forests done with local communities' and customers in Olmotonyi, Arusha and Social Costs caused by forest socio-economic activities done the local communities and customers in Olmotonyi, Arusha.

### **Researcher's direct observations and Researcher's Notebook**

Researcher's direct observations and Researcher's Notebook were used to complement data obtained from other methods in this study. The observations were based on how communities' were involved in their socio-economic activities. Pertinent information was documented and photographed by a digital camera.

#### **3.2.3.2.2 Secondary data**

The study involved the collection of secondary data. This type of data supplemented the primary data. Secondary data of the specific objectives in the study was reviewed from the Forest Manger and customer's financial reports of the SUA Training Forest resources, General Management Plans (GMP) of the communities' around SUA Training Forest, Documentary reports of the SUA Training Forest in Olmotonyi, Dissertation/ Thesis, journals, books and internet.

### **3.3 Data analysis**

Data on the specific objectives in the study was analyzed both qualitatively and quantitatively. The qualitative data was analyzed by Content Analysis. Quantitative data of the specific objectives was coded in the Statistical Package for Social Sciences (SPSS) software and the Microsoft Excel Spread Sheet for analysis. Descriptive statistical

analysis was used to summarize information and explore the qualitative data for the distribution of responses.

A segregated analysis of the sampled villages was considered however; due to the villages being more or less similar in many aspects it was reasonable to combine the results.

### **3.3.1 Stepwise multiple linear regression model**

The Multiple Linear Regression is a type of linear regression that is used to analyze the relationship between single responses variables (dependent variable) with two or more controlled variables (independent variable). The Stepwise regression method is called the Orthogonal Greedy Algorithm (OGA) (Ahmed, 2010). This Algorithm selects input variables to enter a  $p$ - dimensional linear regression model (with  $p \gg n$ , the sample size) sequentially so that the selected variable at each step minimizes the residual sum squares (Ahmed, 2010). The regression technique explains the underlying dynamics by representing variables in combination that might be strongly associated with it, in a particular situation. Therefore, the model emerging from the analysis serves an explanatory purpose as well as a predictive purpose.

Consequently, model of Multiple Linear Regression with Stepwise Approach can be represented as;

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \varepsilon$$

For the study the following was the sequence of dependent and independent variables;

#### **Farmers**

$Y$  = Household Gross Profit per unit area,  $X_1$  = Fertilizer (Cost of Fertilizer used),  
 $X_2$  = Pesticides used,  $X_3$  = Land size owned,  $X_4$  = Years of interaction with the forest

#### **Livestock keepers**

$Y$  = Household Gross Profit per the number of loads collected,  $X_1$  = Number of loads per year,  $X_2$  = Number of livestock kept,  $X_3$  = Years of interaction with the forest,  $X_4$  = Household size

### **Traders**

$Y$  = Household Gross Profit,  $X_1$  = Household size,  $X_2$  = Fertilizer (Cost of the Fertilizer used),  $X_3$  = Pesticides used,  $X_4$  = Years of trade conducted with the forest resources,  $X_5$  = Access to Market

## CHAPTER FOUR

### 4.0 RESULTS AND DISCUSSION

#### 4.1 Description of the socio-economic characteristics of the respondents

##### 4.1.1 Gender of the respondents

The results show that 81.1% of the respondents were women and only 18.9% were men as indicated in Table 1. Expanded market participation and new engagements with income-earning activities have important impacts on pastoral households that make women key players in pastoral livelihood diversification (Smith, 2015). The Waarusha is an evolved pastoral society, which increasingly practices diversified socio-economic activities including crop production and trade to sustain the livelihoods of their families. While men dominate these activities women have sort ways of diversifying their livelihoods by conducting the socio-economic activities. Therefore, currently both men and women have room to participate in the same economic activities in this society including; farming, livestock keeping and trade with the objective of improving their livelihoods.

**Table 1: Gender distribution of the respondents**

<b>Gender</b>	<b>Frequency</b>	<b>Percentage</b>
Males	17	18.9
Females	73	81.1
Total	90	100.0

#### 4.1.2 Age distribution of the respondents

The study found that 78.9% of the respondents engaging in the socio-economic activities of the forest had 18-45 years of age as shown in Table 2. This age range indicated that most of the socio-economic activities were conducted by young, active adults that had the higher flexibility and endurance to build their economy (Kulyakwave *et al.*, 2019).

**Table 2: Age distribution of the respondents**

Age	Frequency	Percentage
18-45	71	78.9
>45	19	21.1
Total	90	100.0

#### 4.1.3 Marital status of the respondents

The findings show that majority (93.3%) of the respondents were married while 5.6% were widows and 1.1% was divorced. The results present that 98.9% of the resource beneficiaries were responsible individuals with families to provide for. This finding is similar to Okayo *et al.* (2015) who found that, households that have families have huge responsibilities of taking care of other household members, their children and even property compared to a single, separated or divorced person.

**Table 3: Household size of the respondents**

Household size	Frequency	Percentage
≤ 5	32	35.6
> 5	58	64.4
Total	90	100.0

The results revealed that 64.4% of the household size of the respondents had above 5 individuals as shown in Table 3. In pastoral societies to have many children is still

considered an asset to the household. Children are useful not only for running small errands and assisting in domestic work, but they are also drawn into animal care at an early age (Dahl, 1987). Among East African pastoralists in particular, there is a general commitment to family growth, an attitude inherited and made possible by the flexibility of the resource base, where livestock numbers fluctuate and grazing boundaries between different populations are not very strict (Dahl, 1987). However, currently there is little potential to increase livestock production by increasing animal numbers among the pastoral societies, since most African rangelands are stocked at or above the grazing capacity (Holechek *et al.*, 2017). Additionally, land resources available for crop cultivation are currently on extreme demand in several African countries (Holechek *et al.*, 2017). Globalization coupled with population increase has staggered livelihood expectations and escalated major conflicts over natural resources (Holechek *et al.*, 2017). The growing concern about the capabilities of the African countries to sustainably feed their future projected generations is still indefinite (Holechek *et al.*, 2017). The conserved customs regarding family growth has caused household heads to face a strenuous role of handling their families' subsistence. Larger households embrace larger responsibilities compared to the small households. Large households are more likely to strain the food budget especially when the earnings are low, that can result to underprivileged livelihoods (Olufemi *et al.*, 2019).

However, there is also a diverging population (35.6%) from the form of culture due to a number of reasons including decrease in resource of possession such as land and livestock (SUA, 2017). This situation has caused households to consider a flexible number of children to sustain better livelihoods of their families. Similarly, young families taking into consideration 78.9% (as shown in Table 2) of the household heads' age was less than

45 years and 81.1% were women (as shown in Table 1). This confirms a fair range that these households still have time to branch out into larger households as time goes by. Therefore, the need of raising awareness on having a considerable household size in reference to the available resource base the household possesses.

#### 4.1.4 Education level of the respondents

The results revealed in Table 4 indicated that 61.1 % of the respondents managed to acquire the basic formal education which is Primary and Secondary Level. The remaining 38.9% have not gone to school but have engaged in an early career using their indigenous knowledge on crop cultivation, livestock keeping and trade to sustain their livelihoods. Formal education is an eye-opener to the benefits of indigenous knowledge by utilizing Western knowledge to craft solutions to human problems (Aikaeli and Mkenda, 2016). Inadequate formal education has an adverse impact on access of information for effective decision making during the extreme economic shifts and climate change conditions. Ability of gaining formal education has also confirmed lowering chances of early marriage and hence promoting population control in societies (Raymond, 2020). Therefore, profound effort should be vested on emphasizing on the importance of education to the local communities for sustainability of their resources and to promote socio-economic development.

**Table 4: Education level of the respondents**

Education Level	Frequency	Percentage
Not gone to school	35	38.9
Primary	50	55.6
Secondary	5	5.6
Total	90	100.0



#### **4.1.5 Interaction period of the local communities with the SUA Training Forest or the resources in relation to the activities conducted**

The activities conducted in the SUA Training forest are influenced by the interaction period of the beneficiaries as shown in Fig. 4. The highest interactants are the livestock keepers with 20% of interactions conducted in the forest involving pasture collection for more than 10 years of interaction. Livestock keeping among the Waarusha tribe is a descending culture, which is conserved and passed along the line of generations. Traditionally, the Waarusha descended from the Maasai tribe but have a higher frequency of practicing subsistence agriculture (Durant *et al.*, 2016). The Maasai are semi-nomadic pastoralists that are highly dependent on livestock and practice less of subsistence agriculture (McCabe, 2003). The farmers' highest interactions were 15% with interaction duration of three to five years. While traders cover only 9% of the forest interactions with duration of three to five years utmost; specifically conducted by the firewood and potato traders.



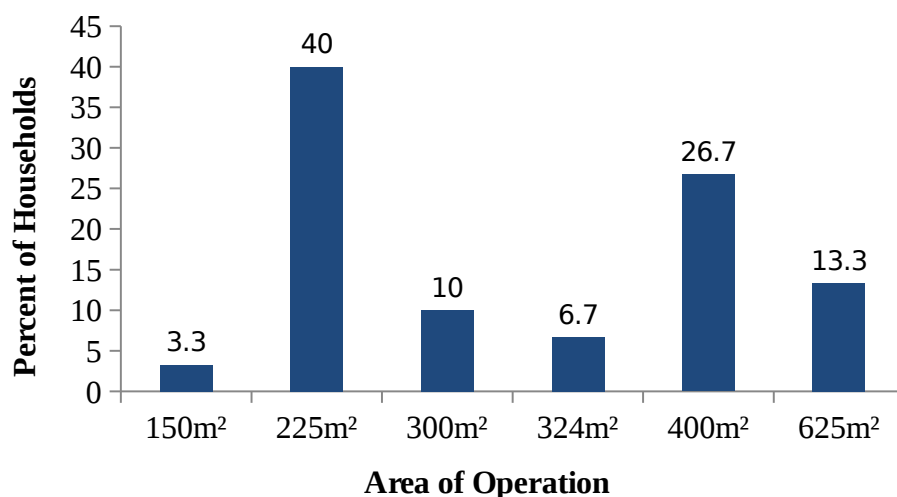
**Figure 4: A Cross-tabulation of number of interactions in/ near the SUA Training Forest and duration of interaction in/ near the SUA Training Forest**

#### 4.1.6 Average plot size of the operation

According to the diversity of the socio-economic activities conducted in the forest by various interactants only the farmers receive portioned plots in the forest area. In these portioned areas they are charged TZS 6000/= to conduct squatter farming (Taungya) for about four years depending on trees canopy closure as shown in Plate 2. About 40% of the households possessed a 15m x 15m plot size. This plot size is less compared to the standards of Forest's Management plan requirements that states at least a 35m x 35m plot

size to be provided to the Local communities (SUA, 2017). The results reveal that, currently no household is portioned the original established plot size as presented in Fig. 5. The allocation of smaller plot sizes is due to the increase in demand for the available resource.

Moreover, 54% of the respondents confirmed population pressure being the main cause of disturbing distributions of the forest resources among the villagers due to high demand of the resources. Additionally, 39% of the respondents that had profound experience in forest interactions (more than 10 years’); declared a staggering experience of plunging production rates due to reduced plot sizes. As a result, 5% of the respondents criticized the unjust plot distributions done by the forest guards due to lack of the villagers awareness on principles and regulations guiding distribution of plots.



**Figure 5: Average plot size of operation**

#### **4.1.7 Livelihood improvement due to utilization of the SUA Training Forest resources**

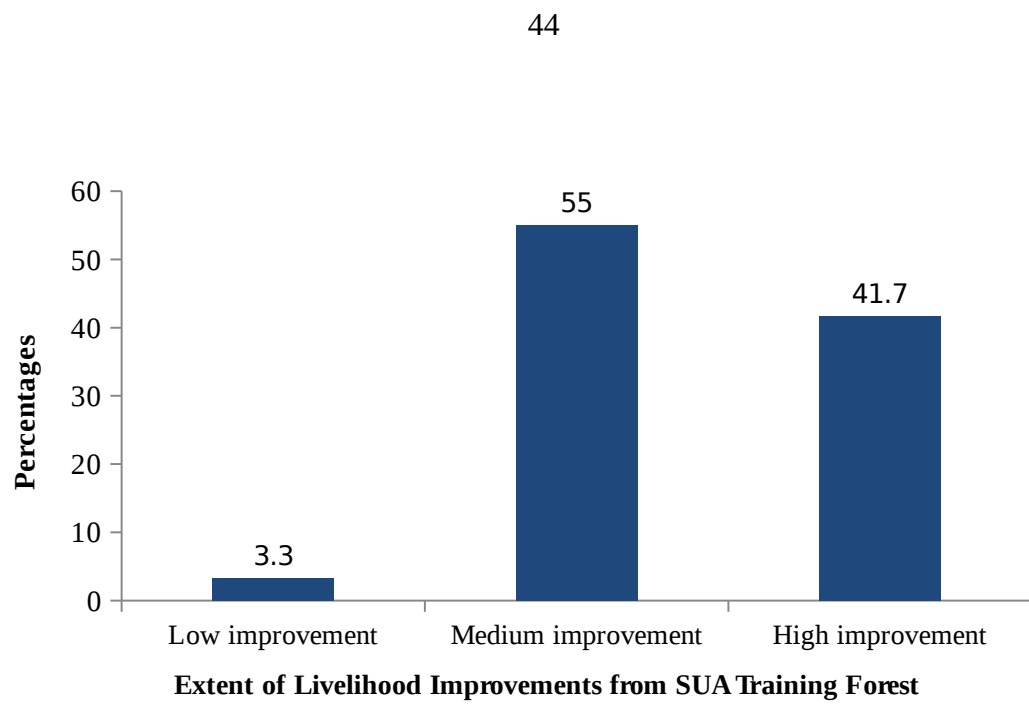
In developing countries, around 20% of incomes for livelihoods rural households' are from the forests resources (FAO, 2018). For approximately 42 years SUA Training forest has been a highly valuable and reliable resource to the villagers (SUA, 2017). About 41.7% of the respondents ranked their livelihoods improvement to be high due to their interaction with the SUA Training Forest as presented in Fig. 6. Revealing that the adjacent locals benefit from the forest resources like fodder for their animals, firewood and plots for cultivation leading to reduced cases of vandalism of the resource. Moreover, the SUA Training Forest has supported water availability among the communities by channeling the water source supplied by rivers from Mount Meru through several channels for irrigation in farm plots and clean water for domestic uses. The irrigation schemes in the homesteads have flourished Carrot and Green vegetable farming encouraging the practice of trade among the adjacent communities.

In addition to the infrastructural services, forest roads constructed by the SUA Training Forest have facilitated movement and transportation of crops from the farms to the desired destinations. Furthermore, employment opportunities has sustained the adjacent local communities as sources of labour to SUA Training Forest as they perform various activities such as planting, land preparation, security and other management activities.

Total of 55% of the respondents associate a medium improvement of their livelihood to their interaction with the resource as shown in Fig. 6. Among the challenges facing the

local beneficiaries is increased population that led to reduction of the allocated plot sizes to half in order to meet the needs of a larger population. In contrary, despite the adaption of the modern alternative source of energy such as gas by various households, the conventional use of firewood has not been replaced. About 100% of the community members use firewood as a main source of cooking and heating in their households. This alarming factor has been a push for SUA Training Forest to initiate intervening activities and preventing over exploitation of the Forest. The aim is to reduce the increasing demand for fuel wood caused by this growing population, threatening sustainable forest management. The initiative involved is provision of free tree seedlings to the locals to employ the squatter farming (Taungya system) as an agro-forestry practice in their homesteads. Tree species such as *Grevillea robusta* are integrated in banana, coffee, maize and beans.

The remaining 3.3% of the respondents said they experience low improvement on their livelihoods as a result of using the forest resources (Fig. 6). However, over reliance on the forest by the adjacent locals as a common pool of resource or the sole source of livelihood has lowered expectations of many interactants (Okumu and Muchapondwa, 2020).



**Figure 6: The extent of livelihood improvements acknowledged by the adjacent local communities from the SUA Training Forest**



**Plate 2: Taungya system practice and pasture loads collected by the local communities from the SUA Training Forest**

## **4.2 Identified socio-economic activities conducted by the local communities adjacent to the SUA Training Forest**

The main socio-economic activities conducted in and along the SUA Training Forest are Crop cultivation, Livestock keeping and Trade. According to the Crop cultivation, the crops cultivated in the SUA Training Forest include Maize, Irish potatoes, Beans and Vegetables. Tree species such as *Pines*, *Eucalyptus*, *Grevillea*, *Acacia*, *Casuarina* and *Cypress Callistemon* are integrated in the food crops.

In livestock keeping animals were cows, goats, sheep and donkeys are kept. Zero grazing is practiced as a form of livestock keeping due to shortage of grazing areas. About 100% of the livestock kept act as an asset of contingency for income production in these households. A total of 90% of the households also depend on livestock as a source of subsistence and income through sale and consumption of animals' by-products such as milk and meat. Trade embraced various forms that included sale of 70.6% Green vegetables, 17.6% Firewood, 8.8% Potatoes and 3% Carrots. Surrounding local communities also depend much on firewood as their main source of energy; therefore it is collected from the forest also for household use.

### **4.2.1 Financial Revenue from the Socio-economic activities conducted in the SUA Training Forest**

The Gross Margin Analysis evaluated the gross profits of the agricultural crops harvested from the SUA Training Forest plots through Proxy Means Test questionnaires. Moreover,

the GMA estimated the gross profits obtained from other socio-economic activities (i.e. livestock keeping and trade) that have been sustaining the lives of the villagers. The research revealed that the community living adjacent to the SUA Training Forest highly interacts with the resource through various socio-economic activities. However, some socioeconomic activities generated less profitable income per household, serving more of a subsistence objective to the villagers. According to World Bank (2018), obtaining less than USD 1.90 per day is a discouraging earning that approximately 10.9% of the world population lives on.

The results showed Crop Cultivation per household had a very low average gross profit of TZS 296.62/= (less than USD 1.90) per unit area in a year. Considering, the approximate average plot size (unit area) was 324m<sup>2</sup> per household, as a result the average gross profit per household was around TZS 96 104.88/= in a year. Assessing the average gross profit of crop yield per unit area helps to express quantitatively a reasonable average amount of crop yield obtained in a single plot (Li, 2018). Whereas in general, 40% of the farmers had gross profits that were twice as much compared to their production cost. The results revealed that these farmers experienced a gain in cash income besides the advantage of food for subsistence. Another 40% of the farmers also obtained food for subsistence but had less gained as cash income. The remaining 20% of the farmers cultivated their crops and ended up with gross losses. These farmers cultivated and obtained food for subsistence only. Generally, crop cultivation had the lowest benefits observed among the conducted socioeconomic activities in forest area (i.e. livestock keeping and trade) as indicated in Table 5; with a major objective of subsistence and less or even none on gaining income.



Furthermore, for livestock keepers quality of pastures for the survival of their livestock from the SUA Training Forests varied seasonally. The SUA Training Forest experiences a wet season of 6 months, with flourishing green pastures and the other 6 dry months with less available pastures for animal forage. The numbers of pasture loads collected from the SUA Training Forest per household vary from 1 to 3 loads per day (Plate 2). An average of 551 pasture loads per household was collected in a year from the SUA Training Forest as fodder for cattle.

The Total Revenue obtained was accounted from number of pasture loads collected as fodder for survival of the cattle and the milk sold per day. The Total Cost was accounted from costs spent on health care for the survival of the livestock per year. Therefore, average gross profit in reference to the number of pasture loads collected from the SUA Training Forest was TZS 4 409.95/= per household in a year. Assessing the average gross profit per unit number of pasture loads collected by the villagers disclosed the changes in animal production affecting the profit margins.

However as presented in Table 5, the overall gross profit in livestock keeping is higher compared to any other socio-economic activity due to the price of livestock kept as a contingency asset by the villagers. In the pastoral society cattle is primarily an asset expressing wealth of the household in possession, the benefits of subsistence the animals provide follow as a secondary benefit to the livestock keepers. The Average Net worth of the livestock kept per household was TZS 717 666.67/= in a year. Moreover, the benefits

observed from livestock's milk production had an average gross profit of TZS 389 083.33/= per household in a year which was utilized for subsistence by 80% of the villagers and the remaining 20% of the villagers that experienced an exceeding production gained cash income from sale of the product.

On the contrary, the traders experienced 96.6% of profits whereas, 3.3% of the respondents engaging in trade experienced losses. Trade is the most promising socio-economic activity among the locals conducted with a primary objective of gaining cash income (Table 5). Trade revealed the highest average gross profit of TZS 928 193.33/= per household in a year. 73.5% of the traders conducted their socio-economic activity along the SUA Training Forests that included farming and sale of Green Vegetables and Carrots directly to the market or engaging with the middle men. These are the traders benefiting from the irrigation water supplied by the SUA Training Forest channeled to their farm plots. Meanwhile, 17.6% of the traders extracted firewood from the SUA Training Forest and traded the product at market. The remaining 8.8% are the middle men that bought bags of potatoes from the SUA Training Forest and traded them to the market areas. The diverseness of the products sold makes it flexible for various actors to engage in business including middle men and farmers. Trade involving potatoes, carrots and green vegetables has included middle men as actors connecting the producers (farmers) to the market. Nevertheless, Firewood and Green vegetable sales have been done by traders and farmers by meeting directly with consumers at the market area to gain premium prices. Product diversification of the traded products has also been an advantage to the traders due to seasonal variability of the product. A trader has the advantage of selling two to three products per year in a circular seasonal series as the product is available for sale at the market.

**Table 5: Overall Gross Profits of the sampled households obtained from each identified socio-economic activity**

S/No	Activity	Total Revenue (TR)	Total Variable Cost (TVC)	Gross profit/loss (TZS/Year)
1	Crop cultivation	6 949 000	4 193 600	2 755 400
2	Livestock keeping	42 067 250	5 280 000	36 778 250
3	Firewood trade	678 000	412 500	265 500
4	Green vegetables trade	37 619 000	23 304 600	14 134 400
5	Carrots trade	1 360 000	179 500	1 180 500
6	Potatoes trade	95 920 000	83 837 600	12 082 400

#### **4.2.2 Factors influencing the contribution of the SUA training forest to the local**

##### **communities**

The difference in interaction has been influenced by the variation in objective of utilization of the Forest resources. The following are predictive (dependent variables) factors and explanatory (independent variables) factors observed according to the various interactants of the SUA Training Forest.

##### **Farmers**

$Y$  = Household Gross Profit per unit area,  $X_1$  = Fertilizer (Cost of Fertilizer used),  $X_2$  = Pesticides used,  $X_3$  = Land size owned,  $X_4$  = Years of interaction with the forest.

##### **Livestock keepers**

$Y$  = Household Gross Profit per the number of loads collected,  $X_1$  = Number of loads per year,  $X_2$  = Number of livestock kept,  $X_3$  = Years of interaction with the forest,  $X_4$  = Household size.

### Traders

$Y$  = Household Gross Profit,  $X_1$  = Household size,  $X_2$  = Fertilizer (Cost of the Fertilizer used),  $X_3$  = Pesticides used,  $X_4$  = Years of trade conducted with the forest resources,  $X_5$  = Access to Market.

According to Ahmed (2010), the Orthogonal Greedy Algorithm (OGA) in the Stepwise Multiple Linear Regression Model sorted the independent variables during analysis and, presented the following independent variables to have a strong association to the dependent variable;

**Table 6: The identified significant explanatory factors influencing the contribution of the SUA Training Forest to the local communities**

Forest Interactants	Variables	$\beta$	p-value
Farmers	Pesticides	-0.609	0.021*
Livestock keepers	Household size	0.456	0.011*
	Pasture loads collected	-0.346	0.039*
Traders	Access to Markets	0.839	0.000**
	Fertilizer application	0.277	0.019*
Constants	Farmers	417.554	0.012
	Livestock keepers	1039.373	0.640
	Traders	87559.617	0.632

Number of cases,  $n = 90$ ,  $\beta$  = regression coefficients

\* Statistically significant at  $\alpha = 0.05$ . \*\*Statistically significant at  $\alpha = 0.01$ .

## **Pesticides**

The result shows that, pesticides application is negatively significant to the Gross profit per unit area of the adjacent farmers at 5% level of probability ( $p < 0.05$ ) as shown in Table 6. In this 21<sup>st</sup> Century improved agriculture management practices have been highly recommended for increased crop production (Lamichhane *et al.*, 2016). Nevertheless, lack of awareness on real risks and improper scheduled application of the pesticide could lead to adverse results. In agriculture, ensuring stable crop yields and quality while reducing reliance on pesticides is a challenge that research and farming community are facing today (Lamichhane *et al.*, 2016). Therefore, Farmers should consider proper procedures and consultation before the application of pesticides with an objective of increased crop production.

## **Household size**

From the findings presented in Table 6 it was observed that, household size is positively significant at 5% level of probability ( $p < 0.05$ ) on the contribution of the Training Forest to the adjacent livestock keepers. Studies have revealed that larger households collect more forest product compared to smaller households, primarily because they have greater demand of resources and have more labor to fulfill this demand leading to higher forest incomes (Almeida, 1992; Adhikari *et al.*, 2004) cited by (Dash and Berhera, 2016).

Therefore, the large households' curb their livestock needs by the collecting freely available pastures from the SUA Training Forests by effective household utilization.

### **Pasture loads collected**

The results of this study indicated in Table 6, that the pasture loads collected are negatively significant at 5% level of probability ( $p < 0.05$ ) in influencing the Training Forest's contribution to the local Livestock keepers (Plate 2). At the SUA Training Forest the pastures collected serve a major role in provision of animal forage. The Training Forest is a restricted area for grazing practices; hence villagers practice a zero grazing system to feed their livestock. The villagers visit the forest once, twice or even three times a day to collect a respective number of pasture loads, specifically only 1, 2 or 3 loads are collected per day. The variability of the pasture loads collected from the SUA Training Forest did not only vary per day but also per month that included 1 to 12 months. For some of the livestock keeper's pastures were collected monthly, while others yearly hence having a higher collection amount per year and a higher dependency on the forest resource.

However, the availability of pasture in the SUA Training Forests decreases seasonally from wet to dry seasons. Cattle have annual live weight gain which varies according to seasons, if the expected forage is also variable seasonally. According to Poppi *et al.* (2018), the live weight gain on the Tropical pastures is reviewed low and therefore supplements may be addressed to the primary limiting nutrient which is crude protein during the dry season.

Furthermore, the biggest drivers in a livestock production system are the annual weight gain and the stocking rate, where the balance between the two is required (Poppi *et al.*,

2018). Stocking rate is defined as the number of animals on a given amount of land over a certain period of time (Redfearn and Bidwell, 2017). The longer the wet seasons, the higher the stocking rate and the longer period of adequate crude protein due to high amount of productive pastures fed to the livestock (Poppi *et al.*, 2018). The SUA Training Forest experiences a wet season of 6 months and the other 6 months dry season. Therefore the livestock keepers depending on pastures from the SUA Training Forest the whole year, for the 6 dry months they experience lower stocking rates and a shorter period of adequate crude protein due to a less amount of productive pastures for their livestock. Consequently, causing uneven production scale for their livestock compared to the livestock keepers that incorporate alternative diet in feeding their livestock in the dry seasons.

### **Access to Markets**

The findings of this study indicate that, access to markets has a positive significance to influencing the Forest contribution to the local traders at 5% level of probability ( $p < 0.05$ ) as presented in Table 6. Access to markets is made possible by mainly 2 factors which are; availability of transport to the trader and availability of market information on products required by the consumers. About 60% of the local producers' meet directly with their final consumers at the market vicinity, this includes the Firewood traders and most of the Green vegetable traders. Approximately, 20% of the local producers' sale their product from their very production plots to the middlemen, including the Carrot traders and some of the Green Vegetable traders. The remaining 20% of the local traders are the middlemen including Potato traders and some Green Vegetable traders; the middle men have the privilege of transporting the product to the final consumers and gaining premium prices as present in Table 5. Access of the producer or trader to the market assists in prediction of

the required production by the consumers (Aikaeli and Mkenda, 2016). Therefore, the ability of the products to arrive to required consumers encourages continuous production and improves the livelihoods of the facilitators and producers in line of production.

### **Fertilizer application**

Fertilizer application in the Green vegetables and Carrot homestead plots has a positive significance at 5% level of probability ( $p < 0.05$ ) as shown in Table 6, on influencing the traders livelihood improvement. Fertilizers have the ability of raising soil fertility and providing plant nutrients and resources that support growth, by increasing plant nutrients during the cycle of growth and decay. Furthermore, fertilizers reduce the cost of production since they can raise yield with increases in total cost per hectare (Cooke, 1972) cited by (Lavison, 2013). Therefore, appropriate and good scheduled fertilizer application has a valuable result in increasing and improving the output for the vegetables for better sales by the traders.

#### **4.2.3 Social costs incurred from the socio-economic activities done by the forest interactants and customers**

The Social Cost identifies the social responsibility of the interactants on how willing they are to maintain the resource and reveals the management's actions in enforcing resource conservation. Social responsibility can be defined as a set of pro-social values representing personal commitments to contribute to the community and society (Flanagan *et al.*, 2016). Social responsibility of a community utilizing a resource is identified when the interactants show accountability on the resources' welfare due to awareness of the



acquired benefits. However according to Çelik *et al.* (2017), social cost works to determine the overall impacts of an economic activity on the welfare of the society. In the SUA Training Forest in every socioeconomic activity conducted to compromise the resource a price is charged through leases, fines and penalties. These charges are defined as the External Costs. Additionally in the line of production, obligatory investments such as the production costs (private costs) confirms the producer's confidence on the resource to invest and gain expected outputs from the resource. Hence, the Private Cost reveal the cost invested during production with a degree of guarantee on the capacity of the resource to generate profit. Therefore, together the Private Costs and External Costs create the Social Cost.

The Social Cost, as the total cost to the society was observed specifically from the farmers that were assigned plots in the forest and any interactants (i.e. farmers, livestock keepers and traders) identified to vandalize the resource. The common offences that led to provision of fines and penalties to the forest interactants and Customers were grazing livestock in the Forest and theft of poles.

The Social Costs was determined by summing the Private Costs and the External Costs from the socio-economic activities done in the forest. These Private Costs were direct costs to the farmers for producing goods at the SUA Training Forest whereas, the External Costs were the costs imposed on lease of utilization and vandalism to the resource. The private costs included internal costs incurred from laborers hired, pesticides, fertilizers used and cost of seeds. On the other hand the external cost included the charges imposed for the plots leases (tax), fines and penalties collected by the SUA Training Forest.

$$SC = PC + EC \dots\dots\dots (1)$$

Where; SC= Social Cost (TZS/Year)

PC= Private Cost (TZS/Year)

EC= External Cost (TZS/Year)

When; PC= Cost of production

EC= Cost of taxes, fines and penalties

$$SC = PC + EC$$

Where; PC= 4 193 600/= TZS/Year

Cost of Taxes =180 000/= TZS/Year

Cost of Fines and Penalties = 1 320 000/= TZS/ Year

$$SC= \text{TZS } (4\,193\,600/= + 180\,000/= + 1\,320\,000/=)$$

$$= \text{TZS } 5\,693\,600/=$$

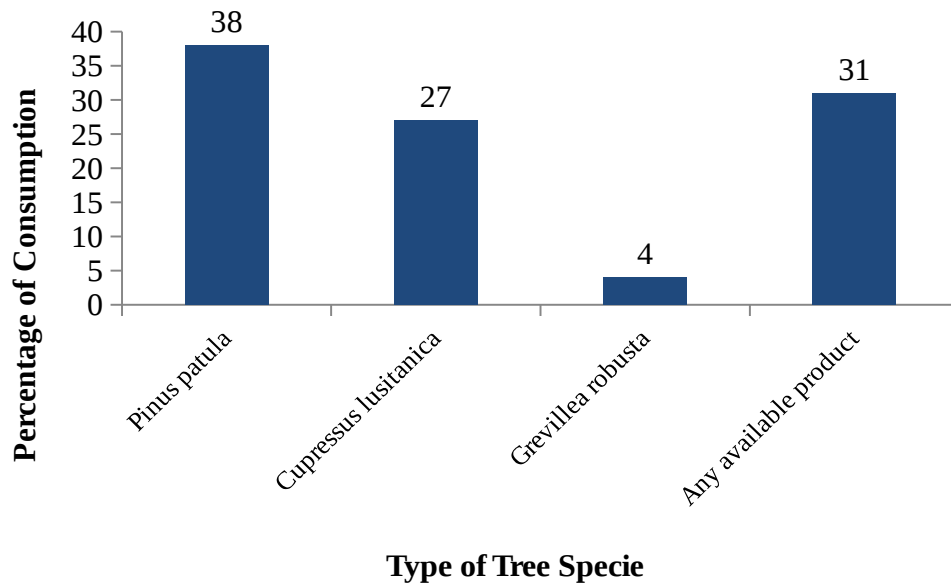
The Social Cost to the households and customers per year from the Training Forest's Management is TZS 5 693 600/=. This Social Cost shows the extent of social responsibility that the local communities have in maintaining the forest. Additionally, the

results also reveal the Forest management's accountability in promoting adequate conservation processes in the Forest resources.

#### **4.3 The identified socio-economic activities conducted by the customers**

Customers' involvement as stakeholders has a great significance in altering the forestry's informal sector, as an asset that ensures broader benefits environmentally, economically and socially. Stakeholders' inclusion in forestry has also prominence in decision-making processes and equitable distribution of costs and benefits in emphasizing improvement on the optimization of the forest resources (UNSPF, 2017).

The SUA Training Forest engages with customers in sale of various tree species including *Pines*, *Eucalyptus*, *Grevillea*, *Acacia*, *Casuarina*, and *Cypress lusitanica*. The consumption varies according to the customers' preference on type of the tree species. The species choice depends on value production, land expectation value (LEV) based on the highest rent, market value, site adaptability and resistant species to diseases. The bar chart in Fig. 7 illustrates the diversity of preference on the species according to various customers at the SUA Training Forest sales.



**Figure 7: Type of Tree Species as preferred by the customers**

#### **4.3.1 The financial revenue accrued to SUA Training Forest from sales to the customers**

The financial revenue accrued from Net Profits of various socio-economic activities conducted in the SUA Training Forest include sales of wood products, forest plots, forest soil, fines and penalties. The market of SUA Training wood products is expanding due to the demand of wood products caused by increased construction activities in Arusha region (Fig. 8). Species which are highly demanded are *Pinus patula* and *Cupressus lusitanica* and the less demanded species are *Eucalyptus* specie and *Grevillea robusta*.

The SUA Training Forest sawmills have been in high production of first grade timber, second grade timber, reject grade one timber, reject grade two timber, reject grade three timber, firewood billets, firewood slabs, slabs, poles, withies and saw dust. The Carpentry unit has advanced in value addition of the timber products. Value addition

has expanded and diversified production revealing the hidden-worth of the harvested wood and motivating the consumers' interests in purchasing the Training Forest's products. The products produced in the Carpentry unit inspiring consumers to purchase include stools, chairs and banana wine crates.

On the other hand, soil fertility is very high and most sites the soils are mainly of *olivine*, *alkaline basalts*, *phondites*, *trachytes*, *raphelinite* and *pyroclastic*. These soils are collected from the areas of the SUA Training Forest's Natural Forest which it is believed to have the highest fertility because of the aged decomposition of leaves on the soil's surface. The SUA Training Forest engages in sale of the forest soil per lorry for TZS 7500/=. The business of Forest soil is appealing due to the soils high potentials for supporting permanent crops. The potential customers for this business includes gardeners and flower industries.

Additionally, the Taungya system conducted since the 1970's to date is on highest demand of plot lease on every harvest season in the SUA Training Forest (SUA, 2017). The forest plots in the SUA Training Forest obtained from the clear-felled areas in which are distributed to the villagers to conduct Squatter farming on a charge of TZS 6000/= per plot to cultivate for about four years depending on the trees canopy closure. Therefore, the charge is a logical contribution for the acquired mutual benefits by both the SUA Training Forest Management and the Villagers.

Furthermore, forest protection by provision of fines and penalties by the Training Forest's management is an approach to enforce law against illegal activities in the Forest. The fines and penalties are imposed to the villagers who are found incriminating the forestry laws in the resources and are charged at the rate of TZS 300 000 to 1 000 000 (Forest Act No. 14 of 2002). Among the violations fined include theft of poles, illegal cutting of trees, causing forest fires and illegal grazing. Moreover, the management tries to handle and solve some conflicts at village level through negotiations with village leaders and when the agreement is not tabled, cases are forwarded to the court. The financial revenue accrued as shown in Table 7 represents the sales that last in the month of 30<sup>th</sup> June of the current year (2019) and that began from 1<sup>st</sup> July of the past year (2018) completing a circle of accounts of the full year.

**Table 7: Financial revenue from the SUA Training Forest Sales**

<b>S/No</b>	<b>Products on Sale</b>	<b>Gross profit accrued per year (2018/2019) (TZS)</b>
1	Wood products	651 338 670. 56
2	Forest plots	3 450 000. 00
3	Forest soil	3 039 000. 00
4	Fines and penalties	1 320 000. 00
	<b>Gross Profit</b>	<b>659 147 670. 56</b>

The VAT being 18% of Gross profit obtained which is TZS 118 646 580.70/=

Net Profit = Gross Profit – Expenses (TZS)..... (2)

= TZS 659 147 670. 56/= – TZS 118 646 580.70/=

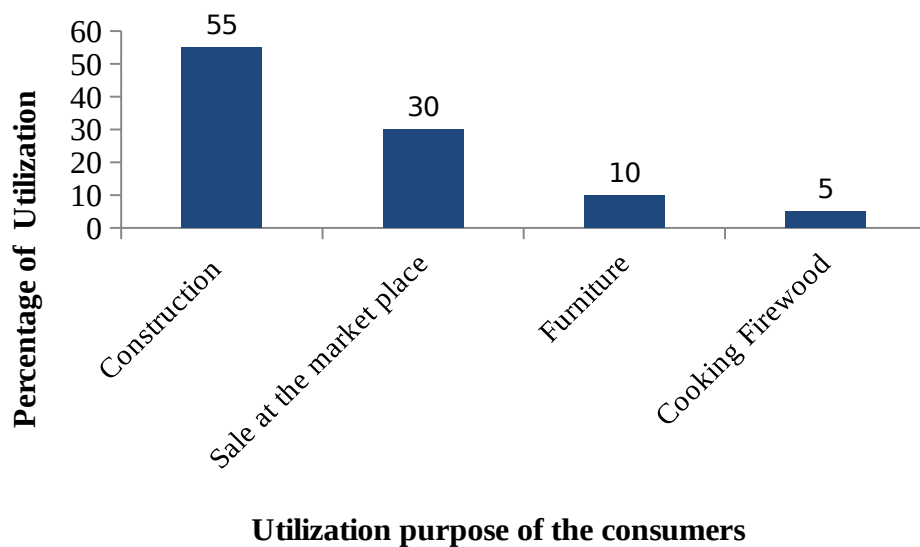
= TZS 540 501 089.90/=

Therefore, the Net profit of the Forest products per year (2018/2019) is TZS 540 501 089.90/=

#### **4.3.2 Factors influencing the contribution of the SUA training forest to the customers**

##### **4.3.2.1 Utilization purpose of the customers**

The utilization purpose of the customers is a motivation of consumption of the SUA Training Forests products due to the activity conducted by the customers. Customers for the SUA Training Forest have been divided into two groups; firstly, customers buying timber in large quantities and then supplying to other consumers. Secondly are customers buying sawmill products for their private use including construction purposes, furniture making and firewood for cooking and heating in homes as presented in Fig. 8.



**Figure 8: Different utilization purposes by customers at the SUA Training Forest**

However, for a number of years the SUA Training Forest has embraced a number of potential customers from industries and institutions such as Arusha Fiber board, A to Z Company, Arusha flower industry, Tanzania Prisons Service, Tanzania Peoples' Defense Force (TPDF), Banana Wine Breweries. These consumers purchased various products such as chip logs from the eucalyptus species, withies for making briquettes, timber and slabs, forest soil, sawdust for warming green houses, firewood and banana wine crates.



**Plate 3: Eucalyptus poles and Banana Wine Crates sold at the SUA Training Forest**



#### **4.3.2.2 Consumers' reasons of purchasing forest products from the SUA Training Forest**

The reason of purchasing the SUA Training Forest products according to the customers goes beyond the species choice. According to various respondents they, consider buying the wood products due to low purchasing price, good grading and assurance of product's good quality, appropriate length of the wood product for the customers' activities especially construction, fair range of choice on products to purchase and a safe and secure payment system that involves no corruption. Around, 52% of the respondents purchase the SUA Training Forest products due to the favorable price.

About, 31% of the customers also found it convenient to purchase products with good grading and assured quality. Approximately, 6% of the customers observed provision of a fair range of choice on products they desired to purchase, with appropriate length for the activities they conducted. The remaining, 11% appreciated a safe payment system which included direct bank payments and a good supervision with no risks of corruption involved.

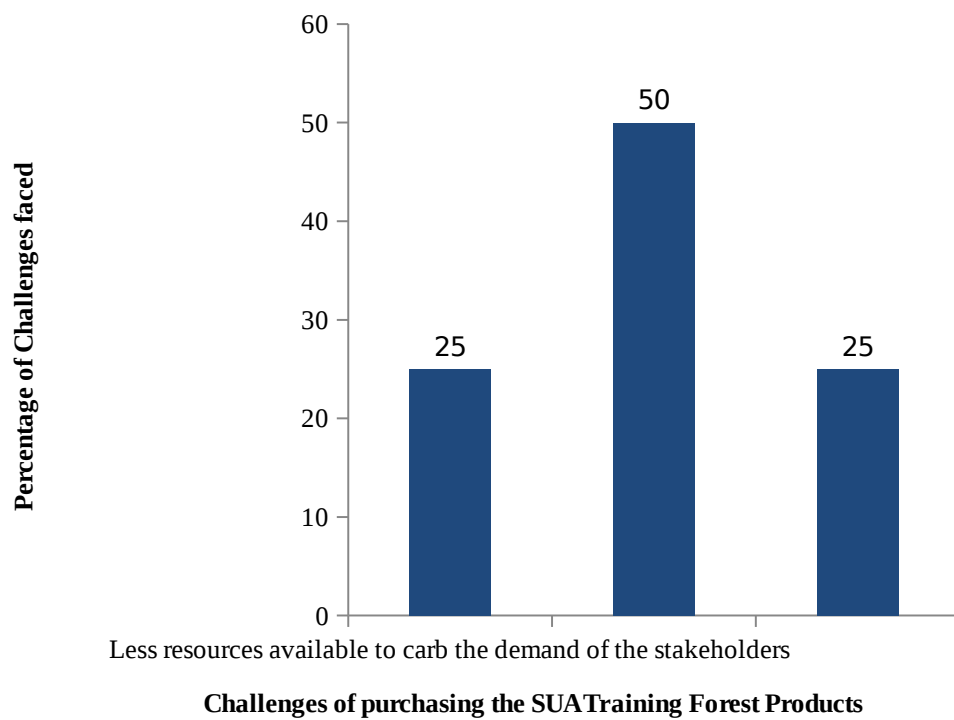


**Plate 4: Sale of Timber to the Customers at the SUA Training Forest**

#### **4.3.3 Challenges faced by customers purchasing the SUA Training Forests products**

Despite the advantages experienced while conducting business with the SUA Training Forest, Fig. 9 presents 50% of the respondents have observed challenges on obtaining the product of interest at the appropriate time due to low skills on the new upgraded payment system. About 25% of the respondents observed fewer resources available to meet the demand of the existing market.

The SUA Training Forest sale of wood forest products has its first priority set on feeding it's sawmill and therefore, the remaining amount shared among customers has failed to meet their current high demand caused by the increased construction activities in Arusha City. The remaining 25% of the respondents experienced unsatisfactory service due to a fewer number of workers present to serve the customers at the market area.



**Figure 9: Challenges that customer encounter while conducting business with the SUA Training Forest**

## **CHAPTER FIVE**

### **5.0 CONCLUSIONS AND RECOMMENDATIONS**

#### **5.1 Conclusions**

The paramount contribution of SUA Training Forest acknowledged from the conducted socioeconomic activities has sustained the livelihoods of the adjacent local communities and beyond. Several vital responses revealed the significance of the Forest resources annually on provision plots for crop cultivation, accessibility of fodder for livestock, gaining income from trade activities and food for subsistence to the villagers', fertile forest soil for gardening and cultivation purposes as well as wood of the finest quality for sale and private use.

The SUA Training Forest's earnings from the socio-economic activities conducted by the villagers have been greatly profitable from the trade activity, whereas livestock keeping had the highest overall gross profit per year due to the price (Net worth) of the livestock kept as a contingency asset by the villagers. Crop cultivation was the socio-economic activity with a very low average gross profit (less than USD 1.90) per unit area of a household in a year, but was still conducted for subsistence of the villagers. The reduced plot sizes due to increased population staggered the production expectations of the farmers. On the other hand sales of wood products from the Training Forest, contribute 98. 8% to the Overall Net Profit earned from sales of the forest products to customers.

Furthermore, household size, access to markets and fertilizer application had a positive influence at a 5 % significance level in promoting socio-economic development of the villagers from the utilized SUA Training Forests resources. Nevertheless, a negative influence at a 5 % significance level was identified from pesticide application and number of pasture loads collected per year from the Training Forest's resources lowering the expected progress from the interactions with the Forest. Similarly, increase of customers' construction activities and the Management's favorable price to customers has influenced over 50% of the forest products sales.

The Social Cost to the households and customers was a beacon of transparency in disclosing the social responsibility of the villagers and management's accountability in forest conservation. The charges, fines and penalties were the implements to enforce forest conservation.

## **5.2 Recommendations**

From the study conducted, the following recommendations can improve the extent of contribution the SUA Training Forest has to its beneficiaries;

- i. There is a need to deliberately conduct capacity building programs in the area due to the scarcity of the available resource, to capacitate community members with an in-depth understanding on how to utilize the available forest resources for their livelihood needs.
- ii. In forestry, distinguishing between rights to land versus forest is very complex; therefore raising awareness on principles and regulations guiding

distribution of plots to the community members should also be a priority. The process will help resolve plot distribution disparities among the community members caused by increased population resulting to a less available resource.

- iii. Diversification of income generating activities that include less of direct forest interactions should be a priority to the villagers. To help lower dependency on the forest products for subsistence. Therefore, generating new alternatives to gaining income will certainly help increase the forest's sustainability.
- iv. The SUA Training Forest should engage in diversifying the forest products by including the non-timber forest products with a broader range of stakeholders and customers including government and non-government organization without excluding local communities during planning for sustainable development of the Forest. This strategy will help diversify the demand of forest products and increase in the range of profit and production in the SUA Training Forest.
- v. The Training Forest's Management should consider adaptable means, with the aid of modalities, to supply the increasing customers' demands sustainably by managing the allowable cut.

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## APPENDICES

### Appendix 1: Household Questionnaire

#### Section A: Background Information

Questionnaire serial number [.....]      Name of Enumerator.....

A.1 District.....

A.2 Division.....

A.3 Ward.....

A.4 Street name.....

A.5 Date of interview.....

#### Section B: Household Characteristics

B.1 Gender of household head; 1= Male, 2= Female [            ]

B.2 Age of the respondent 1=18 yrs, 2=19-45 yrs, 3=46-59 yrs, 4>60 yrs [.....]

B.3 Marital Status; 1= Single, 2= Married, 3= Divorced, 4=Widowed [.....]

B.4 How many people are living in your household (household size)?

Men [.....], Women [.....], Children [.....]. Total [.....] (Note: *Children's age <18 yrs*)

B.5 What is your education level?

1=Not gone to school, 2= Primary, 3= Secondary, 4= University [.....]

B.6 What is your occupation?

1= Farmer, 2=Livestock keeper, 3=Trader (Wholesaler/ Retailer), 4= Any other  
[.....]

B.7 For how long have you been interacting with the SUA Training Forest? (Months/  
Years)

1=<12 months, 2= 1-2 years, 3=3-5 years, 4=6-10 years, 5=>10 years  
[.....]

### **Section C: Socio-economic activit(ies) along the SUA Training Forest**

C.1 Which activities are you conducting in the SUA Training Forest?

(1) Crop cultivation [....] (2) Livestock keeping [....] (3) Wood processing [....] (4)  
Beekeeping [....] (5) Charcoal production [....] (6) Firewood collection [.....](7)  
Others (specify) ...

C.2 For how long have you been conducting your activit(ies) at the SUA Training Forest?

(Months/Years) 1= <12 Months, 2= 1-2 year, 3= 3-5 years, 4= 6-10 years, 5= >10  
years [.....]

C.3 Since you started conducting your activities at the SUA Training Forest, have you ever been involved in any conservation activities/program organized by SUA Training Forest, the management or other customers? 1=Yes 2 = No [.....]

C.5 If the above answer is Yes, mention how you were involved? Eg. Training, Tree planting etc. i..... ii.....  
 ..... iii..... iv.....  
 v..... vi.....

C.6 Do you pay any fee or Tax from your activity? 1= Yes, 2= No [.....]

C.7 If Yes, do you pay per month or per year? .....

C.8 How much do you pay in TZS? .....

C.9 To which authority do you pay? .....

#### **Section D: Gross profit from Socio-economic activities**

D.1 Cost incurred during conducting the activit(ies) (Variable cost only)

S/No.	Activity	Material inputs per season/Month/year	Quantity (Kg,No.,Lts,m <sup>3</sup> )	Cost per Output (TZS.)	Total (TZS.)

	Total Variable Cost(TVC)				
--	--------------------------	--	--	--	--

D.2 Output/harvest/earning/Revenue (in terms of quantity and Cash) from Socio-economic activities per month or year?

S/No.	Activity	Output per season/Month/year	Quantity (Kg,No.,Lts,m <sup>3</sup> )	Cost per Output (TZS.)	Total (TZS.)
	Total Revenue (TR)				

Gross profit = TR- TVC =.....

D.3 What are your harvest/earnings for this year?

Cost (TZS.)	The year 2019
Total Revenue	
Total Variable Cost	
Gross Profit	

**Net profit from the sales revenue of the tree products**

D.3 Cost incurred during conducting the activit(ies) (Expenses only)

S/No.	Activity	Material inputs per season/Month/year	Quantity (Kg,No.,Lts,m <sup>3</sup> )	Cost per Output (TZS.)	Total (TZS.)
	Expenses				



	(Total)				
--	---------	--	--	--	--

D.4 Output/harvest/earning/Gross Profit (in terms of quantity and Cash) from sales revenue of the tree products per month or year

S/No.	Activity	Output per season/Month/year	Quantity (Kg,No.,L,m <sup>3</sup> )	Cost per Output (TZS.)	Total (TZS.)
	Gross Profit (GP)				

Net profit = GP- Expenses = .....

D.3 What are your harvest/earnings for this year?

Cost (TZS.)	The year 2019
Gross Profit	
Expenses (Total)	
Net Profit	

### Proxy Means Test Questionnaire

#### The Proxy Questions used to answer Section D.

1. Which are the months that you had losses from the activity you are conducting at the SUA Training Forest?
2. Which are the months that you got profit from the activity you are conducting at the SUA Training Forest?
3. The approximate cost obtained in the month you got profit?
4. The approximate cost obtained in the month you had losses?

5. The cost of goods traded in

Bags [.....], Sadolin [.....],

Others [.....]

6. Principle cost invested in the business in terms of

Items [.....], Labour [.....],

Others [.....]

7. What is the positive output experienced from engaging in the activit(ies) at the SUA

Training Forest in terms of;

i) The number of children you're educating [.....]

ii) Other business that arose from engaging with the SUA Training Forests

[.....]

8. What is the size of the area of operation in Acre? (if the activity depends directly on

land) (1) < 0.25 acre (2) 0.26- 0.5 acre (3) 0.6- 1 acre (4) 1.1-2 acre (5) >2.1 acre

[.....]

### **Section E. Factors influencing the local community to depend on SUA Training Forest for their socio-economic activities**

E.1 Have you ever conducted the socio-economic activities somewhere else before

coming to SUA Training Forest?

1=Yes

2= No

[.....]

E.2 If, Yes which activity did you conduct? .....

E.3 Which socio-economic activity did you conduct? .....

E.4 Which factors influenced you to conduct activities in the SUA Training Forest and not somewhere else?

- |          |           |
|----------|-----------|
| i.....   | ii.....   |
| iii..... | iv.....   |
| v.....   | vi.....   |
| vii..... | viii..... |
| .....    | x .....   |

E.4 To what extent has the SUA Training Forest contributed to the improvement of your livelihood income? [.....]

1= No improvement, 2= Low improvement, 3= Medium improvement, 4= High improvement.

E.5 What challenges do you encounter in your activities at SUA Training Forests?

- |          |         |
|----------|---------|
| i.....   | ii..... |
| iii..... | iv..... |
| v.....   | iv..... |

E.6 What are your general comments to SUA Training Forest management and other customers in conserving the forest in order to have sustainable utilization of forest resources?

- i.....

ii.....	
iii.....	

## **Appendix 2: Customers' Interview**

1. What type of product do you buy from SUA Training Forest?  
[.....]
2. If, it is a tree specie, which type of tree species from the SUA Training Forest is of high preference for your business? [.....]
3. How has engaging business with the SUA Training Forest products improved your livelihood every year? [.....]
4. Who are your potential customers of the SUA Training Forest products?  
[.....]
5. Why buy SUA Training Forest products? .....
6. What are the challenges you face in engaging in business with the SUA Training forest?  
.....

### Appendix 3: Key Informants' Interview

1. The SUA Training Forest plays a significant role in the economic growth of the local communities, which activities are being conducted in the SUA Training Forest?

- |          |         |
|----------|---------|
| i.....   | ii..... |
| iii..... | iv..... |
| v.....   | vi..... |

2. Are all activities conducted legally? 1= Yes, 2= No [.....]

3. If No, what is your strategy? .....

4. What do you think about the effect of those activities on SUA Training Forest? Are they destructive or not destructive? .....

5. Do you collect any revenue from the activities done in SUA Training in order to support conservation activities? 1= Yes, 2 = No [.....]

6. If No, what is your strategy? .....

7. Is the SUA Training Forest among the factors for economic growth in Arusha Municipal? 1= Yes, No ..... 2. How? .....

8. Do you involve the local community in conserving the SUA Training Forest? 1= Yes, 2=No [.....], If Yes, how? ..... and if No, Why? .....

9. Is population pressure a challenge to the resource? 1= Yes, 2=No [.....]

10. If Yes, what should be done to implement and improve the conservation initiative of SUA Training Forest? .....

11. What are other challenges that interactants encounter in interacting with the resource?

.....

12. What suggested solutions can you provide? .....

#### **Appendix 4: Focus Group Discussion Interviews**

1. The SUA Training Forest plays a significant role in the economic growth of the Arusha region. How does SUA Training Forest influence economic growth of Arusha region?

.....

2. For your opinion, do you think the utilization of SUA Training Forest resources is done sustainably? .....

3. How does the local community being involved in conserving the SUA Training Forest?

.....

4. Is population pressure a challenge to the resource? 1= Yes, 2=No [.....]

5. If Yes, what should be done to implement and improve the conservation initiative of SUA Training Forest? .....