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# þÿ C a r b o n t r a d i n g m e c h a n i s m i n þÿ a r e a s o f N o r t h W e s t e r n T a n z a case study of Kahama district

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# CARBON TRADING MECHANISM IN SEMI – ARID AREAS OF NORTH – WESTERN TANZANIA: A CASE STUDY OF KAHAMA DISTRICT

**By**

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**Dissertation Submitted in Partial Fulfilment of the Requirement for the Degree of Masters of Science in Natural Resources Management**

**The University of Dodoma**

**July, 2012**

## CERTIFICATION

The undersigned certifies that they have read and hereby recommend for acceptance by the University of Dodoma a dissertation entitled: “Carbon Trading Mechanism in Semi – Arid Areas of North – Western Tanzania: A Case Study of Kahama District” in partial fulfilment of the requirements for the Master degree of Science in Natural Resources Management of the University of Dodoma.

…….

Date…….

Dr. C. D.K. Rubanza

College of Natural Sciences, UDOM

## DECLARATION AND COPYRIGHT

I, Ngoma, Charles Emmanuel, declare that a dissertation entitled: “Carbon Trading Mechanism in Semi – Arid Areas of North – Western Tanzania: A Case Study of Kahama District” is my own original work and that it has not been presented and will not be presented to any other learning institution for a similar or any other degree award.

Signature……..

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## DEDICATION

This work is dedicated to my lovely wife, Elizabeth and our children Charles and Emyline Ngoma for their tolerance and moral support during the whole period of my academic endeavors.

## ABSTRACT

A study was undertaken aiming four villages of Kilago, Igung'hwa, Ngulu and Mhongolo of Kahama District, Shinyanga Region. The study objective was to determine carbon trading mechanism in semi-arid areas of north-western Tanzania using Kahama District as a case study. Specific objectives included 1) assessing community involvement in carbon trading mechanisms under REDD+ initiatives; 2) assessing the cost-benefit mechanisms towards adoption of REDD+; and 3) analysing important strengths, weaknesses, opportunities and threats (SWOT) towards implementation of REDD+ in community based forests.

Majority of respondents (84.0%) were aware of the REDD+ initiatives in forest conservation through *in-situ* conservation and agroforestry. About 60.0% of the overall sample respondents were not aware on carbon markets and marketing channels, because carbon trading is a new concept across the study villages. Also there was no respondent who had received any payment for selling carbon credits. The costs related to forest conservation under REDD+ initiatives were associated with buying, planting tree seedlings and security of the *ngitili*. REDD+ initiatives provide villagers with multiple benefits such as wood supply for domestic consumption and acting as a source of household income. The strengths of adoption of REDD+ initiatives in forest conservation across the study villages include existence of good village governance; forest protection by-laws, policies and regulation. The weaknesses of REDD+ initiatives in forest conservation across the study villages include drought resulting from unpredictable rainfall; low forest conservation education within the community; inadequate community awareness of the functioning of REDD+ initiatives and climate change.

The opportunities of adoption of REDD+ initiatives in forest conservation across the study include existing current political will by the government on implementation of REDD+ and the associated climate change mitigation measures; and high willingness among donors (CARE) to fund carbon trade across the study villages; REDD+ project initiatives; energy saving technology via TATEDO; beekeeping practice; existing extension services.

Threats of adoption of REDD+ initiatives in forest conservation across the study include wild animals like lion, hyena; land use conflicts; field/bush fires; pests and diseases; change in donor policies (reliance on donor fund) and reliance on external markets for carbon.

It is recommended that efficient alternative energy sources and efficient utilization of biomass such as improved stoves, improved charcoal kilns, and the use of solar power and biogas should be promoted to reduce pressure on forests.

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## LIST OF ABBREVIATIONS AND ACRONYMS

| | |
|---|---|
| **CBFM** | Community Based Forest Management |
| **CBOs** | Community Based Organizations |
| **CDM** | Clean Development Mechanisms |
| **$CH_4$** | Methane |
| **$CO_2$** | Carbon dioxide |
| **DASS** | Development Associate Ltd |
| **DD** | Deforestation and Forest Degradation |
| **GHGs** | Green House Gases |
| **ICC** | International Chamber of Commerce |
| **IMF** | International Monetary Fund |
| **IPCC** | International Programme on Climate Change |
| **MRV** | Monitoring, Reporting and Verification |
| **NAFRAC** | Natural Forest Resources Management and Agro-forestry Centre |
| **NGOs** | Non-Governmental Organizations |
| **PPM** | Parts Per Million |
| **REDD** | Reducing Emissions from Deforestation and Forest Degradation |
| **SPSS** | Statistical Packages for Social Sciences |
| **SWOT** | Strengths, Weaknesses, Opportunities and Threats |
| **TAFORI** | Tanzania Forestry Research Institute |
| **TATEDO** | Tanzania Traditional Energy Development Organization |
| **UNFCCC** | United Nations Framework Convention on Climate Change |
| **URT** | United Republic of Tanzania |
| **VCT** | Voluntary Carbon Trading |
| **VFRs** | Village Forest Reserves |

# CHAPTER ONE

# INTRODUCTION

## 1.1 Background Information

Over millions of years, the Earth has managed to regulate concentrations of greenhouse gases through a system of sources and sinks. Carbon, in the form of carbon dioxide ($CO_2$) and methane ($CH_4$) is emitted by volcanoes and by rotting vegetation and other organic matter. But $CO_2$ is sequestered, or absorbed, by trees, plankton, soils and water bodies. Indeed, scientists have become aware that increased concentrations of $CO_2$ stimulate the growth of many different types of plants, including trees – this is called the $CO_2$ fertilization effect. For example, a doubling of atmospheric $CO_2$ has been shown to stimulate leaf photosynthesis rate by up to 50 per cent depending on temperature (Oswald *et al*., 1994). Although some of this $CO_2$ will be released back into the atmosphere by increased respiration, hence more carbon should be sequestered. So, if a series of volcanic eruptions or burning of fossil fuels emitted excess $CO_2$, in time it would be partly 'mopped up' by the increased growth of forests, and partly dissolved in the oceans (Arrow, 2001).

According to IPCC (2007), the carbon dioxide concentrations have significantly increased from 290 parts per million (ppm) by volume to greater than 360 ppm in the atmosphere and pose a threat due to its impact on global warming and the associated climate change. This is due to increased utilization of fossil fuels and rapid growth of industries and the related increases emission of green house gases (GHGs) such as $CO_2$ and $CH_4$ especially in the developed countries although the recent trend show China as an emerging single emitter to replace the USA as single

countries while contribution of Developing Countries in the share of emitted GHGs cannot be under estimated (ICC, 2007). The other reasons for the global increase of carbon dioxide concentration are the anthropogenic activities that cause the clearing of forests (deforestation). Role played by the developing countries is mainly through the ever increasing high extent of deforestation and forest degradation. Forests act as sinks that absorb carbon dioxide at great extent. Clearing of vegetation for farm and settlement establishment has caused a massive increase of carbon dioxide gas in the atmosphere beyond the normal natural levels. Carbon dioxide and other green house gases emitted from deforestation in addition to $CO_2$ emitted from the use of fossil fuels are the major cause of global warming and thus the ever increasing high extent of climate change that we face today (Smith, 2001).

Efforts have been devised to alter the already increased global warming through cutting down industrial emissions in Developing Countries; adoption of Clean Development Mechanisms (CDM) by promoting afforestation/ reforestation measures and compensation of individuals according to credits in terms of offset carbon emissions as well from avoided deforestation (Toth, 2001). REDD+ is a global initiative to create a financial value for the carbon stored in forests to compensate governments and companies or owners of forests in developing countries not to cut their carbon-rich forests or to reduce their rate of deforestation and forest degradation as a market mechanism to avoid GHG emissions. REDD+ expands REDD to develop methods for carbon sequestration through conservation of forest (and wetlands, agricultural systems) carbon stocks, sustainable management of forests and enhancement of forest carbon stocks in developing countries (Reyes, 2009).

For the purpose of this strategy, REDD+ refers to reducing emissions from deforestation and forest degradation in developing countries; and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries (Angelsen, 2008). Reducing emissions from deforestation and forest degradation (REDD) initiatives in developing countries and the associated broad approaches through REDD+ initiatives and related approaches represent significant, cheap, and quick win-win potential approaches to reduce greenhouse gases emissions. REDD initiatives are significant because one-fifth of global GHG emissions comes from Deforestation and Degradation abbreviated as "DD". REDD is cheap because much of the DD is only marginally profitable, so reducing GHG emissions from forest are cheaper than most other mitigation measures. It is quick because large reduction in GHG emissions can be achieved with measures not dependent on technological innovations.

REDD is a win-win situation because the potentially large financial transfers and better governance can benefit the poor in developing countries, and provide other environmental gains on top of the climate change related gains. REDD has the potential to deliver large cuts in emissions at a low cost within a short time frame. In addition to enhancing reduced emissions, REDD has the potential to achieve significant co-benefits by alleviating poverty, improve natural resource governance, conserving biodiversity as well as provision of other environmental services (Angelsen, 2008).

REDD is based on simple appeal of rewarding individuals, communities, institutions and governments to engage in avoided deforestation measures and thus offset carbon. The important REDD stakeholders are rewarded against avoided emissions in terms of payments from carbon fund against conservation measures based on emission credits. The carbon credits are traded in two main markets, namely, the voluntary and complementary carbon markets. Since the idea of REDD is new, putting into practice is less certain. Emissions trading, works by setting a quantitative limit on the emissions produced by emitters (Goldemberg, 1996).

The problem of climate change is one where emitters of green house gases (GHGs) do not face the full cost of implications of their actions (IMF, 2008). There are costs associated by carbon emissions, for example, the costs of the fuel being used. However, other costs are not necessarily included in the price of goods or services. These other costs are called external costs (Ngeleja, 2008). They are "external" because they are costs that the emitter does not face. External costs may affect the welfare of others. In the case of climate change, GHG emissions affect the welfare of people living in the future, as well as affecting the natural environment (Toth, 2001). These external costs can be estimated and converted in a common (monetary) unit. The argument for doing this is that these external costs can then be added to the private costs that the emitter faces. In doing so, the emitter faces the full social costs of their actions (IMF, 2008).

## 1.2 Statement of the Problem and justification

Deforestation contributes about one-fifth of $CO_2$ global emissions necessitating for appropriate interventions. Avoiding deforestation has the potential to reverse emissions. Forest conservation through avoided deforestation and the associated REDD+ initiatives such as carbon trading represent important approaches on avoided emissions (Smith, 2001). However, less is known on appropriate carbon trading mechanisms as well as the entire carbon trade. Available information is limited to the different initiatives, for instance through CDM and other Kyoto Protocol initiatives (Shanta, 2009).

Under the Kyoto Protocol, there are three carbon credits exchange mechanisms - Joint implementation, Clean Development Mechanism (CDM) and International Emissions Trading (Smith, 2001). These mechanisms allow the developed countries or companies with high carbon footprint to acquire carbon credits, although all differ according to the clauses of buying and selling the carbon credits. These mechanisms aim at achieving carbon neutrality, which means there should be net zero carbon footprints. One carbon credit (or carbon 'offset') is a closely regulated certificate representing a reduction of one metric tone of carbon dioxide being released into the atmosphere. In dollar terms, carbon credits price per ton is about $15 to $40 (IMF, 2008).

The concept of carbon trading is still new in Tanzania. It is recently introduced in the study area as pilot project due to the fact that people have been traditionally involved in *in-situ* conservation. Therefore, lack of information on the appropriate prices of carbon credits, market channels and market stability leaves the buyers and

sellers in a dilemma about the timing and expectation of optimum price (Toth, 2001). This study dwelled in assessing the existence and types of carbon markets, market channels and prices of carbon credits in semi-arid areas of Kahama district.

## 1.3 Objectives of the study

### 1.3.1 General objective

To assess carbon trading mechanism in semi-arid areas of north-western Tanzania using Kahama district as a case study.

### 1.3.2 Specific objectives

i. To assess community involvement in carbon trading mechanisms under REDD+ initiatives in the study area,
ii. To assess the cost-benefit mechanisms towards adoption of REDD in the study area; and
iii. To analyze factors affecting implementation of REDD in community based forests in the study area.

## 1.4 Research questions

i. To what extent are the communities involved in carbon trading mechanisms under REDD+ initiatives?
ii. What are the costs and benefits related to conservation of carbon stock?
iii. What factors affecting implementation of REDD in community based forests?

## 1.5 Significance of the study

The study intended to reveal the rationale of carbon trading mechanisms in the developing countries with special emphasis to the Tanzanian scenario and semi-arid areas of Shinyanga region and Kahama district in particular. The study on the other hand, generated information on costs related to conservation for increased carbon stock versus benefits in terms of revenue for carbon credits, ecosystem benefits as well as biodiversity values and the associated strengths, weaknesses, opportunities and challenges towards adoption of REDD initiatives in Tanzania.

## 1.6 Limitations of the study

Findings in the current study could be limited by difficulty acquisition of data. On the other hand, most respondents including some experts were hardly convinced to provide information. Some respondents asked some money or other motivations like food before they give information. The latter could limit quality of provided responses.

# CHAPTER TWO

# LITERATURE REVIEW

## 2.1 Introduction

This chapter reviews different work on carbon trading mechanism in semi-arid areas of north-western Tanzania in Kahama district, at national level and the word at large. It provides detailed information on the concept of climate change and carbon offset for better understanding of the study. The chapter also reviews theories of climate change and carbon offset from different authors that support the study. In addition, it provides empirical evidences from other studies done on climate change and carbon offset in different countries

## 2.2 Climate change

Climate change can be defined as the difference between average weather conditions of a particular area at two separate times. The major determinants of weather are temperature, rainfall and wind systems. Climate change is the serious problem the world is facing today. The prediction of weather conditions is generally uncertain. Rainfall, temperature and wind are susceptible to change unexpectedly making the future lives of people unpredictable.

### 2.2.1 Causes of climate change

It has been demonstrated beyond reasonable doubt that the climate is changing due to man-made green house gases namely, carbon dioxide ($CO_2$) and methane ($CH_4$). We are already committed to future substantial change over the next 30 years and change is likely to accelerate over the rest of $21^{st}$ century (IPCC, 2010). There is strong evidence that the warming of the earth over the last half century has been

caused largely by human activity, such as the burning of fossil fuels and changes in the land use, including agriculture and deforestation (IPCC, 2001).

Carbon dioxide ($CO_2$) is undoubtedly, the most important greenhouse gas in the atmosphere. Changes in land use pattern, deforestation, land clearing and agriculture have all led to rise in emission of carbon dioxide. Methane ($CH_4$) is another important greenhouse gas in the atmosphere. It is released from animals such as dairy ruminants such as cattle, goats, and sheep (Tamra, 2007). Before the industrial revolution, the concentration of greenhouse gases (GHG) in the atmosphere remained relatively constant. Except for slow changes on geological time scales, the absorption and release of carbon was kept in balance. During that time, changes in biomass and soil organic carbon were the main sources of fluctuation in atmospheric levels of carbon. By clearing forests and burning fossil fuels more rapidly than the carbon can be sequestered, industrialization may have altered this equilibrium. Currently, human activity is directly or indirectly responsible for the release of six to seven billion metric tons of carbon annually, (Shanta, 2009). Since the industrial revolution, carbon dioxide concentrations in the atmosphere have increased from 290 parts per million (ppm) by volume to greater than 360 ppm (IPCC, 2010). It is expected that atmospheric carbon dioxide levels will continue to rise and may exceed 500 ppm by 2050 (IPCC, 2010).

### 2.2.2 Consequences of climate change

A growing concern is that increases in atmospheric carbon dioxide concentration may be generating changes, including increases in average global temperature and other climate change impacts. Although some of the effects of increased carbon

dioxide levels on the global climate are uncertain, most scientists agree that doubling atmospheric carbon dioxide concentrations may cause serious environmental consequences. Rising of global temperatures could raise sea levels, change precipitation patterns, and affect both weather and climate conditions (Lohmann, 2001).

### 2.3 Carbon offset mechanisms

In light of these potential impacts, strategies to help reverse these emissions trends are increasing in importance. Many states, nations, and international governments are taking steps to more effectively manage and slow the growth of their carbon emissions. For many of these governments, terrestrial sequestration is part of a portfolio of approaches to inventory and reduce greenhouse gas emissions. Their experience is demonstrating that establishing new forests can offer cost-effective management options for offsetting carbon emissions, particularly in the near future (Shanta, 2009). The latter has been translated through incorporation of afforestation/reforestation sub-component in REDD issues. Fossil fuels are consumed in large volumes for power generation, industrial processes, and transportation. As large emitters of carbon dioxide companies such as electric utilities understand they may need to reduce greenhouse gas emissions (GHG). Recognizing this outcome, many utilities are participating in GHG reduction programs. Because market-based emissions trading can offer a low-cost method for managing emissions, companies are beginning to link sequestration projects with the banking and trading of carbon credits (Tamra, 2007).

These carbon credits provide ownership or “rental” rights to the gaseous carbon sequestered in a forest. A company may then buy, sell, or apply the credits to offset its own emissions. Typically ownership rights pertain to the carbon sequestered in a tree–not the tree itself–but this should be clarified on a site-specific basis. Through this market-based approach, organizations can meet their own emission reduction requirements and excess credits can be sold to companies that find it more cost-effective to purchase credits than reduce their own emissions (Reyes, 2009).

### 2.3.1 Carbon offset in developing countries

Participation of developing countries in climate change mitigation is essential, most future growth in greenhouse gas emissions is set to take place in developing countries. For the world to have a chance of limiting the average global temperature rise to 2˚C, developing countries as a group need to deviate from business as usual emissions. Recent analysis indicates that this reduction in emissions will need to be in the order of 15-30% by 2020 (IPCC, 2010). The current international framework for emissions reductions provides for developing country participation through the Clean Development Mechanism (Shanta, 2009).

Deforestation in developing countries contributes around 17% of all the world’s greenhouse gases (IPCC, 2010). Participation of developing countries in climate change mitigation is essential, as most of the future growth in greenhouse gas emissions is set to take place in developing countries. Participation of developing countries in climate change mitigation is essential if we are to avoid the worst impacts of climate change in the future, (Lohmann, 2001).

About 78% of future growth in greenhouse gas emissions will be in developing countries, which is also where more than two thirds of low-cost abatement opportunities are located. Even if all developed countries reduced emissions to zero, the world would still not be able to achieve its 2˚C goal without developing country mitigation (IPCC, 2010). At the same time, the impacts of climate change will be greatest in developing countries. It is important that any international agreement on reducing emissions and adapting to climate change recognizes the principle of common but differentiated responsibilities and respective capabilities. Recent analysis indicates that by 2020, developed countries will need to reduce their emissions by 25-40% below 1990 levels and developing countries as a group to deviate between 15-30% below business as usual emissions, (IPCC, 2010). Climate change is one of the biggest problem posing challenges to sustainable livelihoods and economic development, particularly for Least Developed Countries like Tanzania. There are a number of global and national efforts to address the problem of climate change through adaptation and mitigation activities (Reyes, 2009).

### 2.3.2 Carbon offset in Tanzania

Deforestation in Tanzania is one of the most widespread in Africa, only surpassed by Sudan and Zambia. This makes a significant contribution to global greenhouse gases and is estimated to represent 100 millions tones of $CO_2$ emissions a year. Between 1990 and 2005, Tanzania lost 14.9% - or just over 6 million hectares - of forest cover through deforestation (Otsyina et al., 2008). The Tanzanian government has responded with numerous policies to stem further degradation; however with limited public funds these policies lack the financial incentives to be widely effective. Therefore, many projects related to carbon offset have been initiated. For example,

afforestation and reforestation project in the Southern highlands of Tanzania, this project establishes commercial forests across the Uchindile and Mapanda districts. Four varieties of trees were planted – two each of eucalyptus and pine - covering 7,252 hectares at Uchindile and 3,562 hectares at Mapanda. These trees play significant role in carbon sequestration (Otsyina et al., 2008).

Another example is the HASHI (Hifadhi Ardhi Shinyanga) project which was launched since 1986 with the goal to address the severe land degradation problems in Shinyanga Region as an initiative of the government of Tanzanian and was funded by Norwegian Aid Assistance Agency (NORAD). The Agroforestry research and development component of the project was implemented by ICRAF (World Agroforestry Centre). The project used various participatory techniques to create awareness among the Shinyanga communities on the importance of conserving the existing forests and planting new trees in Agroforestry systems (Otsyina et al., 2008). Therefore, the efforts to offset carbon in Tanzanian started even before REDD+ initiatives. This is just to mention a few.

### 2.4 Adoption of REDD+ as means of carbon offsetting

Reducing emissions from deforestation and forest degradation in developing countries (REDD) has moved to centre stage in the international climate debate over the past three years. United Nations Framework Convention on Climate Change (UNFCCC) documents refer to REDD as a broad set of approaches and actions that will reduce emissions from deforestation and forest degradation (Angelsen, 2008). It is commonly seen as a significant, cheap, quick and win-win way to reduce greenhouse gas (GHG) emissions. Most observers agree that REDD+ is a key

mechanism in global efforts to limit climate change.

### 2.4.1 Adoption of REDD in Africa

The United Nations Collaborative Programme on Reducing Emissions from Deforestation and Forest Degradation in Developing Countries (UN-REDD Programme) was created in September 2008 to assist developing countries to build capacity to reduce emissions and to participate in a future REDD+ mechanism (Angelsen, 2008).

In Africa and other pilot study countries, the UN-REDD Programme is supporting governments to prepare national REDD+ strategies, build monitoring systems, engage stakeholders and assess multiple benefits. Building on the lessons learned and feedback from countries and other partners, the Programme has increased its funding base and the number of participating countries. The Programme is responsive to country needs, and is prepared to support the transformation in the forest sector and other sectors that impact land use in developing country economies needed to achieve readiness for REDD+. The Programme is also responsive to the REDD+ decision at the UNFCCC COP16 on policy approaches and positive incentives on issues relating to REDD+ and stands ready to support, upon demand by countries, the implementation of the COP16 agreement on REDD+ (Arrow, 2001). The overall impression was that there are great environmental and socio-economic opportunities for REDD+ in Africa and for a low-carbon development path, based on the climate change challenge. Additionally, participants recognized that REDD+ project developers face the same CDM-related problems. The existing knowledge and amount of active organizations has grown exponentially.

### 2.4.2 Adoption of REDD+ in developing countries

The United Nations Convention on Climate Change of which Tanzania is a party, recognizes various mitigation and adaptation options, including pro-REDD+ forestry related activities which include biodiversity conservation and carbon sequestration. "REDD+" goes beyond deforestation and forest degradation, it includes the role of conservation, sustainable management of forests and enhancement of forest carbon stocks. The adoption and implementation of REDD+ related activities, therefore, provides an exceptional opportunity for developing countries to benefit from fund based compensation arrangements that take cognizance of the increasing importance of sustainable forest management in reducing emissions and storage of carbon dioxide to mitigate climate change and its impacts, (IPCC, 2010). These efforts are being translated at national levels among many developing countries including Tanzania.

### 2.4.3 Adoption of REDD+ in Tanzania

The National REDD+ Strategy in Tanzania has been developed based on the National Framework for REDD developed in 2009 (IPCC, 2010). The framework is based on the objectives of reducing emissions related to deforestation and forest degradation as well as reducing poverty of forest dependent communities. The REDD+ Strategy is closely linked to the current national growth and development strategies such as the National Growth and Poverty Reduction Strategy Programme (MKUKUTA), the National Forest Programme (URT, 2006) and other strategies that contribute to effective conservation and utilization of Tanzania's natural and renewable resources and improving the livelihoods of its people.

In order for the country's forestry sector to benefit from REDD+ crediting it has to have overall strategies that will aim at reducing all or some of the carbon dioxide emissions. If all the deforestation and degradation were to be stemmed completely, and forests biomass allowed to grow at 1.25 tons/ha/year, the country could potentially earn $630 million, assuming the selling price of carbon is $ 5 per tone of carbon dioxide (IPCC, 2010). It is against this huge potential for REDD+ business that the government of Tanzania considers the REDD+ policy a viable option for meeting the country's obligations to manage her forests and woodlands on a sustainable basis and, at the same time, respond to poverty reduction initiatives, (Tamra, 2007).

### 2.5 Challenges of adoption of REDD and REDD+

There are a lot of challenges facing implementation of REDD and REDD+ activities in developed countries, Africa, developing countries such as Tanzania as well as regions within developing countries such as Shinyanga in north-western Tanzania. The followings are just some of the challenges facing REDD and REDD+ activities implementation. For example, one of the challenges is the inability of REDD+ to address "leakage". There exists no science for predicting the carbon emissions that occur when deforestation is stopped in one area but increases elsewhere as a result (known as "leakage" in the climate jargon), since the underlying drivers of deforestation are not being addressed. And because project developers rely on concession history, regional deforestation rates, and other crude market-based indicators to calculate carbon futures, we can never really know if forests were in fact "protected" above and beyond "what would have happened otherwise". In this context, REDD+ is bad for the climate and to the people as well (Shanta, 2009).

Another challenge is that, REDD+ accelerates logging and creates perverse incentives. REDD+ accelerates logging insofar as countries that increase deforestation now will be in a better position to earn revenue if REDD+ comes into effect. The President of Guyana, for example, has argued that the country should "proceed full-steam ahead with exploitation of forestry resources" in order to reap the benefits of "avoided threatened deforestation" (Shanta, 2009). Further more REDD+ and REDD+ fail to stop forest destroyers and the drivers of deforestation. REDD+ does not regard industrial tree and agriculture plantation interests, loggers, fossil fuel companies, the paper industry, dam builders, etc. as a problem and has no provisions for challenging them. Such actors are likely to use REDD+ to obtain control over natural old growth forests and proceed to cut them down for industry. This includes mining, oil and gas interests, as well as companies promoting monoculture including tree plantations and export crops.

Also REDD and REDD+ will increase monoculture tree plantations. The UN definition of forests includes plantations. Not only is the UN definition of forests so vague that it does not differentiate between a bio-diverse forest ecosystem and monoculture plantations of oil palm, pine, eucalyptus and soy; it also fails to make a distinction between forests and felled or "temporarily un-stocked" areas and plantations of genetically-engineered (GE) trees. Under this fundamentally flawed definition, national and corporate elites can replace forests with monoculture plantations, leading to environmental and social disasters and ignoring local communities' needs including food, medicines, traditions, shelter and even forest-dependent water supplies (Arrow, 2001).

On the other hand, REDD+ restricts access to forests for livelihoods and cultural practices. Indigenous and forest-dwelling Peoples around the world depend on their forests and territories for their livelihoods, spiritual and cultural practices, but few of the world's forests are legally owned by forest-dependent and Indigenous communities. REDD+ does not open up negotiating space for communities but rather creates another barrier. In order to protect investments, some project developers have prohibited communities from using their forests by new REDD+-friendly laws, fences and even armed guards (Reyes, 2009).

### 2.6 Carbon pricing and trading mechanisms

Carbon pricing is an administrative approach imposing a cost on the emission of greenhouse gases which cause global warming. Paying a price for carbon spewed into our atmosphere is a way of motivating countries, businesses and individuals to reduce carbon emissions. It also provides an incentive to invest and deploy renewable energy technology that does not emit carbon to our atmosphere. Such a pricing mechanism would also act as a disincentive for electricity generators to use relatively more polluting coal, gas and oil fired stations (Schmidt, 2009).

Establishing a carbon price is one of the most powerful mechanisms available to reduce national greenhouse gas emissions. Similarly a global bench mark is an urgent challenge for international collective action. A global approach can in theory, be created through internationally harmonized taxation or intergovernmental emissions trading, but neither is straightforward in practice. Simply because it is difficult, does not mean we should shy away from it (Zahabu, 2008). Carbon price is needed to stabilize global greenhouse gas concentrations at levels that limit the risk

of severe future climate change damage. Annual global emissions will need to be reduced substantially in the coming decades. So paying a price for carbon emissions will slow the output (Ngeleja, 2008).

Australia, for instance, is one of the world's largest polluters per capita due to its heavy use of coal-fired power, which accounts for some 75% of electricity output. The plan to price carbon comes less than two years after a global push to tackle climate change stalled in Copenhagen. Unveiling details of the carbon policy, the government said it would set a price of 23 Australian dollars ($24.74) per carbon ton emitted by the country's 500 biggest polluters starting in mid-2012, and then raise the price 2.5% a year until 2015 (Schmidt, 2009). From then, the price would float, though the government would set a floor and ceiling and control the quantity of permits released annually. Emitters would then be able to buy permits from international carbon markets (Schmidt, 2009).

Carbon trading involves the sale of avoided emission in terms of carbon credits. The trade is a market-based mechanism for mitigating the increase of $CO_2$ in the atmosphere. There are two main types of Carbon Trading Schemes that are operating globally to this time. These are Voluntary Carbon Trading (VCT), which is not operated under the Kyoto Protocol where developing countries would, aim to reduce the rate at which their forests are being lost, and receive compensation in proportion to carbon emissions saved compared to a baseline which would represent the ‘without intervention’ case or some other agreed target and the official Kyoto Protocol Carbon Trading Mechanisms (Naeem *et al.*, 2005).

The VCT involves companies offsetting GHG emissions from their activities and

products on a voluntary basis as part of their corporate responsibility. The conditions to participate in the VCT are relatively less stiff, and have no international legal binding requirements. The official forest carbon trading is possible through the CDM of the Kyoto Protocol of the UNFCCC. Under the Kyoto Protocol, developed countries are required to reduce their emissions of GHG by 5% of their 1990 levels by the years 2008 – 2012. These countries can meet their reduction targets for $CO_2$ emissions through improved energy efficiency, by substituting fuels that produce less $CO_2$, and by using renewable energy sources. By undertaking project activities, developed countries can also generate carbon credits which can then be used to offset their reduction commitments (Naeem e*t al*., 2005).

The lack of information on the appropriate prices and market channels including future prospects in carbon trading mechanism and related arrangements makes the buyers and sellers of carbon unsure about timing and expectation of optimum price (Toth, 2001). Therefore, this study is essential as it sought to explain the rationale of carbon trading mechanisms in developing countries, specifically the semi-arid areas of Tanzania in Shinyanga region. Also the study intended to generate important data related to costs of conservation for increased carbon stock versus benefits in terms of revenue for carbon credits and challenges towards adoption of REDD initiatives in Tanzania and the associated carbon trading mechanisms.

# CHAPTER THREE

# RESEARCH METHODOLOGY

## 3.1 Introduction

This chapter provides detailed explanation on methods and materials which were used to collect, analyze and present data. It describes the study area, study population, study design, sample size, sampling techniques and data collection methods. The chapter also explains on how chronologically data analysis was carried out.

## 3.2 Study area

The study was conducted in Kahama district. Two wards, namely Sunaga and Kilago were selected. From Sunaga ward, Igung'hwa and Ngulu villages were selected while from Kilago ward, Kilago and Mhongolo villages were selected for inclusion in the study.

### 3.2 1 Location

Shinyanga region is located south of Lake Victoria at 20 to 160 km from the shorelines forming part of what used to be known as the Sukuma land. The region lies between 2° and 3° Southern latitude and between 31° and 35° Eastern longitude. Shinyanga region is part of the Lake Zone in the Western part of Tanzania. In the eastern part, the region borders Singida, Manyara and Arusha region, to the south Tabora region, to the west Kigoma region. To the northwest is Kagera region and in the north the region borders Mwanza region. On the eastern boundary there is the Serengeti National Park. The western and southern parts follow sand river courses and lakes.

### 3.2.2 Topography

The topography of Shinyanga region is characterized by flat, gently undulating plains covered with low sparse vegetation. The North-Western and North-Eastern parts of the region are covered by natural forests which are mainly miombo woodland. The Eastern part of the region is dominated by heavy black clay soils with areas of red loam and sandy soil.

### 3.2.3 Climate

Kahama district has a tropical type of climate with clearly distinguished rainy and dry seasons. According to meteorological statistics the average temperature for the region is about 28 C. The district experience rainfall of 600mm as minimum and 900 mm as maximum per year. The district has two seasons a year, the rainy season and dry season. The rainy season usually starts between mid- October and December and ends in the second week of May. Normally it has two peak seasons, That is, between mid- October and December, and the longer season that fall between February and mid-May. As such, the whole rainy season covers a total of almost six months, with a dry spell which usually occurs in January. The dry season begins in mid-May and ends in mid-October. This is a period of about five months. The dry season is the worst period for the Kahama district. The soils are hard to cultivate, pastures become very poor, and availability of water for domestic use and livestock become acute. The amount and distribution pattern of rainfall in the region is generally unequal and unpredictable. This implies that rainfall as a source of water for domestic and production purposes in the region is less reliable for sustainable water supply.

### 3.2.4 Vegetation

The North- Western and North- Eastern parts of the region are covered by natural forests which are mainly miombo woodland. Dominant vegetation species include Acacia – Dicrostachys woodland in the east and central parts; Brachystegia combretum woodland in the west especially Kahama and Bukombe district.

### 3.2.5 Demography

Based on the 2002 National Population and Housing Census, Kahama district had a population of 2,805,580 of which 1,369,581 were male and 1,435,999 females.

### 3.2.6 Economic activities

The main economic activities carried out in the area are livestock keeping and crop farming. Livestock include cattle, goats, sheep and pigs. Crops include food and cash crops. Subsistence crops include maize, sorghum, millet, groundnuts, sweet potatoes and legumes. The major cash crops are cotton, rice, and green gram though rice is also used as food crop.

## 3.3 Methodology

### 3.3.1 Study design

A socio-economic survey design was employed during data collection. This assisted in assessing the prevailing socio-economic conditions in the study area. This included provision of a baseline study and characterizing the existing state of the study site. This assisted in identifying the main areas of concern according to Muddock *et al.*, (1986).

### 3.3.2 Sampling frame

The sampling frame consisted of District, Divisions, wards and villages of Shinyanga Region. Two villages from two wards of Kahama District were used to draw the sample for the study. Respondents were also drawn from Shinyanga Regional Natural Resources Office, District Natural Resources Office; Government agencies such as NAFRAC (Natural Forest Resources Management and Agro-forestry Centre), TAFORI (Tanzania Forestry Research institute); NGOs dealing with REDD issues such as TATEDO (Tanzania Traditional Energy Development Organization), DASS (Development Associate Ltd), NGO's, CBOs working in the region and REDD database (Mikkelsen, 1995).

### 3.3.3 Sampling units

The sample units of the study were the villages within the selected wards and households of Kahama district. Non-probability sampling method was used to identify the households. This was due to the fact that not all villages had village forest reserves (VFRs) or locality known as *Ngitili*. *Ngitili* means enclosure. Enclosures of acacia-miombo woodlands that provided the Sukuma with dry season fodder for their cattle as well as firewood and other essential products. Household heads were picked from the updated village register book where all members of the village and households are listed (Deaton, 1998). Households are defined as a group of people living together and identifying the authority of one person of the household head, who is the decision maker for the household (Katani, 1999).

### 3.3.4 Sample size

A total of four villages were selected purposively among the villages found in Kahama district. The households from villages were picked randomly to avoid or reduce biasness. A sample size of 50 respondents was established for this study. This sample size was preferred due to the fact that the population engaging in *ngitili* conservation was relatively small.

### 3.3.5 Sampling techniques

Both primary and secondary data on socio-demographic variables, economic activities, current forest status and management, costs related to carbon stocking, revenues related to carbon trading, types of carbon markets and price of one tone of carbon were collected from the study area.

#### 3.3.5.1 Primary data

Primary data on current forest status and management, aspects related to carbon sequestration potential of the forests and carbon trading mechanism, costs related to carbon stocking, revenues related to carbon trading, types of carbon market and price of one tone of carbon were obtained using socio-economic questionnaires, key informants interviews, panel discussion among potential stakeholders, and by using survey coupled with participatory rapid appraisal through resource assessment.

##### 3.3.5.1.1 Questionnaire survey

The socio-economic survey was employed using both open-ended and close-ended questions. The questionnaires were administered among households drawn randomly from the village register. The information solicited included socio-demographic

variables (education, gender, age, household size and ethnic group); Economic activities such as current forest status and management, the costs related to carbon stocking, revenues related to carbon trading, types of carbon markets, price of one tone of carbon and prediction of cost benefit sharing mechanism on aspects related to REDD+ activities (Mikkelsen, 1995).

#### 3.3.5.1.2 Focus group discussion

Focus group discussion aims at providing insights on attitudes and opinions on carbon trading mechanisms and related aspects such as opportunity costs of investing in carbon sequestration issues and benefits; important strength, weaknesses, opportunities and threats-towards adopting REDD+ initiatives in community based forests. This provided access to a larger body of knowledge of general community information as detailed by Mikkelsen, (1995).

#### 3.3.5.1.3 Key informants interviews

Various key informants were frequently consulted for specific knowledge on, carbon monitoring and evaluation and carbon trading. Relevant official documents were accessed and used as a source of data. The key informants included village executive officers, district forest officers and natural resource managers as detailed by Mikkelsen, (1995).

### 3.3.5.2 Secondary data

Secondary data on carbon stock, carbon markets, carbon price and revenues related to carbon trading were obtained from village executive officers, district forest officers, district natural resource managers, Ministry of Natural Resource and

Tourism, Regional Natural Resources Office, District Natural Resources Office, National REDD Task Force, Government agencies such as NAFRAC, TAFORI, TATEDO, DASS and other NGOs, CBOs, working in the region and REDD database.

### 3.4 Data Analysis

#### 3.4.1 Quantitative data

Primary and secondary data were collected from socio-economic survey and focus group session schedule were analysed using statistical package for social science (SPSS 16). Statistical relationships were developed to establish the relationships between independent and dependent variables such as forests conservation for enhanced carbon sequestration versus benefits due to forest conservation activities. Results were presented as means, frequencies, standard deviations and percentages.

#### 3.4.2 Qualitative data

Content analysis was used to analyze in-depth components of verbal discussion obtained objectively and in systematic manner from selected respondents. This assisted the researcher to identify values and attitudes of the respondents as described by Kajembe *et al*., (2011).

# CHAPTER FOUR

# RESULTS, PRESENTATION OF FINDINGS AND DISCUSSION

## 4.1 Introduction

This chapter presents the findings of the study based on the responses provided by respondents. The analysis and discussion of the findings of this study was guided by three research questions developed by the researcher. The study attempted to make a thorough investigation on carbon payment mechanisms, cost and benefit mechanisms towards adoption of REDD as well as strengths, weaknesses, opportunities and threats in the study area relying on the research questions set for the findings. The findings assisted the researcher to reach a valid conclusion and suggest sound recommendations.

## 4.2 Results

### 4.2.1 Social demographic characteristics

The study was conducted in a manner that both men and women with different age and education background as shown in Table 1 were considered by the researcher. These had a bearing on the nature and quality of information received.

**Table 1: Characteristics of Respondents**

| *Characteristic* | *Village* | | | | | | | | *Total* | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Kilago | | Igung'hwa | | Ngulu | | Mhongolo | | | |
| | N | % | N | % | N | % | N | % | N | % |
| **Gender of respondents** | | | | | | | | | | |
| Male | 9 | 18.0 | 11 | 22.0 | 13 | 26.0 | 2 | 4.0 | 35 | 70.0 |
| Female | 5 | 10.0 | 3 | 6.0 | 1 | 2.0 | 6 | 12.0 | 15 | 30.0 |
| **Total** | **14** | **28.0** | **14** | **28.0** | **14** | **28.0** | **8** | **16.0** | **50** | **100.0** |
| **Education levels of respondents** | | | | | | | | | | |
| Informal education | 1 | 2.0 | 2 | 4.0 | 4 | 8.0 | 2 | 4.0 | 9 | 18.0 |
| Primary education | 13 | 26.0 | 11 | 22.0 | 9 | 18.0 | 6 | 12.0 | 39 | 78.0 |
| Secondary education | Nil | Nil | 1 | 2.0 | 1 | 2.0 | Nil | Nil | 2 | 4.0 |
| **Total** | **14** | **28.0** | **14** | **28.0** | **14** | **28.0** | **8** | **16.0** | **50** | **100.0** |
| **Age of respondent** | | | | | | | | | | |
| 18 – 25 Years | Nil | Nil | Nil | Nil | Nil | Nil | 1 | 2.0 | 1 | 2.0 |
| 26 – 30 Years | Nil | Nil | 2 | 4.0 | 1 | 2.0 | Nil | Nil | 3 | 6.0 |
| 31 – 40 Years | 2 | 4.0 | 6 | 12.0 | 2 | 4.0 | 4 | 8.0 | 14 | 28.0 |
| 41 – 50 Years | 3 | 6.0 | 2 | 4.0 | 4 | 8.0 | 3 | 6.0 | 12 | 24.0 |
| 51 – 60 Years | 4 | 8.0 | 1 | 2.0 | 3 | 6.0 | Nil | Nil | 8 | 16.0 |
| Above 60 Years | 5 | 10.0 | 3 | 6.0 | 4 | 8.0 | Nil | Nil | 12 | 24.0 |
| **Total** | **14** | **28.0** | **14** | **28.0** | **14** | **28.0** | **8** | **16.0** | **50** | **100.0** |

**Source:** Field data, 2011.

### 4.2.1.1 Gender of the respondents

The statistics in Table 1 show that the proportion of male respondents was slightly greater (70.0%) than female respondents (30.0%).

### 4.2.1.2 Age of the respondents

Proportion-wise, most of the overall respondents (28.0%) were in the age group of 31-40 years. The statistics in Table 1 indicates that the age distribution of the respondents across the villages was positively skewed as the majority (more than 92.0%) have 31 years and above.

#### 4.2.1.3 Education Status of the Respondents

Education level of an individual is important as it signifies the ability of the respondent to analyze issues related to different life aspects. Respondents were asked to mention their levels of education and their responses are as summarized in Table 1. The overall results indicate that most of the sample respondents (78.0%) had attained at least primary education.

### 4.2.2 Community involvement in carbon trading mechanisms under REDD+ initiatives

The study found that CBFM halts deforestation and forest degradation while also sequestering carbon and conserving biodiversity, protecting watershed, and conserving soil and water.

#### 4.2.2.1 Community awareness about REDD+ initiatives

The analysis of community awareness about REDD+ initiatives across the study villages was done. The statistics in Table 2 shows that about 84.0% of the overall sample respondents are aware of the REDD+ initiatives in forest conservation through *in-situ* vegetation conservation locally known as *"Ngitili"* and through adoption of sound agro-forestry techniques across the study villages. However, out of 42 respondents with knowledge of the REDD+ initiatives, about 88.1% had acquired such knowledge since 2010 to date.

**Table 2: Awareness on REDD+ initiatives (N=50)**

| *Variable* | *Village* | | | | | | | | *Total* | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Kilago | | Igung'hwa | | Ngulu | | Mhongolo | | | |
| | N | % | N | % | N | % | N | % | N | % |
| **Awareness about REDD+ initiatives by the respondent** | | | | | | | | | | |
| Yes | 13 | 26.0 | 11 | 22.0 | 14 | 28.0 | 4 | 8.0 | 42 | 84.0 |
| No | 1 | 2.0 | 3 | 6.0 | Nil | Nil | 4 | 8.0 | 8 | 16.0 |
| **Total** | **14** | **28.0** | **14** | **28.0** | **14** | **28.0** | **8** | **16.0** | **50** | **100.0** |
| **From which year (since when)** | | | | | | | | | | |
| 2008 – 2010 | 1 | 2.4 | 2 | 4.8 | 1 | 2.4 | 1 | 2.4 | 5 | 11.9 |
| 2010 - to date | 12 | 28.6 | 9 | 21.4 | 13 | 31.0 | 3 | 7.1 | 37 | 88.1 |
| **Total** | **13** | **31.0** | **11** | **26.2** | **14** | **33.3** | **4** | **9.5** | **42** | **100.0** |

**Source:** Field data, 2011

### 4.2.2.2 Community involvement in REDD+ initiatives in carbon trading

Table 3 shows that about 72% of the overall sample of respondents in the study area involved in *in-situ* vegetation conservation through promotion of natural regeneration (*Ngitili*) environmental conservation measures. The statistics in Table 3 also show that about 66.7% of the overall sample respondents involve in in-situ vegetation conservation since 2000s up to date.

**Table 3: Responses on *in-situ* vegetation (*Ngitili*) conservation measures**

| *Variable* | *Village* | | | | | | | | *Total* | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Kilago | | Igung'hwa | | Ngulu | | Mhongolo | | | |
| | N | % | N | % | N | % | N | % | N | % |
| **Involvement of respondent in in-situ vegetation conservation** | | | | | | | | | | |
| Yes | 7 | 14.0 | 8 | 16.0 | 14 | 28.0 | 7 | 14.0 | 36 | 72.0 |
| No | 7 | 14.0 | 6 | 12.0 | Nil | Nil | 1 | 2.0 | 14 | 28.0 |
| **Total** | **14** | **28.0** | **14** | **28.0** | **14** | **28.0** | **8** | **16.0** | **50** | **100.0** |
| **If yes, in which year (since when)** | | | | | | | | | | |
| 1980s - 1990s | Nil | Nil | Nil | Nil | 2 | 5.6 | 1 | 2.8 | 3 | 8.3 |
| 1990s - 2000s | 2 | 5.6 | 2 | 5.6 | 3 | 8.3 | 2 | 5.6 | 9 | 25.0 |
| 2000s – to date | 5 | 13.9 | 6 | 16.7 | 9 | 25.0 | 4 | 11.1 | 24 | 66.7 |
| **Total** | **7** | **19.4** | **8** | **22.2** | **14** | **38.9** | **7** | **19.4** | **36** | **100.0** |

**Source:** Field data, 2011

It was found that about 68.0% of the overall sample respondents own *Ngitili*. Majority (73.5%) of the overall sample respondents in the study villages own less than 20 Hectares of *Ngitili*. The active involvement of the community in *Ngitili* conservation is clearly depicted in Plate 1.

**Plate 1: Community involvement in in-situ vegetation conservation**

**Source:** TATEDO, 2011

The study revealed that the communities across the villages are not only involved in *Ngitili* conservation but also agroforestry. Majority (76.0%) of the overall sample respondents are involved in agroforestry since 2000s to date as indicated in Table 4.

**Table 4: Involvement of the respondent in Agroforestry**

| *Variable* | *Village* | | | | | | | | *Total* | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Kilago | | Igung'hwa | | Ngulu | | Mhongolo | | | |
| | N | % | N | % | N | % | N | % | N | % |
| **Involvement of the respondent in agro-forestry** | | | | | | | | | | |
| Yes | 12 | 24.0 | 11 | 22.0 | 10 | 20.0 | 5 | 10.0 | 38 | 76.0 |
| No | 2 | 4.0 | 3 | 6.0 | 4 | 8.0 | 3 | 6.0 | 12 | 24.0 |
| **Total** | **14** | **28.0** | **14** | **28.0** | **14** | **28.0** | **8** | **16.0** | **50** | **100.0** |
| **From which year (since when)** | | | | | | | | | | |
| 1980s - 1990s | Nil | Nil | Nil | Nil | Nil | Nil | 1 | 2.6 | 1 | 2.6 |
| 1990s - 2000s | 3 | 7.9 | 2 | 5.3 | 1 | 2.6 | 1 | 2.6 | 7 | 18.4 |
| 2000s – to date | 9 | 23.7 | 9 | 23.7 | 9 | 23.7 | 3 | 7.9 | 30 | 78.9 |
| **Total** | **12** | **31.6** | **11** | **28.9** | **10** | **26.3** | **5** | **13.2** | **38** | **100.0** |

**Source:** Field data, 2011

### 4.2.2.3 Carbon markets and marketing channels

Carbon credits play a crucial role in carbon markets. Carbon trading mechanisms are valued highly for their social and environmental benefits, as they deal with people's livelihoods and the protection of important ecosystems. Carbon credits on the voluntary markets are called Verified Emission Reductions (VERs). The voluntary market is very important for agriculture and forestry projects. Voluntary carbon credits are mainly purchased by the private sector. Corporate social responsibility (CSR) and public relations are the most common motivations for buying carbon credits.

Community awareness on carbon markets and marketing channels is presented in Table 5. The statistics in Table 5 shows that majority (60.0%) of the overall sample respondents were not aware of carbon markets and marketing channels. It was also found that about 98.0 % of the overall sample respondents had no idea on specific markets to sell their avoided carbon emissions.

However, the statistics in Table 5 shows that the communities across the villages were aware of the alternative ways to sell carbon stock other than in terms of tones of carbon. The sample respondents were able to mention such alternatives as selling of firewood at Tshs 10,000/= per ox-cart, selling of grazing rights/permits, selling of timber products and selling of building poles.

**Table 5: Awareness among local communities on carbon trading**

| *Variable* | *Village* | | | | | | | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Kilago | | Igung'hwa | | Ngulu | | Mhongolo | | | |
| | N | % | N | % | N | % | N | % | N | % |
| **Awareness about carbon markets and marketing channel by the respondent** | | | | | | | | | | |
| Yes | 6 | 12.0 | 5 | 10.0 | 6 | 12.0 | 3 | 6.0 | 20 | 40.0 |
| No | 8 | 16.0 | 9 | 18.0 | 16.0 | 16.0 | 5 | 10.0 | 30 | 60.0 |
| **Total** | **14** | **28.0** | **14** | **28.0** | **14** | **28.0** | **8** | **16.0** | **50** | **100.0** |
| **Possession of Idea on specific markets where to sell avoided carbon emissions** | | | | | | | | | | |
| Yes | 1 | 2.0 | Nil | Nil | Nil | Nil | Nil | Nil | 1 | 2.0 |
| No | 13 | 26.0 | 14 | 28.0 | 14 | 28.0 | 8 | 16.0 | 49 | 98.0 |
| **Total** | **14** | **28.0** | **14** | **28.0** | **14** | **28.0** | **8** | **16.0** | **50** | **100.0** |
| **Alternative way to sell carbon stock other than in terms of tones of carbon** | | | | | | | | | | |
| Sell of firewood at Tshs 10,000/= per ox-cart | 6 | 16.7 | 5 | 13.9 | 3 | 8.3 | 2 | 5.6 | 16 | 44.4 |
| Sell of grazing rights/permits | 2 | 5.6 | 1 | 2.8 | Nil | Nil | Nil | Nil | 3 | 8.3 |
| Sell of timber products | 4 | 11.1 | 3 | 8.3 | 3 | 8.3 | 2 | 5.6 | 12 | 33.3 |
| Sell of building poles | 2 | 5.6 | Nil | Nil | 3 | 8.3 | Nil | Nil | 5 | 13.9 |
| **Total** | **14** | **38.9** | **9** | **25.0** | **9** | **25.0** | **4** | **11.1** | **36** | **100.0** |
| **Through whom the respondent is linked with the carbon buyers** | | | | | | | | | | |
| Village government | 6 | 16.7 | 7 | 19.4 | 4 | 11.1 | 1 | 2.8 | 18 | 50.0 |
| District government | 1 | 2.8 | Nil | Nil | Nil | Nil | Nil | Nil | 1 | 2.8 |
| Ministry of natural resources | 2 | 5.6 | Nil | Nil | Nil | Nil | Nil | Nil | 2 | 5.6 |
| TATEDO | 5 | 13.9 | 2 | 5.6 | 5 | 13.9 | 3 | 8.3 | 15 | 41.7 |
| **Total** | **14** | **38.9** | **9** | **25.0** | **9** | **25.0** | **4** | **11.1** | **36** | **100.0** |

**Source:** Field data, 2011

### 4.2.3 Costs and benefits related to conservation of carbon stock

Assessing the costs and benefits of REDD+ initiative provides a basis for the effective design of a REDD+ market in a particular area. It was found that costs associated with the reduction of greenhouse gas emissions from deforestation and forest degradation shape both the demand for, and the supply of, REDD+ services in Kahama district. Costs and benefits of REDD+ initiative also have important implications for the participation of local communities in the REDD+ markets in the study area. The study findings provide cost estimates and benefits of carbon trading through REDD+ initiatives in Kilago, Igung'hwa, Ngulu, Mhongolo villages in Kahama district.

#### 4.2.3.1 Costs related to forest conservation under REDD+ initiatives

The costs of REDD+ initiative offered in the study area remains unclear and needs to be resolved for the effective design and implementation of a REDD+ market.

In this study, the costs in managed and unmanaged forest resources were distinguished. The study found that PFM projects (managed forests) sequester and store considerably more carbon than unmanaged forests. The study indicates that the transaction costs of PFM with carbon management include Tshs 1,640,703.60 per village per year for measurement activities, Tshs 2,076.84 per ha per year for measurement, Tshs 3,634.47 per ha per year for verification and 10% of carbon value for other overhead costs. The opportunity costs for forests were Tshs 12,461.04, Tshs 23,883.66, Tshs, 7,268.94 and Tshs 9,345.78 per hectare per year in Kilago, Igung'hwa, Ngulu, Mhongolo villages respectively. Tables 6 summarize the opportunity cost of each crop as average return per ha in Tanzanian shillings.

**Table 6: Return of food and cash crops 2006 nominal price**

| *Crop* | *Average (tonne/ha)* | *Price (TSHS/ tonne)* | *Total revenue/ ha (TSHS)* | *Cost of Production* (TSHS)* | **Return/ha (TSHS)** |
|---|---|---|---|---|---|
| Maize | 0.79 | 159,532.50 | 125,233.01 | 18,784.95 | 106,448.06 |
| Paddy | 0.93 | 371,455.83 | 345,453.93 | 51,818.09 | 293,635.84 |
| Sorghum | 0.63 | 181,959.17 | 114,634.28 | 17,195.14 | 97,439.13 |
| Finger millet | 0.67 | 271,258.33 | 180,386.79 | 27,058.02 | 153,328.77 |
| Irish potatoes | 2.68 | 203,581.67 | 544,580.96 | 81,687.14 | 462,893.81 |
| Beans | 0.46 | 394,512.50 | 179,503.19 | 26,925.48 | 152,577.71 |
| Cotton | 0.56 | 1,628,748.00 | 903,955.14 | 135,593.27 | 768,361.87 |
| Tobacco | 0.71 | 807,340.00 | 573,211.40 | 85,981.71 | 487,229.69 |

**Source:** National Sample Census of Agriculture (2006).
* Cost of production is taken as 15% of total revenue

The statistics in Table 7 indicate that costs associated with patrolling/security of the *Ngitili* against environmental destructing agents and *Ngitili* management costs (Thinning, Pruning and Fire break construction) are relatively higher across the villages as mentioned by majority of the overall sample respondents (84.0% and 68.0% respectively).

**Table 7: Costs related to forest conservation under REDD+ initiatives**

| ***Costs*** | ***Village*** | | | | | | | | **Total** | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Kilago (n=14)** | | **Igung'hwa (n=14)** | | **Ngulu (n=14)** | | **Mhongolo (n=8)** | | | |
| | **N** | **%** | **N** | **%** | **N** | **%** | **N** | **%** | **N** | **%** |
| Costs involved in buying and planting tree seedlings | 11 | 22.0 | 8 | 16.0 | 2 | 4.0 | Nil | Nil | 21 | 42.0 |
| Costs associated with patrolling/security of the Ngitili against environmental destructing agents | 9 | 18.0 | 12 | 24.0 | 13 | 26.0 | 8 | 16.0 | 42 | 84.0 |
| Ngitili management costs (Thinning, Pruning and Fire break construction) | 7 | 14.0 | 12 | 24.0 | 13 | 26.0 | 2 | 4.0 | 34 | 68.0 |
| Costs associated with water for irrigation of tree seedlings | 7 | 14.0 | 1 | 2.0 | 5 | 10.0 | 7 | 14.0 | 20 | 40.0 |

**Source:** Field data, 2011

#### 4.2.3.2 Benefits from carbon stock (Afforestation and reforestation activities)

The study went further by estimating the net carbon benefits that were accrued from both sequestration and avoidance of degradation. Through the responses of key informants, the study found that the net benefits are much higher per household, as much as Tshs 32,191.02 for villages with larger forests compared with those with small forests, which receive only Tshs 5,192.10 per tonne of $CO_2$ sequestered. The study also revealed that villages with 156 and 550 ha of forests could earn about Tshs 12,461.04 and Tshs 18,691.56 per household per year respectively. With the price of Tshs 41,536.80 per tonne of carbon sequestered, which is the prospective selling price, villages with small (between 20 to 50 ha) forests could earn about Tshs 31,152.60 per household, whereas those with better forests (with more than 1,000 ha) might earn up to Tshs 454,827.96.

In the study villages, local communities are involved in tree planting. Villagers are facilitated to establish nurseries, tending and tree planting through the REDD+ initiatives. This is a successful pro-poor REDD+ activity due to its multiple benefits in supplying wood for domestic consumption and acting as a source of household income. It was found that carbon trading through afforestation and reforestation initiatives particularly agro-forestry, has the potential to sequester large amounts of carbon. Agro-forestry systems sequester carbon dioxide through carbon stored in their biomass.

**Table 8: Benefits from involving in Agroforestry measures (N = 50)**

| *Benefit* | *Village* | | | | | | | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Kilago (n=14) | | Igung'hwa (n=14) | | Ngulu (n=14) | | Mhongolo (n=8) | | | |
| | N | % | N | % | N | % | N | % | N | % |
| Regulated/reclaimed climatic condition | 6 | 12.0 | 8 | 16.0 | 11 | 22.0 | 5 | 10.0 | 30 | 60.0 |
| Reduced soil erosion | 12 | 24.0 | 5 | 10.0 | 7 | 14.0 | 4 | 8.0 | 28 | 56.0 |
| Forest products (Firewood, timber, medicine, fruits, poles and tree seedlings) | 13 | 26.0 | 12 | 24.0 | 10 | 20.0 | 8 | 16.0 | 43 | 86.0 |
| Increased Agricultural yield due to increased soil fertility | 9 | 18.0 | 7 | 14.0 | 8 | 16.0 | 6 | 12.0 | 30 | 60.0 |

**Source:** Field data, 2011

**Table 9: Benefits from *in-situ* vegetation conservation system (*Ngitili*) (N = 50)**

| *Benefit* | *Village* | | | | | | | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Kilago (n=14) | | Igung'hwa (n=14) | | Ngulu (n=14) | | Mhongolo (n=8) | | | |
| | N | % | N | % | N | % | N | % | N | % |
| Pasture for livestock | 6 | 12.0 | 8 | 16.0 | 14 | 28.0 | 7 | 14.0 | 35 | 70.0 |
| Fuel wood (Firewood and charcoal) | 7 | 14.0 | 8 | 16.0 | 14 | 28.0 | 7 | 14.0 | 36 | 72.0 |
| Building materials | 6 | 12.0 | 8 | 16.0 | 14 | 28.0 | 7 | 14.0 | 35 | 70.0 |
| Medicine | 6 | 12.0 | 8 | 16.0 | 14 | 28.0 | 7 | 14.0 | 35 | 70.0 |
| Timber | 7 | 14.0 | 8 | 16.0 | 14 | 28.0 | 7 | 14.0 | 36 | 72.0 |
| Conservation of water sources | 6 | 12.0 | 8 | 16.0 | 14 | 28.0 | 7 | 14.0 | 35 | 70.0 |
| Honey production | 6 | 12.0 | 8 | 16.0 | 14 | 28.0 | 7 | 14.0 | 35 | 70.0 |
| Regulation of climatic condition | 6 | 12.0 | 8 | 16.0 | 14 | 28.0 | 7 | 14.0 | 35 | 70.0 |

**Source:** Field data, 2011

In all the visited villages it was affirmed that communities practicing REDD+ had the potential to generate income from their forest resources. In addition to cash returns from the sale of forest products such as grazing rights, firewood and poles, "*ngitili*" restoration had significant gains in reduced effort in the collection of fuel wood, thatch grass, poles, fodder and water. The monetary value per household per

day for the reduced effort in collecting various "*ngitili*" products was found to be Tshs 726.89 for firewood collection, Tshs 519.21 for collecting poles, Tshs 830.74 for collecting fodder, Tshs 571.00 for thatch materials collection, Tshs 311.53 for collecting withies, Tshs 311.53 and Tshs 353.00 for domestic and livestock use of water, respectively. The assessment further showed that the proportion of households whose economic wellbeing at the family level had increased and improved as a consequence of values of benefits from "*ngitili*" were as high as 64%. Thus, it was noted, that individual households also indirectly benefited from funds accruing from REDD+ activities, through environmental goods and services.

### 4.2.4 Factors affecting implementation of REDD+ in community based forests

#### 4.2.4.1 Strengths in implementation of REDD+ initiatives

SWOT analysis towards implementation of REDD+ initiatives identified various strengths such as existence of good village governance; group forest formation and conservation through the available human labour; forest protection by-laws, policies and regulation; forest conservation education from REDD+; forest management campaigns given by environmental conservation NGOs; cooperation among *ngitili* owners, project staff and village leadership; and existence of traditional/natural/family *ngitili* as indicated in Table 10.

**Table 10: Strengths of adoption of REDD+ initiatives in forest conservation (N=50)**

| *Strength* | *Village* | | | | | | | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Kilago (n=14) | | Igung'hwa (n=14) | | Ngulu (n=14) | | Mhongolo (n=8) | | | |
| | N | % | N | % | N | % | N | % | N | % |
| Existence of Sungusungu | 6 | 12.0 | 5 | 10.0 | 10 | 20.0 | 1 | 2.0 | 22 | 44.0 |
| Good Village Governance | 6 | 12.0 | 5 | 10.0 | 6 | 12.0 | 3 | 6.0 | 20 | 40.0 |
| Group forest formation and conservation through the available human labour | 7 | 14.0 | 4 | 8.0 | 8 | 16.0 | 4 | 8.0 | 23 | 46.0 |
| Forest protection by-laws, policies and regulation | 12 | 24.0 | 10 | 20.0 | 13 | 26.0 | 6 | 12.0 | 41 | 82.0 |
| Forest conservation education from REDD+ | 3 | 6.0 | 4 | 8.0 | 6 | 12.0 | 3 | 6.0 | 16 | 32.0 |
| Forest Management campaigns given by environmental conservation NGOs | 6 | 12.0 | 4 | 8.0 | 5 | 10.0 | 3 | 6.0 | 18 | 36.0 |
| Cooperation among *Ngitili* owners, project staff and village leadership | 3 | 6.0 | 3 | 6.0 | 10 | 20.0 | 4 | 8.0 | 14 | 28.0 |
| Existence of traditional/natural/family *Ngitili* | 3 | 6.0 | 5 | 10.0 | 8 | 16.0 | 3 | 6.0 | 19 | 38.0 |

Note: The percentages do not add up to 100% because of multiple responses
**Source:** Field data, 2011

### 4.2.4.2 Weaknesses in implementation of REDD+ initiatives

SWOT analysis towards implementation of REDD+ initiatives revealed the weaknesses such as drought resulting from unpredictable rainfall; low forest conservation education within the community; inadequate community awareness of the functioning of REDD+ initiatives and climate change; lack of land ownership title deeds; income poverty within the community (inadequate capital/money); and overgrazing/overstocking as shown in Table 11.

**Table 11: Weaknesses of adoption of REDD+ initiatives in forest conservation (N = 50)**

| *Weakness* | *Village* | | | | | | | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Kilago (n=14) | | Igung'hwa (n=14) | | Ngulu (n=14) | | Mhongolo (n=8) | | | |
| | N | % | N | % | N | % | N | % | N | % |
| Drought resulting from unpredictable rainfall | 7 | 14.0 | 8 | 16.0 | 5 | 10.0 | 2 | 4.0 | 22 | 44.0 |
| Low forest conservation education within the community | 11 | 22.0 | 9 | 18.0 | 10 | 20.0 | 7 | 14.0 | 37 | 74.0 |
| Inadequate community awareness of the functioning of REDD+ initiatives and climate change | 9 | 18.0 | 6 | 12.0 | 5 | 10.0 | 4 | 8.0 | 24 | 48.0 |
| Lack of land ownership title deeds | 2 | 4.0 | 4 | 8.0 | 2 | 4.0 | 1 | 2.0 | 9 | 18.0 |
| Income poverty within the community (inadequate capital/money) | 3 | 6.0 | 4 | 8.0 | 10 | 20.0 | 7 | 14.0 | 24 | 48.0 |
| Overgrazing/overstocking | Nil | Nil | Nil | Nil | 1 | 2.0 | 1 | 2.0 | 2 | 4.0 |

**Note:** The percentages do not add up to 100% because of multiple responses
**Source:** Field data, 2011

Results from focus group discussions show that the law remains silent over how the benefits of forest management can be equitably shared with participating communities. Without benefits reaching a level that equal or exceed the costs being borne, in terms of local forest management, the long-term future of REDD+ remains uncertain. The Village Councils have a relatively limited role in directly managing the REDD+, except to receive revenues earned from the CBO and then, through normal village government procedures, budget and use those earnings.

Given the high conservation status of many of the forests under CBFM arrangements, the total level of permitted benefits that may be legally harvested from the forests is very low (and may be significantly less than the range of benefits people obtained prior to REDD+ being established, though illegal in nature). Even

where opportunities exist for extractive use of forest reserves, such as in production forests where timber harvesting is permitted, the relative share and type of benefits that can be captured by communities has yet to be agreed on and the mechanism for sharing of benefits is not yet in place.

The highly sectoral nature of natural resource legislation constrains opportunities for communities to obtain multiple benefit streams from the management of forest and wildlife resources on village land. The process for the establishment of community based forest constrain the possibility of obtaining multiple revenue flows from forest harvesting significantly reducing local incentives for long-term natural resource management. Land tenure issues, issues relating to titling and property rights affect the security and entry of local people, particularly smallholder farmers, to participate in REDD+. The issues of REDD+ and carbon trading are very new concepts not well understood by majority of people across the study villages.

Generally, the weaknesses of the adoption of REDD+ initiatives in forest conservation are summarized as low awareness among the local community on the importance of forest conservation and forest management; and traditional practices such ‘slash and burn’ and the associated shifting cultivation.

#### 4.2.4.3 Opportunities for implementation of REDD+ initiatives

SWOT analysis towards implementation of REDD+ initiatives identified several opportunities available across study villages which include political will; high willingness among donors (CARE, TATEDO, NAFRAC) to fund carbon trade across the study villages; REDD+ project initiatives; energy saving technology via

TATEDO; beekeeping (bee hives); and extension services as shown in Table 12. It was found that TATEDO and REDD+ projects are the major opportunities for adoption of REDD+ initiatives across the study villages. This is due to the fact that REDD+ projects provide environmental education to the community while TATEDO provide technology on alternative use of source of energy for efficient utilization of biomass.

**Table 12: Opportunities of adoption of REDD+ initiatives in forest concentration (N = 50)**

| *Opportunity* | *Village* | | | | | | | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Kilago (n=14) | | Igung'hwa (n=14) | | Ngulu (n=14) | | Mhongolo (n=8) | | | |
| | N | % | N | % | N | % | N | % | N | % |
| Political will | 3 | 6.0% | Nil | Nil | 1 | 2.0 | Nil | Nil | 4 | 8.0 |
| Donor support | 11 | 22.0 | 10 | 20.0 | 13 | 26.0 | 7 | 14.0 | 41 | 82.0 |
| REDD+ project initiatives | 13 | 26.0 | 10 | 20.0 | 13 | 26.0 | 6 | 12.0 | 42 | 84.0 |
| Energy saving technology via TATEDO | 9 | 18.0 | 5 | 10.0 | 12 | 24.0 | 5 | 10.0 | 31 | 62.0 |
| Beekeeping (bee hives) | 3 | 6.0 | 1 | 2.0 | 1 | 2.0 | Nil | Nil | 5 | 10.0 |
| Extension services | 8 | 16.0 | 5 | 10.0 | 3 | 6.0 | 4 | 8.0 | 20 | 40.0 |

**Note:** The percentages do not add up to 100% because of multiple responses
**Source:** Field data, 2011

Through focus group discussions it was found that vast alternative sources of energy do exist across the study villages as opportunities that can be scaled up and broadened out to reduce pressure on forests. These sources include improved stoves, improved charcoal kilns, and the use of solar power and biogas as shown in Plate 2.

**Plate 2: Efficient cooking stoves - technology from TATEDO**

**Source:** TATEDO, 2011

Alternative energy sources have the potential to reduce the increase in demand for forest products and to preserve forest health and diversity. This balance is critical to the survival of forests, and to the prosperity of forest-dependent communities. This also has important implications for emissions reduction, employment creation, monetary saving, and time savings – thus reducing pressure on carbon sinks, and improving livelihoods across the study villages.

The study also found various innovations and technologies across the study villages that could contribute to reducing carbon emissions. These include inter cropping, planting of leguminous crops; and encouraging the growing of crops that are resistant to adverse weather conditions – such as cassava, sorghum, millet, sweet

potatoes and so on. In addition, the promotion of sustainable production systems that encourage agricultural intensification in favourable areas, relieving pressure on remaining forest lands, and decrease deforestation by increasing agricultural productivity and profitability provides promising technologies that can be incorporated in the REDD+ strategy across the study villages.

**Table 13: Threats of adoption of REDD+ initiatives in forest conservation (N= 50)**

| ***Threat*** | ***Village*** | | | | | | | | **Total** | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Kilago (n=14)** | | **Igung'hwa (n=14)** | | **Ngulu (n=14)** | | **Mhongolo (n=8)** | | | |
| | **N** | **%** | **N** | **%** | **N** | **%** | **N** | **%** | **N** | **%** |
| Wild animals like lion, hyena | 7 | 14.0 | 7 | 14.0 | 1 | 2.0 | Nil | Nil | 15 | 30. |
| Land use conflicts | 7 | 14.0 | 9 | 18.0 | 10 | 20.0 | 1 | 2.0 | 21 | 42.0 |
| Field/bush fires | 5 | 10.0 | 6 | 12.0 | 11 | 22.0 | 4 | 8.0 | 26 | 52.0 |
| Pests and diseases | 1 | 2.0 | 4 | 8.0 | 5 | 10.0 | 4 | 8.0 | 14 | 28.0 |
| Change in donor policies | 1 | 2.0 | 3 | 6.0 | 2 | 4.0 | Nil | Nil | 6 | 12.0 |
| Hunters and charcoal makers | 5 | 10.0 | 6 | 12.0 | 10 | 20.0 | 4 | 8.0 | 25 | 50.0 |

Note: The percentages do not add up to 100% because of multiple responses
**Source:** Field data, 2011

### 4.2.4.5 Summarized SWOT analysis results across the study villages

After the Village Environmental/Natural Resources Committees in the selected villages discussed on a number of lessons learnt based on their involvement in PFM and REDD+ related initiatives which could guide smooth implementation of future REDD+ initiatives, they were requested to do a SWOT analysis for the REDD+ initiative in their communities. The results of those analyses are summarized in Table 14.

**Table 14: SWOT Analysis of the REDD+ initiative in the study villages**

| Strengths | Weaknesses | Opportunities | Threats |
|---|---|---|---|
| Some villages have been involved in CDM activities such as the use of energy saving stoves as supported by TATEDO | Unsatisfactory enforcement of existing by-laws against forest degradation | Existence of Donor support (CARE, TATEDO, NAFRAC) | REDD‘s donor dependence |
| Some villages have by-laws which are appropriate for ensuring forest conservation | Low level of environmental education that could help extend protection of forest resources to neighbouring communities | REDD+ initiative will give local communities some financial and further technical assistance to manage the reserves | Challenges from surrounding villages not involved with PFM |
| They have committed members of environmental committees with great support from fellow villagers | National Forest Policy and related legal framework not well known to local communities | Increased importance of conservation related economic activities, such as eco-tourism and beekeeping | Forest deforestation and degradation by livestock, elephants and other wildlife |
| They have supporting and well committed village governments and non-governmental organizations in PFM matters | Lack of reliable data base on climate and extent of forest resources, their tenure and use | Improvements in the management of land and forest resources | Forest degradation by wild fires |
| Existence of several NGOs and institutions in some villages researching and promoting | Few officials at the local level are knowledgeable about REDD+ | Expressed need for formulation of policy/legislation/regulations specific to REDD+ | Forest stewardship not qualifying for REDD+ rewards (esp. catchments forests and other |
| Existence of extensive forest resources as reserves or in public land | Many villages do not have land use plans in support of CBFM | Development and implementation of human resource capacity building for REDD+ and forest resources management | Lack of cheap and appropriate alternative sources of energy to wood biomass |

### 4.3 Discussion of the Findings

#### 4.3.1 Social demographic characteristics

The study was conducted in a manner that both men and women with different age and education background as shown in Table 1 were considered by the researcher. These had a bearing on the nature and quality of information received. This is due to the fact that men and women differ at great extent in social responsibilities including *Ngitili* management.

##### 4.3.1.1 Gender of the respondents

The proportion of male respondents is slightly greater (70.0%) than female respondents (30.0%). This situation is due to the fact that men own and control land and *Ngitili*. Women often require men's consent on decisions regarding the harvesting of resources form *Ngitili*. Men normally benefit from timber harvests which women do not have control over. Women get fuel wood and non wood forest products. These results resemble with those found by Rubanza, Otsyina and Zahabu (2008).

##### 4.3.1.2 Age of the respondents

The age distribution of the respondents across the villages was positively skewed as the majority (more than 92.0%) have 31 years and above. All respondents were mature enough to provide valid information regarding the benefits and costs of carbon trading, forest conservation and monitoring the climate change in Kahama District – Shinyanga region. The findings suggest that majority of the overall sample respondents in the study area were of economically productive age who struggle for better life through exploitation of the environmental resources (they are both users

and conservers of the environment). These findings support the idea that relevant and valid data were collected since individuals are perceived to be intellectually and socially experienced and responsible.

#### 4.3.1.3 Education Status of the Respondents

The overall results indicate that most of the sample respondents (78.0%) had attained at least primary education. These findings suggest that having respondents almost all with formal education implies that their knowledge and capacity to analyze issues regarding the benefits and costs of carbon trading, forest conservation and monitoring the climate change in Kahama District – Shinyanga region is guaranteed. These findings suggest that apart from increasing the validity of the data collected by the researcher, education level attained by the respondents may have significant impact on forest conservation and monitoring the climate change in Kahama District – Shinyanga region.

### 4.3.2 Community involvement in carbon trading mechanisms under REDD+ initiatives

#### 4.3.2.1 Community awareness on REDD+ initiatives

About 84.0% of the overall sample respondents are aware of the REDD+ initiatives in forest conservation through *in-situ* vegetation conservation locally known as "*Ngitili*" and through adoption of sound agro-forestry techniques across the study villages. However, out of 42 respondents with knowledge of the REDD+ initiatives, about 88.1% had acquired such knowledge since 2010 to date. These findings suggest that carbon trading is a new concept to the villagers across the study villages. These findings are supported by Kilawe *et al.,* (2008) who revealed that the

issues of REDD+ and carbon trading are very new concepts not well understood by many Tanzanians.

#### 4.3.2.2 Community involvement in REDD+ initiatives in carbon trading

The study found that communities across the study villages are motivated by some factors in establishing *Ngiltili.* Some of such driving forces include ensuring conserved environment for better forest products, diversification of income as a result of carbon trading, and ensuring enhanced benefits from forests/*Ngitili.* It was found that about 68.0% of the overall sample respondents own *Ngitili*. Majority (73.5%) of the overall sample respondents in the study villages own less than 20 Hectares of *Ngitili*. The active involvement of the community in *Ngitili* conservation is clearly depicted in Plate 1.

The study also revealed that the community across the villages not only involvement in *Ngitili* conservation but also agro-forestry. The communities in the study area are aware of the existing relationship between environmental conservation, climate change, increased agricultural productivity and improved livelihoods.

#### 4.3.2.3 Carbon markets and marketing channels

The respondents are not aware of carbon markets and marketing channels. It was also found that respondents have no idea on specific markets to sell avoided carbon emissions. Subsequently, no person had ever received any payment as a result of carbon trading. This may be partly due to the fact that carbon trading is still a new concept to the communities across the study villages. It may also be due to inadequate availability of information related to carbon trading mechanisms. These

findings are similar to what was revealed by Kilawe *et al*. (2008) who observed that developed countries have better information when compared to developing counties, which has serious implications for bargaining in the international REDD+ negotiations. Most of the communities in Developing countries are not sure how carbon will be traded. But basing on Shinyanga region, it is anticipated that, the value of one tone of carbon to range from $ 5.0 to $ 10 (TATEDO, 2012).

Table 5 shows that, the communities across the villages are aware of the alternative ways to sell carbon stock other than in terms of tones of carbon. This awareness was a result of environmental education provided by the REDD+ initiative across the villages. Also TATEDO and village governments play significant role in creating awareness to the community across the study villages on the relationship of sustainable environmental conservation, climate change, agricultural productivity and improved people's livelihoods.

### 4.3.3 Costs and benefits related to conservation of carbon stock

#### 4.3.3.1 Costs related to forest conservation under REDD+ initiatives

The costs of REDD+ initiative offered in the study area remains unclear and needs to be resolved for the effective design and implementation of a REDD+ market. This has potential implications for shaping the REDD+ structure and financing mechanism. In the study area the estimation of the costs of REDD+ is based on three categories, namely: opportunity costs; implementation costs; and transaction costs. The estimates are based on the cost per unit of carbon emission reductions. These findings are similar to the arguments by Viana et al., (2009) who revealed that the cost estimates are based on very limited field data, thus leading to uncertainty in the policy dialogue process. Thus, these findings suggest that the cost estimates of

carbon emissions are location-specific, derived from random sample household surveys conducted across the study villages. Costs related to forest conservation under REDD+ initiatives in the study area include costs involved in buying and planting tree seedlings, costs associated with patrolling/security of the *Ngitili* against environmental destructing agents, *Ngitili* management costs (Thinning, Pruning and Fire break construction), and costs associated with water for irrigation of tree seedlings as indicated in Table 7.

#### 4.3.3.2 Benefits from carbon stock (Afforestation and reforestation activities)

Agro-forestry is one of the strategies being practised by many farmers across the study villages for sustainable natural resource management. It involves planting of multi-purpose trees for fodder, fruit trees, and traditional wood lots (such as "*ngitili*" and sacred forest). It also involves the integration of trees on farms and in the agricultural landscape, diversifying and sustaining production for increased social, economic and environmental benefits for land users across the study villages. Agro-forestry in the study area increase food and nutritional security, fuel wood availability and household income. In this way it achieves the combined benefits of improving income from agriculture, protecting biodiversity and maintaining or increasing forest cover. Tables 8 and 9 show the benefits obtained by the respondents from their involvement in agro-forestry measures and in-situ vegetation conservation system (*Ngitili*) measures respectively. These findings suggest that agro-forestry contribute towards better living standards of the small-scale farmers where it is already in place.

### 4.3.4 Factors affecting implementation of REDD+ in community based forests

#### 4.3.4.1 Strengths in implementation of REDD+ initiatives

SWOT analysis towards implementation of REDD+ initiatives identified various strengths such as existence of good village governance; group forest formation and conservation through the available human labour; forest protection by-laws, policies and regulation; forest conservation education from REDD+; forest management campaigns given by environmental conservation NGOs; cooperation among *ngitili* owners, project staff and village leadership; and existence of traditional/natural/family *ngitili* as indicated in Table 10. These findings suggest that the strengths of adoption of REDD+ initiatives in forest conservation are reflected in rich forest resources, huge area under forests, and strong legal framework on forest management, existing traditional institutions and community willingness on forest conservation.

#### 4.3.4.2 Weaknesses in implementation of REDD+ initiatives

SWOT analysis towards implementation of REDD+ initiatives revealed the weaknesses such as low forest conservation education within the community; inadequate community awareness of the functioning of REDD+ initiatives and climate change; lack of land ownership title deeds; income poverty within the community (inadequate capital/money); and overgrazing/overstocking as shown in Table 11.

Focus group discussions provided information that the law remains silent over how the benefits of forest management can be equitably shared with participating communities. Without benefits reaching a level that equal or exceed the costs being

borne, in terms of local forest management, the long-term future of REDD+ remains uncertain. The Village Councils have a relatively limited role in directly managing the REDD+, except to receive revenues earned from the CBO and then, through normal village government procedures, budget and use those earnings.

Given the high conservation status of many of the forests under CBFM arrangements, the total level of permitted benefits that may be legally harvested from the forests is very low (and may be significantly less than the range of benefits people obtained prior to REDD+ being established, though illegal in nature). Even where opportunities exist for extractive use of forest reserves, such as in production forests where timber harvesting is permitted, the relative share and type of benefits that can be captured by communities has yet to be agreed on and the mechanism for sharing of benefits is not yet in place.

The highly sectoral nature of natural resource legislation constrains opportunities for communities to obtain multiple benefit streams from the management of forest and wildlife resources on village land. The process for the establishment of community based forest constrain the possibility of obtaining multiple revenue flows from forest harvesting significantly reducing local incentives for long-term natural resource management. Land tenure issues, issues relating to titling and property rights affect the security and entry of local people, particularly smallholder farmers, to participate in REDD+. The issues of REDD+ and carbon trading are very new concepts not well understood by majority of people across the study villages.

Generally, the weaknesses of the adoption of REDD+ initiatives in forest conservation are summarized as low awareness among the local community on the importance of forest conservation and forest management; and traditional practices such ‘slash and burn’ and the associated shifting cultivation.

#### 4.3.4.3 Opportunities for implementation of REDD+ initiatives

SWOT analysis towards implementation of REDD+ initiatives identified several opportunities available across study villages which include political will; high willingness among donors (CARE, TATEDO, NAFRAC) to fund carbon trade across the study villages; REDD+ project initiatives; energy saving technology via TATEDO; beekeeping (bee hives); and extension services as shown in Table 12. It was found that TATEDO and REDD+ projects are the major opportunities for adoption of REDD+ initiatives across the study villages. This is due to the fact that REDD+ projects provide environmental education to the community while TATEDO provide technology on alternative use of source of energy for efficient utilization of biomass.

Through focus group discussions it was found that vast alternative sources of energy do exist across the study villages as opportunities that can be scaled up and broadened out to reduce pressure on forests. These sources include improved stoves, improved charcoal kilns, and the use of solar power and biogas as shown in Plate 2. Alternative energy sources have the potential to reduce the increase in demand for forest products and to preserve forest health and diversity. This balance is critical to the survival of forests, and to the prosperity of forest-dependent communities. This also has important implications for emissions reduction, employment creation,

monetary saving, and time savings – thus reducing pressure on carbon sinks, and improving livelihoods across the study villages.

The study also found that there are various innovations and technologies across the study villages that could contribute to reducing carbon emissions. These include efficient nitrogen fertilizer application and agronomic practices, which conserve water – such as mulching, conservation tillage, inter cropping, planting of leguminous crops; and encouraging the growing of crops that are resistant to adverse weather conditions – such as cassava, sorghum, millet, sweet potatoes and so on. In addition, the promotion of sustainable production systems that encourage agricultural intensification in favourable areas, relieving pressure on remaining forest lands, and decrease deforestation by increasing agricultural productivity and profitability provides promising technologies that can be incorporated in the REDD+ strategy across the study villages.

Another notable sustainable production system that could be scaled-up for REDD+ is the promotion of better range land management practices for adaptation to climate change, to improve livelihoods in livestock keeping communities. Range lands are a type of land on which grasses and shrubs dominate the natural vegetation and the land is managed as a natural ecosystem. Range lands support agricultural activity through the grazing of livestock. These grasslands also provide a habitat for native plants and animals, and support a broad range of economic benefits, including recreational activities related to hunting, and the provision of genetic stock for biological research. The benefits of improved range management include the conservation of biodiversity, reduced soil degradation and potential for increased

carbon sequestration. Grazing management involves planning, and then controlling the timing, intensity and frequency of grazing. Good grazing management such as avoiding overstocking and extensive livestock production form part of the forest management systems that can be tapped under REDD+ activities.

Farmer field schools (*Shamba Darasa*) have been established across the study villages to provide farmers with the opportunities to learn and adopt new technologies and innovations. This provides the way forward in creating farmers' networks that can be incorporated in REDD+ related activities. Farmers' field visits and farmer exchange programmes are a few examples that can be used to learn REDD+ related best practices. In order to reach the wider population, education and public awareness materials such as leaflets, brochures, newsletters, booklets, stickers, posters, guidelines, policy briefs, banners, calendars, audio visuals, and inserts in existing newsletters are some of communication methods that could also be used in REDD+ related activities.

#### 4.3.4.4 Threats in implementation of REDD+ initiatives

SWOT analysis towards implementation of REDD+ initiatives identified some threats such as wild animals like lion, hyena; land use conflicts; drought resulting from unpredictable rainfall; field/bush fires; pests and diseases; change in donor policies; and hunters and charcoal makers as indicated in Table 13.

Generally, the threats of adoption of REDD+ initiatives in forest conservation across the study villages is reflected in reliance on donor fund; reliance on external markets for carbon; lack of forest permanence, possibility of carbon leakage; lack of

alternative energy source instead of fuel wood; increasing human and the associated of expansion of areas under forests for new settlements and farms; and difficulties associated to monitoring, reporting and verification (MRV) of carbon stocks due to methodological challenges.

# CHAPTER FIVE

# CONCLUSION AND RECOMMENDATIONS

## 5.1 Conclusion

Majority (84.0%) of the overall sample respondents were aware of the REDD+ initiatives in forest conservation through in-situ conservation and agroforestry across the study villages. However, carbon trading is a new concept to the villagers across the study villages. Some of the driving forces for communities across the study villages in establishing *Ngitili* include ensuring conserved environment for better forest products, diversification of income as a result of carbon trading, and ensuring enhanced benefits from forests/*ngitili*. The communities in the study area are aware of the existing relationship between environmental conservation, climate change, increased agricultural productivity and improved livelihoods.

Majority (60.0%) of the overall sample respondents were not aware of carbon markets and marketing channels. They have no idea on specific markets to sell avoided carbon emissions because carbon trading is still a new concept to the communities across the study villages. However, the communities across the villages are aware of the alternative ways to sell carbon stock other than in terms of tones of carbon such as selling of firewood at Tshs 10,000/= per ox-cart, selling of grazing rights/permits, selling of timber products and selling of building poles. This is a result of environmental education provided by the REDD+ initiative across the villages; TATEDO and village governments.

The costs related to forest conservation under REDD+ initiatives associated with buying and planting tree seedlings, patrolling/security of the ngitili against environmental destructing agents, ngitili management (Thinning, Pruning and Fire break construction), and water for irrigation of tree seedlings.

Through the REDD+ initiatives villagers establish nurseries and plant trees thereby obtaining multiple benefits such as wood supply for domestic consumption and acting as a source of household income. Carbon trading through afforestation and reforestation initiatives particularly agro-forestry sequesters large amounts of carbon dioxide through carbon stored in their biomass. PFM projects (managed forests) sequester and store considerably more carbon than unmanaged forests.

Communities practising REDD+ generates income (cash returns) from their forest resources (sale of forest products such as grazing rights, firewood and poles). "Ngitili" restoration reduces efforts in the collection of fuel wood, thatch grass, poles, fodder and water.

The strengths of adoption of REDD+ initiatives in forest conservation across the study villages include existence of Sungusungu; good village governance; group forest formation and conservation through the available human labour; forest protection by-laws, policies and regulation; forest conservation education from REDD+; forest management campaigns given by environmental conservation NGOs; cooperation among ngitili owners, project staff and village leadership; and existence of traditional/natural/family ngitili.

The weaknesses of REDD+ initiatives in forest conservation across the study villages include drought resulting from unpredictable rainfall; low forest conservation education within the community; inadequate community awareness of the functioning of REDD+ initiatives and climate change; lack of land ownership title deeds; income poverty within the community (inadequate capital/money); and overgrazing/overstocking.

The opportunities of adoption of REDD+ initiatives in forest conservation across the study include political will; high willingness among donors (CARE, TATEDO, NAFRAC) to fund carbon trade across the study villages; REDD+ project initiatives; energy saving technology via TATEDO; beekeeping (bee hives); and extension services. REDD+ projects provide environmental education to the community while TATEDO provide technology on alternative use of source of energy for efficient utilization of biomass. Vast alternative sources of energy such as improved stoves, improved charcoal kilns, and the use of solar power and biogas do exist across the study villages as opportunities that can be scaled up and broadened out to reduce pressure on forests.

There are various innovations and technologies across the study villages that could contribute to reducing carbon emissions such as efficient nitrogen fertilizer application and agronomic practices, which conserve water – such as mulching, conservation tillage, inter cropping, planting of leguminous crops; and encouraging the growing of crops that are resistant to adverse weather conditions – such as cassava, sorghum, millet and sweet potatoes.

The threats of adoption of REDD+ initiatives in forest conservation across the study include wild animals like lion, hyena; land use conflicts; field/bush fires; pests and diseases; change in donor policies (reliance on donor fund); reliance on external markets for carbon; increasing human and the associated of expansion of areas under forests for new settlements and farms; and difficulties associated to monitoring, reporting and verification (MRV) of carbon stocks due to methodological challenges; and hunters and charcoal makers.

### 5.2 Recommendations

- There should be broadened use and promotion of efficient alternative energy sources and efficient utilization of biomass to reduce pressure on forests. These sources include improved stoves, improved charcoal kilns, and the use of solar power and biogas.
- Education on carbon market and market channels is urgently needed so that people become aware of what is going on in carbon trading. Payment for enhanced carbon stock should be immediate.
- There should be intensive use and promotion of innovations that contribute to reducing carbon emissions from productive activities.
- Human resource capacity should be enhanced for REDD+ activities. More emphasis should be put on Farmer field schools (Shamba Darasa) which can provide farmers with the opportunities to learn and adopt new technologies and innovations.
- Education and public awareness materials such as leaflets, brochures, newsletters, stickers, posters, guidelines, calendars, audio visuals, and inserts in existing newsletters could also be used in REDD+ related activities.

### 5.3 Areas for further research

Basing on the results of this research, it is suggested that more research is required in the following areas;

(i) Mechanisms of distributing donor fund to *Ngitili* owners

(ii) Causes that delay payment of donor fund to *Ngitili* owners

(iii) *Ngitili* conservation as a factor for poverty reduction

(iv) Government support on *Ngitili* conservation practices

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## APPENDICES

### Appendix I: Questionnaire for Household Heads

### Carbon Trading Mechanism in Semi-Arid Areas of Tanzania, A Case Study of Shinyanga Region

Date of interview……. Name of respondent……
Name of the place/village of interview……

**A: Personal issues related to natural resource management**

1. What is your gender? (i) Male [ ] (ii) Female [ ]
2. Your level of education is (i) Informal education [ ] (ii) Primary education [ ] (iii) Secondary education [ ] (iv) College education [ ] (v) University education [ ]
3. What is your age? (i) 18 – 25 years [ ] (ii) 26 – 30 years (iii) 31 – 40 years [ ] (iv) above 40 years [ ] (v) 41- 50 years [ ] (vi) 51 – 60 years [ ] (vii) Above 60 years [ ]

**B: Involvement in in-situ vegetation conservation (Ngitili)**

4. Are you involved in in-situ vegetation conservation through promotion of natural regeneration (Ngitili) environmental conservation measures (i) Yes [ ] (ii) No [ ].
5. If Yes, from what year? (years) duration/ range (i)1980s-1990s (ii)1990s-2000s (iii) 2000s- to-date [ ]
6. If you haven't practiced in situ vegetation conservation through promotion of natural regeneration (Ngitili) environmental conservation measures;
   (a) Why have you not done so?
   ……

(b) Do you plan to do so? (i) Yes [ ] (ii) No [ ]

(c) If planning, what motivation(s) driving you to establish Ngitili?

(i) …….
(ii) …….
(iii) …….

7. If the answer (in 4 above) is yes, in what ways are you benefiting from being involved yourself in in-situ vegetation conservation system (Ngitili) measures? Please explain;

(i) …….
(ii) …….
(iii) …….
(iv) …….

8. Do you own any Ngitili? (i) Yes [ ] (ii) No [ ]
9. If Yes, how big in ha…….? (I) <20 ha (ii) 21 – 40 ha (iii) 41 – 80 ha (iv) > 80 ha

**C: Contribution of Agro-forestry on climate change adaptation and mitigation strategies**

10. Are you involved in Agro-forestry measures? (i) Yes [ ] (ii) No [ ]
11. If Yes from what year? (i) 1980s-1990s (ii) 1990s-2000s (iii) 2000s- to-date [ ]
12. How many trees (on average) do you plant/ establish per year? (i) 10 – 50 [ ]
    (ii) 50 – 100 [ ] (iii) 100 – 200 [ ] (iv) Above 200 [ ]
13. In what ways have you benefited from being involved yourself in Agro-forestry measures? [Please explain];
    (i) …….
    (ii) …….

**D: REDD+ as an adaptation /mitigation strategy to climate change**

14. Do you know anything/ are you aware about REDD and REDD+ initiatives taking

place

in your area? (i) Yes [ ] (ii) No [ ]

15. If Yes, from what year? (i) 2008-2010; (ii) 2010 to-date [ ]

16. Are you aware about/with carbon marketing and marketing channel? (i) Yes [ ] (ii) No [ ]

17. Do you have any idea on specific markets where to sell your avoided carbon emissions?

(i) Yes [ ] (ii) No [ ]

18. If yes, what kind of a market would you use (please explain);

(i) …….

(ii) …….

(iii) ……

19. From the time of implementation of REDD+ initiatives, have you received any payment from the sale of carbon stock? (i) Yes [ ] (ii) No [ ]

20. Is there any way would you sell your carbon stock other than in terms of tones of carbon? Please explain ……...

21. Who normally would connect you with the carbon buyers? (i) Yourself [ ]

(ii) Village Government [ ] (iii) District government [ ] (iv) Regional government [ ]

(v) Ministry of natural resources [ ] (vi) Others (please specify)

…….....

22. What costs would you anticipate on forest conservation under REDD+? Please explain;

(i) …….

(ii) ……

(iii) ……...

23. What are strengths, weaknesses, opportunities and threats of adoption of REDD+ initiatives in forest conservation in your area?

1. Strengths;

(i) ……

(ii) ……

(i) ……...

2.Weaknesses;

(i) ……

(ii) ……

(iii) ……...

3. Opportunities;

(i) ……

(ii) ……

(iii) ……...

4. Threats;

(i) …….

(ii) ……

(iii) ……...

24. Give your own views on enhanced vegetation conservation and carbon sequestration under REDD+ initiatives;

(i) …….

(ii) ……

(iii) ……...

(iv) ……...

## Appendix II: Questionnaire for Key Informants

### Carbon Trading Mechanism in Semi-Arid Areas of Tanzania, A Case Study of Shinyanga Region

Date of interview……. Name of respondent……

Designation……. Name of the place/village of interview……

1. (a) What is the extent of involvement in in situ vegetation conservation through promotion of natural regeneration (Ngitili) environmental conservation measures? ……..

(b) Extent of Ngitili by years:

| Year | Total area under Ngitili (ha) | Remarks |
|---|---|---|
| 2011 | | |
| 2010 | | |
| 2009 | | |
| 2008 | | |
| 2007 | | |
| 2006 | | |

**Note:** Most respondents when asked area in ha respond in Acres!! But 1ha = 2.5 Acres

2. What are important benefits accrued from Ngitili? (Hint: Ecosystem goods and services)

(i) …….

(ii) …….

(iii) ……

(iv) ……

(v) ……

3. Contribution of Ngitili on climate change adaptation and mitigation strategies include;

(i) …….

(ii) …….

(iii) ……

(ii) ……

4. What types of Ngitili are found in Shinyanga region? Please explain;

(i) …….

(ii) …….

(iii) ……

5. What areas are under Ngitili in the district by villages?

| Ward | Ngitili | Ownership | Area(ha) | Year of establishment | Remarks |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

6. Contributions of REDD+ as an adaptation and mitigation strategy to climate change include;

(i)…….

(ii) …….

(iii) ……

(iv) ……

7. From the time of implementation of REDD+ initiatives, have the farmers received any payment from the sale of carbon stock? (i) Yes [ ] (ii) No [ ]

8. If the answer for question 8 is No, what are the anticipations of carbon marketing, marketing channels and carbon pricing?

9. Are there any other ways farmers sell their carbon emissions other than in terms of tones of carbon, especially considering REDD+ initiatives? Please explain;

(i) …….

(ii) …….

(iii) ……

(iv) ……

(v) ……

10. Who would/ normally connect the farmers with the carbon buyers? …….....

11. What type of markets available in your region for carbon trading? Please explain;

(i) …….

(ii) …….

(iii) ……

12. What type of markets would you anticipate in your region for carbon trading? Please explain;

(i) …….

(ii) …….

(iii) ……

13. What are strengths, weaknesses, opportunities and threats of adoption of REDD+ initiatives in forest conservation in your area?

1. Strengths;

(i) …….

(ii) …….

(iii) ……

(iv) ……

2. Weaknesses;

(i) …….

(ii) …….

(iii) ……

(iv) ……

3. Opportunities;

(i) …….

(ii) …….

(iii) ……

(iv) ……

4. Threats;

(i) …….

(ii) …….

(iii) ……

(iv) ……

14. Give your own views on enhanced vegetation conservation and carbon sequestration under REDD+ initiatives;

(i) …….

(ii) …….

(iii) ……

15. What are contributions of Agro-forestry interventions on climate change adaptation and

mitigation strategies?

(i) …….

(ii) …….

(iii) ……

16. What kind of Agro-forestry technologies that are practiced in your region? Please explain by filling the table below;

| Type of Agro-forestry, **α** | Ownership, **β** | Area(ha), **μ** | Year of establishment | Species |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

**Note:** **α** = Woodlot, Fodder bank, Boundary tree planting, Alley cropping

**β** = Private, Communal, Community based organization, NGO's, Faith based organizations

**μ** = Area in ha in a range of 0 – 3, 4 – 6, 7 – 10, >10 ha

17. Forest conservation initiatives

Major Projects/programmes dealing with environmental conservation;

| S/N | Programme/project | Year of establishment | Main activity, **α** | Coverage |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

**Note: α** = PFM, CBFM, In situ conservation, Climate change mitigation, Carbon sequestration

18. Are there any conserved forests? (i) Yes [ ] (ii) No [ ]

19. Total area under forest in the district by village/ward by forest management category;

| S/N | Forest name | Forest type | Ward | Ownership | Forest area (ha) |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

20. Important forest reserves;

| S/N | Forest name | Ownership | Area(ha) | Location | Date | Remarks |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| | | | | | | |
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