IMPACTS OF DEFORESTATION ON SUSTAINABILITY IN TANZANIA

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Environmental Engineering

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ABSTRACT

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The aim of this thesis was to summarize and analyze some of the main causes and consequences of the rapid and continuing deforestation in Tanzania, and to illustrate the impacts of the problem on the social, economic and environmental systems of the country. It also suggests the best methods for overcoming deforestation in Tanzania. The thesis is structured to critique previous methods proposed in other research studies, mainly those conducted by the Tanzania National Forest Programme.

The issue of deforestation in Tanzania is a long debate between the country's desire for economic growth on the one hand, and environmental protection on the other. Multiple conflicts exist in policy-making and decision-making, which account for the difficulties in solving the problem. Activities undertaken by individuals and corporations concerned about their own financial gain bring a huge cost to the environment, to today's society, and to the future generations.

This paper provides a critical analysis of data from previous research studies and information published by the forestry sector in Tanzania. Failure to overcome deforestation up until now suggests a failure of previous methods to sufficiently address the problem. For this reason, a further assessment is provided in this thesis to highlight suitable approaches that might improve the situation. Adoption of affordable technologies could serve as a solution to deforestation in Tanzania.

The findings of this thesis expose the poor leadership and management in Tanzania, which gives rise to numerous problems, mainly poverty. This poverty in turn is a major contributing factor in the current levels of deforestation and the social, economic and environmental unsustainability of the country.

Key words: Tanzania, Deforestation, Sustainability

CONTENTS

ABBREVIATIONS AND TERMS

EU	European Union
FAO	Food and Agriculture Organization
GDP	Gross Domestic Product
LPG	Liquefied Petroleum Gas
MDG	Millenium Development Goals
NEMC	National Environment Management Council
NSGRP	National Strategy for Growth and Reduction of Poverty
PFM	Participatory Forest Management
PMI	President's Malaria Initiative
PRS	Poverty Reduction Strategy
REDD	Reduced Emissions from Deforestation and Forest Degradation
TANESCO	Tanzania Electric Supply Company
TDBP	Tanzania Domestic Biogas Programme
TIC	Tanzania Investment Centre
UN	United Nations
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
VCT	Voluntary Carbon Trading
VICOBA	Village Community Bank

1 INTRODUCTION

Deforestation is a process by which trees are cut down for other purposes. This tragedy has mainly affected the developing nations. Africa is the most deforested continent compared to others. According to Holmberg, Bass and Timberlake 1991, forests in Africa were being cleared 29 times faster than they were being planted in the early 1980s in comparison with 10.5 times in Tropical America and 4.5 times in Tropical Asia. However, the rates of deforestation vary from one country to another and this is due to the fact that different nations choose to approach forest monitoring differently hence the data is therefore inconsistent when comparing at global level. Differences in classification systems, assessment methods, and difference in frequencies by different nations all contribute to these variations (Holmberg, Bass and Timberlake 1991).

Tanzania, which is officially known as United Republic of Tanzania is located in Eastern part of Africa, bordering Uganda, Kenya, Rwanda, Zambia, Malawi, Mozambique, Burundi and the Democratic Republic of Congo. The Eastern borders of the country lie to the Indian Ocean. Tanzania was formerly known as Tanganyika but after it gained independence in 1961, Tanganyika and Zanzibar islands came together to form the United Republic of Tanzania. It has a population of 50.8 million people and surface area of 947,300 km^2 making it the 31^{st} largest country in the world and the 14^{th} largest in Africa. Population density is moderate with 47.5 persons per square kilometer. Tanzania has one of the highest birth rates in the world and the annual population growth rate is approximately 3.0%. (Government of Tanzania 2014)

The purpose of this study is to provide a clear understanding of the alarming rate of deforestation in Tanzania and the processes involved. The aim of the study is also to raise awareness by providing reliable information to the extent and causes of deforestation while linking this with the current social, economic, and environmental status of the country.

2 BACKGROUND

2.1 Previous Studies

Previous studies have suggested that Tanzania has undergone rapid rates of deforestation however so many different studies show differences in the magnitude of the situation. For instance, research that was carried out by the Ministry of Tourism, Natural Resources and Environment approximates that Tanzania has lost between 300,000-400,000 hectares of forestland per year (MTNRE 1989a). Other researches show that already more than 700,000 hectares of land has been deforested (Ahlback, 1988) while the World Bank and FAO have estimated the annual rate to be as low as only 130,000 ha of land deforested. This brings a huge problem when it comes to assessment of the problem and finding the right strategies to deal with reducing the levels of deforestation.

Furthermore, these variations on the rates, magnitude and causes of deforestation in Tanzania exist in different areas of the country. Different areas carry out different activities that help to sustain them economically and socially. Certain areas rely on agriculture as the main activity and this could be because of the presence of fertile soils, enough water and other reasons to favor growth of food while other areas are not favorable for agriculture. Since the activities are different, the urge in which people clear the land is also different. Therefore, in order for the case of deforestation in Tanzania to be reviewed accurately, all these variations have to be put in consideration so as to make an overall statement.

Tanzania has a total land area of approximately 94.5 million hectares and about 94% of this (88.6 million ha) is occupied by landmass while the remaining 6% (5.9 million ha) is covered by water bodies. From the 88.6 million ha covered by land, 35.3 million ha is forestland out of which 16 million ha is only reserved forests, 17.3 million ha are forests in open access land and 2 million ha are forests located in national parks. (Sawe et al., 2014)

Forests in the general land are unprotected and open to the public with no restrictions. So many activities are carried out here like setting up of wild fires, settlements, cutting down of wood for charcoal and timber and other uses which include agriculture and grazing of cattle. These activities contribute to the degradation of forestland. However, due to lack of finances for proper management of forests and high levels of corruption, the government of Tanzania has faced difficulties in preventing these illegal activities from occurring even within the reserved forests. Therefore both the forests in the general land and reserved forests are losing value.

Sources of capital for forest management in Tanzania mainly include income generated from forest products and services, funds allocated from the national budget towards forest maintenance and enhancement and grants and loans from partners funded to forestry related projects. The majority of these channels are mainly traditional and they do not generate enough capital to support innovativeness in the forest sector. However, recently some organizations are contributing foreign aid to the Tanzania forestry sector as it is heading to a hazardous state. Tanzania being the most deforested country in the world. (Ministry of Natural Resources and Tourism 2009)

Tanzania's population is growing so fast, approximately 2% per year according to research carried out by UN and this largely contributes to the rate of deforestation because most people rely on charcoal for energy. This mainly occurs in the rural areas and charcoal happens to be cheap compared to other energy sources like electricity.

Report released by the National Environmental Management Council of Tanzania (NEMC) suggests that the rate of deforestation in Tanzania is currently the highest in the world. The annual rate is approximately 1.1% compared to the global rate, which is at 0.5%. This implies the rate at which trees are being cleared in Tanzania is approximately twice the rate at which the activity is carried out in the world. The report further suggests rapid changes in the climate of the country. Approximately 300,000-400,000 hectares of forestland is lost through deforestation each year in Tanzania. This indicates how desperate the nation is for alternative fuels in order to overcome the situation (NEMC 2013)

The use of forests in Tanzania has proven to be very vital because they supply 90% of the national energy through wood fuel and charcoal and also cover over 75% of the

demand for materials used in construction. Use of these forests for other purposes has caused negative effects to the environment. The chemical engineer of NEMC Menan Jangu carried out this research and cited some of the effects like changes in the distribution of species, rivers and streams getting drier and changes in the hydrological cycle. This further affects the quality and quantity of water needed by humans and the environment. (Jangu 2013)

Most people in Tanzania mainly in urban areas currently rely on gas for fuel so a good alternative to prevent deforestation is for the government of Tanzania to consider lowering the prices of gas so as to preserve the forests. (Muyungi 2013)

Tanzania is blessed with beautiful flora and fauna, which is being destroyed by deforestation. A clear example is the melting of the ice glaciers at the top of Mountain Kilimanjaro. This is the highest mountain in Africa and it generates a lot of revenue to the country as it attracts so many tourists each year. For so many years, the Serengeti winds which blow at the bottom of the mountain carry cool air containing moisture to the top. This cool forest air would then replenish the glaciers and hence prevent melting of the ice. However, deforestation practices at the slope of the mountain have caused the winds to remain warm and dry resulting to the melting of the glaciers as the air flows to the top.

Foreign aid has been useful in assisting the government of Tanzania to overcome deforestation. Some of the companies investing in Tanzania are clearly non-profit and they aim at helping disadvantaged Tanzanians in improving their health, education and sustain the environment. For example, Wings of Kilimanjaro, a company founded in 2010 and registered in Australia has proved to be very beneficial especially to the village communities. (Wings of Kilimanjaro 2013)

The company developed Village Community Banking known as VICOBA program, which fund the poor families and support them to manage their small businesses. The weekly loan meetings bring the community together and this is used as the chance to educate the masses on importance of forests, water conservation and other sustainable methods of living. Most of the deforestation in Tanzania occurs in rural areas where the poor people cut down trees to get land for agricultural use and charcoal therefore education is really vital so as they understand the consequences.

2.2 Impacts of Poverty on the Environment

Poverty in most developing countries is usually referred to as a rural phenomenon. Recent developments in urban areas in Africa, Asia and the Pacific region have sparked rural-urban migration hence decreasing population pressure on agriculture land. This resulted to increase in agricultural productivity and reduction in poverty in these developing regions. (Dasgupta et al. 2005)

It is evident that poverty and lack of alternative sources of income have largely contributed to environmental degradation both in rural and urban areas. Previous studies suggest that for the case of Africa, the relationship between poverty and the environment has to be assessed with the gender issue in mind. Most African states have a strong culture in relation to gender and division of labour, which has an effect on how people interact with the environment and how resources are used. (UNDP 2003)

Based on this fact, Tanzania introduced national policies and strategies that deal with poverty reduction with the natural environment as a priority and all the stakeholders involved. Poverty Reduction Strategy (PRS) was developed in 2000 and the National Strategy for Growth and Reduction of Poverty (NSGRP) also known as MKUKUTA in 2005. These strategies were formulated mainly to commit in reduction of poverty, environmental degradation, illiteracy and discrimination against women. They were described as the UN's Millennium Development Goals (MDGs). (The REDD desk 2015)

Poor rural communities contribute highly to deforestation in Tanzania because they exploit natural resources inefficiently in search for biomass and income generation activities. Unsustainable use of these forests and its resources affects the needs of the future. The rate of urbanization in Tanzania is quite high and this accounts for the increasing rural urban migration. Anna Tibaijuka, the former Minister of Land, Housing and Human Settlements Development noted that at least one in four children in Tanzania is living in the urban centre and this either offers them a brighter future or a life of poverty. This is due to the increasing costs of food, housing and other necessities, which most families cannot afford. One out of six families in Tanzania residing in the urban areas live below the poverty line.

Poverty is a consequence of urbanization in Tanzania, which further leads to negative effects to the environment as the majority of the poor population will then exploit the natural resources available in order to survive. Some of which include cutting down trees for wood and charcoal, which are used for cooking, land degradation caused due to over crowding of the urban centres and increased levels of human activity causing over exploitation of the urban environment (WRI 1992). Most of the poor people also reside in informal settlements that are often set up in unsuitable land and this increases chances of flooding and erosion unlike the wealthier households who live in planned settlements. (UNICEF 2012)

2.3 Impacts of the Environment on Poverty

Poor households in most developing countries who are living below the poverty line are very dependent on natural resources to generate income and other necessities. It has been observed in Tanzania, that some of these poor people survive by selling fish from water resources, wood from forests and other natural resources. It is also true that the poorer the household, the greater the share of its income from environmental resources. Therefore the environment helps to sustain their livelihood but also causes negative impacts to the health of the poor.

Briggs explains that the environment is a major source of medicine for the poor households but environmental degradation contributes to the increase in health risks of these people. This is very common in most developing countries that have weak environmental management systems and poor technology, which causes increasing levels of pollution. (Briggs 2003)

Some parts of Tanzania especially Dodoma and Singida regions have been faced with poverty because of unavoidable low rainfall. Most of the people in these regions depend on agriculture but with very little harvests caused by the long drought season. Better technology serves as the only solution to this problem for instance use of simple water harvesting structures, simple compost pits and growing appropriate crops that can withstand the dry season. Sorghum is preferable to maize and cowpeas to beans in the dry season because they need less water but the population are resistant to change to

new crops. They also have low incomes to afford these sustainable methods. (Rohrbach et al., 2002)

Pollution to the air, water and land leads to diseases. Indoor air pollution, which is very common in both rural and urban areas in Tanzania due to the usage of charcoal for cooking, has been rendered harmful to the health of the citizens in most cases the poor households who cannot afford alternative methods of cooking like electricity and the use of gas cookers. This summary shows a strong linkage between the environment and the health and livelihood of the poor. Therefore appropriate policies and strategical measures should be introduced in order to intervene and study how to make the life style of the poor sustainable.

2.4 Rural vs. Urban Setting

The relationship in which poverty is linked with the environment in rural areas is different from that in urban areas. Tanzania is a very poor country and it has been debated that "Poverty is a major cause and effect of global environmental problems…"(WCED 1987). This has already been evident in Tanzania and other developing countries however there is still a tendency to conclude to simple relationships for instance afforestation, which in the end do not bring positive changes to the people. The relationship between poverty and the environment must not be overlooked as they conflict with each other. Poverty reduction and environmental protection could possibly have conflicting goals and much attention for that matter is necessary. (Holmberg 1991)

2.4.1 Rural Communities and the Environment

In most rural communities, family is the link for the transfer of knowledge, behavior, skills and environmental values from one generation to another. For example in the African culture, women are taught by their grandmothers that rain comes from trees (Opubor 2010). Rural people are usually blessed with extensive environmental knowledge but they often face difficulties in decision making when trying to preserve the surrounding environment against sustaining their families economically.

To a large extent, rural urban migration usually involves men, the head of the family moving to urban areas to look for jobs so as to support their families in the village. This puts more pressure and additional burdens to women in the rural areas as they are left solely responsible for the family. Large-scale migration results in environmental degradation as the women are left with no alternative but to provide at the cost of the environment (Rodda 1991).

2.4.2 Urban Communities and the Environment

Research suggests approximately 60 million people are added to the urban population in the world each year and the population will grow to an estimated 1.8 billion people in the next 25 years (World Bank 2006). This growth is expected to occur in the developing world and this will have negative implications on the environment and depletion of natural resources. The United Nations Environment Programme (UNEP) has described some of these areas under rapid urban expansion including Sub-Saharan Africa and Asia as regions under environmental assault. Existence of a number of people in these urban communities living in slums has negative effects on the utilization of resources and the environment. Urban environmental degradation is a huge challenge to most developing cities in the world today and cannot be solved by merely technological innovation alone. (World Bank 2006)

3 CURRENT SITUATION IN TANZANIA

3.1 Trends in the Forest Sector

Forests in Tanzania are classified into two categories: reserved and nonreserved forests (Tanzania, 2002b). Reserved forests are basically local government forest reserves, forest reserves in the village land and government industrial plantations while the nonreserved forests are situated on general land. (Tanzania 2001)

Forests are believed to be the heart of Tanzania because their contribution to the economy is very significant. Other economic sectors like agriculture and tourism also rely on forests however the contribution of the forest sector is highly unrecognizable and much of the forest data is missing and unrecorded (World Bank 2005). Much of the trade related to forest products and services is usually illegal that's why the information on the transactions is not recorded. An analysis made by the World Bank summarises that the economic importance of the forest sector to the national economy is not felt or seen because the contribution of forests to the GDP is not accurate (World Bank 2005). This undervaluation affects the decisions made by the government towards forest management and allocation of financial resources.

Illegal logging is part of the activities ripping up Tanzanian forests. Weak forestry management usually leads to heavy corruption and the staff that is responsible of ensuring efficient utilization of forests is then involved in illegal timber harvesting and other activities. This is strongly associated with low wages and high poverty rates, which initiate people to find alternative ways to earn more income and cater for their individual needs. Also, high demand for wood by the construction and furniture industries leads to extinction of some indigenous tree species as 70% of the harvested woods is unaccounted for (Smith 2015). This makes it difficult not only to Tanzania but to all developing countries to overcome deforestation and grow economically as a lot of revenue is lost.

3.2 Forestry Research

Emphasis of all previous researches has been placed on linking management of forests with the pressing socioeconomic issues like poverty alleviation, food security and

improvement of people's lives. Conservation of natural forests is also highly associated with biodiversity conservation globally. However, due to lack of enough funds in Tanzania, the research findings are hardly put into application. Too much reliance on foreign funds is not reliable and the Millennium Development Goals (MDG) set by the government are hardly accomplished. More research is needed on illegal activities being carried out in the forestry sector as this contributes to deforestation and the negative impacts associated to the environment.

3.3 Forest Biodiversity

Tanzania is classified as a "mega diversity" nation because of the high variety of habitats located in different parts of the country (see Table 1). Other countries in this same category include Brazil, Indonesia and the Democratic Republic of Congo. This clearly shows how important forests are to Tanzania and deforestation as a means of sustaining the economy can be a big threat to biodiversity.

Table 1: Some Critical Biodiversity Aspects in Tanzania (Tanzania Country Study on Biological diversity 1998. modified)

Habitat Type	Location	Importance
The Eastern Arc Montane Forests	Usambara, Ukaguru, Udzungwa and Uluguru Mountains	High diversity and endemism; also important catchment areas
Montane Grasslands	Udzungwa mountains, Ufipa plateau and Southern highlands	Remarkable and endemic flora
Coastal Forests (including mangroves) and thickets Mangroves	Coastal areas and Zanzibar	Many rare and endemic taxa and species and sub-species
Grasslands and open woodlands	Serengeti and Maasai Steppe in the North-West and North-East	Greatest concentration of large mammals in the world
Itigi thickets	Central Tanzania	Unique habitat due to high degree of endemism
Miombo woodlands	South and West of Tanzania	Some of the world's most significant population of elephants and black rhinos

Huge loss of biodiversity is still an ongoing process due to improper management of wildlife and the forests, which result to activities like forest encroachment, overgrazing, poaching, wild fires and illegal logging.

3.4 Training and Education Services

Most activities in African communities especially in the rural communities, resulting to increase in poverty occur due to lack of awareness (Strydom 2011). It is very important to educate the masses so as to set up standards and boost the quality of life. Some of these include gender inequality. The African culture system is very biased and until today women in Africa are not empowered. Young girls remain uneducated at times not because of the culture or unwillingness but because of the already existing poverty where boys are favoured to pursue their education with the limited funds available.

Some of the problems that arise due to lack of education include increase in the incidences of HIV/AIDS and increase on the rates of deforestation as people cut down trees without awareness of the consequences. Education is one of the most important tools in eradicating poverty, as young educated girls would be able to acquire jobs and contribute to the economic situation in their families hence reducing dependency on men.

However, increasing access to education would compromise the quality of education so heavy investment is required from the government so as to ensure the existing resources are not strained. In 2002, the Government of Tanzania made a huge investment in primary education and abolished school fees. This caused the number of enrolled students to rise from 60% in 2002 to 96% in 2006 (National Bureau of Statistics, United Republic of Tanzania 2007). In order to meet the increased pressure in providing the necessary support and infrastructure, another huge investment was made on training thousands of teachers and provision of grants for construction of more schools. Therefore, access to education was increased without compromising the existing quality. (National Bureau of Statistics, United Republic of Tanzania 2007)

Poor technology and lack of technical know-how among the forest employees in Tanzania affect the harvesting and processing activities hence the output from forests contributes less than expected to the economy making the whole process unsustainable.

3.5 Trade Liberalization

National GDP estimates do not take into account so many factors, which diminish the value of the forestry sector in the national economy. Some of these factors include forest products that generate huge income but the trade is not formal and the contribution to the GDP is then zero. Tanzania's GDP is also largely boosted by agriculture and the contribution of forests towards agricultural production is ignored. This explains that the forestry sector is very vital to the economy of Tanzania (Sharma 1992).

Nationally, Tanzanian forests are valued at US $750 per hectare and this is calculated based on the earnings from tourism, exports and royalties collected however globally the value of the Tanzanian forests are given more value based on their capacity to fix carbon dioxide levels in the atmosphere. They are approximated to be worth US $ 1,500 per hectare. Furthermore, these forests contain products for export such as logs, wood, honey which increase their value. Exportation of these products has been facilitated by the liberalization of trade. (FAO 2013)

Trade Liberalization basically means the removal of trade barriers such as duties, subsidies, licensing regulations and other barriers that do not facilitate the free flow of goods and services. This has benefited the sale of forest exports from Tanzania.

However, Liberalization has not only been economically beneficial because it has resulted in the increase of the volume of forest products that are consumed. For instance wood products that were consumed by the construction sector after the introduction of trade liberalization increased by 459,000 m^3, the quantity of wood consumed by the manufacturing sector increased by 551,838 m^3 and amount of fuel wood that was consumed in Tanzania after liberalization increased by 900,000 m^3. The quantity of fuel wood might not be reliable due to the presence of so many kinds of users both in the rural and urban areas. Changes in the amount of wood consumption also cause changes to the rate of deforestation and this has an impact to the environment (Investopedia 2015).

3.5.1 Environmental costs

Increased exportation on the quantity of wood and its products after liberalization has contributed to increased rates of deforestation in Tanzania. This is harmful to the environment however the effects cannot be placed solemnly on liberalization. Developing countries like Tanzania have benefited positively and liberalization under no circumstance could not be discouraged however policy makers have been encouraged to authorize only those policies that bring environmental, social and economic benefit to the country. Approximately 45,000 hectares of forests have been directly or indirectly lost through trade liberalization. This estimate was made after ignoring other activities that can lead to deforestation like expansion of agricultural land and increase in population (UNEP 2004).

Trade liberalization in Tanzania resulted to both positive and negative impacts to the environment and social standards. Positively, it caused the expansion of the forestry industry through increased production and trade of forest products, which further led to an increase in the economic contribution of the sector to the country. There was an increase from 3% to 11% of the country's total exports coming from the forestry sector in Tanzania after trade liberalization came into play. This led to increase in GDP and employment opportunities to the people (UNEP 2004).

Negatively, there is increased deforestation due to increased demand of wood and forest products for export after liberalization was adopted. However, policies to sustain the existence of trade liberalization have to be introduced in Tanzania so as to sustain the environment. These include: pollution control agreements, forest product duties, license to control forest operators, certificates on forest products and other strict measures like heavy fines and penalties. (UNEP 2004)

4 GOVERNMENT POLICY

This section provides a review of the national policies that address environmental issues and how they attempt to increase sustainability and also overcome deforestation.

4.1 Land Policy

Land Policy was introduced in the United Republic of Tanzania with a main purpose of responding to all kinds of pressures like human and livestock population growth and urbanization. The policy also gave the locals assurance and protection from external invaders on their land. It emphasizes proper land use and protection of hazardous land, which implies improved management of the environment (Ministry of Lands and Human Settlement Development 1995). However successful implementation of this policy faces numerous challenges in Tanzania partly because of the history of the country. Colonial times and demographic trends contributed to the problems today related to land use and land tenure thus solving the problem by a mere policy or directive almost seems impossible because so many issues have to be addressed. Some of the issues include growth of the rural and urban areas, agricultural growth and environmental protection.

On a positive note, the land policy has assisted in conserving the environment and reduces land degradation, which indirectly reduces the rates of forest loss in Tanzania.

4.1.1 Women Access to Land

Often under the law, women in Tanzania have inferior rights towards ownership and access to land (Ministry of Lands and Human Settlement Development 1995). It should be noted that women especially in villages rely on land especially forest land for forest produce like timber and wood and the new policy grants them permission to access land through purchase and allocations. The advantage in this case is that the policy limits the owner of the land to develop it rather than degrade it under the land use regulations. Therefore, previous land degradation which was occurring unnoticed will then be minimized in this case as the owner of the land will be held accountable. (Ministry of Lands and Human Settlement Development 1995)

4.2 Forestry Policy

The objective of the National Forestry policy introduced in Tanzania in 1998 is to assure that the forest sector contributes towards sustainable growth of the country and management of natural resources (National Forest Policy 1998). The policy encourages Participatory Forest Management (PFM), which involves participation of the local communities in utilization and management of forest resources. PFM has benefited the locals as it has granted them control and easy access to the forest resources. However, the policy has been unclear in certain occasions like payment of royalty fees and specifics regarding financial incentives. It states that royalty fees from utilization of forest resources should be according to the current market value of the harvested products but it does not indicate how the process will be conducted. Regarding financial incentives, that are required for the management and replanting of forests, the policy does not specify what these incentives exactly are. (National Forest Policy 1998)

The policy has seen no achievements mainly due to the centralized forest management system of Tanzania whereby the government institutions have control in managing the forests. The National Forest Programme has cited low capacity by the government institutions in efficiently managing the forests, which has resulted in a number of illegal practices including poor revenue collection that further affects the economy of the nation (MNRT 2001)

The government has been forced to further review the policy so as to identify the errors and ensure proper implementation (Ministry of Natural Resources and Tourism 2006). Poverty is a major issue that has to be addressed in the new policy, as it is a concern to the sustainability of the environment. Improved forest monitoring methods are under development to ensure accurate data is obtained for analysis and efforts to create other economic activities, which will reduce the pressure on forest resources. Corruption is also still a huge challenge to overcome to ensure growth in the forestry sector. A scandal occurred in 2004 in Rufiji, Tanzania, which involved government officials accepting bribes that fostered illegal harvesting of logs valued at approximately USD 205,405.

In order to improve forest management, the government of Tanzania passed the Forest Act in 2002 that grants legal permission to individuals, communities or groups to own and manage forests under specified conditions. This is also known as Participatory Forest Management (PFM), which is now widespread in the country, but only few villages are operating with the new forest management as required in the Forest Act, 2002. (Ministry of Natural Resources and Tourism 2006)

4.3 Energy Policy

Energy consumption by most of the population in Tanzania is directly linked with the levels of poverty but this is not addressed in the energy policy. The policy acknowledges that major source of fuel for cooking and heating is wood fuel and an energy switch is most likely never going to occur because the alternative forms of energy are more costly. Due to the high consumption of wood fuel, the rates of forest loss are much higher compared to the rate at which they are regenerated. The objective of the policy however was to find means to exploit the alternative sources of energy that included: hydroelectricity, natural gas and coal resources and also petroleum with a purpose of controlling wood depletion. The policy also suggests better land management and more efficient technologies on wood fuel. (Mnzava 2011)

The policy was then revised in 2003 due to the involvement of the private sector in policy implementation, changes in the role of the government and changes in the global markets that enhanced changes in the economic structure of the country. The revised energy policy in 2003 had a mission to improve on the sustainability of the country by introducing better technologies in production of energy and efficient monitoring of energy sources from production, transportation and distribution to the end user. (Mnzava 2011)

Poverty eradication which highly accounts for energy consumption in Tanzania was still not given a priority in the reviewed policy and hence failure to reach its targets. Other challenges that contributed to failure of the policy include lack of intensive research, ignorance of the locals and some laws have still not been passed as they lack legal support. (Mnzava 2011)

Results of the current status of the Tanzanian energy policy, which was analysed, based on data collected from different sectors and individuals between 2010 and 2012 clearly indicate that the policy is not working efficiently and review is highly required. (Mnzava 2011)

Mnzava's findings on the analysis of the policy show poor understanding and awareness of the policy to individuals and sectors, weakness on implementation of the policy and low participation from different sectors. The policy is also outdated and therefore review is highly required. (Mnzava 2011)

5 CAUSES OF DEFORESTATION

Total forest area of Tanzania is approximately 35million hectares and the current research conducted by the National Framework for REDD (Reduced Emissions from Deforestation and Forest Degradation) shows that 412,000 hectares of this forest land is lost through deforestation annually (Tanzania Forestry working group 2009). The framework further suggests that some of these deforestation activities are occurring inside the reserves, which is illegal. Poor management and corruption among officials causes the breaching of these laws. Most of the forest loss is taking place outside the reserved forests and the reasons behind this activity mainly include searching for fertile land for agricultural activities as demand for food has increased and woodlands are being converted into farmed lands and also increase in the population which causes people to seek land for settlement. Agricultural practices and population expansion are the main factors behind increasing deforestation. The majority of the population also relies on woodlands for charcoal and timber, which leads to further loss in forests. (Malimbwi 2008)

5.1 Population dynamics and Urbanization

In most cities that are growing so fast, forestland has been largely cleared to create room for infrastructural development and also support the expanding population (Mather 1991, Sands 2005). Once an area is equipped with good infrastructure like roads, railways and airports, then that area is exposed for further development, which attracts many people to move and settle there.

Major cities in Tanzania are expanding rapidly in population and urbanization activities For example Dar es Salaam city, which has a population of approximately 5 million people (equal to 10% of Tanzania's population). Dar es Salaam currently has a growth rate of about 5.6%, which is equivalent to additional 250,000 people per year. This is a huge number and it exerts a lot of pressure on the economic and social sytems. Over 70% of the people in Dar es Salaam reside in unplanned settlements and the local authorities are faced with a huge challenge to provide the residents with basic services. (Kidata 2013)

5.2 Agricultural Expansion

It is rare to find a single factor that leads to deforestation. Usually multiple processes of work are involved. Conversion of forest land to farm land is a direct cause of deforestation but it can also result from other direct factors for example costruction of roads provides entry and access to previously remote areas and farmers take advantage of the situation. This previously inaccessible forestland sooner or later is converted to agricultural land.

Tanzania's economy heavily relies on agriculture, which is a huge challenge in overcoming deforestation (Malimbwi 2008). Most of the employment and revenue from exports is derived from agriculture. One example is tobacco growth in Central Western Tanzania, in Tabora, which is massively contributing to deforestation over the decades thus causing extremely poor weather conditions. Tobacco has been a major source of income for the farmers of the region and efforts to persuade or educate the locals on the effects of cutting down trees for growing of tobacco have proven a failure. Today, there is shortage of firewood in the area, water shortages due to lack of rainfall and wild animals like antelopes that lived in the forests are not seen anymore. This clearly indicates deforestation brings more harm than good. (Thomas Reuters Foundation 2012)

A potential conflict exists between agricultural expansion and loss of biodiversity related to deforestation in the country. Increased interest from foreign and domestic companies on agricultural investments in Tanzania for export is a big threat to the existing ecosystems and biodiversity. Policies, which favour foreign investment, need to be revised to ensure a clear understanding of the implications. These tend to be part of the driving factors accountable for conversion of natural lands to subsitence or commercial land. (Pintea 2012)

Charcoal Energy

The use of charcoal is common among the population in Tanzania mainly because it's cheap. It is used widely among the urban poor and also in rural areas. Even the high-income households in the urban areas who are accustomed to the use of electricity and

gas still consume large quantities of charcoal. Wealthier households can afford to buy charcoal in bulk and so they pay less per unit price compared to the poorer households who often buy in smaller quantities usually on a daily basis. Charcoal is also used as the source of energy for cooking in most institutions in Tanzania like schools, hospitals and restaurants.

Dar es Salaam is the former capital city of Tanzania and it is the most industrialized and developed city in the country. There are two types of people who live there, the wealthy and the poor. Many people from the rural areas migrate to the city in search for jobs and better standards of living, which accounts for the increase in demand for charcoal. Charcoal is the most used energy source and the use of electricity has depreciated because it is expensive. Increase in electricity tariffs in 2014 by an average of 40% had direct impacts on its usage as only 18% of the households in Tanzania had access to it. Firewood is hardly used at the city because it involves transportation of wood from the rural areas, which is not very reliable. The consumption of charcoal has increased over the years because it's affordable and Tanzania is also faced with a major problem of electricity shortcuts that leaves charcoal as the quickest alternative. (World Bank 2015)
In other urban areas of the country, charcoal and firewood have been widely used over the years while in the rural areas, most of the population use firewood for cooking. The use of electricity for cooking in rural areas has totally diminished.

Charcoal Consumption

Charcoal consumption rates have been increasing at a high rate in most developing countries, which alarmed donors as early as mid-1970s to fund projects in order to overcome this challenge. This mainly consisted promoting the use of other fuels as well encouraging the use of modern stoves that are more fuel-efficient. However many households in developing countries have not adopted the use of these modern stoves due to the high investment costs involved. (Schlag et al. 2008)

Other reasons why the modern stoves adoption has not been successful is due to their fragile nature which most people think and thus their life span is shorter as compared to the traditional cooking stoves (CHAPOSA 2002) and the wrong assumptions from the manufacturers of these stoves to meet the needs of the end users. Improved stoves are designed with a main purpose of fuel savings while the stove users are mainly interested

in the cooking speed of the stoves. A study that was undertaken in the neighboring country Uganda that also has many users of traditional stoves provided evidence about the efficiency of different types of stoves under different circumstances (USAID 2007). The test was conducted in 2 common cooking situations in the daily lives of the local people. These involved boiling of water and cooking of food using the modern and traditional stoves. The results revealed that different stoves are more efficient under different circumstances and this is a fact that needs to be highly considered when conducting the process of switching fuels to alternative fuels in order to improve efficiency. This accounts for the reason why the wealthier households prefer to mix energy sources in their daily consumption. Use of charcoal mainly for meal preparation and using modern methods like LPG (Liquefied Petroleum Gas) for quick usage like boiling water or tea. Using LPG for cooking which consumes more time has been discovered to be more expensive and consumes more energy.

Furthermore, the use of new improved stoves by the local people would imply acquisition of new cooking tools which means more expenditure and the need to change their usual cooking habits using the old utensils and the majority would find this difficult to adopt. Also, wealthier households in most developing countries like Tanzania usually hire a maid to help in food preparation and other activities. These maids usually are not responsible for the consumption of fuel and choice of cooking methods because the financial burden lies on the owner of the premises. Men are most times the head of the house and are responsible for provision to the rest of the family. Women usually have less power when making financial decisions of the family, which also denies them the opportunity to decide on the inputs in the household or the fuel choice. This suggests that even with the adoption of the improved stoves, there is a strong culture among the target group that requires transition as well.

However, low rates of awareness in Tanzania highly contribute to the majority of the behavior of the people. More work needs to be done on informing the masses, that the use of modern fuels is beneficial to their health and sustainable to their living. Most common cooking method of burning wood fuels is associated with inefficient and incomplete combustion, which causes indoor air pollution. Some of the common pollutants include carbon monoxide, sulfur and other harmful particles, which can result to respiratory and pulmonary diseases (Fullerton et al. 2008).

Charcoal production and consumption is a source of employment to many Tanzanian citizens and a source of income of many entrepreneurs especially in the city Dar-es-Salaam where the consumption is the highest. An estimate of 2,650 tons of charcoal is consumed in Tanzania on a daily basis, which amounts to approximately 1 million tons per year (Malimbwi et al. 2007). This is equivalent to more than 125,000 hectares of deforested land annually. Dar-es-Salaam, which is over populated, consumes about half of the total charcoal consumption, which is approximately 1500 tons per day (Malimbwi et al. 2007). Based on these consumption trends, it has been predicted that charcoal consumption only in Dar-es-Salaam will double in the next 20 years if improper forest management activities continue. Most of the firewood consumed in Dar-es-Salaam comes from the surrounding districts because most of the forests that were present in the city have been lost to settlement. These trends further suggest that the forest cover in the 3 surrounding districts nearest to the city is expected to disappear in the next couple of years. (Malimbwi et al. 2007)

Charcoal production and consumption is an activity that will be so difficult to overcome in Tanzania because it involves so many beneficiaries some of whom include the government, the laborers, transporters, traders and the individuals who finally consume the product. The government earns revenue by issuing licenses for the exploitation of the forests and the transporters and traders of the product also pay duties and taxes. However, due to improper management, so many illegal activities are carried out and some of these forest resources are exploited without authorization, which cost the government revenue. Approximately 80% of the charcoal product transported to Dar-es-Salaam is processed and traded illegally. (Malimbwi et al. 2007)

Pollution from Charcoal

Claims have been made that domestic use of fuel increases the risks of malaria as the pollution increases the number of mosquitoes. Women and children are the most exposed to these pollutants in developing countries. (Zhang et. al. 1999)

Indoor air pollution in Tanzania resulting from the use of traditional cooking stoves is accountable for approximately 1.9 million premature deaths annually. Majority of the adults suffer from lung diseases and lung cancer while the children are affected by

pneumonia, which result to death. Approximately 1.5 million children die of pneumonia due to the smoke from traditional cooking ways. (Luffman 2010)

3-Stone Fire is the most common method for cooking in the rural areas of Tanzania. In this method, the 3 stones are used to support the cooking utensil while wood is burnt at the bottom directly below the utensil. Approximately 94% of the rural population use wood for cooking and the remaining 6% prefer charcoal. Urban regions of the country also mainly use charcoal for cooking. The improved stove of the first generation is currently widely used and with its increased energy efficiency, it has helped in reducing the levels of carbon emissions to the atmosphere as well as on the amount of wood required for burning. The most improved stoves with greater efficiency are not common because of the expenses and cultural barrier in changing cooking habits. (Tanzania Projects 2015)

These improved stoves are hand made usually from metal scrap and clay and can be used to burn both wood and charcoal. They are ideal for outdoor cooking but also used indoors. They are also the most used stoves among the Tanzanian people.

Most families in the rural areas consume a lot of time in search for large amounts of firewood for cooking using the 3-stone stove but the improved stove shown above uses less firewood and burns more efficiently while producing less smoke. Therefore, the improved stove is not the most efficient stove to use but it has benefits to the people, which include saving their time in the forests looking for firewood, reducing on the chances of respiratory diseases because it produces less smoke and also reducing on the rates of deforestation. Research shows that this improved stove saves over 50% of firewood, which would have been consumed while using the 3-stone stove. (Tanzania Projects 2015)

6 IMPACTS OF DEFORESTATION

6.1 Environmental impacts

Deforestation leads to soil erosion and pollution and disruption of the hydrological cycle, which result to the loss of habitat for plants and animals. Trees in the forests help in maintenance of soil fertility by reducing the speed of water flow from rain hence reducing soil erosion (National Geographic 2015). In January 2009, the North Mara Gold Mines without proper environmental impact assessment of the effects in the future disposed off 2000 tonnes of toxic substances to the surrounding community. When the rains started, this debris was washed away to the river known as River Tighite, which is utilized by the neighbouring villages of Nyakunsuru, Nyamone and Weigita located in the Mara region. This resulted to the death of fish in the river and pollution of the water meant the community was in danger of catching diseases. Trees in existence at this location which were previously cleared would have served to control soil erosion and the debris being transported to the river (Bitala et al. 2009). This is just one example of the hazards of deforestation in Tanzania as it is a negative factor to the growth of the country.

Major concern of deforestation however is the loss of biodiversity. Tanzania is very rich in diverse resources but recent studies show that over 22 mammal species, 30 bird species and 326 plant species have been shortlisted as endangered since 2001. (Social watch report 2012)

During my practical training at the National Environmental Management Council (NEMC) in Tanzania which is an organization appointed by the government to handle all environmental issues of the nation, part of my study and findings included the extinction of the Kihansi spray toad (Nectophrynoides asperginis). They are known as Kihansi because they are only found at Kihansi falls, in the Kihansi Gorge which is located in the mountains. This species is unique as compared to other toads because it does not undergo a tadpole stage, with the females giving birth to live toadlets. (NEMC 2015)

These toads are very sensitive. They can only survive on a specific environment, which was available at the Kihansi gorge. Sprays coming from the Kihansi falls created a

certain microclimate around the area, which was favorable for their survival. However, the government of Tanzania decided to take advantage of the Kihansi falls and construct Kihansi dam so as to generate electricity to other parts of the country. The construction of this dam also lowered the amount of water flow to the gorge, which hugely affected the volume of spray as well as affecting the vegetation. The Kihansi toads could not survive in this environment and the population was becoming extinct. Several artificial ways have been developed so as to mimic the natural spray of the Kihansi ecosystem so as to save the remaining population of these toads. For example an artificial gravity-fed sprinkler system was set up and this seemed rather useful as the population of the toads started to grow. Some of the toads were quickly transferred to the United States for research and also save the amphibians from extinction. A similar environment was created so as the toads could survive. (NEMC 2015)

Deforestation was part of the practices, which had to be carried out to favour construction of this dam so as to pave way for establishment of work sites, residential camps, storage sites, office facilities and construction of roads. This facilitated the exctinction of the amphibian.

Deforestation at the slopes of Mountain Kilimanjaro, which is the highest mountain in Africa located in Northern Tanzania, is also responsible for changing of the moisture flow patterns and vanishing of the snow cover at the top of the mountain. This can be a clear example of global warming in the world as a result of changes in the land use. However some researchers claim climate change should not be associated with the melting of the ice on Mountain Kilimanjaro. (Cook 2015)

6.2 Social impacts

The community conceives impacts of deforestation in many ways. Depending on how fast it spreads and affects them. Some of the impacts are considered acceptable, tolerable and some intolerable. For example in Liwale district located in Southern Tanzania, no conservative measures are taken against deforestation because it is considered acceptable. Liwale is one of the communities located in Tanzania with very large forest cover. Forest area is approximately 7 ha per person on average. (Kaale 2013)

Taking note a common African saying, ‘When the last tree dies, the last man dies.’ however its interpretation has not been effective in most communities. Trees are a source of food and medicine to humans and there existence is very important in solving problems of climate change. (Ghanaian Chronicle 2010)

In Tanzania today, the Government is not addressing environmental issues appropriately and favour is still given to foreign enterprises that come and displace the poor farmers from their land. The economy of Tanzania is very dependent on agriculture, which contributes over 40% of the GDP and therefore displacing these farmers who solely depend on farming for income and food raises a lot of problems. It causes increases in food insecurity and poverty in the society. The policies set by the Tanzanian Investment Centre (TIC) are too open for investors to come and explore resources, which give rise to increased deforestation as some of the forests need to be cleared for development of infrastructure. Therefore, positively some of the areas where trees have been cut down for such developments begin to progress as more jobs are created. However the process is unsustainable to the environment. (Social watch report 2012)

Deforestation also contributes to the rise of diseases in the community. When trees are cleared, there is an increase in the ground temperature, which further results to the increase at the rate in which mosquitoes develop into adults and the rate at which the parasites develop within the mosquitoes (Hawkins 2010). These mosquitoes lead to the spread of malaria. It has been analysed that ‘For every 1% reduction in forest cover, there is an increase in 8% of the malaria mosquito population.’ (Hawkins 2010). A clear example are the previously malaria-free highlands of East Africa where malaria is now wide spread due to the increase in surface temperatures resulting from loss of forest cover. However, it is also important to note that a forest-dwelling mosquito in SouthEast Asia is responsible for the spread of malaria in the region so in this case, deforestation helps to solve the situation (Hawkins 2010).

Malaria is one of the main health problems in Tanzania and nearly all people residing in Tanzania are at the risk of getting infected by malaria. Approximately 14-18 million cases are reported annually and this accounts for 100,000-125,000 deaths that occur in all age groups. Children under 5 years of age are more vulnerable to the disease and approximately 70,000-80,000 deaths occur annually. This disease is part of the challenges Tanzania faces in order to sustain its economy as it reduces productivity of

individuals between the ages of 15-55 years and also scares away foreign investors. (Ministry of Health 2002)

Government intervention and foreign support has aided in overcoming the widespread of malaria and hence reducing on the number of deaths over the years. An initiative was launched in 2005 known as the President's Malaria Initiative (PMI), which aimed at fighting malaria and saving lives by using appropriate technology and effective treatment measures (PMI 2014). Currently Tanzania is a focus country of this initiative for 9 years now and improvement on malaria has been noted (see Table 2). Deforestation is not the main cause of malaria in Tanzania but it is a contributing factor so attention needs to be noted so as an overall and effective solution is found. The disease can be prevented but many factors including political, environmental and socio-economic issues affect its control and prevention. (PMI 2014)

Table 2: Malaria deaths in Tanzania (World Malaria Report 2010 modified) Available at http://www.who.int/malaria/publications/country-profiles/profile_tza_en.pdf

Deaths	All Ages		Less than 5 years	
Year	All-cause deaths	Malaria deaths	All-cause deaths	Malaria deaths
2000	736	379	490	252
2001	702	390	439	249
2002	696	374	420	232
2003	597	308	305	178
2004	657	312	321	187
2005	613	247	319	163
2006	451	137	243	88
2007	388	64	187	36
2008	379	29	186	23
2009	266	21	139	20

6.3 Economic impacts

As much as trees are very important to the environment and to man for food, medicine, jobs, climate change etc, conflicts arise when the same trees are equally important when they are cut down for infrastructure and source of revenue for the country from exports.

The forestry sector contributes towards sustaining the economy of Tanzania however its contribution to GDP has been low over the years. However, the forestry industry has boosted other sectors such as tourism because Tanzania is one of the countries in the world blessed with numerous biologically diverse resources. The highest number of mammals in Africa, second highest number of plants (10,000 species), third largest number of birds (1,035 species), fourth largest number of amphibians (123 species) and fourth highest number of reptiles (245 species) are all found in the forests of the country (UNEP 2004). Tourism plays an important role towards the development of the country as it employs over 200,000 Tanzanians and also generating over 25% of the foreign exchange inflows to the country. This accounts for over 17.2% contribution to the GDP (allafrica 2010). Therefore, deforestation that leads to loss of biodiversity stands as a diminishing factor to the country's tourism market and growth of the economy.

However, positive impacts of deforestation include the selling of forest products, which contribute largely to the economy as well. Jobs are created and revenue for the government is acquired. Trade and production of these forest products was enhanced by trade liberalization whose policies have had positive and negative impacts to the environment, social and economy. Table 3 illustrates positive impacts in the increase on the sale of forest products that are friendly to the environment. Before the adoption of trade liberalization strategies, most of the forest exports were unprocessed for example logs but trade liberalization policies stand for processing of domestic products before exportation so as to add value and reduce on intensive harvesting which leads to massive deforestation. (UNEP 2004)

Table 3: Economic benefits influenced by trade liberalization (Trade statistics and Economic surveys. modified) Available at http://www.investopedia.com/terms/t/trade-liberalization.asp

Ex ante annual trade value of wood and related products	
Item	In US dollars
Wood products	1,544,400
Timber and its products	0
Processed wood products	0
Ex post annual trade value of wood and related products	
Item	In US dollars
Wood products	21,110,000
Timber and its products	8,000,000
Processed wood products	2,000,000

Net benefit of the trade effect can be seen from the table above and contribution of the trade of the forest products after deforestation can also be seen.

7 CHALLENGING ISSUES

Based on the analysis above, the following issues have to be addressed appropriately as they are relevant in facilitating a successful implementation on the required actions and necessary policy reforms in order to increase efficiency and achieve the goal of reducing forest loss and degradation.

7.1 Law Enforcement

Rate of deforestation in Tanzania today is still very high and this is due to insufficient resources to enforce the law or corruption, which accounts for the irresponsibility undertaken by the authorities in deliberately breaching the law.

Recent survey by experts clearly shows that legislation and policies to promote sustainable production and trade exist in Tanzania but the stakeholders involved are not aware of what they are responsible for in addressing sustainability. It is then a challenge to enforce a law that is not clear to the parties involved. Legislation is very vital in overcoming deforestation so it must be clear and precise to the stakeholders so they are held responsible when breaching the law. (Tambwe, 2014)

The government of Tanzania has set up numerous strategies aimed at protecting the forests but it is still evident until today that illegal activities are being carried out on a daily basis. Weak laws, lack of resources combined with corruption all contribute to forest loss.

Complexity of the problem

Illegal activities such as illegal logging involve many players. Some of the players include small groups of villagers or people who chop and saw an average of 3-4 trees a day. There are thousands of these small groups operating daily, which then sums up to plenty of trees lost in a day. Medium sized groups who use boats to transport illegally cut wood through rivers to saw mills for processing and the big players who include international companies who own logging permits. These international companies often mix illegal wood in their processing activities and it is usually tons of illegal wood.

Demand for wood in the world has increased and it is estimated that approximately 40% of wood products entering the EU from Asia is a result of illegal logging. This shows the connection of criminal offences committed worldwide in the forestry industry by the big players and the increased market for forest products. (WWF, 2008)

Tanzania is identified as a country blessed with one of the best forests however a survey conducted by the Transparency International in 2014 which uses the corruption Perception index to indicate the levels of corruption in a country ranked Tanzania 119 out of 175 countries. Laws are breached very frequently in Tanzania because of corruption and illegal activities are supported by this system. Failure to comply with the law accounts for the high rates of forest loss in the forestry sector. (Transparency International 2014)

7.2 Policy Conflict

Process of implementing many policies in Tanzania and also in the world usually brings rise to conflicts as to what is be expected to be gained in the end. Emphasis especially in most developing countries is usually put on promoting growth and the wellbeing of the natives at times is not given priority. This creates the issue of unsustainability and all the negative impacts involved.

Some of the existing policies like the agricultural policy, livestock policy and natural resource policy already conflict with each other. The priorities in agriculture and livestock affect the natural resources negatively and so is the vice versa.

Present in Tanzania, there is existence of village, private and collective rights on forests, which do not describe ownership of the rights and is highly contributing to deforestation in the country. The Land Act introduced in Tanzania in 1999 is aimed at maintaining reserved and general land while the village Land Act is responsible for management of village land (URT 1999). Conflicts arise in land ownership because some of the village land is legally determined or an agreement between bordering villages and part of reserved land, which include forests, are located within village boundaries. Therefore in this situation the Land Act and Village Act overlap one another causing controversies. Studies carried out have indicated that the nature of these land policies and property rights are a major factor leading to deforestation in many developing countries like Tanzania. (Ligon & Narain, 1999; Dolisca et al., 2007; de Oliveira, 2008)

Dolisca et al., (2007) further suggests that the nature of these land tenure systems and policies affect decision of the farmers who might cultivate more on illegal land and use more forest land for agricultural purposes. This is very common in Tanzania and these kinds of disputes contribute to inefficient forest management. Lack of resources to efficiently regulate and administer the land is a major set back to the implementation of these policies. (Petersen & Sandhövel, 2001; URT, 1998)

Colonial rule

During the colonial period, local people did not benefit from the natural resources because of the policies that were introduced by the colonial masters restricting access of the local people (Misana et al., 1996). This is one of the factors that has contributed to low expertise and knowledge of the local people in management practices. (Munyanziza & Wiersum, 1999; Kajembe, 1994) After Independence, Tanzania has undergone policy and institutional focused at economic growth rather than environmental management, which accelerated, forest degradation.

7.3 Low Implementation Capacity

Excellent policy ideas do not operate on their own; there has to be a driving force to make them work and this involves a lot of practical effort to support the initiatives. Researchers and experts in different fields have cited out that Tanzania has very good and reliable policies that can help foster socio economic development but the results and benefits have not been seen in practice, which implies that these policies are not working, or being implemented at a very slow pace. (Mbani 2013)

Many factors contribute towards low ability to implement policies in developing countries like Tanzania and some of these include poor leadership and lack of funding. Experts like Mr. Chris Tan, the director of Malaysian Performance Management & Unit who analysed development policies of Tanzania, suggested that leaders especially cabinet ministers responsible for policy formulation should be held fully accountable for the success and failures of the policies as it is in Malaysia currently (Mbani 2013). *In my view*, this is a very important proposal because most leaders in developing countries do not perform their work efficiently because in most cases they are not held accountable for the success and failure of their work. Tan further indicated that without

funding the so-called best document and put it into practice then it is simply a draft. (Mbani 2013)

Tanzania has a challenge to embark crime and corruption because they contribute to failure of implementation of development policies. Most of the policies have failed due to lack of a proper budget, very donor dependent, lack of enough expertise who can concentrate on details and execute efficiently, and lack of trust for the private sector which has been corporated by the government in implementing these policies. The private sector was put into play by the government so as to reduce costs of capital. The challenges affecting implementation of policies have largely contributed to the high rates of deforestation in the country.

7.4 Poverty Issues

Lack of alternative sources of income and low-income generating activities are key issues that lead the population to encroach forests and thus increase the pressure on deforestation. For example, in Dodoma and Morogoro regions, Monela et al analyzed that a sample of households in these two regions acquire over half of their cash income from selling forestry products like charcoal, honey and firewood (Monela et al, 2000).

Tanzania's economy is growing at a fast rate with increase in its gross domestic product (GDP) over the past decade but it is still ranked as one of the poorest countries in the world with approximately a third of the population living below the poverty line. An estimate of 57.8% of the population surviving on only 1 dollar a day and at least 90% of the people spend only less than 2 dollars a day (UNDP 2006). Tanzania was ranked 152nd of 187 countries in 2013 on the Human Development Index of the United Nations Development Programme. Although the government has tried all means to fight poverty, the results have been slow and not evenly shared. (IFAD 2013)

Tanzania is highly dependent on agriculture, which then justifies as to why many trees are cut down for cash crop and food crop growing. Rural poverty has been the source of many illegal activities, which include, charcoal burning, illegal mining and illegal harvesting for construction materials. The locals depend on these activities to sustain their daily lives. At times, when the locals have nothing to eat at all, they go to the

forests in search for edible plants and fruits and in the meanwhile this contributes to forest degradation.

The challenge to manage forest resources, which have been threatened constantly by human activities, is very huge in Tanzania. The government is faced with difficulties in finances to manage proper forestry management systems and ensure sustainability on the forest resources. Besides rural poverty, the country itself does not have enough funding to fight deforestation. This causes a lot of reliance in foreign funding which to my view is not sustainable. Foreign funds are mishandled by the authorities usually government officials and in the end do not meet the needs which they were supposed to serve.

Corruption has largely contributed to deforestation because the responsible authorities who are meant to ensure that illegal activities do not occur end up accepting bribes. These illegal activities include encroachment of forest reserves, wild fires, illegal logging, mining and shifting cultivation. Low incomes or salary play a major role in the increase of corruption in the country.

Also, satellite-based survey conducted by the UN Food and Agricultural Organization (FAO) indicated that deforestation was largely carried out in the tropics and most tropical forests were being converted to agricultural land. Therefore the fight against deforestation in developing countries like Tanzania involves efforts towards poverty alleviation. (Tuovinen 2011)

8 ALTERNATIVE SOURCES OF ENERGY

8.1 Electricity trends in Tanzania

Most of the households use electricity for lightning but other uses of electricity include cooking, operating electronics, refrigeration and boiling water and other liquids. Previous studies conducted in numerous locations within the country indicate so many factors that account for the preference to use a certain energy source. Poverty has played a huge part in Tanzania, as so many households are not capable of acquiring electric appliances for their daily use. Even middle-income earners who are not grouped under the poverty line prefer a cheaper method of sustaining their daily lives. As much as they could afford the electric appliances like electric cookers, refrigerators and others, the increasing electricity tariffs in the country render it difficult to use electricity.

The organization responsible for the generation and distribution of electricity in Tanzania is known as TANESCO, Tanzania Electricity Supply Company. Residents have expressed concern on the increase in electric tariffs over the years with monthly electricity bills doubling and thus causing a negative implication on the budgets of different households. This current situation causes customers to swith for a cheaper alternative, which happens to be charcoal. This adds more pressure to the forests with increased deforestation that is unsustainable to the environment.

8.2 Use of Gas

Gas is produced in Tanzania in small quantities to cater for domestic consumption (EIA, 2014). Due to the high electricity prices, which most people cannot afford in Tanzania, especially the rural areas, the government launched the Tanzanian Domestic Biogas Programme (TDBP) for the purpose of promoting market for domestic biogas. (EIA, 2014)

Why Biogas?

Consumption of biogas in Africa and Tanzania in particular is very important due to the problems of energy supply in the continent. Commercial fuels are too expensive and very unreliable as they are not available at times. Since the low-income earners even in

rural areas could afford the use of biogas, it saves a lot of time and energy spent by the local people especially women and children gathering wood or crop residues in the forests.

Combustible biogas is used in simple gas stoves for cooking but can also be used for lightning in lamps. Manufacture of this gas comprises the use of domestic resources like manure from cattle, pigs and even human excreta. These inputs are largely available due to the presence of big numbers of livestock in the rural areas in Africa.

Health benefits derived from the use of biogas include, reduction in acquisition of respiratory diseases and eye diseases, which is usually as a result of the smoke produced by the traditional ways of cooking. It is also sustainable to the environment as reduction in pollution implies reduction in green house gas emissions (Jesper, 2009). However the use of gas is also very risky as there are threats of explosion in people's kitchen accidentally.

9 RECOMMENDATIONS

Charcoal will still remain the main source of energy in the future to most Tanzanians especially for cooking purposes due to the fact alternative sources of energy are available but people have low incomes to afford them. Tanzania is faced with a huge challenge to overcome deforestation and the Government has put all its efforts but the positive results have not been achieved. The government introduced large-scale production of charcoal for commercial purposes but this was not successful. (Emrich and Mwihava 1989).

9.1 Forest Carbon Trading

The mechanism behind carbon trading involves selling of carbon credits (UNFCCC, 2015). The aim of this trade is to help in reduction of greenhouse gases in the atmosphere. It is also referred to as emissions trading but carbon dioxide is the principal greenhouse gas that's why it is usually called carbon trading. The government or international authority administers this trade and sets a limit on the amount of carbon dioxide that is acceptable for emission. The authority issues permits to companies or other groups that offers them with credits to pollute a certain amount of carbon dioxide. However, if the company forecasts more pollution than the required amount in the permit, then they are allowed to buy credits from other companies that pollute less. Exchange of these credits is referred to as trade. Therefore, the seller of these credits benefits financially for low emissions of carbon dioxide while the buyer pays to pollute.

Carbon trade was a result of the Kyoto protocol that was signed in 1997 by 180 nations, which called for the reduction of green house emissions by 5 % by the most industrializes states between 2008 and 2012. Comparison in reduction was to be compared by the emissions made in 1990. The Kyoto protocol therefore created this carbon trade and the commodity in form of emissions. (UNFCCC, 2015)

However, there are two types of carbon trading and the other one is known as Voluntary Carbon Trading (VCT). In this trade, there are no tough requirements and the condition to participate is voluntary. Companies tend to reduce their Greenhouse gas emissions from their activities as a part of their corporate responsibility.

Under the Kyoto protocol, of the United Nations Framework Convention on Climate Change (UNFCCC), industrialized countries, which are the developed countries, were required to adopt better technologies or solutions to cut down their CO_2 emissions. Some of these solutions included the use of renewable fuels that produce less carbon dioxide and the use of more efficient energy resources. Another viable option was through investment to projects in developing countries and to use this this opportunity to offset their reduction ambitions. Since, the developing countries are less industrialized, they pollute less and earn carbon credits and so the developed countries who polluted more would then buy these credits so as reach their emission targets. (UNFCCC, 2015)

Some of the projects that were eligible under the Clean Development Mechanism of the Kyoto protocol included afforestation and reforestation. This means that the developed countries were able to acquire credits by carrying out and funding these activities in the developing nations. Afforestation and reforestation are very important in fighting climate change and they also cover up for losses that have been made through deforestation. Reduced Emissions through Deforestation and forest Degradation (REDD) is still under discussion by parties to the UNFCCC and has not yet been included in the carbon crediting criteria. It means currently, it is not possible to gain carbon credits by reducing rates of deforestation and forest degradation, which would be very beneficial to developing countries like Tanzania.

The government of the United Republic of Tanzania has foreseen the importance of the REDD policy in assisting the country to meet its targets of sustainable management of forests and woodlands and also in eradication of poverty. Already, Tanzania has initiated a National Strategy and Action Plan for REDD with so many stakeholders that will help in building local capacity and make necessary arrangements for adoption of REDD in the future. (Ministry of Natural Resources and Tourism, 2009)

Tanzania like so many developing countries is faced with massive rates of corruption especially in the public sector, which contributes to a large extent to its poverty and unsustainability. Therefore, once the REDD policy comes into play, this will enable developed countries to invest and assist in overcoming these problems and ensure sustainable forest management and conservation.

9.2 Adoption of a solar cooking method

Manufacturing of solar cookers

A solar cooker is basically a device that uses direct sunlight to cook food without using any other fuel like LPG or kerosene. These can be manufactured as box types (see figure 1) that trap the heat in the box and cook the food or the parabolic type, which converge sunlight to a single point hence creating heat.

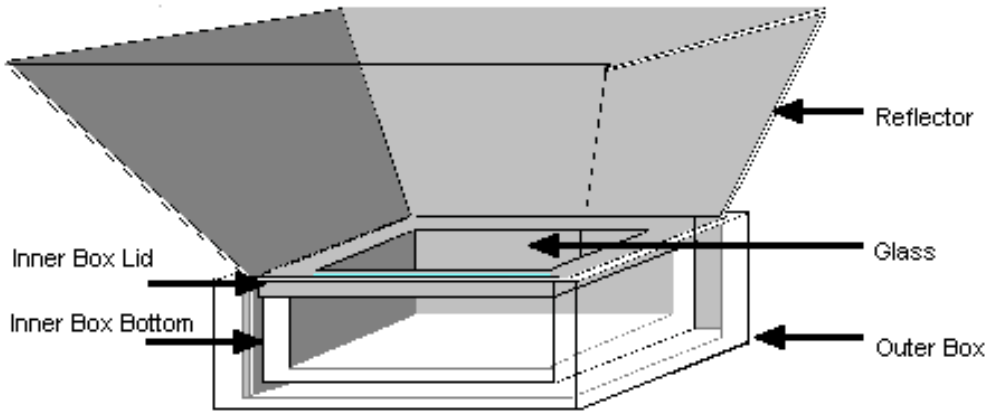

Figure 1: Box type solar cookers

Materials required for the construction of the solar cooker include cardboard boxes or wooden box, 4 cardboard sheet for the lid, rolls of good quality aluminium foil, black spray paint (non-toxic when dry), and glass cover, white glue.

Instructions to build the solar cooker:

The base of the cooker can be made of 2 cardboard boxes or wooden box. The outer box should be slightly bigger than the inside box. The flaps of the inner box are not cut but instead glued with aluminium foil from the inside to act as reflectors. The surface of the box or wooden material and the sides too are then painted black to increase heat absorption, which is then transferred by conduction to the cooking vessel. It is also possible to keep the interior with a shiny aluminium color because the sunrays entering the box will then be reflected to the cooking vessel hence cooking the food.

Once food is placed inside the box or wooden material, it is then covered with a lid, which could be glass or an oven bag. Glass is more expensive and fragile so it cannot fit to the poor households in Tanzania but an alternative is the use of an oven bag, which can work to temperatures approximately 400 degrees so they are suitable for solar cooking. However, one disadvantage of the oven bag is that they become less transparent when used for a long time so they might need to be replaced. Using this method also requires that all foods be cooked in dark covered thin pots for better heat transfer.

Glass also is not the best material to act as an insulator because it conducts heat out quicker than other materials. This accounts for heat loss by radiation and conduction in most solar cookers that have glass covers. However glass is also the best material for letting in the sunlight to the cooker that's why it is widely used. Another material that can be used in place of Aluminium is cast iron but this has a longer heating time hence increasing the cooking time. One advantage of using the cast iron is that once it's heated, it retains the heat for a longer time. Therefore, if someone is cooking food without the emphasis on time then the cast iron is just perfect.

Solar cookers can also be manufactured in parabolic shapes. The parabolic can be supported by a circular stand and the angle at which it is elevated for tracking of the sun is moved or adjusted by an extension arm. The reflective film is the most important part in the parabolic because it reflects and concentrates the sun energy to the cooking plate. This reflective film is usually made of vinyl, which is durable and might need to be replaced when it's worn out.

10 CONCLUSION

The research carried out was faced with a lot of difficulties especially in finding up todate information so as to accurately analyse the problem and make appropriate suggestions. The analysis and findings of this research are based mainly on critical analysis of the National Forest Programme of Tanzania for the years 2001-2010.

Due to the unavailability of published information, some of the data was corrected from interviews with authorities working in the forestry department in Tanzania and personal observations made during my practital training period in Tanzania.

The target communities related to deforestation in the country are mainly the rural communities that reside in the forest areas. It would have been desirable to collect information and conduct a survey especially in these villages and remote areas so as to improve on the accuracy of the output of this paper. Based on the current trends of heavy corruption in the country, it is also difficult to approve the accuracy of the information published.

The study aimed at finding a real working solution for the problem that is being presented in my thesis, which I intend to continue researching and find out its applicability in a real life scenario. During the research process, the idea of the use of solar cookers started to look like a promising solution and more attention should be paid on that matter.

My major contribution in this study is analysis based on improving the social behaviour of the Tanzanian community. Previous studies all have appropriate solutions but the reality is that none of this will be applicable if the people do not change their attitudes and improve on their sense of responsibility. This is highly linked with being more aware and educated. Improvement on behaviour of the community starts from the management level. If the leaders show a good example then the people will follow.

Tanzania is endowed with resources and the economy does not really need to be boosted by deforestation and its related export products. Education and responsibility are the keys to a better future for the citizens.

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