THE IMPACTS OF CHARCOAL PRODUCTION ON FORESTS MANAGEMENT IN DODOMA MUNICIPALITY.

By

Nuru Nyalusi

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SUPERVISOR'S CERTIFICATION

The undersigned certify that he has read and hereby recommends for acceptance by the University of Dodoma, a dissertation entitled ***The Impact of charcoal production on forest management in Dodoma Municipality*** in partial fulfillment of the requirements for the degree of Masters Science in Natural Resources Management at the University of Dodoma.

……..

Dr. Ahmad Kanyama

(SUPERVISOR)

Date……

DECLARATION AND COPYRIGHT

I Nuru Nyalusi, declare that this dissertation is my own original work, and that it has not been presented and will not be presented to any other University for a similar or any other degree award.

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DEDICATION

The dissertation is dedicated to my Almighty God, my beloved Sister late Tumain Joseph, my aunt late Atuganile Kasebele, my mothter Ester Kaseble, my uncle David Kasebele, my aunt Anna Kasebele, my grandmother Ennes Samaholi and my lovely sister Mary for their love, care and support.

ABSTRACT

This study analyzed the impact of charcoal production on forest management in Dodoma Municipality, Ng'o hong' honha ward was a case study. The study used a case study type of research in order to collect detailed information about the problem. Questionnaire, observation and interview guides were used as tools of collecting data. Stratified sampling and the simple random techniques were employed. A sample of 95 households were used to represent the whole population, due to time and financial limitation only 95 households were used to represent the at Ng'o hong honha ward.

Currently, the forest resources have diminished due to human interference both in area and in species richness. Increase in population has led to increase in demand of charcoal in urban areas. Lack of alternative source of livelihood in Dodoma municipality has forced the majority of people to depend much on charcoal production as their main economic activity. This has an impact on the forest resource base, threatening the productive and protective capacity of the resources

The study findings concluded that, the impact of charcoal production on forests management in Dodoma Municipality could be minimized through provision of alternative sources of livelihood, establishment of JFM and CBFM, improvement of energy policy and formulation of independent charcoal policy, active participation of various NGOs, local communities, stakeholders and private sectors.

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LIST OF ACRONYMS AND ABBREVIATION

CBFM-Community Based Forest Management

CHAPOSA-Charcoal Potential in Southern Africa

CIFOR-Centre International Forest Resources

DBH-Diameter at Breast Height

DONET- Dodoma Network of Environment in Tanzania

FAO- Food and Agricultural Organization

HADO-Hifadhi Ardhi Dodoma

JFM- Joint Forest Management

KG-Kilogram

LAFRs-Local Area Forest Reserve

LPG- Liquified Petroleum Gas

MAI-Mean Annual Increment

MNRT-Ministry of Natural Resources and Tourism

NGO'S-Non Governmental Organizations

NRFs- National Forest Reserves

NSGRPR- National Strategy for Growth and Poverty Reduction

PFM-Participatory Forest Management

SPSS-Statistical Package for Social Sciences

TAS-Tanzania Assistance Strategy

TFAP- Tanzania Forestry Action Plan

TSH- Tanzania Shilling

UN- United Nations

UNEP-United Nations Environment Program

URT-United Republic of Tanzania

VLFRs- Village Land Forest Reserves

WRI-World Resource Institute

CHAPTER ONE

1.0 INTRODUCTION AND BACKGROUND

1.1 Introduction

In Africa about 1.5 billion people depend on fuel and wood as their primary source of energy and the average amount of wood used for cooking and heating in 63 less developed countries is about $1m^3$ per person annually (UN, 2003). Many people in Africa especially Sub-Saharan Africa cook over open fires that deliver only about one-tenth of the available heat to cooking pots, in turn the problem has resulted into clearing of the tropical forest in Africa whereby about 0.8 percent of the remaining tropical forest is cleared every day, charcoal production is a big threat because it targets specific preferred species found in natural forests and woodlands, most of which are poorly managed. The result is unsustainable harvesting especially in drier areas, where the regenerative capacity is lower, unplanned and unmanaged charcoal production accelerates the processes that lead to desertification. In most countries of the continent, regulation of charcoal production is uncoordinated and there is little investment to make business more efficient and cost-effective. This makes charcoal extraction unsustainable and contributes to its negative image on forest generally (Cunningham, 2007).

Tanzania has about 33.55 million hectares of forests and woodlands. Out of this total forest area about 90% is covered by Miombo woodlands, the rest being mangrove forests and forests other than mangrove. Such a forest resource contains large values in the form of timber and catchment. According to the new forestry policy these forests are

Managed for production and or protection based on forest management plans. Forests on public lands are without any legal protection and in accessible areas their utilization is exploited without any control. Most Miombo woodlands, which constitute the largest forest ecosystem in the country, fall under public lands (URT, 1998).

Despite of the efforts being taken, management of forest resource is becoming a complex task all over the world since the human demand on forest resource has increased, especially on charcoal production which in turn brings about deforestation. For instance about one-third of human population depends on charcoal as the principle of heating and cooking fuel thus fuel wood alone accounts for about half of all wood harvested all over the world (UN, 2000).

Charcoal production not only affects forest resource but also the entire environment, for example the United Food Nations and Agriculture Organization (FAO) reported in October 2006 that deforestation accounts for 25 to 30 percent of the release of greenhouse gases as charcoal production and use is increasing worldwide rather than decreasing Brazil for example as the world's largest producer and user of industrial charcoal, consumes more than 7.3 million tons (1992 level) a year. Many studies have shown that because of the synergistic effect of improved charcoal technology and advanced cultural practices, the use of charcoal and its impacts will continue to increase as billion tones is caused by deforestation (Mugo and Ong, 2006).

Tanzania mainland has not been able to attain sustainable management of forests and woodlands, which are the main source of these critical commodities. While majority of Tanzanians are heavily dependent on wood-based energy for cooking purposes, there has been very little and deliberate national efforts to improve supply of wood fuel either

by initiating sustainable management options or by establishing energy plantations. Nearly 99% of charcoal used in Tanzania is from natural forests and woodlands and production of charcoal is done through inefficient earth kilns and also woodcutting for charcoal making is not controlled (Mnzava, 1991).

In Dodoma region the impacts of charcoal production on forest management is inevitable since more than a half of the population depends on charcoal as the primary source of energy where each person in small and median villages in Dodoma region consumes the amount equivalent to 1m3 solid air-dried wood per year (URT, 2007). The semi-arid Dodoma region in Tanzania is typical of areas in many developing countries. The current pattern of wood production and other land use activities in Dodoma have reduced the area of natural woodland. Many of the urban poor in Dodoma rely on charcoal produced in the natural woodlands and transported to urban markets (Ibid).

1.2 STATEMENT OF THE RESEARCH BROBLEM

Forest management has become a complex phenomenon which requires much attention since majority of people all over the world especially in developing countries depend on charcoal as their primary source of energy, (FAO, 2006). Despite of the measures and efforts taken from local to global level to enhance forest management in a sustainable way, still forests are not yet managed and organized due increased demand of charcoal (Mugo and Ong, 2006).

In Tanzania charcoal is the main affordable source of energy for cooking especially in urban areas. Degradation of forests in Tanzania is related to increasing demand for wood-energy particularly charcoal, (Malimbwi and Zahabu, 2008).

In Dodoma region forest management has been a serious problem due to the fact that most of people depend much on charcoal as a primary source of energy and income for most of rural dwellers. The increased demand of charcoal has been attributed to the increase in the number of people and growth of Dodoma town (URT, 2007).

Degradation of forests as a result of increased charcoaling activities has widespread impacts on forest management at Ng'o hong' honha ward since large number of trees are being cut.

The amount of charcoal produced in Tanzania annually is about 675 tons which put much pressure on tree species which are more suitable for charcoal (URT, 2007).

Government and NGO'S have taken various initiatives to combat the impacts of charcoal production on forest management such as adoption of energy policy likewise in 1998 the Government adapted National forest policy which aimed at conserving and managing forest resources. In Dodoma various NGO'S such as DONET and HADO contribute much in forest management activities, establishment of joint forest management and community based management programs (URT 2007).

Despite of the effort undertaken to overcome the impacts of charcoal production on forest management still charcoal production pose a big threat on forest resources (URT, 2007).

Therefore, this study was centered on assessing the impacts of charcoal production on forest management using Ng'o hong' honha ward as a case study in Dodoma municipal.

1.3 Objectives of the study

General objective

To assess the impacts of charcoal production on forest management in Dodoma municipal a case study of Ng'o hong honha ward.

Specific objectives

(i) To determine the socio-economic importance of charcoal production in the study area.

(ii) To examine the magnitude of charcoal production in the study area

(iii) To examine the intervention undertaken to overcome the impact of charcoal production on forest management

(iv) To identify the challenges facing forest management in the study area

1.4 Research questions

(i) what is the socio-economic importance of charcoal production at Ng' hong' honha ward?

(ii) How has charcoal production affected the environment in the study area?

(iii) Which interventions have been undertaken in the study area to curb the impacts of charcoal production on the environment?

(iv) What are the challenges faced in curbing the increased charcoal production at Ng'o hong'honha ward?

1.5 Significance of the study

The study will definitely provide an understanding about the contribution of charcoal production on forest management. The knowledge to be obtained will be useful in policy making and planning whereby the data obtained will help the decision makers and planners to promote measures upon forest resources management while addressing deforestation as a result of charcoal production.

In academic issues the knowledge obtained will be useful as reference materials for further research while in learning institutions it will be used as training materials. Also the study will provide knowledge on how charcoal production may be improved in a sustainable way to enhance forest management in an effective manner to promote local peoples income so as to improve their livelihood and living standard generally.

1.6 Scope of the study

The study was conducted in South east of Dodoma municipality particularly at Ng'o hong' honha ward where it covered three villages namely; Mapinduzi, Mazengo and Mhande. The study concentrated on the impacts of charcoal production on forest management in Dodoma municipal which is an area where charcoal production is carried out to a large extent. South east of Dodoma was chosen due to the fact that it is easily accessible from Dodoma town and the rate of forest degradation is high and Ng'o honha ward was being chosen as a case study because is one of the wards in Dodoma Municipality where unsustainable charcoal production has been a serious problem towards sustainable forest management.

CHAPTER TWO

2. 0 LITERATURE REVIEW

2. 1 Introduction

This chapter narrates the problem in global context, policies available for charcoal in Tanzania as well as review on perspectives of other researchers and scholars concerning

the same problem, this was done through review of books, journals, internet sources as well as articles.

2.2 Definition of terms

Forest: This means all land bearing a vegetative association dominated by trees of any size, exploitable or not, and capable of producing wood or other products of exerting influence on the climate or water regime or providing shelter to livestock and wildlife (URT, 2002).

Forest reserve refers to a forest area, either for production of timber and other forest produce or for protection of forests and important water catchments (ibid).

Forest management is a branch of forestry concerned with the overall administrative, economic, legal and social aspects and with the essentially scientific and technical aspects especially civil culture protection, and forest regulation. This includes management for aesthetics, fish, recreation, urban values, water, wilderness, wildlife, wood products, forest genetic resources and other forest resource values. Management can be based on conservation, economics, or a mixture of the two. Techniques include timber extraction, planting and replanting of various species, cutting roads and pathways through forests, and preventing fire (Hall et al, 2009).

Charcoal refers to the dark grey residue consisting of carbon and remaining ash, obtained by removing water and other volatile constituents from animal and vegetation substance. Charcoal is usually produced by slow pyrolysis, the heating of wood or other substance in the absence of oxygen (Mugo and Ong, 2006).

Community Based Forest Management (CBMF) - refers to a kind of forest management arrangement that takes place on village land, on forests that are owned and managed by the Village Council on behalf of the Village (Hall, et al, 2009).

Participatory Forest Management (PFM) - refers to processes and mechanisms that enable people who have a direct stake in forest resources to be part of decision-making in all aspects of forest management, from managing resources to formulating and implementing institutional frameworks PFM may be developed in unreserved forests in the village or general land or National forest reserves or forest reserves owned by Local Authorities at district level (ibid).

2.3 Overview of Forest Management in Tanzania

The forest sector in Tanzania is centrally managed through Forest and Beekeeping Division of the Ministry of Natural Resources and Tourism (MNRT). However, past experience indicates that the sector has not performed to the expectation; this is manifested by forest degradation through illegal activities and human pressure (URT, 1998). Generally forest resources in Tanzania have faced both ecological and socio-economic threat speeding up resource base degradation. According to Luoga et al (2000), forest cover has continually been declining from more than 50% during independence to 45% in late 1970s. In 1990s, the decline in forest cover was reported to be 41%.

The paradigm shift in natural resources management started way back in 1980s, learning from past failures in natural resources management forest in particular. The National Forest Policy of 1998 supports devolution of ownership and management responsibilities to local communities under participatory forest management (PFM)

approaches (URT, 1998). This approach expected to enable local people to access forest resources for livelihood enhancement and sustainable forest resources utilization (Hutton and William, 2003). Reasons for the paradigm shift in forest management included, failure of the state to manage protected areas effectively, high transaction costs for effective management of forests, relevancy of local knowledge of ecological dynamics to proper management and increased motivation for community to conserve forests (Kajembe and Kihiyo, 2000).

Despite of this shift in forest management and implementation of CBFM in particular, few precise data are available which capture broad general conditions and relationships both at individual household and community level with respect of forest income and rural livelihoods (Kijazi, 2007). The community may enjoy same rules and regulations in CBFM, however, economic cultural and social heterogeneity may be found between households in their access to endowments such as land, labor, and capital, in their motivations, skills and in income generating activities (ibid).These parameters therefore are important when considering paradigm shift in forest management and how they have been impacted on forest income and rural livelihoods, since impact includes both positive and negative consequences whether foreseen and expected or not (Kijazi, 2007).

2.4 Implication of Community Based forest Management and Participatory Forest Management on impacts of charcoal production on forest management

2.4.1 Community based forest management

In Tanzania the government supports Community Based Forest Management activities in various areas through various donor agencies and NGO's, there is about 20 regions

and about 1082 villages which are implementing Community Based Forest Management on 2,047,824 hectares of forested land (Hall et al, 2009).

Communities can become effective institutions for sustainable forest resource management, but only if they are granted genuine proprietorship, that is the right to use forest resources, determine the modes of usage, benefit fully from their use, determine the distribution of such benefits and determine rules of access. Any policy which excludes these components will frustrate the goal of making communities effective institutions for forest resource management (Willy, 2002).

There are many advantage of CBFM towards forest management which include decreased illegal harvesting of forest resources, decreased encroachment, decreased fire incidences, decreased unregulated activities such as charcoal burning , Improved water flow from water sources or streams Increased household income through initiated income-generating, activities, which diversified the economy thus reducing poverty, Improvement of livelihood of communities, Improved management of forests (Kajembe, 1994).

CBFM encountered with several problems such as; Delays in assisting communities to prepare management plans of their Village land Forest Reserves, Delays in signing of management plans, Lack of enough forest staff to assist communities to implement CBFM, Inadequate equipment, Lack of solid integration of CBFM with Local Governments' plans to, ensure sustainability (Hall et al,2009).

At the local level, when local governance institutions are not downwardly accountable to the community and benefits are disproportionately captured by local elites. Tensions exist in some places between the development of locally accountable governance and traditional authorities. Often, CBFM interventions are not accompanied by the type of

long-term investments in capacity-building required to ensure broader participation and the accountability of local leaders to their community. The distribution of local benefits of CBFM can also be influenced by the nature of benefits generated and how individuals are able to gain access to them. In some cases the principles that govern the distribution of benefits are built into CBFM systems (Kajembe, 1994).

Conflicts between local groups and other more powerful actors, including both state agencies and private sector investors over forests resources remain widespread which result in unsustainable utilization of forest resources hence pose challenge in managing forests. There are strong political economic incentives for political elites and central bureaucracies to consolidate their control over natural resources. Foreign donors and international NGOs spearheading CBFM efforts are often poorly positioned, in a political sense, to address these challenges. Further conflicts arise from differences in perceived priority management objective the most appropriate scale at which to manage from an ecological perspective rarely tallies with the most appropriate scale from a social or economic perspective (Willy, 2002).

2.4.2 Participatory Forest Management

Participatory forest Management is another form of forest management which is characterized by sharing power instead of just benefits and assuming owner or user rights of forests. It may apply to forests that are either rich or poor in biodiversity, intact or degraded, large or small, moist montane or dry woodlands or mangrove forests or even commercial plantations (Kajembe and Luoga 1994).

PFM approaches are well linked to other macro-economic policies of addressing poverty reduction.

- These include the Tanzania Development Vision 2025
- The National Poverty Reduction Strategy Papers (PRSP) of 2000
- The Tanzania Assistance Strategy (TAS)
- The National Strategy for Growth and Poverty Reduction (NSGPR) of 2004 (URT, 2008).

Legal framework in support of PFM in Tanzania is revealed in the: Forest Act No. 14 of 2002

- Land and Village land Acts of 1999
- The Local Government Laws (Miscellaneous Amendments Act No. 6 of 1999.
- The Forest Act No. 14 of 2002 supports PFM as it categorizes national, local authority, village and private forestland and makes full provision for actors in each of these categories to declare forest reserves.

Role of PFM in forest management

- Help to reduce the role of, and cost to, the state in protecting forests and the conservation value of forests.
- Ensure environmentalist images of more effective resource protection by those living in close proximity to the resource
- Increase control of forests resources to local people control which help to protect local livelihoods for large numbers of rural households;

- Enhance a belief that decentralized institutions are more locally responsive and would manage forests more efficiently by harnessing the skills, motivation and labor of interested local populations;
- Encourage a philosophical commitment to people's participation in their own affairs and to the principles of self-determination and democracy (Kajembe, 1994).

A wide variety of objectives and management arrangements under PFM vary according to the forest type and the marketed and non-marketed benefits which are sought. For high-value tropical moist forests, they range from community consultations prior to industrial logging operations through to full community involvement in logging operations and timber transformation for lower-value tropical dry forests; they include community involvement in biomass regeneration, community plantations and involvement in fuel wood production and the commodity chain (Willy, 2002).

PFM also encompasses a wide range of different co-management arrangements with different levels of control from relatively conservative "benefit sharing" to genuine "community-based natural resource management" where local communities have full control over management of the resource and the allocation of costs and benefits. There is an expectation that PFM can bring substantial benefits in terms of livelihood security and poverty reduction, as well as providing important indirect benefits to the poor in terms of improved local governance and empowerment. At the same time, there is growing concern that PFM approaches may not be as pro-poor as they could be and that, in some cases, poor people may be actively disadvantaged by PFM initiatives (Hall et al, 2009).

But it is recognized that many programs supporting co-management and community based management of forests have outcomes that are not positive for the poorest elements of society. Co-management processes, and the institutional arrangements that oversee their implementation, may easily be dominated by wealthier, more powerful members of the community, producing an outcome that perpetuates or even reinforces social inequity which end up in degradation of forest resource through illegal and unplanned harvesting of forest products for instance cutting large number of trees for charcoal production (Willy, 2002).

2.5 Deforestation of Natural Forests Cover

Over the last 20 years, more than 300 million hectares of tropical forests have been cleared for plantations, agriculture, pasture, mining, or urban development. Today forests cover is only half of the area compared to when agriculture began 11,000 years ago (World Resource Institute, 1995). This earlier loss of 50% of the Earth's forests is sufficient, in itself, to severely disrupt the global carbon cycle. Natural forests also help regulate local and regional rainfall. They are sources of food, medicine, clean drinking water and they provide immense recreational, aesthetic, and spiritual benefits estimated that, at current deforestation rates, about 40% of today's intact forests will be gone within 10-20 years (ibid).

The change of forest area in Africa is the highest among the world regions, with the annual net loss estimated at 5.3 million hectares or 0.8% compared with the global average deforestation rate of 0.2% Primary forest is being replaced by extensive areas of secondary forests, grasslands and degraded lands. Between 1990 and 2000 Africa lost about 52 million hectares of forest (FAO, 2001).

Southern Africa accounted for about 31% of the forest loss of the continent. Three countries (Sudan, Zambia and the Democratic Republic of Congo) accounted for almost 44% of Africa's deforestation (FAO, 2003). The loss of forest has become a major concern in 35 countries in Africa. It has been reported that there are competition for land resources, in most of the countries in Sub-Saharan Africa. Arable land for crop production and range lands for grazing, forests, water and others have been increasing since 20th century (UNEP, 2006).

Sub-Saharan Africa contains a wide variety of ecosystems with rich diversity in plant and animal wildlife. However, Africa's land resources continue to be degraded through poorly planned activities related to agriculture, forestry, and industry as well as by urban slums and infrastructure development. The five major human causative factors of land degradation are overgrazing, deforestation, agricultural mismanagement, fuel wood consumption and urbanization (UNEP, 2006).

In Togo, fuel wood and charcoal account for more than 80% of national household energy consumption, estimated at 62 kg/year per capital, at national scale, an average of 320,000 tons of charcoal is produced every year. This exploitation results in heavy pressure on the woody vegetation estimated at 386,000 ha (Fontodji, 2007). Charcoal production is high during the dry season across the country and reaches its peak in December, particularly in forest zone. It is characterized by poor efficiency of 15 to 20% or 150 to 200 kg of charcoal per ton of wood (Girard, 2002).

Current charcoal production techniques create a particular pressure on species providing slow combustion charcoal. This quality charcoal is obtained from slow-growing species that are overexploited. To lessen these pressures on the ecosystem, a good knowledge of the woody capacities is required. Unfortunately, studies conducted so far are mainly

focused on market circuits and charcoal production techniques and only address slightly the impact of the charcoal industry on the ecosystems (Akpamou, 2003).

The semi-arid Dodoma region in Tanzania is typical of areas in many developing countries. The current pattern of wood production and other land use activities in Dodoma have reduced the area of natural woodland. Many of the urban poor in Dodoma rely on charcoal produced in the natural woodlands and transported to urban markets by otherwise empty trucks returning from deliveries in the rural areas (Allen 1984). Thus the current system of wood fuel supply to urban areas in Dodoma and elsewhere in Africa has contributed to the gradual disappearance of woodland in circular areas around the cities. This pattern is obvious from aerial photographs of Dodoma region over the period from 1956 to 1978. Wood availability in deforested areas is consequently limited by the capacity to transport wood fuels from other areas, and by the rates of growth that can be attained either by regenerating natural woodland or by so called fast growing exotic tree species (Mnzava, 1996).

2.6 Policies available for charcoal and forest management

In many developing countries there are no specific policies and legislation on charcoal. Instead, charcoal is covered under energy, forestry, agriculture or all three. No particular institution has taken the responsibility to plan and implement charcoal production programs. Even the available energy policies do not adequately address the problem. The energy policy for Zambia for example was approved in 1995 and Uganda's in 2002 and those for Kenya and Tanzania were formulated in 2004. In Ethiopia and Eritrea, the documents are in draft form. Significantly, the four policies that have been officially adopted emphasize modern energy and pay little attention to charcoal (Mugo and Ong,

2006). Except Sudan and Kenya which have specific legislations to govern the charcoal industry, although the implementation of the policies tends to depend largely on the political goodwill of the officials in office. Policies and laws relating to wood are scattered across different sectors, making it difficult for their provisions to be enforced (ibid).

The government of Tanzania designed and implemented environmental policies aimed at improving conservation and management of natural resources and people's well-being, raising public awareness about environmental issues and the links between environment and livelihoods and promoting international cooperation on the environment agenda. Although, population growth in a limited land area, domestic demand for wood products already far outstrips domestic supply potential, resulting in shortages of some wood fuel products, price hikes, and higher imports (Melissa et al, 2007).

Management and conservation of forest resources in Tanzania are guided by the National policy. The policies are based on forest conservation and management while charcoal is abandoned. For example Forestry Policy, which is more directed towards control and protection of forest resources than to sustainable utilization. One of the provisions of the 1953 Forestry Policy is to demarcate and reserve forest, for the benefit of present and future inhabitants of the country, sufficient forested land or land capable of a forestation so as to preserve or improve local climates and water supplies, stabilize land which is liable to deterioration, and provide a sustained yield of forest produce of all kinds for internal use and also for export. The utilization of forests under this provision is, however, limited to commercial exploitation (Anderson, 1986).

2.6.1 National Forest Policy and Energy policy

In 1998, Tanzania approved a National Forestry Policy, the first new forest policy since 1963 which promoted substantial change in the way forests are managed (URT, 2008). The policy aims to promote participation in forest management through the establishment of VLFRs, where communities are both managers and owners of forests, as well as through JFM, where local communities co-manage NFRs or LAFRs with central and local government authorities (Ibid). Furthermore, the policy recognizes the substantial area of forest that lies outside the formal forest reserve network and the levels of deforestation and degradation that takes place in these areas due to poor management and uncertain tenure. Ascribing clear and legally mandated tenure for these forest areas to Village Councils was considered a rational way in which overall management levels could be improved (URT, 2008a).

The policy was followed by the enactment of the Forest Act in 2002, which provides the basis in law for communities to own, manage, or co-manage forests under a wide range of conditions and management arrangements. The Forest Act is notable in embracing the principle of subsidiary, stating its aim as "to delegate responsibility for the management of forest resources to the lowest possible level of local management consistent with the furtherance of national policies" (URT, 2002).

The provisions of this policy focused on four main areas of forest conservation and management in the context of sustainable development namely; forest land management, forest based industries, and products, ecosystem conservation and management and human and institution resources. While these areas of focus are keys to the development and implementation of comprehensive programs relating to the policy but require the

establishment of appropriate legal frame work. In this regard, The Forest act No. 14 of 2002 and the Bee keeping act of the same year were put in place and from the basis for development and implementation of programs of forest resources (URT, 1998).

The Tanzania energy policy of 1997 still stress the development and use of indigenous energy sources such as bio-energy, coal, natural gas and hydropower (URT, 1997). Less than two percent of energy development budget is allocated to wood energy programs, fuel wood being regarded as minor forest product with little market value (TFAP 1989).The vast majority of wood fuel consumers cannot afford the high investment costs associated with those alternative commercial energy sources (Moyo *et al* 1993).

The availability, reliability of supply and cheaper prices renders fuel wood more preferable compared to other alternative sources of energy. According to the present economic forces the majority of urban population in Tanzania will continue to depend on fuel wood for longtime to come (URT 1998; Moyo *et al* 1993). Furthermore due to the anticipated steady increase in population (at an annual rate of increase of 2.8%) it is expected that actual consumption of firewood and charcoal will continue to rise to a greater extent. This can put strains on natural forests from where the charcoal is obtained, possibly resulting in deforestation of the forest ecosystems (ibid).

Commercial fuel wood extraction such as charcoal production requires large volume of wood, which in turn depletes tree stocks resulting to various forms of soil erosion. Little is known about the actual extent of deforestation due to urban charcoal use, the social and economic patterns, which determine the exploitation, or the policy options available to mitigate the problem. According to FAO Forest Resources Assessment deforestation is defined as a change of land use with the depletion of tree crown cover to less than 10 percent (Adger et al, 1994). Furthermore the extent of forest resource, use impact, their

growing stock and Mean Annual Increment (MAI) are not known with any degree of precision. The understanding of the potential of the forests to supply firewood and charcoal over a medium time perspective is limited. This has implications on the country regarding its ability to design and implement appropriate energy policies that can intervene in the charcoal sectors. Rational decisions in management of natural forest depend on information available on their growing stock. Acquisition of forest growth information is prerequisite to any forest management system and sustainable land use (Mgeni et al, 1990)

2.7 Forces driving the production of firewood and charcoal

In case of the forces driving for charcoal production, in most cases people engage in Charcoal production since that charcoal contribute to the economy by providing rural incomes, tax revenue and employment. It also saves foreign exchange that would otherwise be used to import fuel. Therefore for most of the poor people charcoal is not only the primary source of energy rather a source of income. In the Licuati region of Mozambique, for example, 65.4% of rural incomes are derived from charcoal (Malimbwi and Zahabu, 2008).

Another reason that forces people to engage in charcoal making is to get energy especially the areas which have no access to electricity. Example in Africa about 1.5 people depend on fuel and wood as their primary source of energy and the average amount of wood used for cooking and heating in 63 less developed countries is about $1m^3$ person annually (UN, 2003). Furthermore many people in Africa especially Sub-Saharan Africa cook over open fires that deliver only about one-tenth of the available heat to cooking pots, in turn the problem has resulted into clearing of the tropical forest

in Africa whereby about 0.8 percent of the remaining tropical forest is cleared every day Also because of affordability for charcoal there has been energy declining shift for kerosene by 12% between 2001 and 2007 (Cunningham, 2007).

At the same period users of charcoal as a primary source of energy have increased from 69% to 78%. While the percentage of electricity users as a first choice source of energy has remained constant. These energy shifts indicate an increase in biofuel consumption in the city of Dar es salaam (Malimbwi et al, 2008) although charcoal meets 80% of urban households' energy needs in eastern Africa. Hence charcoal will remain the main cooking fuel for most people in the region's towns for the foreseeable future because it is affordable (Mugo and Ong, 2006)

2.8 Processes employed in charcoal making and their impacts on forest

Many works of different scholars have discussed the processes employed in charcoal production. The charcoal making has been viewed negatively because it is associated, rightly, with deforestation and land degradation, slow and unsustainable growth of trees, wasteful use of wood, environmental pollution and poor working conditions of those involved in production Charcoal making is considered wasteful because only 30-40% of the wood is converted to charcoal while the rest is released into the atmosphere as gases as sources of greenhouse gases There are many techniques for making charcoal, the simplest method, wood is burned in an open fire and the charred remains recovered as charcoal. With this technique two main methods are traditionally employed. One, the wood is stacked on the ground and covered with soil, forming the so-called an earth mound kiln (CHAPOSA, 2002).

The second method involves digging a hole in the ground into which the wood is placed and then covered with soil, as it is commonly referred to as a pit-kiln both of this methods in turn pollute the forest as their produce smoke on forest species (Mugo et al, 2006). Furthermore charcoal production was responsible for degradation of 29,268 hectares (24.6%) of closed woodland and deforestation of 23 308 hectares (19.58%) of closed woodland and 92,761 hectares (50.8%) of open woodland in the catchment area to the west and north of Dar es Salaam that supplied charcoal to Dar es Salaam City (Malimbwi and Zahabu, 2008).

Charcoal making process that is usually done in public lands involves wood cutting, kiln preparation, carbonization and finally unloading charcoal from the kiln. While 13, 10 and 14 days are spent for wood cutting, kiln preparation and carbonization, respectively; unloading the charcoal kiln takes only about 4 days (Zahabu, 2001).

2.9 Extents of trees cut for charcoal production

Although it is difficult to quantify the amount of trees cut for charcoal making, but the extent can be measured through deforestation situation and the demand of charcoal as the result of population growth and urbanization which increase the demand for charcoal. For example the Morogoro-Dar es Salaam highway in Tanzania confirmed that unemployment and demand for charcoal by urban consumers were reducing the Miombo woodlands at the rate of 4354 ha a year, which would be equal to 1524 km2 in 35 a year It was estimated that restoring the Miombo woodlands to their original state would as many years (Mugo and Ong 2006).

Another example in Tanzania can be revealed on changes in natural woodland in a 10,000 sq km area supplying Dar es Salaam city with charcoal. It is estimated that

harvesting of wood for charcoal had cleared 25% of closed woodland and deforested 20% of the same. It had also degraded 51% of open woodland. This was proved by a socio-economic survey in which 75% of respondents in Mbewe, Bana and Kitulangalo areas of Tanzania identified charcoal as the main cause of woodland degradation and deforestation. The study found that in most of the areas trees were cut and left to regenerate as opposed to land being cultivated for agriculture (Malimbwi, 2008).

2.10 Capacity of Local Institutions in Forest Management

Communities throughout the world are increasingly involved in the management of local natural resources and the environment. This trend toward participatory decision-making introduces challenges and opportunities for foresters. This is a role that the development agencies have often assumed could not be done by the communities. However, for sustainable management of resources to be realized, the involvement of communities and more specifically in local institutions must be considered. It is in this stark light that, the prospects for conserving tropical forests must be considered." If we do not soon change public policy regarding tropical forests, the primary forest will probably be gone sometime before 2045 (UNEP, 2006).

Existing efforts to enforce forestry and conservation laws in many countries have had significant negative impact on the communities and their livelihoods, very often the forestry and conservation laws restrict the access rights to forests and usufructs of the communities, creating mistrust and tension between communities and foresters (CIFOR, 2004). Under the new regulations enforcing community forest management systems, local communities expected to gain access rights to government forest resources under community forest management while communities' expectations are raised when the

government makes promises, these are often made in isolation without a full understanding of the forest resource base and pre-existing legal or customary rights of the communities (ibid). As a result, promises are often broken. With new government regulations such as creation of forest reserves and national parks, communities are still poorly positioned to preserve their access rights to traditionally utilized forest resources. The fines and sanctions used as mechanisms to discourage local communities from felling trees in forests are often imposed in arbitrary manner preventing the communities from negotiating more lasting settlements and encouraging community forestry initiatives (Bergman et al, 2004).

2.11 Challenges facing forest management and ways to address them

The management of natural vegetation such as forest resource is becoming a complex task all over the world since when the human demand on that resource has increased, especially on charcoal production which in turn brings about deforestation, about one-third of human population depends on charcoal as the principle of heating and cooking fuel thus fuel wood alone accounts for about half of all wood harvested all over the world. Increasing demand for charcoal due to rapid urbanization which exerts pressure on forests and woodlands, most of which are poorly managed and prone to degradation (UN,200). Most of the world original forests have been depleted and converted to crop land pastures and settlements while the remaining 3.8 billion hectares of natural vegetation such as forest and wood land covers about 29% of the land on earth's surface. Charcoal production does not only impact on natural vegetation but also on the entire environment by increasing greenhouse gases. Brazil is the good example as the world's

largest producer and user of industrial charcoal, consumes more than 7.3 million tons of charcoal per year (ibid).

Despite the creation of new organizations to promote sustainable forestry, and continuing efforts of major international conservation organizations, the rate of forest loss accelerated through the 1990s. Deforestation is driven by a wide range of social and economic forces, but underlying them all is the relentless march of human population growth and the exponentially rising demand for land and forest products such growth generates" These demands are not going to slacken in the decades ahead, indeed, they will only expand. Slowing down tropical deforestation, much less halting it will therefore entail bucking powerful and growing forces (Mugo and Ong, 2006).

Many researchers have discussed a bit over the challenges facing forest management such as lack and inappropriate policy and poor governance of forest management in which conservation efforts are directed to forest reserves. Forests outside the reserve areas have been neglected over the years causing significant deforestation and creating fuel wood scarcity (Anderson, 1986).

The inadequate government control of the forest reserves has resulted in their encroachment for settlement, agriculture, grazing and charcoal are like population growth and urbanization, commercialization of forest resource especially charcoal trade, land clearance and expansion of agriculture, fire and lack of tree planting as well as lack of traditional management system which all end on deforestation hence put pressure on forest management (ibid).

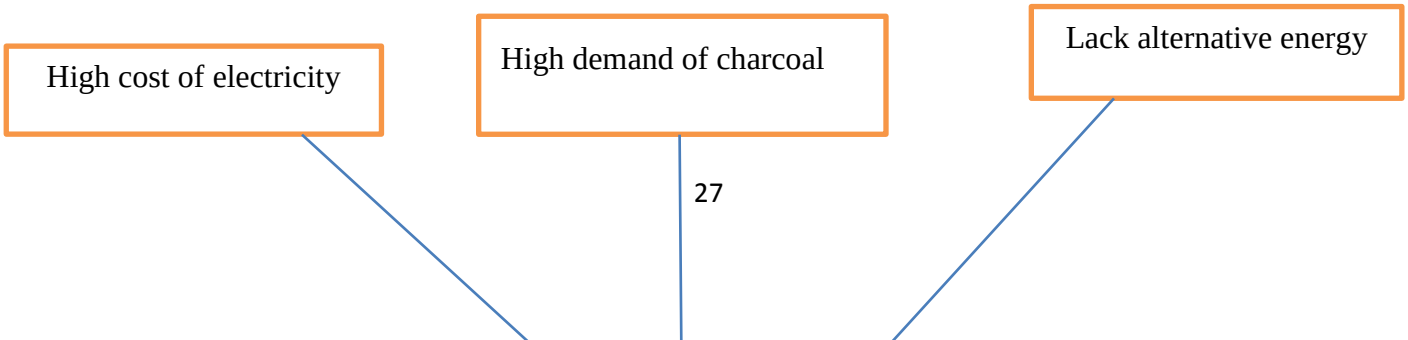
There must be charcoal policy which should be connected with forest resource as it is to Kenya, Sudan and Brazil, commercialization of forest resource due to charcoal trade suggested that charcoal is a technically and financially feasible energy option, but should

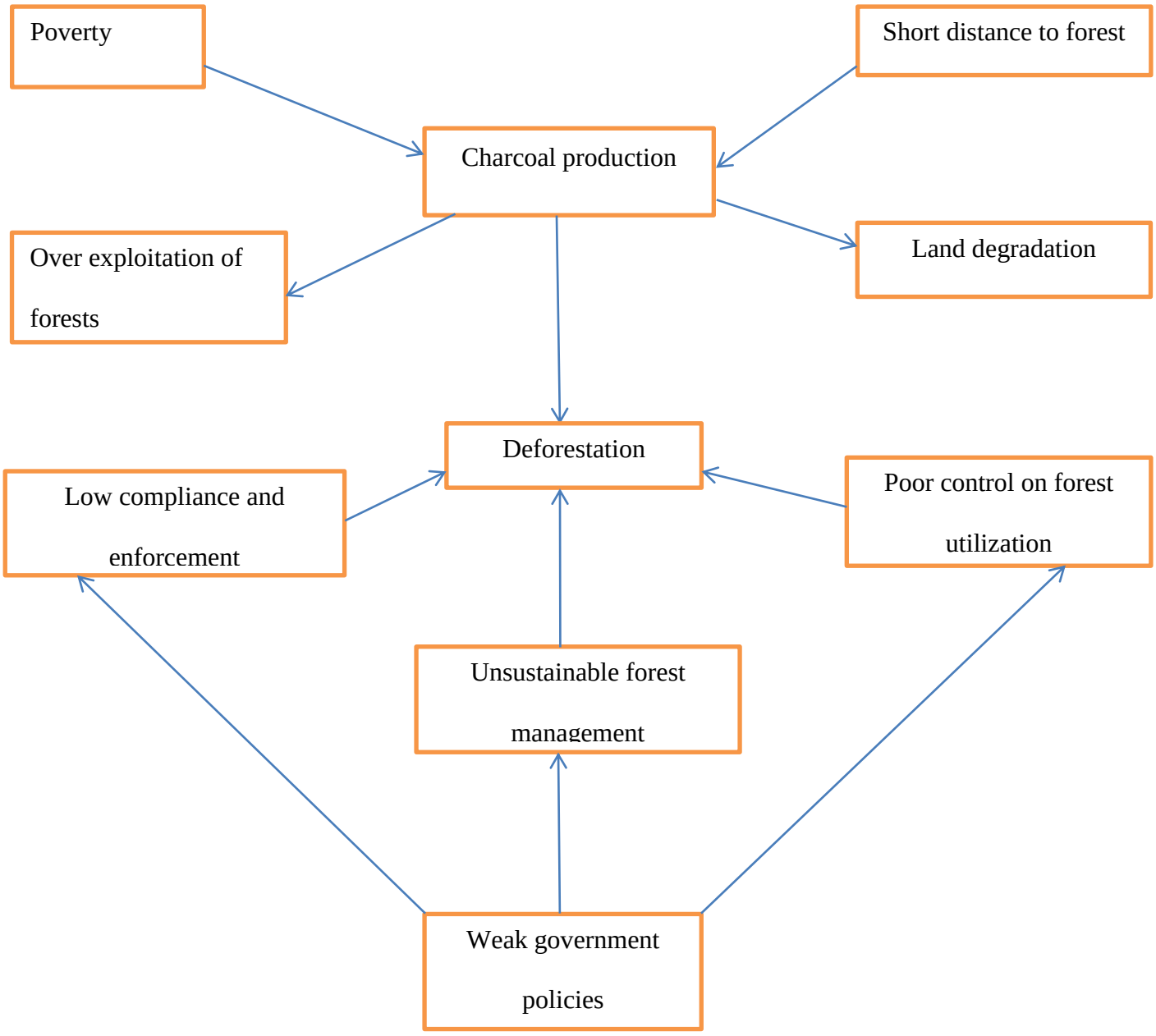
be produced under a long-term scheme to ensure a sustainable supply especially on the processes employed for charcoal making as well as planting trees as Sudan do where in each year ye about 100,000 ha are planted with Acacia seyal and Acacia nilotica for charcoal (Mugo and Ong ,2006) .

2.12 Knowledge Gap

The gap of knowledge identified from the literature review indicated that the demand of forest resources has increased which led to high depletion of forest resources, lack of alternative resource base for communities to meet their daily needs resulted into over utilization of forests resources which in turn created misunderstanding with local institutions on management of natural forests since most of the communities surrounding natural forest engage in unsustainable consumption of forest products particularly charcoal production. Moreover, the relationship between forest degradation and charcoal production at Ng'o hong'honha ward is less documented.

Figure 1: Conceptual framework





Source; Researcher own creation

CHAPTER THREE

3:0 RESEARCH METHODOLOGY

3.1 Introduction

This Chapter deals with the description of the methods applied in carrying out the study. It is organized under the following sub-topics: study area selection and criteria, research design, sampling design, data collection approaches, data analysis, data validity and reliability.

3.2 Research Design

A research design refers to decisions regarding what, where, when, how much and what means concerning an inquiry or a research study. It is the arrangement of the conditions for the collection and analysis of data in the manner that aims to combine relevance to the research conducted. It constitutes the blueprint for the collection of measurements and analysis of data (Kothari, 1990).

This study has employed descriptive and diagnostic designs which are concerning with variables and their associated features. Both descriptive and diagnostic designs lay a great stress on detailed study of the express characteristics of the problems. In contrary diagnostic design is concerned with express characteristics and existence of the problem and suggest ways and means for their solutions while descriptive designs is designed to formulate on the basis of the description of the existing data or material to acquire knowledge (Rwegoshora, 2006).

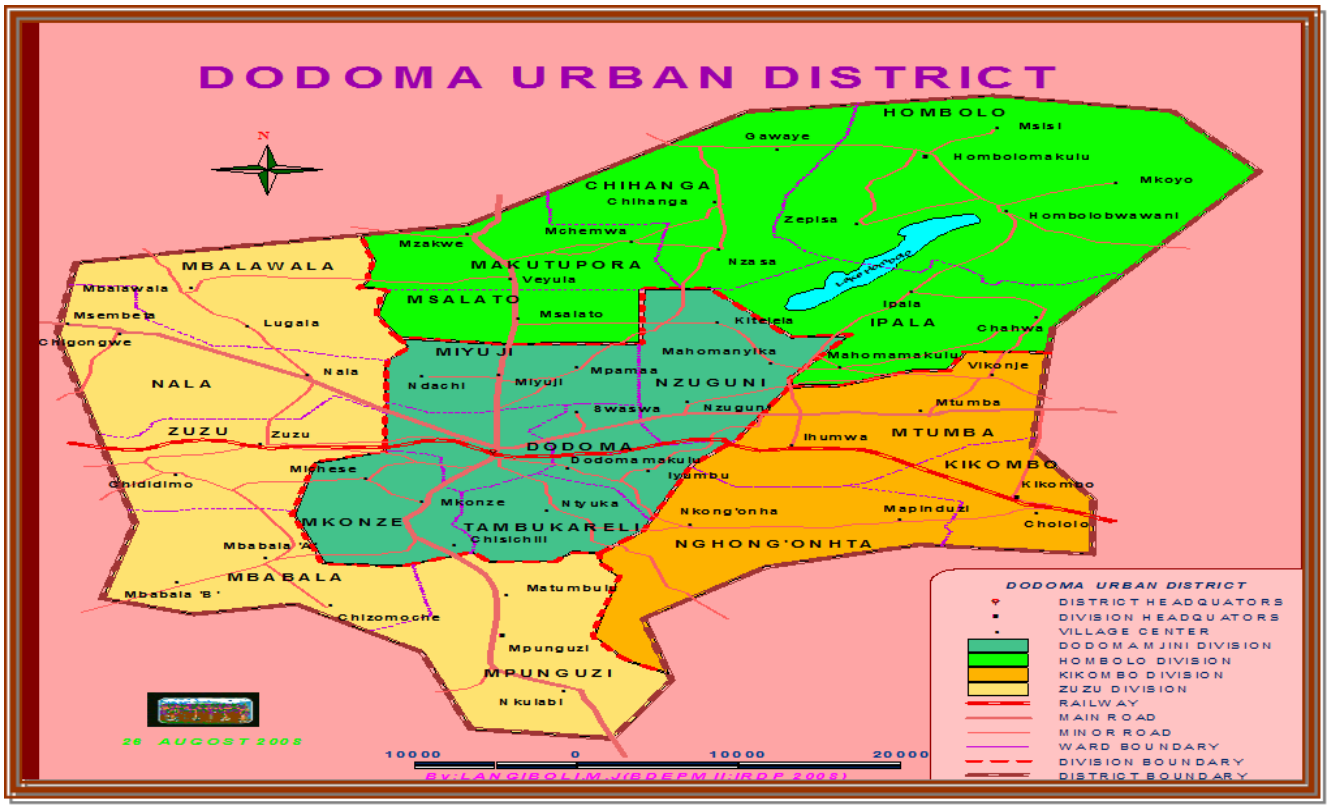
3.3 Study area and selection criteria

The study has been carried out in Dodoma municipality specifically at Ng'o hong'honha ward. The area has been selected as a case study due the fact that; the area is in periphery area where the entire population has no access to electricity hence depending on charcoal and firewood as their primary source of energy for cooking and heating, most of people live under absolute poverty hence depend on charcoal as their main source of income. Ng'o hong'honha ward has been facing the problem of deforestation as a result of charcoal production whereby in past years area was used to be vegetative but as the rate of tree felling for charcoal making is increasing, the area is now non-vegetative (URT, 2007).

3.3.1 Population

According to the URT (2013), the population of Dodoma region is about 2,083,588 people with an average household size of 4.6, the population of Dodoma municipal is 410,956 and an average household size of 4.4. The annual Average Population growth rate of Dodoma region (2002 – 2012) is 2.7 percent, the number of Households is about 453,844 with an average household size of 4.6 and the population Ng' hong'honha' ward is about 9,536 people whereby the number of men is about 4513 people and women is about 5,023 with an average house hold of 4.1.Dodoma region is populated by different ethnic groups with the Gogo, Rangi and Sandawe being the native ones (URT, 2013)

Figure 2: The map of Dodoma urban district



Source : URT (2007)

3.4 Back ground of the study area

3.4.1 Geographical Location

Dodoma region is positioned at the center of Tanzania mainland, it lays between latitude 40 and 70 (degrees) South Latitude and 350 – 370 (degrees) East longitude. The region is bordered by four regions namely Arusha to the northern part, Morogoro to the eastern part, Iringa to the southern part and Singida to the western part. The region is

characterized by plateau rising from some 830 meters in Bahi swamps to 2,000 meters above sea level in the highlands North of Kondoa (URT, 2007).

3.4.2 Land Areas

Dodoma region is ranked 12th largest among the regions in Tanzania Mainland and covers an area of 41,310 square Kilometers (equivalent to about 5% of the total area of Tanzania Mainland) (URT, 2007).

3.4.3 Climate

Dodoma region has a dry savanna type of climate, which is characterized by a long dry season lasting between late April to early December and a short single wet season during the remaining months. The region lies in a rain shadow behind the mountains area of Dodoma in the eastern side (URT, 2007). The region receives about 570mm of rain, about 85% of this falls in four months between December and March. Rainfall is higher in Mpwapwa and Kondoa districts. Rainfall in Dodoma region is not only low but it is rather unpredictable in frequency and amount, particularly in the month of January in which most crops are generally sown. In Dodoma region temperature varies according to altitude but generally the average maximum and minimum temperature from October to December are 31°C and 18°C respectively. The corresponding figures for the cool dry season of June – August are 27°C to 28°C and 10°C to 11°C (URT, 2007).

3.4.4 Economic activities

The dominant economic activities in Dodoma region are agriculture and livestock keeping especially in the rural areas while the majority of people urban areas engage in trade, others engage in charcoal production and transport it from rural to urban areas. The major crops grown includes; maize, sorghum, pigeon peas, groundnuts, bull rush millet, cassava, Irish potatoes, beans and guava just to mention but a few (URT, 2007).

3.5 Sampling procedures

3.5.1. Sample Specification

Sampling is the research strategy of collecting data from a part of a population with a view of drawing inferences about a whole population. It is a procedure and principle used to identify, choose, and gain access to relevant units which are being used for data generation by any method. It is very often associated with a logic driven from general laws of statistics and probability. Sampling is used in order to have a representative sample of the whole population. Sampling serves time and money as it is less expensive and procedures results at a relatively faster. Therefore, the purposive sampling and simple random sampling was employed in this study to examine the extent to which charcoal production hinder forest management .Sample size is a portion or an element of the population to be studied to represent the entire population, the size of sample depends on the number of factors like the size of the population, purpose of the study, accessibility of the element as well as the cost of obtaining elements (Wilson, 1995)

3.5.2. Purposive Sampling

This is the set of procedures where the researcher selects the information purposely before the data collection so as to collect adequate data. Purposive sampling was used by the researcher to interview selected officials like Ward executive officer, forests officers and civil society leaders to acquire information on the impacts of charcoal production on forest management.

3.5.3. Simple Random Sampling

This is the method based on the assumption that each person in the population has a probability of being selected. The justification of using simple random sampling is that, it is not only easy but also reduces bias by ensuring that quota is adequately presented. Therefore, the selection of the study respondents based on simple random sampling was employed to capture the adequate information from the respondents.

3.5.4 Study Population and sample size

Population is the set of elements that the research focuses upon and to which results obtained by testing the sample should be generalized (Bless and Smith, 1995). It was undertaken in rural community. The target populations in the study area were charcoal producers forests experts, charcoal traders, farmers and livestock keepers. Key informants such as village leaders, forest officer and civil society leaders formed part of the study population.

The sample for this study was 95 household out of 2325 which is the total number of household in the ward, obtained by dividing the total population of the ward which is 9536 by average household size of 4.1. The sample included 10 key informant .The

sample was taken from three villages namely, Mapinduzi, Mhande and Mazengo, 55 households from Mapinduzi village with 300 households, 21 households from Mazengo village with 96 households and 19 household from Mhande village with 87 households.

The following formula by Yamane (1967) was used to obtain the sample size.

$$\mathbf{n=}\frac{N}{1+N(e)^2}$$

Where n = sample size

N is the number of household where N = Total population /average household size since Total population is 9536 and average household size is 4.1, N = 9536/4.1 = 2325.8537 Therefore N = 2325

e is standard error = 10% = 0.1

$$n = \frac{2325}{1 + 2325\ (0.1)^2} = 95.876$$

Therefore n = 95

3.6. Methods of Data Collection and types of data

This section bears two major types of data that is primary and secondary data. The primary data are all about those data which are collected as fresh and for the first time. The secondary data on the other hand, are those which have been already collected by someone else and which have passed through statistical process. Under primary data, interview, questionnaire, and observation methods was used while documentation was employed to collect secondary data (Kothari, 1990).

3.6.1 Interview method

This method employed the use of dialogue between two or more persons particularly the interviewer (researcher) and the interviewee (respondent(s) in the course of data collection for a particular subject of study (Rwegoshora, 2006). The data was collected through discussions between a researcher and the key informants. The method helps to obtain additional information and study events which are not open to observation. Structured kind of interview was employed.

3.6.2. Key Informant Interviews

Key informant interviews are qualitative in depth interviews with selected individuals who have first-hand information on issue under study in the community. The justification of choosing this method is that, the researcher gained access to available information, key informant interviews were supplemented with data gathered through questionnaire. Key informants for this study were forest officers, ward executive officer, village executive officers, and Agricultural officers, NGO'S (Babbie, 1998).

Distribution of the key informants

Position of the respondents	Mapinduzi	Mhande	Mazengo	Total
Forest officers				1
Village executive officers	1	1	1	3
Ward executive officers	_	_	_	1
NGO's	_	_	_	2
Agricultural officers	1	1	1	3
TOTAL				10

3.6.2. Questionnaires

Questionnaire is the systematic designed questions for the purpose of collecting data from a respondent. Is a set of questions, which is usually sent to the respondents to answer at their own convenience and returned back the filled questionnaire to the researcher. The decision of choosing this method is that it influences the need of maintaining uniformity in questions asked. A lot of information was collected from this method. Moreover, it takes short time to fill the questionnaire. The method is easier to manage and analyze compared to other methods. The questionnaire was administered by reading questions to the respondents and recording the answers. This method is the cheapest and consumes little time if the respondents are collected together as a group of respondents (Kothari, 1990). In this study, the questionnaires methods were used during data collection since it avoids researcher's subjectivity. The questionnaires were administered to the sampled communities involved in charcoal production, selling charcoal, agriculturalist, and community living adjacent toe forest areas. The

information from respondents related to the impact of charcoal production on forests (Mugenda, 1999).

The questionnaire designed was Semi-Structured Questionnaire**.** It was used to administer relevant open ended questions to key informants which provided guidance to in-depth interviews. This method minimized non- response, ensured valid and reliable information collection. Also Open ended questions provided respondents with freedom of self-expression and more creativity in providing detailed information (Emerson, 1985). Structured questionnaire was adopted to administer close ended questions to obtain quantitative data. Added value from this technique is its efficiency in terms of providing standard answers, which simplified the coding and analysis of data (Blalock, 1998).

3.6.3. Direct observation

This is the research method technique involving systematic and accurate looking, listening, and recording behavior and characteristics of people living in the areas concerned. The justification of using this method is that, it enables a researcher to collect information to complete the data collected from other techniques. It enables a researcher to probe the reality of natural or real life settings (Mugenda, 1999). The added advantage of using this method is that, it gives a researcher detailed and context related information and permits a researcher to collect information on facts not mentioned in interview where it permits tests of reliability of responses to questionnaires (Marson, 2002).

The researcher has observed the deforested areas by looking scale of deforestation and the site where charcoal kiln were located to determine the extent of trees cut for charcoal and forest management measures taken. The technique was used to observe and

document relevant information relating to the study. Also, it was used to facilitate the gathering of sufficient information during and after the interview sessions. Through observation it was possible to observe some of the impacts of charcoal production on forests.

3.6.4. Documentary Search

Documentation in this context embodies a large body of data, which are related to the study and have already been collected by other researchers. Document evidence was used to collect relevant information and acknowledging other studies contribution to this study. Justification for selecting this instrument is its added advantage or value that include, enabling the researcher to construct processes and appreciate trends of the same, following the research of relevant long past events to be related to the current study. Its non-reactivity nature gives room for the instrument to be shared with other methods like indirect observation (Bailey et al, 1987).Further the document search allows longitudinal analysis for comparing events over a long time. The instrument is also relative cheaper because documents were accessible in one Centre like libraries and other resources center (ibid).

Therefore, in this study documents were consulted from both government and non-government agencies that are dealing with the impact of charcoal production on forests. The source of information, which was consulted were policy documents, magazines, newspapers, books, researches and official reports so far published out on impact charcoal production on forests.

3.7. Techniques of Data Analysis and presentation

Both qualitative and quantitative methods of data processing and analysis were used. The interpretation and analysis was directly linked to the research objectives. Quantitative analysis was applied by using tables, which show frequencies and percentage of various variables; figures were generated to show different trends. Qualitative analysis was applied by using text form to interpret the findings where cross-sectional method and Statistical Package for Social Sciences (SPSS) was used to analyze the data that collected. Cross-sectional method is purposively selected because it allows getting systematic overview of data so that we have a clear idea of its coverage scope, and also SPSS is useful for quick retrievals of data. The data obtained was presented and organized through charts, graphs, tables and maps in a summarized ways.

3.8. Validity and Reliability of the Instruments

3.8.1 Validity

Validity is the process whereby an empirical measure adequately reflects the real meaning of the concepts under consideration (Babbie, 1998). Therefore, Internal Validity in this research was achieved through proper identification of research problem, building a theoretical perspective on the impact of charcoal on forests as well as using secondary information to guide the research processes. Predictive or Criterion Validity in this research also was achieved through proper identification of the research problem, following the scientific research process and the use of different research methods. In order to achieve it, the scientific research process was adopted from designing the

research problem, designing the research design and undertaking the research process (Robson, 1993).

3.8.2 Reliability

Reliability is a matter of whether a particular technique applied repeatedly to some object would yield the same results each time (Babbie, 1998).Therefore**,** the stability and equivalence aspects of reliability of this research study was achieved by carefully replicating the research methods and test them before implementing the research process.

CHAPTER FOUR

DATA PRESENTATION, ANALYSIS AND DISCUSION OF FINDINGS

4.1. Introduction

This chapter presents the study findings obtained from the data collected. Interview, observation and questionnaire were employed to collect primary data while documentary review was used in collecting secondary. This chapter covers presentation, analysis and discussion of the findings based on research questions.

4.2. Profile of the Respondents

This section provides the general characteristics of the respondents involved in assessing the impacts of charcoal production on forest management. These characteristics are age group, sex, marital status, educational level and main occupation of respondents. The discussion of each characteristic is presented below.

4.2.1 Age Group of the Respondents in the Area of Study

About 16.8% of respondent's ranges in the age of 16-25, and 36.8% ranges between 26-35 years. The Table also shows that about 27.4% of respondents range in the age 36-45, 10.5% range in the age of 46-55, 6.3% range 55-65 and 2.1% range in the age 65+ (see table 1).

Table 1: Age Distribution of Respondents

Age Group	Number of respondents	Percentage (%)
16-25	16	16.8
26-35	35	36.8
36-45	26	27.4
46-55	10	10.5
56-65	6	6.3
65+	2	2.1
Total	**95**	**100.0**

Source: Field Data, 2015

4.2.2. Sex of the Respondents in the Study Area

This section provides the general characteristics of respondents in terms of their sex. This was done in order to assess if there was equal distribution of sex. In this study, about 81.1% of respondents were males and about 18.9% were females (see table 2).

Table 2: Sex Distribution among Respondents

Sex	Number of respondents	Percentage (%)
Male	77	81.1
Female	18	18.9
Total	**95**	**100.0**

Source: Field Data, 2015

4.2.3. Marital Status of the Respondents

About 23.2% of the respondents were single, 54.7% of respondents were married, 10.5% of respondents are divorced, 7.4% of respondents were widows and 4.2% of respondents were widowers (see table 3).

Table 3: Marital Status of Respondents

Marital status	Number of respondents	Percentages (%)
Single	22	23.2
Married	52	54.7
Divorced	10	10.5
Widow	7	7.4
Widower	4	4.2
Total	**95**	**100.0**

Source: Field Data, 2015

4.2.4. Education Level

About 53.7% of the respondents had primary education, 12.6% of respondents had secondary education, and 2.1% of respondents had attained vocational training education as well as about 31.6% of the respondents had not attended school at all (see table 4).

Table 4: Education Level of Respondents

Education Level	Frequency	Percentage (%)
Primary	51	53.7
Secondary	12	12.6
Vocational education	2	2.1
Not educated	30	31.6
Total	**95**	**100.0**

Source: Field Data, 2015

4.2.5. Main economic activities Respondents

About 15.8% of respondents were engaging in crop production, 13.7% were livestock keepers, 11.6% engaged in petty trade and about 58.9% were engaging in charcoal production (see table 5).

Table 5: Economic activities Respondents

Economic Activity	Frequency	Percentage (%)
Crop production	15	15.8
Livestock keeping	13	13.7
Petty trade	11	11.6
Charcoal production	56	58.9
Total	**95**	**100.0**

Source: Field Data, 2015

4.3. Charcoal production issues and its implication on forest management

With respect to socio-economic importance of charcoal 80% of respondents felt that charcoal was their main source of income while 20% of respondents felt that charcoal was their main source of cooking energy (see table 6).

Table 6: Social economic importance of charcoal production

Socio-economic importance	**Frequency**	**Percentage (%)**
Source of income	76	80.0
Source of cooking energy	19	20.0
Total	**95**	**100.0**

Source: Field data 2015

4.3.2 Use of energy efficient cooking stoves

Results showed that 32.6% of respondents were using energy efficient cooking stoves while about 67.4% percentage of respondents were not using energy efficient saving stoves (see table 7).

Table : 7 Use of energy efficient cooking stoves

	Number of respondents	Percentage (%)
Yes	31	32.6
No	64	67.4
Total	**95**	**100.0**

Source; Field data, 2015

4.3.3 Reasons for abandoning energy efficient cooking stoves

With respect to the reasons for abandoning energy efficient cooking stoves 31.6% of respondent felt that not available, 38.9% of respondents felt lack awareness on energy efficient stoves and 29.5% of respondents felt that energy efficient stoves are not affordable (see table 8).

Table 8; Reasons for abandoning energy efficient cooking stoves

Reasons	Frequency	Percentage (%)
No access	30	31.6
Lack of awareness	37	38.9
Expensive	28	29.5
Total	**95**	**100**

Source; field data, 2015

4.3.4 Methods of charcoal production

With respect to the methods of charcoal production, 74.7% of respondents felt that it was Earth mound kiln, 15.8% of respondents felt that it was pit kiln and 9.5% of respondents felt that both methods of charcoal production were being used to produce charcoal in the study area (see table 9).

Table 9: Method of charcoal production

	Frequency	Percentage (%)
Earth Mound kiln	71	74.7
Pit kiln	15	15.8
Both	9	9.5
Total	**95**	**100**

4.3.5 Average charcoal produced per month

Results shown that; 4.2% of respondents felt that the average charcoal production per month ranged between 1.5 tons -3.75 tons, 21.1% of respondents felt that it range between 4.5 tons-6.75 tons, 23.1% of respondents felt that it range between 7.5 tons-9.75 tons, 49.5% of respondents felt that average charcoal produced per month was more than 10.5 tons and 2.1% of respondents felt that the do not know the amount of charcoal produced per month (see table 10).

Table 10: Average charcoal produced per month

Average charcoal	Frequency	Percentage (%)
1.5 -3.75tons	4	4.2
4.5-6.75tons	20	21.1
7.5-9.75tons	22	23.2
More than 10.5tons	47	49.5
I do not know	2	2.1
Total	**95**	**100.0**

Source; Field data, 2015

4.3.6 Intensity of charcoal production

Results showed that 81.1% respondents felt that the intensity of charcoal production was high and could degrade environment, 14.7% respondents felt that it was moderate intensity and 4.2 % of respondents felt that the intensity of charcoal production was less intensity and could not harm the environment (see table 11).

Table 11: Intensity of charcoal production

	Frequencies	Percentages
High	77	81.1
Low	14	14.7
Medium	4	4.2
Total	**95**	**100.0**

Source: field data, 2015

4.3.7 Sustainability of charcoal production

All respondents (95) in the study area felt that charcoal is produced in unsustainable way. With respect to the sustainability of charcoal production 18.9% of respondents felt that was due to over cutting of trees,42.1% of respondents felt that it was due to failure to replace trees after cut,16.9% of respondents felt that it was due to soil erosion and 22.1% of respondents felt that it accelerates drought and deforestation (see table 12).

Table 12: Sustainability of charcoal production

	Frequency	Percentage (%)
Overcutting of tree	18	18.9
No replacement of trees	40	42.1
Soil erosion	16	16.9
Drought and deforestation	21	22.1
Total	**95**	**100.0**

Source: field data, 2015

4.3.8 Trend of utilization of forests from 2005-2015

The results from field showed that more than half of respondents (74.7%) felt that there were more users of forests in the period of 10 years, 14.7% felt that the number of users has remained the same while 10.6% of the respondents felt that there was fewer users of forests products (see table 13).

Table 13: Trend of utilization of forests from 2005-2015

	Frequency	Percentage (%)
More users	71	74.7
Same users	14	14.7
Few users	10	10.6
Total	**95**	**100.0**

Source; Field data, 2015

4.4 Impacts of charcoal production on forest management and measures to address the impacts

4.4.1 How charcoal production affects environment

Respondents in the study area were asked to explain how charcoal production affects environment and the responses were; 21.1% of respondents felt that it led to desertification and drought, 33.7% felt that it led to deforestation, 25.2% of respondents felt that it led to soil erosion, and 20% of respondents felt that it led to loss of species diversity (see table 14).

Table 14: Effects of charcoal production on environment

Education Level	Frequency	Percentage (%)
Drought	19	20.0
Deforestation	32	33.7
Soil erosion	25	26.3
Loss of species diversity	19	20.0
Total	**95**	**100.0**

Source; Field data, 2015

4.4.2 Impacts of charcoal production on forest management

The results from field showed that 33.3% of respondents felt that it increases cost of forest management, 11.6% of respondents felt that it led to violation of forest policies and laws, 17.9% of respondents felt that it led to deforestation ,36.8 of respondents felt that it led to increase in corruption (see table 15).

Table 15: Impacts of charcoal production on forest management

Impacts	Frequency	Percentage (%)
Increased cost of management	32	33.7
Violation of policies and laws	11	11.6
Deforestation	17	17.9
Increased Corruption	35	36.8
Total	**95**	**100.0**

Source; Field data, 2015

4.4.3 Suggestion on curbing indiscriminate charcoal production

The assessment on the suggestion to curb the increased illegal charcoal production indicated that about 29.5% of respondents suggested speeding up of enforcement of village forests by-laws, 30.5% of respondents suggested establishment of CBFM and JFM, 9.5% of respondents suggested fines and penalties, 9.5% of respondents suggested provision of awareness and environmental education and about 21.1% of respondents suggested provision of alternative source of livelihood (see table 16).

Table 16: Suggestion on curbing indiscriminate charcoal production

	Number of respondents	Percentages
Village by laws	28	29.5
Establishment of CBFM and JFM	29	30.5
Fines and Penalties	9	9.5
Awareness and Education	9	9.5
Alternative source of livelihood	20	21.1
Total	**95**	**100.0**

Source; Field data, 2015

4.4. Government intervention to curb impacts of charcoal production

With respect to the government intervention to curb impacts of charcoal production 89.5% of respondents felt that there was no any kind of intervention undertaken to curb the impacts of charcoal production on forest management, while only 10.5% respondents felt that there was intervention undertaken to curb the impacts of charcoal production on forests (see table 17).

Table 17: Government Intervention to curb impacts of charcoal production

	Frequency	Percentage (%)
Yes	10	10.5
No	85	89.5
Total	**95**	**100.0**

Source; field data, 2015

4.4.5 Effort taken by local community to curb impacts of charcoal production on forest

Results has shown that 96.5% of respondents felt that there was no effort taken by local community while only 3.5% of respondents felt that there were efforts taken by local community to curb the impacts of charcoal production on forest (see table 18).

Table 18: Effort taken by local community to curb impacts of charcoal production on forest

	Frequency	Percentage (%)
Yes	3	3.2
No	92	96.8
Total	**95**	**100.0**

Source; field data, 2015

4.4.6 Reason for failure of local community to take effort to curb impacts of charcoal production on forest

With respect to the reasons for the failure of local community to take effort to curb impacts of charcoal production on forests 17.9% of respondents felt lack of awareness and education, 23.2% of respondents felt that was due to lack of forest by-laws, 29.5% of respondents felt it was due to poverty, 16.8% felt that it was due to apathy, 6.3% felt that it was due to lack of local community organization and 6.3% felt that it was due to lack of government support (see table 19).

Table 19: Reasons for failure of local community to curb the impacts of charcoal production on forests.

	Frequency	**Percentage (%)**
Lack of awareness and education	17	17.9
Lack of forest by-laws	22	23.2
Poverty	28	29.5
Apathy	16	16.8
Lack of community organization	6	6.3
Lack of government support	6	6.3
Total	**95**	**100.0**

Source; field data, 2015

4.4.6 Challenges in curbing increased illegal charcoal production

Results showed that there were number of factors which pose challenges on the efforts of curbing indiscriminate charcoal production as follows, 35.8% of respondents felt that it was due to poverty, 13.7% of respondents felt that it was due to lack of awareness and education, 10.5% of respondents due to lack of government support, 24.2% of respondents felt that it was due to weak policy and laws and 15.8% of respondents felt that it was due to lack of community involvement (see table 20).

Table 20: Challenges in curbing indiscriminate charcoal production

Challenges	Number of respondents	Percentages
Poverty	34	35.8
Lack of education and awareness	13	13.7
Lack of Government support	10	10.5
Weak policies and by-laws	23	24.2
Low community involvement	15	15.8
Total	95	100.0

Source; Field data, 2005

4.4.7 Reasons for failure in curbing indiscriminate charcoal production

All respondents (95) in the study area reported that there was no success in curbing illegal charcoal production when they were asked to point out the reasons for failure in curbing indiscriminate charcoal production the results were; 8.4% of respondents felt that there was no forest by laws and regulation, 29.5% of respondents felt that it was

due to poverty, 5.3% of respondents felt that it was due to lack of awareness and education, 23.2% of respondents felt that it was due to low community involvement, 24.2 % of respondents felt that it was due to poor governance and 9.4% of respondents felt that it was due to corruption (see table 21).

Table 21: Failure in curbing indiscriminate charcoal production

	Number of Respondents	Percentages
No forest by-laws	8	8.4
Poverty	28	29.5
Lack of awareness and education	5	5.3
Low community involvement	22	23.2
Poor governance	23	24.2
Corruption	9	9.4
Total	**95**	**100.0**

Source: Field data, 2015

4.7 Discussion of findings

4.7.1 Charcoal production issues and its implication on forest management

4.7.1.1 Lack of awareness and education

The result has shown that, Lack of awareness and education increases pressure on forest management since majority respondents (81%) in the study area have low level of formal education or no education at all as shown on table 4. In this case, the destruction of natural forests was high due to the fact that, the respondents have no other means to run their daily life which has resulted into over exploitation of natural forests. Also it has been observed that, respondents with primary or no education participate more in the deterioration of natural forests through their involvement in charcoal production in order to meet their daily needs. As CHAPOSA (2002) has shown in Tanzania 40% of the charcoal makers have no formal education. This is because the activity requires neither formal education nor large capital investment although it is time consuming and labor intensive (ibid).

4.7.1.2 Source of livelihood

The findings of the study has shown that livelihood of majority of people in the study area depend much on the traditional activities which has accelerated the depletion of forest resources (see table 6), charcoal production was found to be the leading source of income in the area. This means that, people in the study area depend much on forest resources while other socio-economic activities like subsistence farming, livestock keeping and trade has remained to be minor sources of income (see table 6).

Also the results have shown that, more than half of respondents depend much on charcoal production as their main source of livelihood (see table 5). Increasing in demand of charcoal in urban areas and harsh climatic condition of the region which does not support agricultural activities has forced large segment of the population in the study area to invest much of their efforts in charcoal production .Large scale utilization of natural forests for charcoal pose a great challenge on managing the available forests.

Forests have greater contribution on the livelihood of rural societies through cash and non-cash sources. It provides goods such as timber, fuel wood, fodder, wild fruits and honey as well as services that are divided into ecosystem services and environmental services, but in areas where agriculture does not perform well forest remain the main source of livelihood for largest portion of the community (Brown et al, 2007).

4.7.1.3 Uses of energy efficient cooking stoves

Result from findings has shown that majority of respondents in the study area have low preference for energy efficient cooking stoves (see table 7). The reasons for poor preference for energy efficient cooking stoves were; lack of access due to high cost since the price of energy efficient cooking stoves continued to be high compared to the traditional stoves which consume more charcoal, lack of awareness limit the switch from traditional to modern cooking stoves. The interview with district forest officer showed that even in urban areas most of people do not use energy efficient cooking stoves.

Normally charcoal is used to cook meals that take many hours to be ready for eating such as beans. Many people in Africa especially Sub-Saharan Africa cook over open fires that deliver only about one-tenth of the available heat to cooking pots, in turn the problem has resulted into clearing of the tropical forest in Africa whereby about 0.8

percent of the remaining tropical forest is cleared every day (Cunningham, 2007). Thus the shift from traditional stoves to modern ones which consume less charcoal is a panacea toward the achievement of sustainable forest management (ibid).

4.7.1.4 Method used in charcoal production

The result from findings showed that majority of respondents (see table 9) felt that most of charcoal producers in the study area were using earth mound kiln as their common methods of charcoal production. The reason behind was that construction of earth mound kiln was cheap compared to pit kiln but in term of efficiency earth mound kiln use large number of trees to produce charcoal while pit kiln use less trees. This has resulted into large scale deforestation and brings about poor management of forest since charcoal producers cut even young trees in order to increase the quantity of charcoal (Bailis, 2003).

Improved kilns could contribute significantly to efficient charcoal production, in earth-mound kiln, which is the most common method of making charcoal in sub-Saharan Africa, between five and ten tons of wood are needed to make 1 ton of charcoal (at a mass-based conversion efficiency of 10-20%). Thus, using such kiln between 60-80% of the wood's energy is lost in the production process of charcoal, (ibid).

Experience from CHAPOSA (2002), shows that kiln efficiencies in Tanzania, is at an average of 19%, 18 trees of 32 cm DBH (diameter at breast height, measured at 1.3 m) on average are used to produce 1.378 tons of charcoal. That is 1 m^3 of wood yields 1.378 tons of charcoal. In spite of their efficiency the use of improved kilns has failed due to lack of capital for kiln construction. The need to process the billets into specific sizes and transport them to kiln sites is an added cost which is limiting. Therefore the use of

earth mound kiln as the main method of charcoal production could continue to degrade the available natural forests and hinder the achievement of sustainable forest management (ibid).

4.7.1.4 Environmental degradation

Charcoal production affects environment negatively (see table 14) by way of cutting down large number of trees. Environment is being affected by charcoaling activities which exacerbate drought, soil erosion, deforestation, and loss of species diversity. According to the ward executive officer charcoal production is carried out in unsustainable way where by even young trees are cut down because there are no strictly regulations guiding the production of charcoal.

Charcoal production accelerate drought through the removal of vegetation cover which resulted into loss of moisture which could be converted into clouds to form rain hence resulted in reduction of the amount of rainfall. Furthermore according to the District forest officer charcoal production results into loss of species diversity because the tree species which are targeted for charcoal undergo local extinction also some animal species which were residing on hills have disappeared as a result of human being encroachment. For instances according to District forest officer spotted hyena and monkeys have disappeared likewise wind erosion now is a common phenomenon because the land left bare after large number of trees has fallen for charcoal.

According to the village agricultural officers from Mhande, Mapinduzi and Mazengo villages, and environmental degradation at Ng'o hong' honha ward has forced majority of the people to deviate their effort towards charcoal production since the area has

become unsupportive for agricultural activities. With high dependence on natural forests for their survival the achievement of sustainable forest management is difficult.

Globally the trend of accelerated environmental degradation has been driven by land use changes as a consequence of frontier expansion and population growth. Land use practice and land use changes significantly impacts natural forests, the environment and the whole biosphere. Socio-economic and political factors have created incentives for rapid exploitation of forests and intensified pressure on the remaining tropical forests and arid woodlands (Sharma, 1992).

4.7.1.5 Population growth and demand for charcoal

Population growth is one of the most critical social economic factors that alter the pattern of forest resource use. The rapid population growth in both rural and urban areas has negative impacts on forest management. Due to the increase in population the encroachment of forest area for agriculture, charcoal production and settlement is increasing at an alarming rate (URT, 2007). At Ng'o hong' honha ward forest management is widely affected by population growth since the area is characterized by semi-arid condition which does not support agriculture which in turn cause over dependence on forest resources as their main source of income particularly through charcoal production (Monela et al, 2000).

Increase in demand of charcoal in urban areas resulted into large scale deforestation of natural forests for charcoal production and bring about management pressure. The rapid population increase in urban areas bring about high demand for charcoal as the main source of energy while percentage of electricity users as a first choice source of energy is low due to high charges which most of the poor urban dwellers cannot afford. For

instance, most of people in Dodoma urban live in chronic poverty which force them to depend on charcoal as their main source of energy (Malimbwi and Zahabu, 2008).

The interview with key informant revealed that forest management is under great pressure from charcoal production because of increased demand of charcoal in urban areas which influence majority of people to shift from using firewood to charcoal. Some of the factors influencing the choice of using charcoal instead of firewood in urban areas includes; (i) Charcoal has a higher calorific value per unit weight compared to firewood (About 31.8 MJ per kg of completely carbonized charcoal with about 5 percent moisture content as compared to about 16 MJ per kg of firewood with about 15 percent moisture content on dry basis, (ii) it is more economical to transport charcoal over longer distances compared to firewood, Storage of charcoal takes less room as compared to firewood, (iii) charcoal is not liable to deterioration by insects and fungi which attack firewood, (iv) charcoal is smokeless and sulphur free, as such it is ideal fuel for towns and cities (CHAPOSA,2002).

Since charcoal meets 80% of urban household's energy needs in East Africa, it will remain the main cooking fuel for most people in urban areas for the foreseeable future since it is affordable (Mugo et al, 2006).

4.7.1. 6 Poverty

The linkage between forest resources and poverty in semi-arid rural areas is crucial since agriculture has become less profitable in the study area it induces most of people to engage in forest utilization as a means of earning a living which in turn exerts much pressure on the available natural forests and affects the effective management of forest resources (Monela et al, 2000). Charcoal production employ large segment of the

population at Ng' o hong' honha ward (see table 5). A study by Monela et al (2000) showed that forest resources contribute 58% of the cash income of farmers in six villages of Dodoma municipality, improvement of infrastructure have made easier for charcoal producers to bring charcoal to the market for sale (ibid).

Forest resources provide an important security for resource poor households particularly at time when other income sources are unavailable. For instance when rains fail and the harvest is poor. The increase in demand of charcoal in Dodoma urban attracted majority of people at Ng'o hong' honha ward to deviate much of their effort towards charcoal production as their only means to alleviate chronic poverty, this has caused large portion of natural forest to be degraded rapidly in turn hampering the forest management programs.

4.7.1.7 Policy implication on charcoal production and forest management

Management and conservation of forest resources in Tanzania are guided by the National policy. The policies are based on forest conservation and management while charcoal is abandoned. For example Forestry Policy, which is more directed towards control and protection of forest resources than to sustainable utilization. One of the provisions of the 1953 Forestry Policy is to demarcate and reserve forest, for the benefit of present and future inhabitants of the country. The utilization of forests under this provision is, however, limited to commercial exploitation (Anderson, 1986).

In 1998, Tanzania approved a National Forestry Policy, the first new forest policy since 1963 which promoted substantial change in the way forests are managed (URT, 2008). Furthermore, the policy recognizes the substantial area of forest that lies outside the

formal forest reserve network and the levels of deforestation and degradation that takes place in these areas due to poor management and uncertain tenure (ibid).

The Tanzania energy policy of 1997 still stress development and use of indigenous energy sources such as bio-energy, coal, natural gas and hydropower (URT, 1997).Less than two percent of energy development budget is allocated to wood energy programs, fuel wood being regarded as minor forest product with little market value (TFAP 1989).Yet still the vast majority of wood fuel consumers cannot afford the high investment costs associated with those alternative commercial energy sources (Moyo *et al* 1993).

According to the interview with the ward executive officer despite of the presence of forest policy and energy policy the degradation of forest at Ng' o hong' honha ward has continued to be a serious problem for many years. Large segment of the population depend on forests as their main source of income through charcoal production, lack of awareness and education led to unsustainable utilization of forests also lack of clear laws concerning utilization of forests at village level pose a challenge on implementing forest and energy policies which in turn hamper the management of available natural forests.

Charcoal Production was found to be the main source of livelihood and cooking energy at Ng'o hong' honha ward since Dodoma municipality is characterized by semi-arid condition where by rainfall is unreliable hence discourage people to engage in agricultural activities also likewise the increase in demand of charcoal in Dodoma urban attracted many people to engage in illegal charcoal production despite of the available policies which prohibit illegal utilization of forests.

The availability, reliability of supply and cheaper prices renders fuel wood more preferable than alternative sources of energy. According to the present economic forces the majority of urban population in Tanzania will continue to depend on fuel wood especially charcoal for longtime to come (URT 1998; Moyo *et al* 1993).

The understanding of the potential of the forests to supply firewood and charcoal over a medium time perspective is limited. This has implications on the country regarding its ability to design and implement appropriate energy policies that can intervene in the charcoal sectors. Rational decisions in management of natural forest depend on information available on their growing stock. Acquisition of forest growth information is prerequisite to any forest management system and sustainable land use (Mgeni et al, 1990).

In many developing countries there are no specific policies and legislation on charcoal. Instead, charcoal is covered under energy, forestry, agriculture or all three. No particular institution has taken the responsibility to plan and implement charcoal production programs. Even the available energy policies do not adequately address the problem.

The failure to develop independent charcoal policies and link it with the available forests and energy policies lead to improper management of forests which are not found in protected areas, also most of forest which are not managed under JFM and CBFM suffer from deforestation since its utilization is carried out randomly. Therefore for better management of natural forests the formulation of charcoal policies is important, charcoal production must be carried out in a systematic way where by the information concerning

charcoal must be documented to specify the amount of charcoal produced annually which will help in designing different management strategies.

Weak policy and laws on charcoal production made the effort of curbing increased illegal charcoal production an impossible task, there must be charcoal policy which should be connected with forests resources in order to ensure sustainable charcoal production and at the same time ensures effective forest management (Mugo et al, (2006).

Result from the finding showed that charcoal production in the study area was not sustainable since all respondents said that charcoal production carried out in unsustainable ways. Majority of respondents showed that there was no replacement of tree after cut (see table 12), since most of charcoal production activities are done illegally. Observation from the researcher showed that large area of the land remained bare due overcutting of trees without replacement, this pose a great challenge on forest management. Drought and deforestation in the study area was found to be the outcome of unsustainable charcoal production so as soil erosion and land degradation was severe in the study area. As also noted by CHAPOSA, (2002), charcoal producers are not planting trees to replace those cut for charcoal production thus contributing to deforestation at the magnitude of over 400,000 ha per year in miombo woodlands. The reasons behind the failure to replace trees after cut are; (i) lack of forest by-laws (ii) lack of awareness and education (iii) weak supervision of charcoal production activities which results into large scale degradation of the woodland (ibid). Charcoal production is responsible to large scale deforestation that has occurred in Southern Africa over time.

4.7.2.1 Impacts of charcoal production on forest on forest management

The results from findings showed that charcoal production hinder achievement of sustainable forest management (see table 15). Since charcoal production is done in traditional ways it affects management programs in the study area which bring about large scale deforestation of natural forest.

Forest management programs are affected by charcoal production activities through the increase in management cost and corruption. The increases in number charcoal producers require large number of people to be recruited for making frequent patrols in forests. Likewise in areas where large scale deforestation has occurred the rehabilitation cost become higher and the cost of afforestation increase (WRI, 1995).

Increase in corruption affect forest management program to a large extent since charcoal production has become a beneficial industry in rural areas which attracts large number of people to invest in charcoal production as a substitute of agricultural production which prove failure due to semi-arid climatic condition. Restriction on encroachments of some forest areas created a room for charcoal producers to bribes forest officers which in turn affects forest management programs since large number of trees even young ones are being cut illegally (CIFOR, 2005).

Deforestation and violation of forest by laws interfere with forest management programs since most of charcoal production activities are done in unsustainable ways (ibid).

4.7.2.3 Challenges on curbing indiscriminate charcoal production

Lack of diversified source of livelihood poses a big challenge in curbing increased illegal charcoal production (see table 20). Majority of people at Ng’ o hong’ honha live in chronic poverty, since the area is semi-arid which does not support agricultural

activities thus forcing majority of people to depend on charcoal production as their main economic activity which in turn affects forest management to a great extent.

The income from the sale of charcoal was also found to be above the minimum level of income earned from other economic activities thus attracting a large segment of the population to engage in charcoal production. Likewise because majority of the population have only primary education which limit them to be employed in formal sectors making them to depend much on charcoal production as the back bone of their economy, about 59.6% respondents felt that charcoal producers earn more than 700,000 Tsh from selling charcoal into urban. Since income from charcoal is higher compared to the capital invested, forest resources are under threat which in turn affects management activities. According to (CHAPOSA, 2002; Brigham et al, 1996), the income from the sale of charcoal was also found to be above the minimum wage paid to most of the governments' employees. This has a consequence of attracting more people to engage in charcoal making. Migration to charcoal producing areas is common. Therefore given the low education level required, the income may attractive other people to join the business, and thus more deforestation to the woodlands, (Ibid).

In the study area there were no specific laws and regulation to guide sustainable utilization of forest resources. There were absence of Community based forest management and joint forest management since forests resources are owned as open access whereby anybody is free to utilize without any limitation thus has resulted into large scale deforestation.

Low community involvement in forest management activities discourage the participation of local people in curbing the impacts of charcoal production, most of forest management plans use top-bottom approach where by all decision concerning the

management and utilization of available forests are decided from central government and should be implemented by local people. Most of these plans fail because they do not comply with the local needs and priority. Furthermore local community fail to invest much of their effort on curbing impacts of charcoal production on forest management because they lack support from the government, which create fear of conflicts with their fellows who depend much on charcoal production. Low community participation on curbing the impacts of increased illegal charcoal production made forest management in semi-arid areas to be an impossible task (Zahabu, 2001).

4.7.2.3 Intervention on curbing indiscriminate charcoal production

Charcoal production continued to be greater obstacle towards achieving sustainable forest management in the study area because local community and government do not take much effort in curbing the impacts of charcoal production on forest, (see table 17 and 18).

The establishment of CBFM and JFM, formation of village by-laws and provision of alternative source of livelihood, fines and penalties and provision of awareness and environmental education are the possible measures to intervene the impacts of indiscriminate charcoal production on forest management.

The CBFM allows local communities to declare and gazette, village, group or private forest reserves and take full responsibilities of setting and enforcing rules and regulations over forest management and use. In JFM local communities are allowed to enter into agreements with government, these mechanisms can reduce illegal charcoal production to great extent because it give power to local community over the control of forests resources in a means which could benefit the whole community. (Mustalahti

,2007) argued that local governments and people can become effective forest managers if central governments are committed to institutionalize a decentralized natural resources management model and to build up the necessary human and physical resources.

For sustainable management of resources to be realized, the involvement of local institutions must be considered. It is in this stark light that, the prospects for conserving tropical forests must be considered." If we do not soon change public policy regarding tropical forests, the primary forest will probably be gone sometime before (UNEP, 2006).

According to village executive officers, fines and penalties was being used as mechanisms to discourage local communities from felling trees in forests only but the conflict arise with the local people because fine and penalties are imposed in arbitrary manner preventing the communities from negotiating more lasting settlements and encouraging community forestry initiatives. These mechanisms could be effectively in curbing increased illegal charcoal production if they are implemented in a way which local community can real felt its pains (ibid).

According to agricultural officers, diversification people's livelihood in the study area could help much in curbing increased illegal charcoal production since majority of people depend on charcoal as their main economic activities.

CHAPTER FIVE

CONCLUSION, RECOMMENDATIONS AND AREAS FOR FURTHER STUDIES

5.1. Introduction

This chapter describes the conclusion, puts forward recommendations based on the main issues rose from findings and discussions of the study and areas for further study will be delineated at this juncture.

5.2. Summary of the Findings

In general this study investigated the impact of charcoal production on forest management in Dodoma municipality. Noted findings from the current study revealed that charcoal production hinder the achievement of sustainable forest management because it employs large segment of the population at Ng'o hong' hona ward.

Primarily the study examined the community views attributed through knowledge to the impact of charcoal production on forest management in Dodoma municipality. It was expected that the study findings could establish empirical body of literature in this area, as well as assisting government planners in organizing and managing forest resources that could benefit the community in the foreseeable future.

The research examined the policy weakness on legislation of charcoal production from national to village level which result in degradation of natural forests. In Tanzania there are no specific policies which link charcoal production and forest management; there is no clear data on the amount of charcoal produced also in most cases charcoal production

is produced without any clear supervision which hinder forest management because it create the room for corruption to forest managers from charcoal producers.

Population growth and increase demand of charcoal increases stress on forests management. Due to the increase in population the number of forests users also increased at Ng'o hong' honha ward since it characterized by semi-arid climatic condition which does not support agriculture hence force most people to invest in charcoal production as their main source of livelihood. Increase in demand of charcoal in Dodoma urban attracted most of the energetic people in the area to engage in charcoal production because the amount earned is greater compared to other activities.

Charcoal production increases management cost since the number of charcoal producers increase rapidly due to the fact that charcoal production does not require higher level of education since most of people in the study area have only primary education which limits them to be employed in formal sector. Since the number of charcoal producers is higher the rates of deforestation is higher and bring about high rehabilitation cost and increase the cost of employing more people to conduct patrols in forests.

5.3 Conclusion

Charcoal production resulted to an increase in management cost since majority of people at Ng'o hong' honha ward depend much on charcoal as their main source of livelihood which force village to employ large number of people to make frequent patrols in order to curb indiscriminate charcoal production.

Environmental degradation force people to depend much on charcoal production to earn a living shortage of rainfall and loss harvest discourage most of farmers to invest in

agriculture, and hence shift into charcoal production which bring about large scale deforestation that affects forest management negatively.

Population growth and increase in demand of charcoal increases level of stress on forest management. The increase in demand of charcoal in Dodoma urban attracted majority of people at Ng'o hong' honha ward to engage in charcoal production. Population increase resulted to massive extraction of forests which in turn hinder the achievement of effective forest management.

Due to lack of alternative means of livelihood, majority of people in semi-arid areas are forced to invest much of their energy on forest extraction activities. Since the study area is semi-arid area most of the time farmers loose harvest and since there are no water bodies which can be used for irrigation, thus they on forest resources as a major source of income which lead to massive deforestation.

Charcoal production is done in unsustainable way where by, large number of trees are felled down without replacement .In order to maximize their income, charcoal producers cut even young trees which increase vulnerability of wind erosion which pose a negative effects on young trees which fell down as result of strong wind. Since the study area is characterized by semi-arid climatic condition and the soil lack moisture and nutrient to support the rapid growth of trees resulted into slower rate of regeneration of trees after cut. Currently large portion of land in the study area is covered with thorn trees and trees which are not suitable for charcoal such as cactus. Since charcoal producers have a tendency of cutting specific species of trees suitable for charcoal production, this resulted in loss of tree diversity.

Forest policies do not comply with forests by laws and regulations at village level, policies do not embrace local people's interests in terms of their local needs and

aspirations which resulted in to conflicts with local people when forest managers want to implement different forest management plans.

Failure to recognize indigenous systems of forest management and indigenous rights to resources at policy level has led to: loss of incentives by the local communities to protect trees-hence indiscriminate tree felling, discouragement of local people to engage in tree planting and reforestation projects, and excessive reliance by the state on punitive measures to enforce the law in order to achieve sustainable forest management resulted into conflicts with local people which in turn hinder the implementation of forest management strategies.

5.4 Recommendations

- In order to achieve sustainable forest management, fines, penalty and reformulation of policies concerning charcoal production is necessary.
- Establishment of afforestation and reforestation projects together with bee keeping projects will be helpful in managing forests in semi-arid areas.
- Establishment of district forest utilization committee in order to prepare and maintain a register of all charcoal dealers in the district under the custodian of the District Forest Office.
- Provision of environmental management education to the villagers should be mandatory. This will assist in increasing awareness and a sense of responsibility among the local communities.
- Rules and regulations guiding management and utilization of the forest resources should be improved to provide more tangible incentives for local communities to

use their optimal potential in the management and utilization of forest resources to meet their priority needs.

- Transfer of control over natural forest resources from the central to the local level and community-based management systems that can build on science, information and traditional knowledge that used for protecting and managing natural forests.

5.5. Areas for Further Study

The impact of charcoal production on forest management is a wide subject beyond the ability of single study like this to investigate all issues. In these circumstances several areas that need to be addressed for immediate and long term researches includes;

- Clarification of the forest management categories to the extent that has already taken place with the protected area categories.
- How forest management categories can be used to help summarize, identify forest management challenges and plan forest management approaches on a landscape, national or regional level.
- Assessment of the institutional capacity to enforce rules and regulations and address traditional interests of the people and their involvement in the management of natural forests.
- Awareness about conservation and management principles of natural forests in semi- arid areas.
- Development of standards for wood fuel forests management in Tanzania.
- Applied research on efficient wood fuel production, processing (packaging, labeling and branding).

- Development of appropriate local institutions to support the forest certification process.

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APPENDICES

QUESTIONNAIRES FOR HOUSEHOLDS RESPONDENTS

INSTRUCTION TO RESPONDENTS

Read the questions very carefully and write the most appropriate answer

These questionnaires are for academic purpose only; feel free to bring about required information. Your information will be confidential. Please select appropriate answer in your opinion and make a tick mark [✓] in the space provided for questions that have listed the possible answers

You may choose more than one alternative for the questions that need more than one answer.

For some questions, please provide responses in your own words

SECTION A: PERSONAL INFORMATION

1. Age group……..

i) 16 - 25 [ ] ii) 26 – 35 [ ] iii) 36 – 45 [ ] iv) 46 - 55 [ ] v) 56-65 [ ] vi) 65+ [ ]

2. Sex …… i) Male [ ] ii) Female [ ]

3. Marital status… i) Single [ ] ii) Married [ ] iii) Divorced [ ] iv) Widowed [ ]

4. Education level i) No education [ ] iii) Primary education [ ]

iii) Secondary education [ ] iv) Above secondary education [ ]

5. Size of household i) Adult above 18 years [ ] ii) Children below 18 years [ ]

6. Main economic activity

Crop production [ ]

Livestock keeping [ ]

Petty trade [ ]

Charcoal production [ ]

Employee [ ]

7. What are the major sources of your income? ……...

8 a) Are there alternative source of incomes in the household? i) Yes [ ] ii) No [ ]

b) Mention those alternatives……

9. Income per month (Tshs) i) Less than 150,000 [ ] ii) 200,000 -400,000 [ ]

iii) 450,000-600,000 [ ] iv) More than 700,000 [ ]

SECTION B: FORCES BEHIND CHARCOAL PRODUCTION

10. a) Are you involved in charcoal making i) Yes [ ] ii) No [ ]

b) If yes do you make charcoal for domestic use or for sale

c). How many bags of charcoal do you use per month.....?

i) 1-2 [ ] ii) 2-3 [ ] iii) 4-5 [ ] iv) > 7 [ ]

d). How much do you earn from charcoal production.....

11. a). Do you use energy efficiency saving stove i). Yes [ ] ii). No [ ]

b). If no what are reasons.....

12. What is the general trend of utilization of forest for past 10 years ago?

a) Same number of users [ ] b) More users [ ] c) Fewer users [ ]

13. What are the impacts of charcoal production on forest management?

.....

.....

.....

SECTION C: MAGNITUDE OF CHARCOAL PRODUCTION

14. What is the extent of forests destruction caused by charcoal production for the past 10 years? i) High destruction [ ] ii) Low destruction [ ] iii) None [ ]

15. Is the current charcoal production sustainable? a) Yes [ ] b) No [ ]

If no why.....

16. What is the average amount of charcoal produced per month?

i).1.5-3.75tan [ ] ii) 4.5-6.5tan [ ] iii) 5.5-7.5tan [ ] iv). Others specify…….....

17. a). What methods are employed to produce charcoal? i). Earth mound kiln ii). Pit-kiln

iii). Both iv).Others (specify)…….....

b) . Why the method (s) mentioned above

prefered.....

.....

.....

18. What is the trend of availability of trees for charcoal production in the past five years ? i). Increasing ii). Decreasing iii). The same

SECTION D : INTERVENTION TO OVER COME THE IMPACTS OF CHARCOAL PRODUCTION ON FORTEST MANAGEMENT

19. a) Are you involved in curbing charcoal production? i) Yes [ ] ii) No [ ]

b) Is there any success? i). Yes [ ] ii). No [ ]

c). If yes what are the success.....

.....

.....

d). If no why……...

.....

.....

20. a). Are there any measures taken by the government to curb increased charcoal production ? i). Yes [ ] ii) No [ ]

b). If yes what are they and what are theachievement?.....

.....

.....

.....

c). If no why .....

.....

.....

21. a). Are there any intervention undertaken by the local community to curb the impacts of charcoal production on environment? i). Yes [ ] ii). No [ ]

b). If yes what are they.....

.....

.....

.....

22 . a). Do replacement of trees done after cut? i). Yes [ ] ii). No [ ]

b). If yes, how long does it take to make replacement? i). Soon after cut ii). 1-2 years after cut iii). 3years & above iv).Other (specify).....

c). what are the reasons for the answer in part b above

.....

.....

.....

23. a). There is any awareness about the impacts of charcoal production on forest Management provided in this area? i). Yes [ ] ii). No [ ]

b). If yes what are the awareness provided?.....

.....

.....

.....

c).If not aware why?.....

.....

.....

24. On your own opinions, what should be done to curb increased charcoal production on study area ?.....

.....

.....

.....

.....

25. What are the role played by the government on forest management in your area?

i). provision of education [ ] ii). Afforestation and reforestations [ ] iii). Laws[ ] and regulation iv). Establishment of CBFM and PFM[ ]v). Others

(specify).....

.....

.....

26. What are the NGO'S engage in forest management in your

area?.....

.....

.....

SECTION E: CHALLENGE FACING REDUCTION OF CHARCHOALIN G ACTIVITIES

27. Are the decision taken by leaders effective for managing forest resources?

i) Yes [ ] ii) No [ ]

How? Please explain: ……

28. a) Are there any by-laws guiding forest extraction in your community ? i) Yes [ ] ii) No [ ]

b) Do you know them? i) Yes [ ] ii) No [ ]

c) Are the local community participating in by-making?

i) Yes [ ] ii) No [ ]

How? Please explain: ……

29. What are the challenges facing in curbing charcoal production in your area? i). Lack of education [ ] ii). Poverty [ ] iii). Poor government support [ ] iv). Weak laws and policy [ ] v). Low community involvement [ ] vi) Others specify

.....,.....

.....

30. What are the measures undertaken to curb the challenges in above question

.....

.....

31.What are the socio-economic importance of charcoal production in your area?.....

…….

……

……...

THANK YOU FOR YOUR COOPERATION

GUIDE QUESTIONS FOR KEY INFORMANTS

The impact of charcoal production on forest management in Dodoma Municipal

Instruction;

This questionnaire is for academic purpose only; feel free to bring about required information. Your information will be confidential. Please provide responses in your own words.

1. What are the legal fines for people engage in illegal extraction of forest resource?

..…….....

.....

.....

2. Who are the responsible for decision making in the management of forest resources**.**

.....

…….

3. What is your perception on the Ministry of natural resources and tourism on combating illegal charcoal production for sustainable forest management .....

.....

.....

4. **a).** What kind of intervention undertaken by local community to curb the impacts of charcoal production on the environment? .....

.....

.....

b). What kind of success achieved?.....

.....

.....

5. a). What kind of government intervention undertaken to curb the impacts of charcoal production on the environment.....

.....

.....

b). What kind of success achieved.....

.....

.....

c). What are the challenge facing government effort in curbing the increased impacts of charcoal production on the environment?.....

.....

.....

.....

6. What are the challenges facing the effort of curbing charcoal production forest in the study area?

…….....

.....

.....

7. How charcoal production affect the environment at Ng' hong' ohna ward?.....

.....

.....

8. What intervention have undertaken to curb the impacts of charcoal production on the environment?.....

…….

……

9. What do you suggest on the strategies and policies guiding the utilization of forest resource?

……..

……

…….....

THANK YOU FOR YOUR COOPERATION