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Population Dynamics and Natural Resource Management in Tanzania

*N. F. Madulu**

Abstract

A wide variety of measures, have been taken in the name of environmental and/or natural resource protection. However, none of these measures have managed to reverse the rate of environmental degradation in general and resource depletion in particular. Excessive resource exploitation has continued in many developing countries while environmental and air pollution has widened in developed countries. This has led to serious environmental consequences. Such trends have been caused to a large extent by rapid population growth through unsustainable production and consumption patterns to meet the ever-increasing and changing population demands. This type of relationships imply that no assessment of resource potentials and prospects for their effective use is complete without understanding the population trends and their socioeconomic characteristics. This paper attempts to examine the existing linkages between these three variables in Tanzania. In the process of discussing the relationships, the paper links demographic factors to peasant agrarian economy which largely lead to environmental degradation. It demonstrates that the dominance of high population growth and the persistence of peasant agrarian systems contribute significantly to rapid resource depletion, hence, to serious environmental consequences. A conclusion is made that population; development and environment are variables linked in a mutually reinforcing partnership. Such linkages necessitate the use of a multi-dimensional approach in all developmental and environmental conservation policies and strategies.

Introduction

The relationship between population, environment and development has drawn attention of many scholars in recent decades. In most cases population has been viewed as a major cause of environmental change and a hindrance to the overall socioeconomic development especially in developing countries (World Bank, 1989). The World Population Conference held in Bucharest in

* Associate Professor, Institute of Resource Assessment, University Of Dar Es Salaam

1974 recognized the existence of a strong link between population and development and adopted specific resolutions for integrating demographic and development programs (UN., 1975). The 1984 International Conference on Population held in Mexico reaffirmed this stand by recommending that national and international development plans, programs and strategies be formulated on the basis of an integrated approach that takes into account the interrelations between population, resources, environment and development (ECA, 1988). Since then, a great deal of research and various environmental and developmental projects, programs and policies have been started in many countries aiming at improving the socioeconomic and living conditions of the people (UN, 1988). Research and interest in the links between population dynamics and environmental change was given renewed impetus by the United Nations Conference on Environment in 1992. The conference summary statement "Agenda 21" recommended the development and dissemination of knowledge on links between population and sustainable development including environmental impacts (UN., 1993a).

Although such environmental or developmental programs and projects are often designed to stimulate changes in the environment and economic conditions, most of them have had impacts beyond the environment and development spheres to affect the lifestyle of the people and their demographic behavior as well. Such tendencies have led to an increasing concern on the link between environmental factors and population which has been stimulated by rapid environmental change and population growth especially in developing countries.

Human beings adapt differently to the environment from one socio-economic and cultural situation to another. Any environmental change may influence changes in people's behavior including their consumption patterns. Although this might be the case, emphasis has been placed on the impact of population on the environment and development (Tanzania, 1977; World Bank, 1989; Green, 1992). Analysis of the impacts of environmental changes and development projects on demographic factors has drawn much less attention. Consequently, information about this subject is very limited.

This paper attempts to bridge this information gap by examining the linkages between environmental change and population and vice versa. Various case studies will be used to demonstrate these linkages.

Background information

Different schools of thought exist to explain the association between population, environmental change and development. Boserup (1965) argued that population growth and the resulting increases in population density

'induces' technological changes which allow food production to keep pace with population growth. In other words, population pressure causes changes in the mode of production and, hence, may result into improvements in the technology used (Boserup, 1965). Ehrlich and Ehrlich (1990) argued that population growth is one of the major causes of environmental stress. This school calls for an immediate reduction of population growth because population size will rapidly reach a level above the earth's long-term capacity to sustain it. Another point of view considers population pressure as a force for technological improvement. This view advocates a linear relationships between population and environment (Marquette, 1997). Yet another view maintains that the population-environment relationship is linked by many social, economic, technological and political factors which play vital intervening roles (Clarke, 1993). Using the intervening factor argument, Clarke demonstrated that the relationship between population and environment is multiplicative in that each factor magnifies the effect of the others.

The high rates of the population growth in sub-Saharan Africa have had significant environmental implications. In many areas, the environment has been degraded to the extent that it can no longer support ecological balance and the provision of necessary resources to present and future populations (UNFPA, 1991; Green, 1992). Population increase causes increased demand for food, water and arable land. Agricultural expansion encourages deforestation, which in turn contributes to climatic change. Population growth also increases demand for energy, especially fuel wood and charcoal, which provides energy to virtually all rural areas and most urban populations in sub-Saharan Africa. The increase in fuel wood consumption results in excessive deforestation especially around large urban settlements. This creates an imbalance between environmental resources and population leading to environmental consequences such as soil erosion, deforestation, floods, environmental refugees, increasing poverty levels, and sometimes deaths (Tanzania, 1977). Sadik (1988) discussed the impact of population growth on the environment by arguing that:

> In rural areas of developing countries, increasing numbers and concentration of poor, mostly land-less people are being forced to destroy their own resource base. In their search for food, water, fuel, and fodder, they use up wood faster than it is being grown, farm marginal land at non-sustainable levels, deplete water supplies and overgraze range-lands with increasing numbers of animals (Sadik, 1988:2).

This argument suggests that rapid population growth stimulate environmental damage, endangers the means of human survival, and worsens the plight of people living in absolute poverty (Green, 1992). In other words, rapidly growing populations place a greater burden on environmental resources.

The linkage between population, environment and natural resources exploitation can be demonstrated by the associations between consumption, technology and population. In order to gain some sense of the contribution of population growth to resource depletion and various forms of pollution, Paul Ehlrich developed the **IPAT** Model[1], which demonstrate that environmental Impact is a joint function of Population, Affluence, Technology.

I = PAT where: **I** = **I**mpacts on the environment
P = **P**opulation (size, growth rate, distribution)
A = **A**ffluence (consumption pattern)
T = **T**echnology (production per unit of GNP)

This model sees population size as integrating in a multiplicative way with other factors to create impacts on the environment (Marquette, 1997). The three factors compound each other's impacts to the extent that whatever the size of A and T, the role of P is bound to be significant. According to UNFPA (1991), it is argued that:

> For any given type of technology, for any given level of consumption, for any level of poverty or inequality, the more people there are, the greater is their overall impact on the environment (UNFPA, 1991:22).

Variations of this equation yields insights into the profound impacts that population growth and distribution can have on the quality and quantity of critical natural resources. The people's lifestyle, incomes and social organizations usually determine consumption patterns. Similarly, the technologies in use determine the extent to which human activities damage or sustain the environment and the amount of waste associated with any level of consumption (UNFPA, 1991; UN., 1993b). Population determines how many persons are there to use the resources. This model demonstrate that economic development cannot continue if key resources are depleted, hence, it calls for a multi-dimensional approach to resource conservation.

Boserup (1965) suggested that high population pressure may lead to technological change. However, land fragmentation has been practised in many high density areas in sub-Saharan Africa and some people are forced to open up farms in marginal areas to earn a living. Existing acute poverty, ignorance and lack of economic progress may have stimulated such responses. Such

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[1] The IPAT Model explains the linkages between population, environment and development. The general relation among these factors are represented in the equation **I=PAT** where **I** is **I**mpact on the environment; **P** is the **P**opulation (size, distribution and growth rate); **A** is the **A**ffluence reflected by the per capita consumption and production patterns; and **T** is the **T**echnology used in the production processes (UN., 1993b:22-24).

responses explain why increasing population and the resulting resource demands lead to environmental change in many developing countries.

Environmental change influence changes in the mode of life and production patterns that may also need different social organizations and resource use. Various studies have demonstrated that changes in the environment and natural resource base stimulate changes in the lifestyle of the people (Henin, 1968; Hill, 1985; Rutenberg and Diamond, 1993). Handwerker (1983) argued that changes in the flow of income and the ways of acquiring subsistence may lead to changes in the environment which also modifies the economic factors and how the population adapts to changing economic conditions. Given these circumstances, human adaptation to environmental change differs from one area to another.

In most developing countries, high population growth has been blamed for poor economic development and environmental deterioration (U.N, 1975; World Bank, 1989; UNFPA, 1991). However, little has been said about the impact of poor economic development on population growth and environmental destruction. Emphasis has been put on reduction of population growth while neglecting the fate of the people who are actually responsible for generating the high growth rates.

Rapidly increasing population makes it more difficult to tackle either the causes or the effects of resource abuse. Although such blames seem to be sound, there is need to examine the causal relationships between these variable. Harrison (1990) argues that:

> Those who blame population for environmental degradation may neglect important changes in technology, lifestyle, and social justice. Those who blame other factors will ignore population problems. Only if we attack all factors are we likely to make real progress (Harrison, 1990:14).

The foregoing discussion demonstrate that an increase in the number of people causes increased demand for food, water, land and other essential materials from the natural resource pool. It also threatens the natural environment and it's various resources (Harrison, 1990; UNFPA, 1991). These factors affect the sustainability of both the environment and development strategies.

The Population of Tanzania

The population of Tanzania has been growing at a rapid rate especially since 1967. A closer examination of census data indicate that the population increased more than threefold between 1948 and 1988 (Tanzania, 1968, 1989). About 16 million people have been added to the population over the past forty years. Between 1967 and 1988, the population almost doubled (Tanzania, 1983,

1989). Table 1 shows the population size, growth rates and the estimated doubling periods of the population between 1948 and 1988.

Table 1: Population Size and Growth Rates for Tanzania (1948-1988)

Years	Population	Growth Rates (%)	Doubling Time (years)
1948	7,410,269	-	-
1957	8,665,336	1.8	39
1967	12,313,469	3.0	23
1978	17,512,610	3.2	22
1988	23,174,336	2.8	25

Source: Tanzania (1968, 1989:21)

During the 1948/57 period the Tanzania's population increased by 17 per cent. The population increase rose to 42 per cent in 1957/67 and 1967/78, and dropped to 32 per cent in 1978/88 (Madulu, 1996). Basing on the 1978/88 growth rate of 2.8 per cent, the population is projected to reach 32.5 million people in the year 2000 and 43.0 millions in 2010 (Tanzania, 1991). Table 2 shows the regional population distribution and growth rates as observed from the 1967, 1978 and 1988 censuses.

Table 2: Population Size and Growth Rates in Tanzania by Regions (1967-88)

Regions	Population			Growth Rates (%)	
	1967	1978	1988	1967/78	1978/88
Dar es Salaam	356,286	843,090	1,360,850	7.8	4.8
Rukwa	276,091	451,897	694,974	4.5	4.3
Tabora	502,938	817,907	1,036,293	4.4	2.4
Kagera	658,712	1,009,767	1,326,183	3.9	2.7
Arusha	610,474	926,223	1,351,675	3.8	3.8
Shinyanga	899,468	1,323,535	1,772,549	3.5	2.9
Mbeya	753,765	1,079,864	1,476,199	3.3	3.1
Ruvuma	395,447	561,575	783,327	3.2	3.4
Dodoma	709,380	972,005	1,237,819	2.9	2.4
Kilimanjaro	652,722	902,437	1,108,699	2.9	2.1
Morogoro	682,700	939,264	1,222,737	2.9	2.6
Kigoma	473,443	648,941	854,817	2.9	2.8
Mwanza	1,055,883	1,443,379	1,878,271	2.8	2.6
Tanga	771,060	1,037,767	1,283,636	2.7	2.1
Iringa	689,905	925,044	1,208,914	2.7	2.7
Singida	457,938	613,949	791,814	2.7	2.5
Mara	544,125	723,827	970,942	2.6	2.9
Lindi	419,853	527,624	646,550	2.1	2.0
Mtwara	621,293	771,818	889,494	2.0	1.4
Coast	428,041	516,586	638,015	1.7	2.1
Mainland	11,958,654	17,036,499	22,533,58	3.2	2.8
Zanzibar	354,815	476,111	640,578	2.7	3.0
TANZANIA	12,313,469	17,512,610	23,174,336	3.2	2.8

Source: Tanzania (1983:93; 1989:21).

The data reveal great variations in terms of population size and growth rates between regions. The number of regions with over a million people rose from one in 1967 to five in 1978 and twelve in 1988. These regions contained 9 per cent of the population in 1967, 34 per cent in 1978, and 70 per cent in 1988. The 1978/88 regional growth rates ranged between 1.4 per cent in Mtwara Region and 8 per cent in Dar es Salaam Region. However, the national population growth rate declined from 3.2 per cent in 1967/78 to 2.8 per cent in 1978/88. The growth differentials are also observed within regions where certain districts have higher growth rates than others (Tanzania, 1994a). Such growth differences reflects variations in culture, natural increase, migration, and resources distribution and exploitation (Tanzania, 1983).

The national population density increased from around 9 persons per square kilometre in 1967 to 20 and 26 persons per square kilometre in 1978 and 1988, respectively. These figures give a false interpretation that Tanzania is under-populated. However, density masks many significant internal disparities and tends to treat all land equally by assuming that people are evenly distributed over a given area. In reality, people are very selective with regards to location of settlements, cropping, and livestock grazing area. This implies that the population is not evenly distributed.

Higher concentrations of people are observed in regions like Mwanza, Shinyanga, Mbeya, Kilimanjaro and Dar es Salaam. In 1978, about 64 per cent of the population occupied 36 per cent of the land area (Tanzania, 1983). In 1988, about 50 per cent of the total population occupied only 35 per cent of the total land area. In almost all regions, population density increased suggesting significant increases in the regional populations. Even at regional levels, population density differ between districts, wards and villages (Tanzania, 1994). The impact of increasing density is reflected in the declining per capita land from 12 hectares in 1948 to 4 hectares in 1988 (Tanzania, 1989). These observations may suggest that the higher the concentration of people in an area, the higher the possibility of resource depletion.

Environmental concerns in the National Population Policy

The Tanzania's National Population Policy (NPP) was adopted in 1992. The principal objective of the policy is to reinforce national development through developing available resources in order to improve the quality of life of the people (Tanzania, 1992; 1998). Among other policy goals, the issue of promoting sustainable relationship between population, resources and the environment has been given high priority. The NPP target at bringing sustainable economic growth with equity that is in harmony with the environment. Although the NPP has not been fully implemented, efforts are

underway to develop implementation mechanisms and strategies for coordinating the integration of population activities into the development planning process. The adoption of a population policy that recognizes the linkages between population, environment and development, is a positive step towards attaining sustainable development in Tanzania.

The Tanzania's major environmental concerns have been classified into six categories, namely, land degradation, deforestation, lack of accessible water supply and poor water quality, environmental pollution, deterioration of aquatic systems and loss of wildlife habitat and bio-diversity (Tanzania, 1994b). These concerns are linked in one way or another, to overuse or misuse of the natural resources base (land, water and air).

Land degradation

Land degradation is manifested in the form of severe soil loss, silting, and decreasing land productivity. Farming is by far the most important human activity that causes land degradation. The area cultivated by smallholder farmers has increased from 4 million hectares in 1974 to about 9 million hectares in 1988 (Tanzania, 1994). The problem of degradation of agricultural land is compounded by the unequal distribution of land and shrinking land holdings, the latter being a direct result of population growth. Other major causes include natural constraints of soils and environment, rapid population growth, deforestation, fuel wood cutting and overstocking (Tanzania, 1994). Due to rampant deforestation, the problem of land degradation has increased in many areas. Consequently, there has been a rapid decline in crop yields while the population continued to expand. Over-cropping of the land and the continuing fragmentation of farms is a direct result of rapid population growth. All these conditions partly lead to a problem of food insecurity.

Deforestation

Deforestation is defined as the permanent conversion of forest land to other uses such as pasture, shifting cultivation, mechanized agriculture, or infrastructure development (World Bank, 1989). Three major processes responsible for deforestation in Tanzania are (i) the clearing of land for agricultural purposes, (ii) the harvesting of fuel wood and energy, and (iii) commercial logging. Although the estimated sustainable supply of fuel wood in Tanzania is 19 million cubic meters per year, the total consumption has been estimated at 43 million cubic meters per annum. This level of consumption is almost 126 per cent higher than the estimated sustainable supply (UN., 1993a). The demand for fuel wood, charcoal and agricultural processing has been increasing over years causing further environmental problems.

Rapid population growth, ignorance and poverty are among the major causes of deforestation in Tanzania (UN 1993a). Rapid population growth exerts increasing pressure on forestlands for agricultural expansion, fuel wood, timber and pasture for the livestock. Slash-and-burn cultivators sets in motion a series of events leading to environmental collapse. The destruction of forests has several adverse consequences such as increase in soil erosion, scarcity of fuel wood, faster rates of evaporation and climatic change. These consequences vary in intensity from place to place depending on the approaches used to exploit resources from the natural environment.

Lack of accessible water supply and poor water quality

Fresh water resources are being used up at such rapid rates that ground water supplies are dwindling and surface water are fouled with pollutants from industries, municipalities and agriculture. There is a direct link between the amount of water available in the hydrological cycle and population growth. Since water resources are finite, there is only so much water circulating around the globe. More people means less water per capita. The impact of human activities on the quantity and quality of water resources also directly affect the availability of water. Chronic water shortages and impaired water quality hamper economic development and impair public health. Lack of accessible water supply and poor water quality is also a major environmental problem affecting a large proportion of the Tanzania's rural and urban population. By 1991, only 42 per cent of the rural population and 50 per cent of the urban population were served with water (Tanzania, 1994). The lack and poor quality of water associated associated to many incidences of water-borne diseases such as typhoid, diarrhea, and cholera, which have remained a major problem in many regions of Tanzania.

Environmental Pollution

Environmental pollution which includes urban pollution, industrial pollution, agro-chemicals, mining pollution and coastal and beach pollution is rapidly increasing in Tanzania. The major causes of the increase include poor sanitation, inadequate solid waste disposal, affluent discharge, rapid and unplanned urbanization, mining, and increasing use of chemical fertilizers and insecticides. Air and water pollution are largely caused by the production or consumption of industrial products. Like other common property resources, air and water have been too heavily exploited because users have inadequate incentive to maintain their quality. Although the rate of air pollution in Tanzania is still low, efforts to control it need to be started. Due to poor sanitation and sewerage disposal systems, water pollution is well advanced. Surface run-offs collects all types of excreta and these are moved into the rivers, dams and sometimes into wells. The ocean has been considered to be the

best dumping place for all urban sewage. These water bodies are the primary sources of fish and water for domestic and other uses.

Loss of wildlife habitats

Tanzania has committed about 25 per cent of her land to protected area (wildlife and forestry). However, the existence of these natural resources is threatened by human disturbances of the ecosystem. This situation is caused by over-exploitation of resources from the natural habitats (Tanzania, 1994). For example, local pressure has been increasing in some protected areas to extend agriculture at the expense of forests and wildlife. Meertens, et.al (1995), reports the presence of settlements in the Maswa Game Reserve in Maswa District. Moreover, poaching has been increasing at the expense of the endangered species. All these human pressures have a negative influence on biodiversity.

Coastal zones management

Another related environmental problem is the deterioration of aquatic systems. Aquatic resources include the marine and fresh water ecosystems, mangrove forests, coral reefs, seaweed and grasses, wetland, lake and rivers. Although these resources provide livelihood to a significant number of people, they are increasingly being polluted, depleted and misused through environmentally destructive fishing methods, introduction of exotic flora and fauna, and large amounts of affluent discharge (Tanzania, 1994). Mangrove forests and coral reefs ecosystems have been degraded over the past three decades. Population pressure on coastal resources is intense and is growing worse.

Population pressure and environmental problems in Tanzania

The linkage between population growth and the environment is reflected in many ways. Harrison (1990) argued that many of the environmental problems such as deforestation, soil erosion, loss of species and loss of land, result from taking something away from the environment. An increase in the number of people rises the demand for food, water and arable land. Agricultural expansion encourages deforestation that contributes to climatic change in turn. Shishira et. al. (1998) observed the impact of population pressure on land cover in the Pugu and Kazimzumbwi forest reserve between 1952 and 1989. They argued that:

> ...cultivation and harvesting of forest products are the main factors influencing spatial and temporal changes in the land cover. Similarly, increasing population pressure around the forest reserve is likely to lead to encroachment into the forest reserve proper, hence, threatening its sustainability (Shishira et.al., 1998).

In many areas, the steady increase in population has been accompanied by declining food production. Population pressure reduces the per capita arable land while increasing the acreage under cultivation to meet the increased demands for agricultural products. These effects contribute (both directly and indirectly) to environmental problems such as soil erosion, desertification, famine, regular floods and recurrent droughts. Agricultural activities have been started even in areas that were reserved for grazing in the past. Experiences from the Kihansi River Catchment area show that catchment forests have significantly been reduced to pave the way for agricultural activities, and farming is extended to the steep hill slopes and river banks (Madulu, 1998). Such expansions have serious consequences on the environment in general and on natural resources in particular. In other areas, the consequence has been over-grazing and land use conflicts.

According to Darkoh (1982), most areas that receive a mean annual rainfall of 200-800 millimetres in Tanzania are susceptible to desertification. Although these areas suffer from recurrent droughts, water shortages and periodic famines; they are also characterized by rapid deforestation, rapid population growth and concentration of large livestock herds. The observed environmental problems in regions like Dodoma, Arusha and Shinyanga, for example, are to a larger extent a product of human activities and unplanned resource exploitation. Barke and Sowden (1992) argued that as the population continue to increase, the arid and semi-arid marginal areas of Tanzania become the last great frontiers into which people can expand. However, these arid areas are delicate and needs careful and well-planned resource exploitation approaches.

The increase in population has, in many cases, occurred at the expense of resource conservation and their effective utilization. This has resulted into rapid degradation of the environment as demonstrated by the increasing evidences of deforestation, pollution and soil erosion (Tanzania, 1994; Madulu, 1996; Mbegu, 1996). The physical link between population growth and natural resource utilization demonstrates that man has been placed at the heart of resource depletion and the resultant environmental degradation.

In many cases, human actions have lead to environmental degradation through non-sustainable production and consumption patters. Often, resource users have been forced to adopt strategies that have short-term gains at the expense of resource conservation and environmental protection. Management strategies adopted have underrated the importance of population by assuming that available resources can be exploited indefinitely. This assumption is limited in that the demand for resource exploitation is dependent on the size and characteristics of the population. Demographic trends in Tanzania correlate significantly to the existing resource depletion in many areas suggesting remarkable population/resource imbalances (Madulu, 1996; Shishira et. al.,

1998). Some studies, however, point to the significance of social factor considerations such as gender relations in resource productivity assessment (Rugumamu, 1997 and 1999).

Population and natural resource utilization

The populations of Tanzania have been growing at the expense of resource conservation and their effective utilization. While the population increased more than threefold between 1948 and 1988 (Tanzania, 1968, 1989), the natural resource base has been dwindling over-time. Consequently, rapid degradation of the environment has occurred in many areas. Evidence from central Tanzania demonstrate that the more fragile the environment is, the more delicate is the balance between population and ecological resources (Madulu, 1996).

Rapid population growth affects the resource base in many ways. Firstly, increased number of people cause increased demand for food, water, arable land and other essential materials from the natural resource pool. Secondly, expanded agricultural activities encourage deforestation. Many forests have already been destroyed to give way to agricultural expansion. Thirdly, population increase leads to expanded fuel wood consumption, which is the only source of energy especially in the rural areas.

Fuel wood and charcoal

The fuel wood consumption varies between one and two cubic meters per person or five to seven cubic meters per household per year (UN., 1993b). The consumption of fuel wood in Tanzania increased from 23,565 cubic meters in 1980 to 32,405 cubic meters in 1991, and that of charcoal increased from 1,110 cubic meters in 1981 to 1,670 cubic meters in 1991. The combined consumption of fuel wood and charcoal increased by over 50 per cent between 1980 and 1991 (FAO, 1993). FAO (op.cit.) estimated a 166 per cent increase in fuel wood and charcoal consumption in Tanzania between 1980 (12.6 million cubic meters) and 1991 (33.5 million cubic meters). This high demand of fuel wood has led to indiscriminate cutting of trees around the large towns, and to scarcity of fuel wood and building materials in many rural areas.

Remarkable increase in the amount of charcoal extracted from the Pugu and Kazimzumbwi forest reserves have been recorded. This increase is a function of population growth in Dar es Salaam and nearby villages (Shishira et. al., 1998). The increases in fuel wood needs often result into excessive deforestation especially around large towns (Shishira et. al., 1998; Shechambo, 1986). This effect is aggravated further by periodic fire burning in the forests and grasslands (Madulu, 1996, 1998). Bush fire destroys the undergrowth vegetation and organic matter making topsoil easily erodible.

The impact of this unsustainable fuel wood consumption is reflected by the rate of size of various forest reserves in some regions (Shishira *et. al.*, 1998). Clear evidences of diminishing forests can also be seen in the Usambara Mountains, Mount Kilimanjaro, the Southern highlands, the Kondoa Irangi highlands, and in the Mangrove Forests along the coastline. Evidence can also be seen in Dar es Salaam and other towns where a big number of lorries carrying logs, firewood, building poles, and charcoal are seen every day. The flow has been increasing year after year due to expanding demand in response to population increase. Users have been forced to adopt a strategy of short-term gains at the expense of the local environment in order to survive.

The above discussion suggest that no assessment of resource potentials and prospects for effective utilization is complete without understanding the population which is the end user of those resources. Management strategies adopted in various countries underrate the importance of population by assuming that resources are readily available and can be exploited indefinitely. This attitude is limited in that the demand and supply of resource exploitation need to be linked together. The higher the population increases the higher the rate of resource exploitation.

The agrarian peasant economy and access to land

Tanzania's economy is basically agriculture-oriented. Agriculture provides the livelihood to over 80 per cent of the rural population (Tanzania, 1994b). The share of agriculture in the GDP was estimated at 59 per cent in 1991 and about 50 per cent in 1994 (World Bank, 1989). The majority of the rural population is smallholder producers (peasants) who practice extensive farming and small-scale livestock keeping. These people need sufficient arable land to cultivate their food and obtain cash; enough pasture to graze their livestock, enough woodland to supply them with fuel wood; and enough water within reasonable distances. Thus, availability of arable land and its quality explains the internal disparities with regard to population distribution and density.

The area cultivated by smallholder has increased from four million hectares in 1974 to over 8 million hectares in 1988. Subsistence farming accounts for about 50 per cent of the agricultural output. This farming system is often linked to environmental degradation. Many small-scale producers depend largely on local experiences accumulated over many generations. Dependence on peasant agriculture also contribute to the impact of population pressure on the land. Generally, activities to prevent soil erosion at village level have less priority than food production to meet the food demands of the growing population. Peasants are compelled to over-exploit their natural resources on which their long-term development depends. Myers (1989) argued that:

> There is hardly any agent more destructive of natural resources -notably soil cover, grasslands, and forests - than the subsistence cultivator who cannot produce enough to eat by cultivating traditional farmlands. ... this marginal person is inclined to seek his livelihood in marginal lands. ... But the result is the same: widespread deforestation, soil erosion, and spread of deserts (Myers 1989: 47).

Due to population growth, the arid and semi-arid marginal areas have become the last great frontiers into which people can expand (Darkoh, 1982). The conditions in these areas are delicate and need careful and well-planned resource exploitation. In addition to high population growth, these areas suffer from unreliable rainfall, repeated water shortages, periodic famines, rapid deforestation, increased cultivation and concentration of large herds of livestock (Mbegu and Mlenge, 1984).

Recent interventions to environmental problems in Tanzania

Land degradation is a major problem in many areas of Tanzania. This problem is largely a function of various human activities such as overgrazing, over-cultivation, deforestation and high population pressure on the land (Mbegu and Mlenge, 1984). Darkoh (1982) observes that the area that seemed untouched by accelerated erosion in 1890s, became devastated over the next thirty years as increasing population (both human and animal), and ill-suited cropping and animal husbandry practices served steadily to impoverish the land. For example, about 72 per cent of the land area in Kondoa District (910 km^2) has been classified as having *"heavy to severe gully erosion"* and 28 per cent (346 km^2) have *"light to moderate erosion"* (Mbegu and Mlenge, 1984). Evidence from the Provincial Commissioner's reports suggest that signs of land degradation were documented as early as in the 1920s (Tanganyika, 1931,). The large scale forest clearing carried out since 1927 in the name of *"Tsetse Flies Eradication Campaigns"* was intended to open up new land in order to accommodate the excess population and reduce the pace of land degradation in the highlands. These measures marked the onset of population resettlement and extensive deforestation (Darkoh, 1982).

Land conservation efforts in Tanzania started since the colonial times when the British colonial government established the Soil Conservation Advisory Committee in 1930 and later adopted the policy of improving land use methods (Tanganyika, 1936). These methods include:

> ... reduction of stock numbers, ridge cultivation, contour banking of uncultivated land, gully control, rotational grazing, as well as depopulation. By 1953 some 2,176 km of contour banks had been constructed on uncultivated land in the then Central Province, which embraced the present Dodoma and Singida Regions. Prison labour was sometimes used in the construction of conservation structures. There were occasions when people were forced to contribute labour. In Kondoa

> District where the menace of gully erosion was greatest, farmers were obliges to plant sisal *(Agave Sisalama)* around their farms (Mbegu, 1996:147)."

Due to growing awareness on environmental problems, a number of national, regional and district level programs have been established. These programs include the formulation of the National Environmental Management Council (NEMC), the Land Management Program for Environment Conservation (LAMP) in Babati District, and the Kigoma and Rukwa Integrated Development Program. Other programs are the Hifadhi Ardhi Shinyanga (HASHI) project, the Hifadhi Ardhi Dodoma (HADO) project, the Hifadhi Mazingira project (HIMA) of Iringa, the Soil Erosion Control and Agro-forestry Program (SECAP) in Lushoto District, and the Soil Conservation and Agro-forestry Program (SCAPA) in Arumeru District (Tanzania, 1994b). These efforts indicate the government's commitment to environmental protection.

However, none of these programs has given priority to the population factor. Similarly, none of these programs and projects has examined the impact of environmental change and/or the impact of the project's activities on population aspect. Fighting environmental degradation alone without considering the population and development aspects (including technological change) may not lead to success. These drawbacks suggest that many of the environmental conservation programs might be short-lived because they neglected the population factor which is an important component of environmental change. Already in some parts of Tanzania, the ecological damage has reached an advanced stage.

Experiences from Dodoma Region

In Dodoma Region, for example, the **Hifadhi Ardhi Dodoma** project (HADO) was started in 1973. as a deliberate attempt to fight land degradation in the region. This was in response to failures of previous conservation measures (Mbegu and Mlenge, 1984). Anti-erosion measures during the 1940s and 1950s proved to be unpopular mainly because they were discriminatory in nature and coercive in approach (Mbegu, 1996; Mbegu and Mlenge, 1984). Many of these measures were ignored or abandoned after independence (Mbegu, 1996). The main objectives of the HADO project were: (i) to conserve the land and water and rehabilitate the already depleted areas; and (ii) promote and encourage people to plant trees for fruits, fuel wood and other wood requirements (Mbegu 1996). These objectives were elaborated further during Phase Two of the project (1986/87 - 1995/96) by putting emphasize on conservation activities both on cultivated and uncultivated land; community involvement; and in integration of relevant disciplines and institutions in solving conservation problems (Tanzania, 1986). In 1979, the HADO project implemented a destocking policy in order to encourage natural regeneration of vegetation.

Some 46,375 cattle, 28,840 goats and 10,666 sheep were removed from the Kondoa-Irangi highlands. This strategy met with a lot of opposition from both politicians and villagers as demonstrated by Mbegu (1996).

> A well-educated local gentleman holding a high post in government shouting abusively at the suggestion to close to grazing certain areas which are obviously overgrazed, certainly represent the view of some people who were opposed to the destocking process. This resentment over destocking was later manifested through different actions, some of which include the threatening of lives of the HADO project workers. The resistance to destocking was supported by arguments that the move was depriving people of milk, manure and meat. .... Sometimes the resentments have been manifested in the form of encroachment into restricted areas to graze livestock, due to grass shortage in the surrounding areas particularly during the dry periods (Mbegu, 1996:153).

Generally, the activities of the HADO project has for the past 20 years lacked both people's and political support. Mbegu (1996) describe this lack of cooperation as follows:

> A high ranking politician tries to attract votes at election time promising to return livestock to the destocked area. As if this is not enough, ... a donor organization enters into an agreement with a ministry and regional officials to re-introduce livestock in the destocked areas at an arbitrary rate of ten cattle to each family, probably unaware that in so doing they would pour more than twice the number of animals originally evicted. ... Village leaders remain silent about their people's actions, which contravene the spirit of conservation and rehabilitation of the KEA. ... Bush fires are now a menace to the natural vegetation that has regenerated in the closed areas. ... In dealing with defaulters, ... some of the law enforcement agents are either reluctant or just defiant to properly prosecute the defaulters (Mbegu, 1996:153)".

Lessons from past experiences in natural resource management

These institutional and political problems mentioned above are not only the most pressing, but also the most difficult to solve. In many cases, such problems characterize most of the environmental conservation projects that have been established without or with minimal community participation. Using experiences from Kenya, Darkoh (1992) suggested that conservation activities that do not place the welfare of the people at the centre of attention are doomed to failure. However, there are many lessons that can be learnt form the past experiences in natural resource management. These include:

- Although it is possible to control environmental degradation and natural resource mismanagement, there is need for firm commitment and sacrifice from all stake holders.
- Conservation of severely degraded areas do not necessarily require complicated and expensive techniques. The HADO project in Kondoa.

District has demonstrated that even large and deep gullies can be stabilized through simple means like planting of elephant grasses or sugar cane, and the degraded vegetation can quickly regenerate the main perturbation is removed (Mbegu, 1996).

- There is need for community participation in any natural resource conservation programs. This strategy creates a friendly working environment and develops a sense of responsibility among the local population.
- Environmental management is a multi-dimensional problem which require an integrated and a multi-disciplinary approach.
- Population growth plays an important role in accelerating environmental degradation. Experiences of farm expansion, deforestation and seasonal migration reflect the effectiveness of population in natural resource conservation and environmental management.

Tanzania has effected various policies that have had direct impact to population distribution and resource utilization. The villagization exercise in the early 1970s, for example, relocated a large proportion of the rural population from scattered homesteads into *"ujamaa villages"*. The environmental consequences of this exercise include deforestation, overgrazing, concentration of population in specific areas, scarcity of water and fuel wood, increasing distance to farms, and ever-growing land use conflicts (Madulu, 1996). Population relocation has been used elsewhere as a measure to reduce population pressure. For example, people from Kilimanjaro Region were encouraged to migrate to other regions like Morogoro in order to reduce the amount of land-less people and increase agricultural production. However, efforts need to be made in advance to plan resource utilization in the areas of destination. Lack of proper planning may lead to serious environmental consequences in those areas.

Conclusion

This paper discussed the partnerships between population natural resource management in the Tanzanian context. The discussion was based on a general framework that impacts on the environment are a function of population, affluence and technology. In an attempt to trace the causes of environmental degradation, various factors such as large scale deforestation, overgrazing, rapid population growth, improper agricultural practices and agricultural expansion were identified to contribute to resource depletion, hence, environmental degradation. The paper argued that the linkages between population, environment and resource management can be clearly understood through application of a multi-dimensional and multi-disciplinary approaches.

Although Tanzania has effected various policies and strategies related to environmental protection, no direct intervention has been made to reduce the pace of population growth. An increase in environmental degradation has stimulated population movements from one area to another. These movements necessitates opening of new farms far away from homesteads. As a result, rapid population growth has continued to put pressure on the natural resources in order to meet the demands of the population. This means that measures taken in the name of natural resource management sometimes help to transfer environmental problems to less affected areas. This type of causal relationship puts population at the centre of the environment and development linkages. This is because environmental factors and population development influence each other.

Although deliberate measures have been taken to fight environmental degradation, no similar efforts have been made to associate the environmental conservation activities and the demographic factors. This study has attempted to tackle this gap and the observations suggest a significant association between environmental change and population growth. This linkage is an important input to policies or programs which attempt to tackle natural resource management problems. At all levels, policies and projects should be designed with the environment in mind, and the population aspect should be given priority. It is through such an approach that sustainable natural resource conservation and sustainable development can be achieved

References

Baerke, M. AND C. Sowden 1992 Population change in Tanzania 1978-88: A preliminary analysis", *Scottish Geographical Magazine*, Vol. 108, No. 1, pp. 9-16

Boserup, E. 1965 *The Conditions of Agricultural Change*, Aldine, Chicago.

Clarke, J.I., 1993 Education, population, environment and sustainable development", *International Review of Education,* Vol. 39, No. 1-2 pp. 53-61.

Darkoh, M.B.K. 1982 Desertification in Tanzania", *Geography*, Vol.67, pp. 320-331.

Darkoh, M.B.K. 1992 Planning arid lands development in Africa: Some reflections from the ringside", in A. H. Ornas (ed.), *Security in African Drylands: Research, Development and Policy, Department of Human and Physical Geography*, Uppsala University, Uppsala.

Darkoh, M.B.K. 1992 Planning arid lands development in Africa: Some reflections from the ringside", in A. H. Ornas (ed.), *Security in African Drylands: Research, Development and Policy, Department of Human and Physical Geography*, Uppsala University, Uppsala.

ECA 1988 *Drought and Population: The Case of the Sahel*", Fifth Session of the Joint Conference of African Planners, Statisticians and Demographers, Addis Ababa, Ethiopia, 21-28, March.

Ehrlich, P. and Ehrlich, 1990 *The Population Explosion*, Simon and Schuster, New York.

FAO 1993 *FAO Yearbook: Forest Products, 1991*, Food and Agricultural Organization of the United Nations, Roma pp. 16-29.

Green, C.P. 1992 The environment and population growth: decade for action. In *Population Reports, Series M.,* No. 10, Baltimore, John Hopkins University, Population Information Program.

Handworker, W. P. 1983 "The first demographic transition: An analysis of subsistence choices and reproductive consequences", *American Anthropologist*, Vol. 85 pp. 5-27 .

Harrison, P. 1990 Beyond the blame-game: population and environment links", *Populi*, Vol. 17, No. 3, (14-21).

Henin, R.A. 1968 Fertility differentials in Sudan. *Population Studies,* Vol. 22, No. 1, pp. 147-163

Hill, A.G. (ed.), 1985 *Population, Health and Nutrition in the Sahel: Issues in the Welfare of Selected West African Communities*. Routledge and Kegan Paul International, London.

Madulu, N.F. 1996 *Environmental Degradation and Marital Fertility Changes in Tanzani a: The Case of Kondoa District"*, Unpublished Ph.D. Thesis, University of Dar es Salaam.

Madulu N. F. 1998 *Main Socio-Economic Study for the Kihansi River Catchment Management Plan*", A Research Report Prepared for the Kihansi River Catchment Management Plan (IRA/CST98.1).

Marquette, C. 1997 *Population and Environment Relationships in Developing Countries: A Select Review of Approaches and Methods*, Working Paper No. WP 1997:15, Chr. Michelsen Institute, Bergen, Norway.

Mbegu, A. C. 1996, "The problems of soil conservation and rehabilitation lessons from the HADO project.in C. Christiansson and I.S. Kikula (eds.), *Changing Environments: Research on Man-Land Interrelations in Semi-Arid Tanzania*.Regional Soil Conservation Unit. Swedish International Development Cooperation Agency, Nairobi p. 147-157.

Mbegu, A. C. and A.C. Mlenge 1984 *Ten Years of HADO: 1973-1983* Ministry of Natural Resources and Tourism, Forest Division, Dar es Salaam, Tanzania.

Meertens, H.C.C, L.J. Ndege and H.J. Enserink 1995 *Dynamics in farming systems: Changes in time and space in Sukumaland, Tanzania*, Royal Tropical Institute, Amsterdam.

Myers, N. 1989 Population, environment and conflicts I K. Davis, M.S. Bernstan and H.M. Sellers (eds.), *Population and Resources in a Changing World: Current Readings*. Morrison Institute for Population and Resources studies, Stanford University, California (pp. 43-55).

Rugumamu, W. 1997 The Impact of Gender on Land Productivity in Tanzania. National University of Lesotho. *ISAS Series* No. 13. 97pp.

Rugumamu, W 1999 Gender Dimension in Relation to Desertification Control Initiatives in Southern African Development Community. *Desertification Control Bulletin. UNEP* NO. 34 pp 41-47

Ruterberg, N. AND I. Diamond 1993 Fertility in Botswana: The recent decline and future prospects *Demography* Vol. 30, No. 2 (pp. 143-157).

Sadik, N. 1988 *State of the World Population, 1988.* United Nations Fund for Population Activities (UNFPA), New York.

Shechambo, F.C., 1986 Urban Demand for Charcoal in Tanzania: Some Evidence from Dar es Salaam and Mwanza. *IRA Research Report,* No. 67, University of Dar es Salaam.

Shishira, E.; P.Z. Yanda and G. Lyimo 1998 *Human Pressure on Coastal Forests in Tanzania: The Case of Pugu and Kazimzumbwi Forest Reserves and Surrounding Areas*, Institute of Resource Assessment Research Papers, University of Dar es Salaam.

Tanganyika, 1931 *Annual Reports of the Provincial Commissioners on the Native Administration*. Government Printers, Dar es Salaam.

Tanganyika, 1936 *Annual Reports of the Provincial Commissioners on the Native Administration*, Government Printers, Dar es Salaam.

Tanzania, United Republic Of, 1968 *Recorded Population Changes, 1948-1967*, Central Bureau of Statistics, Dar es Salaam.

Tanzania, United Republic Of, 1977 *The Threat of Desertification in Central Tanzania*, A Technical Paper Prepared for the United Nations Conference on Desertification, Ministry of Agriculture, Dar es salaam, 29th August to 9th September.

Tanzania, United Republic Of, 1983 *Population of Tanzania: 1978 Population Census, Vol. 8,* Bureau of Statistics, Ministry of Finance and Economic Planning, Dar es Salaam, Tanzania.

Tanzania, United Republic Of, 1986 *Hifadhi Ardhi Dodoma (HADO) Project: Phase Two Project Master Plan (1986/87 - 1995/96*, Forest and Beekeeping Division, Ministry of Natural Resources and Tourism, Dar es Salaam.

Tanzania, United Republic Of, 1989 *1988 Population Census, Preliminary Report*, Bureau of Statistics, Ministry of Finance and Economic Planning, Dar es Salaam.

Tanzania, United Republic Of, *1991 Population and Development in Tanzania,* Presentation Reports, Population Planning Unit, Bureau of Statistics and National Family Planning Program, Dar es Salaam.

Tanzania, United Republic Of, 1992 *The National Population Policy.* Planning Commission, President's Office, Dar es Salaam.

Tanzania, United Republic Of, 1994a *Population of Tanzania: An Analysis of the 1988 Population Census, 1988* Population Census Reports, Bureau of Statistics, Dar es Salaam, Tanzania.

Tanzania, United Republic Of,1994b *Tanzania: National Environment Action Plan, A First Step,* Ministry of Tourism, Natural Resources and Environment, Dar es Salaam.

Tanzania, United Republic Of, 1998 *The National Population Policy,* Planning Commission, (Draft Edited Version) President's Office, Dar es Salaam.

United Nations, 1975 *The Population Debate: Dimensions and Prospects, Vol.1,* (Papers of the World Population Conference, Bucharest, 1974), United Nations, New York.

United Nations, 1988 Interrelationships between child survival and fertility, in *Population Bulletin of the United Nations,* No. 25-1988, United Nations, New York.

United Nations, 1993a *Report of the United Nations Conference on Environment and Development (UNCED), Vol. 1,* Rio de Janeiro, 3-14th June, 1992.

United Nations, 1993b *Population, Environment and Development in Tanzania,* Demographic Training Unit (University of Dar es Salaam) and United Nations Department of Economic and Social Development, New York (URT-89-PO7).

UNFPA 1991 *Population, Resources and the Environment: The Critical Challenges,* United Nations Fund for Population Activities, New York.

World Bank, 1989 *Sub-Saharan Africa: From Crisis to Sustainable Growth (A long-term Perspective Study),* The World Bank, Washington.