

Assessment of Linkages Between Population Dynamics and Environmental Change in Tanzania

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Abstract:

This paper discusses the linkages between population growth and environmental degradation in Tanzania. Tanzania's major environmental problems, demographic characteristics, and the linkages between environmental change and rapid population growth both at national and regional levels are discussed. These discussions are intended to provide an empirical base for analysing the impact of changing environment on the people's lifestyle and their demographic behaviours including the reproductive ones. In the course of discussion the impacts of a rapidly growing population on the environment have been brought in the agenda. Examples from various parts of Tanzania have been given to provide empirical evidences to the arguments given. Generally, the paper demonstrates that high population growth and economic backwardness are dependent variables and both contribute significant impacts on the environment. There negative impacts are also reflected in the diminishing economic growth given the fact that the Tanzanian economy is agrarian. Environmental degradation affects agricultural productivity through land degradation, climatic change, and declining land per capita. A conclusion is made that environmental change is as an important factor to demographic and economic factors as it is population growth to economic development and environmental conservation. A change in the environment may influence changes both in the demographic behaviour and socio-economic conditions of the people, hence, population growth.

Key words: population, density, environment, Tanzania, agricultural change, land degradation,

1. Introduction

There is an increasing recognition of the linkages between rapid population increase and the quality of the environment. Population growth and the resultant human activities generate pressures to the natural and man-made environments. This statement is demonstrated by the rapid decline in tropical forests, global warming, and world pollution, to mention only a few (UN, 1993). While the population have reached the 6 billion mark in 1999, the world natural resource base has continued to be at a diminishing state. Similar consequences are evident at regional and national levels, including Tanzania.

Over the past century, many scholars maintained the thinking that rapid population growth is the major cause of many environmental concerns especially in developing countries. Human beings have been viewed as destructive intruders to natural environment, hence, the solution is to effect stringent rules and legislation that protect the environment. Although different environmental protection strategies have been effected in different regions, strict protection measures have been used as the most sustainable strategy to conserve biodiversity in many areas. This has been the policy in many protected areas in Africa, and in Tanzania in particular where the use of armed guards has been a common strategy to keep people out of the protected areas. It is, however, important to note that human population and the environment have very strong complementary linkages and relationships. In actual fact, environmental conservation efforts can only sustain if the local population and the public support them in general. This argument suggests that it is not enough to establish stringent

and expensive environmental conservation projects and programs without considering the demographic behaviours of the local population and their interactions with their environment. This suggests that there is need to take on board demographic factors in all environmental conservation issues.

2. Environmental Problems and Current Interventions

2.1. Major environmental problems 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 biodiversity (URT, 1994). These concerns are linked to overuse or misuse of the natural resources base.

Land degradation is a major problem in many areas of Tanzania. It is mostly manifested in the form of severe soil erosion, siltation, and loss of soil fertility. Measurements of soil loss from Shinyanga Region, for example, illustrated an increase in the amount of soil loss per hectare between the 1960-65 and the 1965-80 periods (URT, 1994). Similar experiences of soil loss have been observed in Dodoma, Morogoro and Arusha Regions. This problem is largely a function of various human activities including overgrazing, over-cultivation, and deforestation (Mbegu and Mlengi, 1984; Madulu, 1999; URT, 1994). Inappropriate farming techniques are probably the most important human activity that causes land degradation. These features of the land degradation problem partly lead to food insecurity in many areas that are severely affected.

Deforestation is another major environmental problem in Tanzania. Three major processes, namely: agricultural expansion, fuel wood and energy supplies, and commercial logging, mainly cause it. Agricultural expansion is probably the most important human activity that causes deforestation. Between 300,000 and 400,000 hectares of forest and bush land are estimated to be cleared annually for agricultural expansion purposes (UN, 1993). An elaborate example of the Usambara Mountains suggests that almost 70 percent of the rain forests have been destroyed since 1954. While in areas like Tabora and Songea, tree felling for tobacco cultivation and curing is rampant (Shishira and Yanda, 1998), agricultural expansion in forested areas is very common in Kondoa, Iringa, and Mufindi Districts (Madulu, 1998a, 1998b). Slash-and-burn cultivators sets in motion a series of events leading to destruction of forests. These trends have several adverse consequences that include accelerated soil erosion, fuel wood scarcity, high rates of evaporation, and climatic change.

Although the sustainable supply of fuel wood in Tanzania is estimated to be 19 million cubic meters per year, the total consumption is estimated at 43 million cubic meters per annum (UN, 1993). This level of consumption is almost 126 percent higher than the sustainable supply. Actually, the demand for fuel wood, charcoal and agricultural processing has been increasing over years causing further environmental problems. Rapid population growth has been viewed as the main cause of deforestation in Tanzania.

Lack of accessible water supply and poor water quality is another major environmental problem affecting a large proportion of the Tanzania's rural and urban population. In many areas of Tanzania, fresh water resources are being used up at such rapid rates that ground water supplies are dwindling. Moreover, surface water is 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. By 2002, water service coverage for municipal and industrial water

supply was 72 percent and for the rural water supply was 50 percent (URT, 2002). The lack and poor quality of water associated with incidences of many water-borne diseases, which have remained high in many parts of Tanzania.

Environmental pollution which includes 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. Surface run-offs collect all types of excreta and these are moved into the rivers, dams and sometimes into wells. The ocean has continued to be the best dumping place for all urban sewage. Due to poor sanitation and sewerage disposal systems, water pollution is well advanced.

There is also a problem of loss of wildlife habitat and biodiversity that is largely caused by increasing human pressures over resources and the natural habitats. In many areas, there is an increasing local pressure to extend agricultural activities at the expense of forests and wildlife resources are observed (URT, 1994; Madulu, 2001). Tanzania has committed about 25 percent of her land to protected area (wildlife and forestry). However, the existence of these natural resources is threatened by human disturbances of the ecosystem. Experiences from Forest Reserves in Tabora Region (Shishira and Yanda, 1998), Coast Region (Shishira et al, 1998), and Dodoma Region (Madulu, 2001) demonstrate clearly the dwindling biodiversity in most protected areas due to human interference in the ecosystems.

Another related environmental problem is the deterioration of aquatic systems. Aquatic resources include the marine and fresh water ecosystems, wetlands, mangrove forests, coral reefs, lakes 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 discharge of large amounts of urban wastes and affluent materials (URT, 1994). Population pressure on coastal resources is intense and water pollution is rapidly growing especially due to rapid and unplanned urbanization.

2.2. Recent interventions efforts to environmental problems

Land conservation efforts in Tanzania can be traced back to 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 included:

"... 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 labor was sometimes used in the construction of conservation structures. There were occasions when people were forced to contribute labor. In Kondo District where the menace of gully erosion was greatest, farmers were obliged to plant sisal (*Agave Sisalama*) around their farms (Mbegu, 1996:147)."

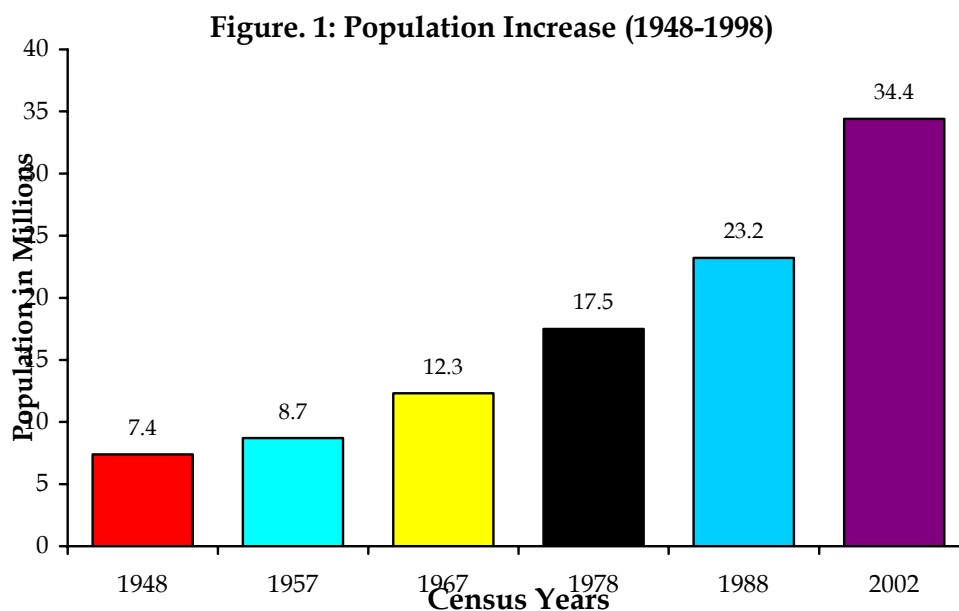
Over years, environmental awareness has increased significantly both at national and local levels. For example, the adoption of a National Population Policy (NPP) in 1992 that recognizes the linkages between population, environment and development demonstrates this increase in environmental awareness. 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 (URT, 1998). It gives high priority to the promotion of sustainable relationship between population, resources and the environment, and bringing sustainable economic growth with equity that is in harmony with the environment. The adoption of a population policy that recognizes the linkages between population and the environment is a positive step towards

sustainable development in Tanzania.

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 Division of Environment in the Vice President’s Office, 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 (URT, 1994). These efforts indicate the government's commitment to environmental protection. However, none of these programs has given priority to the population factor, which is an important component of environmental change.

3. Population size and trends

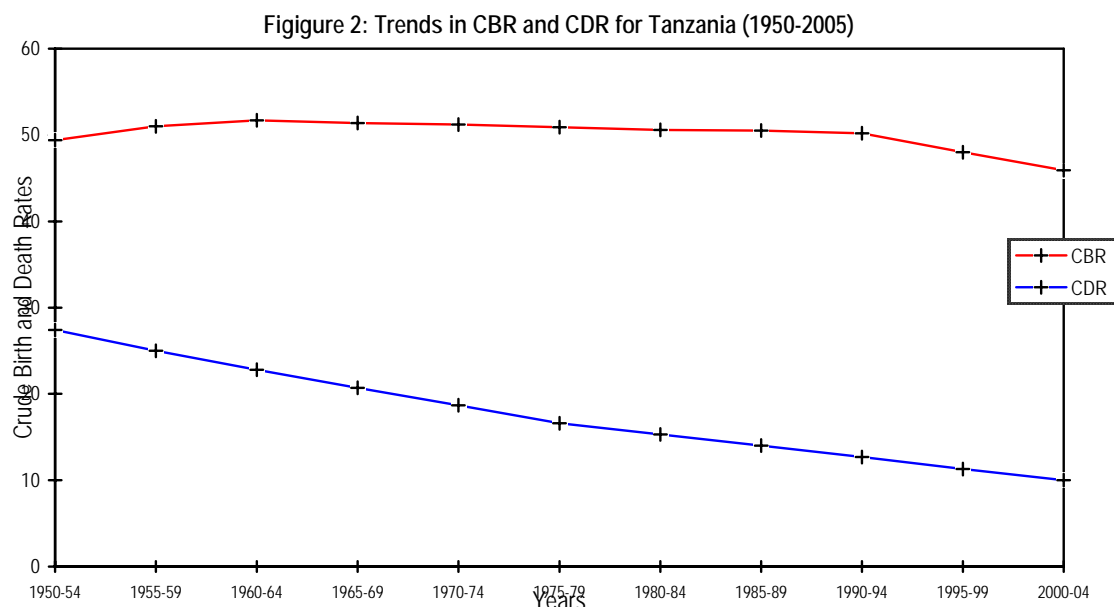
Documentation of the Tanzania’s population can be traced back to the colonial period when population counts were conducted in 1913, 1921, 1928, and 1931. Detailed censuses were conducted in 1948, 1957, 1967, 1978 and 1988. Figure 1 shows the trends in population size between 1948 and 1998



Source of Data: Tanganyika (1958), URT (1991, 2003)

The demographic trends for Tanzania reveal that the population grew almost fivefold between 1948 and 2002. The population almost doubled between 1967 and 1988 a period of 21 years, and almost tripled between 1967 and 2002 a period of 35 years. The data also demonstrate that the population increased by about 17 percent in the 1948-57 inter-censal period, by 42 percent in 1957-67, by 42 percent in 1967-78, by 32 percent in 1978-88, and by 49 percent in 1988-2002 periods. Moreover, the rate of population growth increased from 1.8 percent in 1948-57 to 3.0 percent in 1957-67, 3.2 percent in 1967-78, declined to 2.8 percent in 1978-88, and slightly increased to 2.9 in 1988-2002 (URT, 1989, 2003; Barke and Sowden, 1992). Figure 2 demonstrates the trends in crude birth rates (CBR) and crude death rates (CDR) for Tanzania as estimated and projected by the United Nations (medium variant projections) for the period 1950

to 2005 (U.N, 1991).



Source: United Nations (1991).

A continuous decline in CDR is observed from 27.4 deaths per thousand population in 1950-55 to an estimated 10 deaths per thousand population in 2000-05. The trend also illustrates an almost stagnant CBR at a high level above 50 births per thousand population between 1950 and 1990. The consequence of the widening gap between the stagnant birth rate and the rapidly declining death rate has been an increase in the growth rates.

Although a decline in growth rate has been recorded in the 1978-88 and 1988-02 periods, but the level is still high suggesting that the absolute increase in the population is remarkably great (U.N, 1989, 1992). For example about 11.3 million people were added on the Tanzania population in the 1988-2002 inter-censal period. Table 1 compares the population of Tanzania mainland regions as recorded in the 1967, 1978, and 2002 censuses. The data reveals that none of the regions exhibited a population decline between one census and another, with the number of regions that had over a million population increasing from one in 1967 to five in 1978, twelve in 1988, and nineteen regions in 2002.

Table 1: Census Counts and Inter-censal Growth Rates by Regions (1967-2002)

Region	Population				Growth Rate		
	1967	1978	1988	2002	1967-78	1978-88	1988-02
Dodoma	709,380	972,005	1,233,835	1,692,025	2.8	2.6	2.2
Arusha	610,474	926,223	1,344,001	1,288,088	3.8	3.5	3.9
Kilimanjaro	652,722	902,437	1,102,934	1,376,702	2.9	2.0	1.6
Tanga	771,060	1,037,767	1,278,995	1,636,280	2.7	2.1	1.8
Morogoro	682,700	939,264	1,212,659	1,753,362	2.9	2.6	2.6
Pwani	428,041	516,586	633,352	885,017	1.7	2.1	2.4
Dar es Salaam	356,286	843,090	1,357,248	2,487,288	7.8	4.7	4.3
Lindi	419,853	527,624	644,851	787,624	2.1	1.8	1.4

Mtwara	621,293	771,818	884,745	1,124,481	2	1.4	1.7
Ruvuma	395,447	561,575	777,486	1,113,715	3.2	3.2	2.5
Iringa	689,905	925,044	1,183,484	1,490,892	2.7	2.6	1.6
Mbeya	753,765	1,079,864	1,471,784	2,063,328	3.3	3.3	2.4
Singida	457,938	613,949	860,141	1,086,748	2.7	2.6	2.3
Tabora	502,068	817,907	1,034,391	1,710,465	4.4	2.3	3.6
Rukwa	276,091	451,897	696,206	1,136,354	4.5	4.4	3.5
Kigoma	473,443	648,941	848,562	1,674,047	2.9	2.8	4.8
Shinyanga	899,468	1,323,535	1,760,869	2,796,630	3.5	2.9	3.3
Kagera	658,712	1,009,767	1,304,459	2,028,157	3.9	2.6	3.1
Mwanza	1,055,883	1,443,379	1,820,728	2,929,644	2.8	2.6	3.2
Mara	544,125	723,827	942,765	1,363,397	2.6	2.7	2.6
Manyara	N/A	N/A	NA	1,037,605	N/A	N/A	3.9
Mainland	11,958,654	17,036,499	22,393,495	33,461,849	3.2	2.8	2.8
North Unguja	56,360	77,017	97,047	136,639	2.8	2.3	2.4
South Unguja	39,087	51,749	70,269	94,244	2.6	3.0	2.1
Urban West	95,047	142,041	208,389	391,047	3.7	3.7	4.5
North Pemba	72,015	106,290	137,086	185,326	3.5	2.6	2.1
South Pemba	92,306	99,014	127,185	175,471	0.6	2.5	2.3
Zanzibar	354,815	476,111	639,976	981,754	2.7	2.9	3.0
Tanzania	12,313,469	17,512,610	23,033,471	34,443,603	3.2	2.8	2.9

Source: URT (1991; 2003)

With the exception of Arusha, Coast, Mtwara, Kigoma, Kagera, Mwanza and Shinyanga regions, the population growth rates declined in all other mainland regions between 1978-88 and 1988-2002. The observed differences in growth rate are mainly caused by variations in the rates of internal migration, and differences in natural increase. These factors are influenced by climatic conditions and differences in resource endowment (Maro, 1983).

Population distribution describes spatial spread of people within an area. Population density, on the other hand, refers to the ratio of a given number of people to a given land area (Maro, 1983). Differences in population density often reflect the aerial variation of people and resources over the land. The national population density increased from around 9 persons per square kilometre in 1967 to 20, 26 and 39 persons per square kilometre in 1978, 1988 and 2002, respectively (URT, 2003). These density figures give an impression that Tanzania is sparsely populated. However, variations exist between regions, districts, divisions and even at ward levels. Table 2 demonstrates the regional variations in population size and density for the 1988 and 2002 censuses.

Table 2: Population size and density by regions (1988 and 2002)

Region	Land Area		1988 Population			2002 Population		
	Km ²	% of Total	Population	% of Total	1988 Density	Population	% of Total	2002 Density
Dar es Salaam	1,393	0.2	1,360,865	5.9	976.9	2,487,288	7.2	1785.6
Urban West	230	0.0	208,571	0.9	906.8	390074	1.1	1696.0
South Pemba	332	0.0	127,623	0.5	384.4	175471	0.5	528.5
North Pemba	574	0.1	264,802	1.1	461.3	185326	0.5	322.9
North Unguja	470	0.1	96,989	0.4	206.4	136639	0.4	290.7
Mwanza	19,592	2.2	1,876,635	8.1	95.8	2,929,644	8.5	149.5
South Unguja	854	0.1	70,313	0.3	82.3	94244	0.3	110.4
Kilimanjaro	13,309	1.5	1,104,673	4.8	83.0	1,376,702	4.0	103.4
Kagera	28,388	3.2	1,313,594	5.7	46.3	2,028,157	5.9	71.4
Mara	19,566	2.2	946,418	4.1	48.4	1,363,397	3.9	69.7
Mtwara	16,707	1.9	889,100	3.8	53.2	1,124,481	3.3	67.3
Tanga	26,808	3.0	1,280,212	5.5	47.8	1,636,280	4.7	61.0
Shinyanga	50,781	5.7	1,763,800	7.6	34.7	2,796,630	8.1	55.1
Kigoma	37,037	4.2	856,770	3.7	23.1	1,674,047	4.8	45.2
Dodoma	41,311	4.7	1,235,327	5.3	29.9	1,692,025	4.9	41.0
Arusha	36,486	4.1	632,530	2.7	17.3	1,288,088	3.7	35.3
Mbeya	60,350	6.8	1,476,278	6.4	24.5	2,063,328	6.0	34.2
Pwani	32,407	3.7	636,103	2.7	19.6	885,017	2.6	27.3
Iringa	56,864	6.4	1,193,074	5.1	21.0	1,490,892	4.3	26.2
Morogoro	70,799	8.0	1,220,564	5.3	17.2	1,753,362	5.1	24.8
Manyara	45,820	5.2	715,640	3.1	15.6	1,037,605	3.0	22.6
Tabora	76,151	8.6	1,036,150	4.5	13.6	1,710,465	4.9	22.5
Singida	49,341	5.6	792,387	3.4	16.1	1,086,748	3.1	22.0
Ruvuma	63,498	7.2	779,875	3.4	12.3	1,113,715	3.2	17.5
Rukwa	68,635	7.8	698,718	3.0	10.2	1,136,354	3.3	16.6
Lindi	66,046	7.5	646,494	2.8	9.8	787,624	2.3	11.9
Total Tanzania	883,749	100.0	23,095,878	100.0	26.1	34,569,232	100.0	39.1

Source: URT (1991; 2003)

While the population density at the national level increased from 26 persons per square kilometre in 1988 to 39 persons per square kilometre in 2002 (URT, 2003), some regions like Dar es Salaam (1,786) and Urban West (1,696) recorded the highest population densities in Tanzania. In almost all regions the population density increased between 1988 and 2002 suggesting that there were significant increases in the regional populations in absolute numbers. The highest absolute change in population density were observed in Dar es Salaam (from 977 to 1,786) and Urban West (from 907 to 1,696).

The 2002 census data revealed that almost 50 percent of the population was concentrated in only 39 percent of the total land area. In 1988, 50 percent of the population occupied only 35 percent of the land. According to Maro (1983), 65 percent of the population were concentrated in only 28 percent of the total land area in 1978 census. Increases in population density are largely a function of natural increase and net migration patterns. The impact of high population density is reflected by land per capita which fell from around 12 hectares in 1948 to 4 hectares in 1988 (URT, 1991). The availability of arable land and its quality is of considerable importance in explaining the internal disparities in population density. Table 3 shows the percent distribution of the population by type of residence as observed in 1967 through 2002.

Table 4: Distribution of Population by type of Residence (Rural/Urban)

Area	Census	Population	Population Distribution by Residence	
			<i>Percent Rural</i>	<i>Percent Urban</i>
Tanzania	1967	12,313,469	93.8	6.2
	1978	17,512,610	86.2	13.8
	1988	23,174,336	81.6	18.4
	2002	34,443,603	76.9	23.1
Tanzania Mainland	1967	11,958,654	94.3	5.7
	1978	17,036,498	86.7	13.3
	1988	22,455,207	82.0	18.0
	2002	33,461,849	77.4	22.6
Tanzania Zanzibar	1967	354,815	76.5	23.5
	1978	476,111	67.4	32.6
	1988	640,675	68.2	31.8
	2002	981,754	60.4	39.6

Source: URT (1991, 2003).

Given the fact that over 80 percent and 77 percent of the Tanzanian population lived in rural areas in 1988 and 2002 and depend on peasant agriculture, the quality of the land and its accessibility encourage the population to select the best parts in the first place. Although the magnitude of population increase differs from one region to another, its consequences on the land resources and the overall impact on the environment may be similar. Long distance to the farms, declining productivity, increasing resource depletion, landlessness, land use conflicts, and land degradation are common phenomena in almost all regions which record high population densities and growth rates.

There are many factors that can be responsible for the persistence of high population growth in Tanzania. Analysis of the demographic data demonstrate that high fertility, high but rapidly declining mortality, low education attainment, division of labour by age and sex, and high rates of non-contraception are the most pressing factors that need immediate attention. The persistence

of old customs and traditions favouring high reproductive rates and the persistence of high economic value of children hinder fertility decline among the rural populations. Figure 3 compares the women's education and the number of CEB in Tanzania as observed from the 1967 population census.

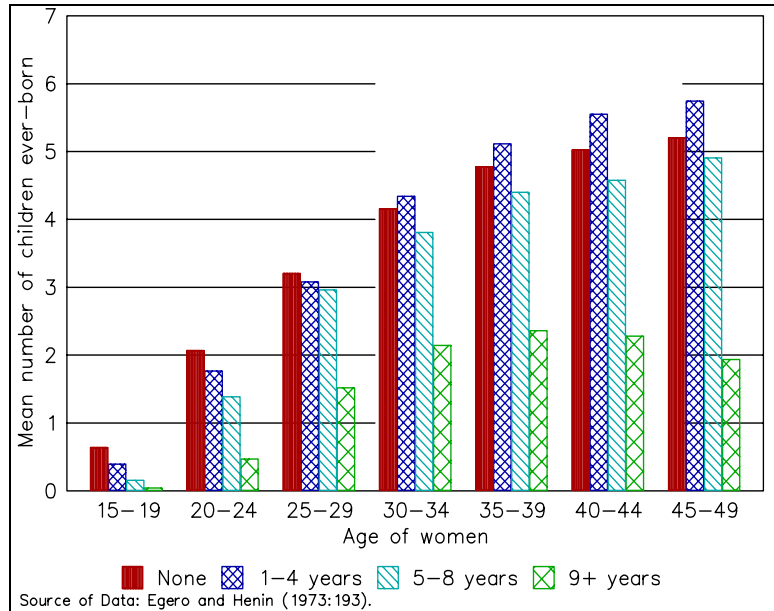


Figure 3: Mean number of CEB by age of women and education.

The graph demonstrates that the fertility of women with some education declined consistently with increasing educational attainment in all age groups. For all age groups, women with education beyond primary school level had lower mean number of CEB than all other educational categories. The trend reveals that women over 30 years who had 1-4 years of schooling had a higher mean number of CEB than those with no formal education and those with 5-8 years of education suggesting that low levels

of education can even lead to slightly higher fertility. Similar trends were noted in the 1973 National Demographic Survey (Henin, 1973). Given the lower level of education among many rural women, high fertility and high population growth may continue for a long period.

4. Population growth and economic development:

The alleviation of poverty especially in developing countries is an important exercise for environmental sustainability. In the process of poverty reduction, one need to understand that population is a basic entity that determines the pace of poverty reduction. 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 increases pressure to environmental resources, and demand for social services that have to be financed by the national economy.

High population growth produces a depressing effect on the gross national product (GNP) and the per capita income (Barke and Sowden, 1992). In other words, high population growth generates an economic burden to the governments by channelling the meagre resources towards provision of services rather than investing in the development sector. Such arguments are probably not convincing at the individual family level, but they certainly encourage governments to provide family planning services within their overall development plan. It is important, however, to note that the provision of social services needs to match the rates of population and economic growth because the higher the population growth the higher the demand for socio-economic and environmental resources.

The economy of Tanzania is largely dependent on agricultural production. Nyerere (1968) viewed agricultural progress as the basis and the only road for Tanzania's development. It provides livelihood to over 80 percent of the population, the majority of which are living in rural areas and depend on small-scale agricultural production (URT, 1991). These people need sufficient arable land to cultivate, pasture land to graze their livestock, and enough woodland to supply them with fuel wood for domestic and agricultural processing purposes. They also need reliable water sources within reasonable distance. An increase in the area cultivated by smallholder has been observed from 4 million hectares in 1974 to about 8.8 million hectares in 1988 (UN., 1993). The share of agriculture in the GDP was about 59 percent in 1991 and small-scale subsistence farming accounts for more than 50 percent of the agricultural output. Among the Sukuma of northern Tanzania, a large family is described as an important factor contributing to increased production of food surpluses (Malcom, 1953). A man with a largest family is considered to be the wealthiest man; and a large family is equated to an asset of unequalled value as it means more hoes, and hoes spell grain, which is the most important material wealth today.

Subsistence peasant agriculture is often linked to environmental degradation. In many cases, the need to meet the people's immediate needs is often given the first priority mostly at the expense of environmental conservation. Local communities are compelled to over-exploit the natural resources on which their long-term survival 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. ... (He) is often impelled by forces of political structures, economic systems, and/or institutional factors, of which he may have little understanding and over which he exercises virtually no influence. But the result is the same: widespread deforestation, soil erosion, and spread of deserts (Myers (1989: 47).

In addition to crop farming, rural communities in Tanzania are also engaged in livestock keeping. Livestock are valued as a source of protein, capital, investment, labour, prestige and respect. The 1984 livestock census gave a figure of over 22 million livestock units (L.U) in Tanzania. In most areas, pastoralism is widely practised and there exists no formal control of grazing in the rangelands that are communally owned. Although 69 percent of the total land area of Tanzania is considered to be suitable for livestock keeping, about 60 percent of the livestock population are concentrated in only 10 percent of the land, mostly in the semi-arid areas of northern and central Tanzania. The consequence of such concentration of livestock is excessive overgrazing in the less favourable areas leading to severe environmental damage. The increase in the human populations and the expansion of cultivation into the traditional grazing areas has in many areas driven the pastoral population into the less fertile and more fragile areas.

Examples to illustrate the marginalization of the pastoral population can be drawn from the Barbaig of Hanang District (Kjærby, 1980) and the Masai in Ngorongoro and Bagamoyo Districts (Arhem, 1981; Mustafa, 1988). The influx of agro-pastoral tribes and the opening of large and small scale farms forced the pastoral Barbaig to squeeze themselves with their livestock in the vastly reduced and drier areas causing overgrazing and severe soil erosion (Madulu, et. al., 1993). Similarly, large portions of the Masai pastureland has been converted into other land uses including state ranches, wheat farms, bean-seed farms, and national parks. Consequently, the pastoral Masai have migrated southward into Pwani, Morogoro, Iringa and some have gone as far as the Usangu plains in Mbeya Region. The long-term implications of such migrations is the acceleration of the land degradation processes in the areas of destination.

5. Population pressure and environmental concerns

The linkage between environment and population trends is a less documented phenomenon in Tanzania. Whereas the environment is considered to be the primary supply of resources for human use, population size and its composition generates the demand for these resources and the impact on the environment (UN., 1993). This linkages between population and the environment is clearly impact demonstrated by Ehrlich and Ehrlich (1990) in their *IPAT Model*, which argues that the environmental impact (**I**) is a joint function of population (**P**), affluence (**A**), and technology (**T**). The model sees population size (**P**) as integrating in a multiplicative fashion with affluence (**A**) and technology (**T**) to create impact (**I**) on the environment (UNFPA, 1991). This implies that population determines how many persons are there to consume available resources and producing more impacts on the environment. In other words, the more people there are, the greater is the impact on environment even when a population and its growth are relatively small.

The high rates of the population growth in Tanzania 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 also 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 Tanzania. The increase in fuel wood consumption has been observed in many areas resulting into excessive deforestation especially around large urban centers like Dar es Salaam and Mwanza (Shechambo, 1986; Shishira et. al., 1998). Sadik (1988) argued 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 recent years, more and more farms have been opened up in the marginal areas and even in the protected areas in an effort to earn a living (Shishira and Yanda, 1998; Madulu, 2001). 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 way for agricultural activities and human habitation. In areas like Kondoa and Kwimba Districts, cultivation has been extended to areas with less suitable conditions especially in the former grazing areas a (Madulu, 1998b). This observation suggests that as the population increases, the arid and semi-arid marginal areas are becoming the last great frontiers into which people can expand (Barke and Sowden, 1992). Forest clearing for agricultural expansion has been rampant around the Swagaswaga Game Reserve in Kondoa District (Madulu, 2001). Such expansions have caused serious consequences on the environment and stimulated lands use conflicts. Observing the impact of population pressure on land cover in the Pugu and Kazimzumbwi forest reserve between 1952 and 1989. Shishira et. al. (1998) 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)".

Many of the environmental problems that are observed in Tanzania today result from taking resources away from the natural environment. The increasing rate of exploitation of the natural resources is probably a function of an increase in the number of people as it raises the demand for food, water and arable land. The steady increase in population in many areas of Tanzania has been accompanied by declining food production because population pressure reduces the per capita arable land while increasing the acreage under cultivation.

6. Conclusion

The above discussion on the linkages between population and the environment seems to suggest that man, through his non-sustainable production and consumption patterns, is placed at the heart of and environmental problems in Tanzania. The impacts are manifested through resource depletion and the resultant environmental problems. This is confirmed by the demographic trends in Tanzania that correlate significantly with the deterioration on resource base, and environmental degradation suggesting remarkable population/resource imbalances.

Different groups of people interact differently with the environment. The impact of these interactions is aggravated by the use of inferior technology and poor economic development as illustrated in the *IPAT Model*. Tanzania is not keeping pace with the demand of the rapidly increasing population. In many areas, the traditional farming and land tenure systems have been unable to adapt to population pressure so as to prevent degradation of the environment. Consequently, decline in food production, land degradation, and the resultant climatic change have accompanied the steady population increase.

The discussion has demonstrated that an increase in the number of people has a negative implication to the environment. Issues like increased demand for food, water, arable land and other essential materials from the natural resource pool are of interest in this respect. Increased exploitation of resources from the natural environment threatens ecological balance and sustainable natural resource conservation.

Many more examples can be cited to illustrate the negative impacts of rapid population growth on the environment and vice versa. Land use conflicts and competitions between cultivators and herders are becoming common features of the rural communities in many regions, and in some cases leading to violent conflicts. High population growth in the highland areas of mount Meru, mount Kilimanjaro and the Matengo highlands, to mention only a few, have caused serious deforestation and influenced out-migrations of peasant groups into the adjacent drier plains. The examples given in this discussion have emphasised the existence for strong linkages between population growth and environmental degradation in Tanzania. In actual fact, none of these variables can operate on its own without stimulating effects on the other.

7. References

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