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The Environmental Implication of Population Dynamics in Ethiopia: Review

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***Abstract* – This paper analyzes the nexus between population dynamics and environmental degradation in Ethiopia. The paper focuses on spatial and temporal changes in forest from 1990-2005 and cropland in Ethiopia. The trend in population growth and land use land cover change over those periods reveals that decline of forest and wetland cover, while substantial increase in cropland with increase of population. This indicates the prevalence of converting forest and wetland in to cropland and the weak technological improvement for a large number of farmers, as forestland and wetlands areas were cleared to increase crop production rather than improving current farming techniques. This has given rise to high rates of environmental degradation, and increasing damage to ecosystems that cannot sustain crop cultivation. The policy implication is that encouraging policies enhancing sustainable intensification of land resources that would lessen the need for agricultural extensification that could latter reduce pressure on environmental resources. In the short-run, family planning policy that enables couples to avoid unwanted pregnancy would reduce fertility and population growth that will result reducing pressure on environmental resources is recommended. However, this paper failed to see the complex interaction of non-demographic factors that will determine population's environmental influence.**

***Keywords* – Population, Environmental Degradation, Land Cover, Land Use.**

I. INTRODUCTION

The country's population has been growing at a rapid rate since the 1950s, and the evidence suggests that the rate of growth has been increasing over the last quarter of a century. Current estimates show a population growing by about 2.44 percent per year, or an increase of about 2 million persons annually. At the same time, the natural resource base that support people's livelihoods and wellbeing are being rapidly degraded. The rate of soil erosion and deforestation is currently quite high, deforestation is occurring on a large-scale, and the pressure on the remaining forests is quite severe[1].

It has become increasingly clear that human population have a powerful effect of environment. Yet the exact relationship between population dynamics and environment is complex and not well understood. The interplay between population growth, resource depletion, and environmental degradation has been a matter of debate for decades. However, after the United Nations Conferences on Environment and Development, held in Rio De Janeiro in 1992 and on: Population and Development, held in Cairo, 1994, there have been many attempts to explore the linkages between population and environment.

In most cases, the population is seen as an aggregate of consuming units, putting stress increasingly on the natural resources leading to environmental degradation. Nevertheless, in reality the inter-relationship between population and environment is more complex and multi-dimensional. Human beings are not always consumers they are also producers and some time they are conservators of nature and environment. The quality and quantity of the population of a country have inevitable interaction with its natural resources and environment. On the other hand, environmental changes due to both anthropogenic and natural causes have vital effects on population structure and on social systems[2].

By drawing demographic and environment literature, this paper presents the synthesis of environmental implication of population dynamics, based on current knowledge of the relationship between population factors and various aspects of the natural environment. The paper backed by empirical data on trends in population dynamics to highlight its relationships with environmental change in the Ethiopian context. This inquiry is important in such a way that an understanding of such relationships could provide a sound basis for the integration of population variables in a better understanding of environmental issues. This review is framed in the les of the Malthusian ("limits to growth") and the Boserupian ("cornucopian") theoretical framework of current researches concerning population-environment relationships.

The rest of this paper is structured as follows; section two presents dominant theoretical frameworks that guide population-environment nexus. Methods used to analyze data obtained from different sources are presented in section three. Trends in population growth and population growth rate over a rage of time are described in section four. Section five presents the relationship between population dynamics and environmental degradation both at national and some local level. The last section draws conclusions and policy recommendation emanating from the lessons learned of the paper.

II. THEORETICAL FRAMEWORK: POPULATION-ENVIRONMENT NEXUS

Various theoretical frameworks often guide current research undertakings on the population–environment nexus. However, reviews of literature on the subject appear to show that the Malthusian and the Boserupian perspectives have dominated such frameworks. However,

critics argued that the Malthusian and Boserupian theories described as the linear views and they emphasized the one-sided, linear and direct relationships between population and environment.

Malthusian view analyses population growth as a threat to the natural limit of arable land to provide food, shelter and subsistence. Malthus [3] put forward the theory that whereas human population has a tendency to grow geometrically, agricultural/food production grows only arithmetically. In this way, population growth tends to outstrip the capacity of agriculture/food production and hence the productive capabilities of land resources to support the population. The result is that 'positive' checks, such as famine and increased mortality, or 'preventive' checks, such as postponement of marriage and limitation of family size, work to reduce population growth. According to Malthus if not checked by either by preventive or positive checks the consequence would famine, poverty and increased mortality.

The Malthusian viewpoint relies on the concept of 'carrying capacity', which implies that the ability of land to produce food is limited; and exceeding those limits will result in degradation and declining productivity. In more general terms, the Malthusian viewpoint suggests that limited natural resources place a restriction on population growth. According to UNESA [4], this viewpoint has been used as a benchmark for much of the popular discussion on population-environment relations. This viewpoint emphasizes the "limits" to population growth.

As an extension of the Malthusian theory, Moretimore [5] on his study in Kenya stated that increase in population density brings about a corresponding increase in frequency of cultivation and the shortening of the fallow period that is needed to rejuvenate soil fertility. As fallow length is reduced, soil fertility is bound to decline and this leads to declining yields. Falling output is experienced, which eventually culminates in food scarcity. The problem of food shortage subsequently leads to further accelerated degradation of environmental resources. However, Malthusian theory was highly criticized because of not foreseeing the future technological advancement.

As described above, the force limiting agricultural progress in the classical growth theory is population growth accompanied by diminishing returns to agricultural labor. However, this pessimistic view has been rejected by optimists like Easter Boserup [6]. Boserup explicitly takes into account technological changes that have allowed agricultural output to increase faster than population growth, which Malthus did not. According to Boserup [6] in some cases population growth and resulting increased population density might induce technological changes that allow food production to keep pace with population growth. Similarly, Berry[7] went further to suggest that population growth induces sufficient technological change to expand food output faster than population. Boserupian theory focuses on the relationships between these three factors: population, environment, and technology. The Boserupian perspective has had an influence on global and regional research, which examines the relationship between population growth and changes in agricultural production [8].

Discussing the relationship between population and the environment is not simple. Population is a multidimensional concept that can relate to the size, distribution, density, or composition of an area's inhabitants. MacKellar et al. [9] posited that environment is no less complex-encompassing qualities of air, water, and land on which humans and all other species depend. Further complicating the relationship between population and the environment are the myriad "mediating" influences that ultimately shape this association. These include technological factors, political factors (e.g. environmental regulation), and cultural factors (attitudes towards wildlife and conservation). Figure 1 presents a conceptual framework describing the relationship between population and the environment in fairly simple term.

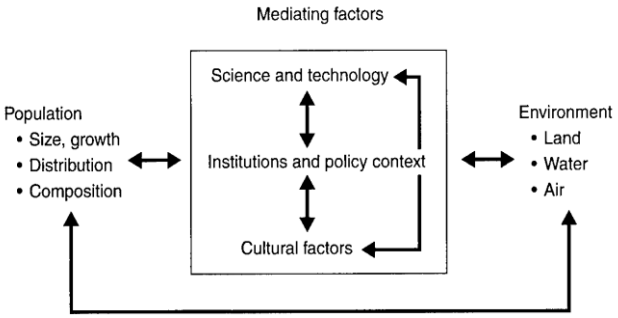

Fig.1. Framework for considering the relationship between population and environment
Source: Adapted from MacKellar et al., 1998.

III. METHODS AND MATERIALS

This paper is based on desk reviews and empirical data on population-environment nexus. Various theoretical frameworks were reviewed to guide this paper on the population–environment nexus. More specifically Malthusian and the Boserupian perspectives were taken as theoretical framework for considering the relationship between population and the environment.

The paper employed spatial and temporal data on population dynamics and land use land cover change over time in Ethiopia. Emphasis was give to conversion of forestlands and wetlands to cropland as indicator for environmental degradation. Information at national level was supported by empirical data at local levels. These data were taken from different sources such as Central Statistical Authority of 1984, 1994, and 2007, data set from FAO on Global Forest Resources Assessment 2005, data of Land use change in Lake Tana Woreda from 1973 to 2008 by Amare and Ramesware [10]. Finally, quantitative data was analyzed using trend analysis between population change and land use land cover change over certain period assuming that increased cropland in the expense of forestlands and other natural resources will result environmental degradation.

IV. Population Dynamics in Ethiopia

Population Size and Growth

Ethiopian population change analysis can be broken into two main parts: those prior to census and after census of 1984. Population data prior to first census (1984) was scant in Ethiopia and based on sample surveys that have done in different times. For example, in 1964/65, the first national sample survey was conducted by the then Central Statistical Office [now Central Statistical Agency (CSA)], and since then, various sample surveys have been undertaken that have provided estimates for population data for the country. However, these data had their own limitations and permitted only a crude approximation of the actual size of the Ethiopian population [11].

In order to make demographic estimates on the current status and future trends of a population, Ethiopia has conducted several demographic sample surveys and three population and housing censuses in 1984, 1994, and 2007 [12] [13] [14] but a registration system for vital events (births, deaths, etc.) is not yet in place. Figure 2 illustrates the trend of Ethiopia's population growth since 1940 using various estimates and counts from the three censuses that shows increasing population size.

The rate of population growth increased to a peak of 3 percent in the late 1980s and early 1990s. Figure 3 indicates that the growth rate has begun to slow down from the mid-1990s. However, the rate at which it is declining is very slow indicating that the overall population will continue increasing rapidly in the years to come. This implies that the influence of population growth on scarce natural resources is only a concern in the short-run. To put it differently, the long run impact of population on natural resources will get minimal.

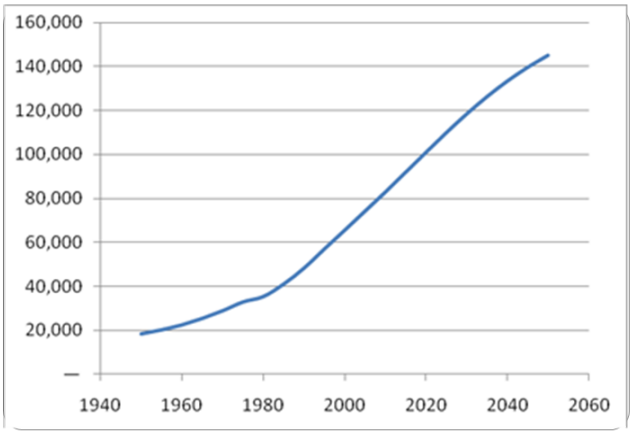

Fig.1. Trends in population size in Ethiopia during 1940-2060

Sources: Assefa [15] PHCC[12] [13] [14].

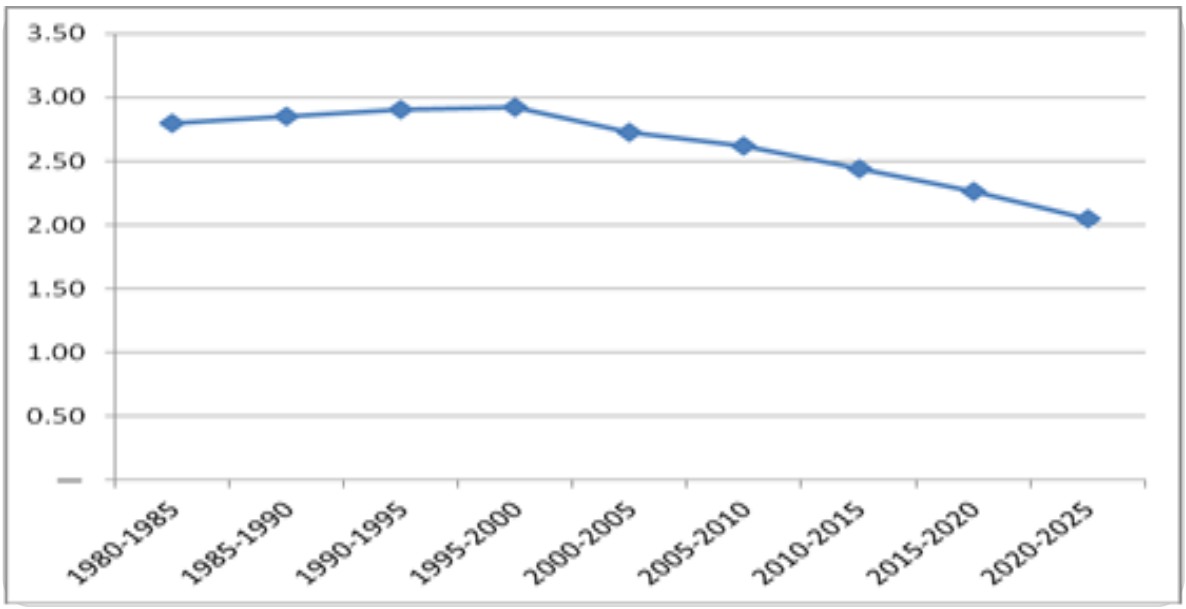

Fig.2. Trend of population growth rate of Ethiopia during 1980–2025.

Sources: *Assefa*[15] [14]

Age and Sex Composition

Population composition refers to the characteristics of a particular group of people. These characteristics include the distribution of population across age categories and the number of men relative to the number of women [16]. Sex is one of the basic characteristics of a population. Sex composition is very important for any analysis, as data on sex provides useful information about reproductive potential, human resources, level of school attendance by each sex, and the potential fertility. Age composition is an important implications for future population growth because younger population posses greater momentum. An important way of assessing the age and sex structure of a population is using the population pyramid. Population pyramids are effective means of comparing the male and female population over a range of ages.

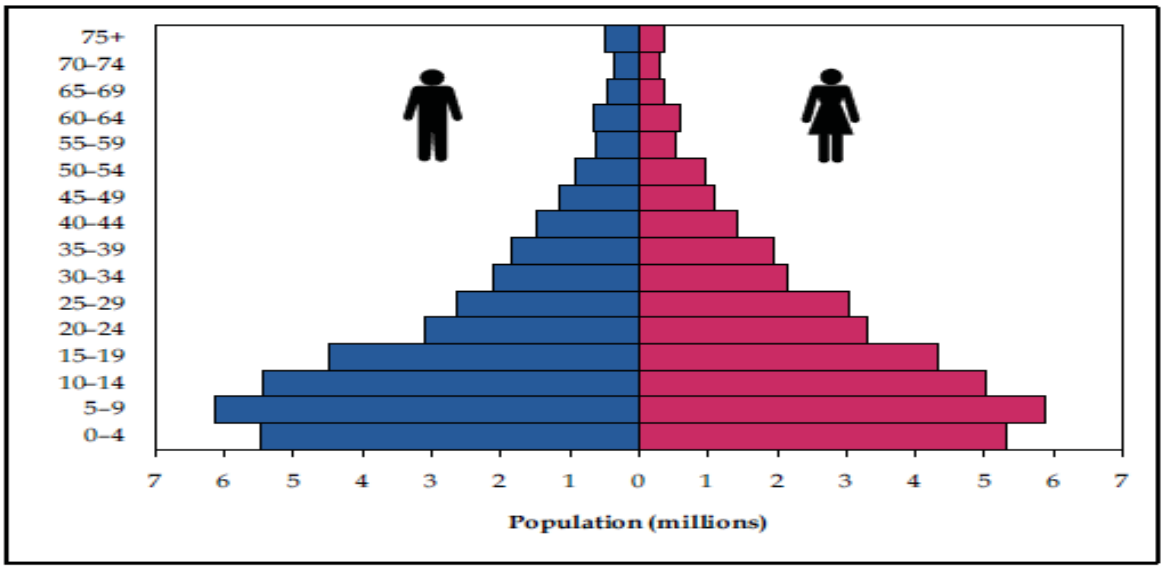

Fig.3. Population Pyramid of Ethiopia for 2007

Source: PCC [14].

A closer look at the above population pyramid reveals a high potential for future rapid population growth. Moreover, the age-sex pyramid depicts the typical types of developing countries with rapid population growth and high proportion of young population. A critical analysis on Ethiopian population pyramid by Amare [17], the distribution of the national population by broad age groups shows that the proportion of young population under age 15 has declined from 49.8 percent in 1984 to 45.0 percent in 2007. Conversely, the proportion of population in the working age group 15-64 has increased from 50.2 percent in 1984 to 51.9 percent in 1994. A closer look at the population pyramid shows broader at base and tapers up because of lower proportion of old age population.

Components of Population Change

Population dynamics encompasses population change over time due to births, deaths and migration. However, in Ethiopia the two basic factors in determining population changes are fertility and mortality, while the influence of international migration has been found to be negligible [18]. This section addresses the historical trends of fertility and mortality of Ethiopian population.

Fertility is one population dynamics that determines the size and age structure of a given population. Assessment made on fertility shows a declining trend from 6.4 births per women in 1990 [19] to 5.4 births in 2005 [20], a one child drop in the past 15 years. Taking comparison between urban and rural fertility rate, the fertility level is considerably higher in rural than urban areas.

Although there has been a declining trend in all measures of mortality and improvements in the health sector service provision systems, mortality levels still remain high in Ethiopia. The crude death rate has shown modest decline in the last two decades. The current maternal mortality rate (673/100,000) is among the highest in the world [17]. Data from the 2005 EDHS showed that infant mortality has declined by 19 percent over the last 15 years. Even though both infant and child mortality rates are declining, the current levels of infant mortality rate (77/1000) and child mortality rate (123/1000) are still highest.

In Ethiopia, the overall review of population growth using the existing data has shown that the growth of population became rapid after 1950's. Some of demographic variables seem to decline slightly but they are still the highest in world. This section posed the question "*do this population momentum has threatened the environment of the country at past, present and will influence in the future?"* for the next section.

V. Population and Environment Linkages: Some Evidence from Ethiopia

National studies showing Population-environment linkage

Ethiopia is one of the countries in sub-Saharan Africa that is well endowed in terms of its natural resources including biodiversity, and particularly its agricultural biodiversity. Although the country is endowed with an enormous land resource potential, it has been affected by multifaceted environmental problems including land degradation and declining biodiversity [21]. Land degradation in Ethiopia is triggered by complex processes and factors [22] [23]. Although influenced by natural forces, the challenge of land degradation is mainly the result of unprecedented population growth in the highlands that leads to exploitative subsistence agriculture [24]. This section attempt to present the impact of population growth on environmental degradation referring to land use land cover change over certain period.

Under increasing population size, farmers can respond in two ways: they can expand farm acreage or they can intensify cultivation in existing farms [25]. In a situation where most farmers experience financial strains to access farm inputs (fertilizer and plough), they obviously opt for expanding cropland acreage through conversion of forests and woodlands [26]. The direct causes of land degradation

in Ethiopia are the expansion of annual crop cultivation into steep lands.

The general trend observed in figure 5 and 6 is an increase in agricultural land, and a decrease in forested land. A closer look at the relationship between agricultural land and forestland, the expansion of agricultural land that is driven probably by population pressure, was by the outflow of bush/shrub land, forestland and grass land. Similarly, the trend in figure 6 reveals that crop land has a linear relationship with population growth. This is most probably because the newly emerged individuals tendency to convert forestland to cropland as a means to get access to farmland. As the population continues to grow, the gap between supply and demand for agricultural land continues to expand. Such a situation is leading to severe land-use conflicts between the crop production, and other types of land use such as forests, which will cause further clearance of forestland and, consequently, environmental degradation.

Moreover, the correlation between population and change in cropland in figure 6 indicates the prevalence of shifting cultivation and the weak technological improvement for a large number of farmers, as new areas were cleared to increase crop production rather than improving current farming techniques. This has given rise to high rates of environmental degradation, and increasing damage to ecosystems that cannot sustain crop cultivation but have been turned into farms by demographic stress and land scarcity. With the increase of population pressure, development of agricultural production involves an increased risk of land degradation through deforestation and expansion to new lands that are often fragile and susceptible to erosion making them marginal for crop production [21]. The future prediction also shows that Ethiopia is expected to reach a population of 120 million by 2020, will lead to sever increased pressure for access to arable land.

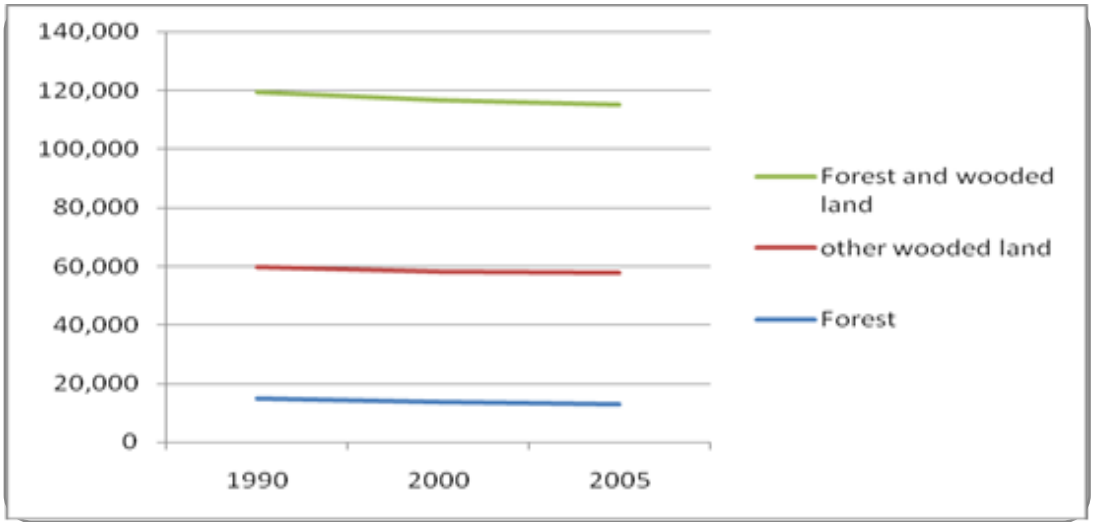

Fig.4. Trend of Forest Resources in Ethiopia over time (1000 ha)

Data source: FAO[27].

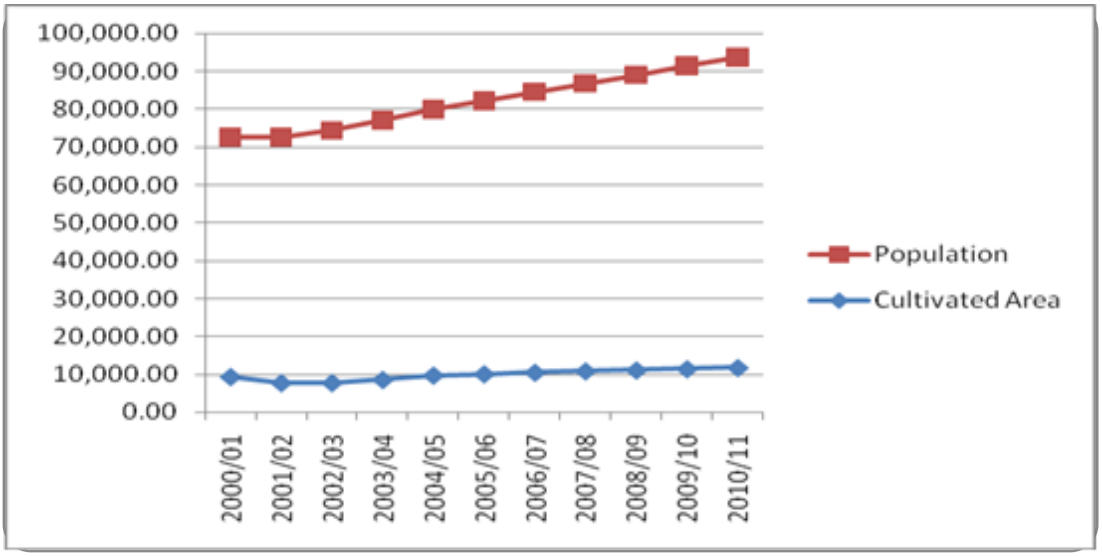

Fig.5. Population-cultivated area linkage:area cultivated is estimated in thousands of hectare

Source: CSA [28].

Local Case studies showing Population-environment linkage

All the above figures are, however, restricted in scope, focusing mainly on large scale, thus context specific recommendation at village or district scale difficult. Therefore, this paper further goes to present local studies[1] conducted to examine the relationship between population growth and environmental degradation so as to support sound and informed decision making for sustainable environmental resource management in different part of the country. This section reviewed few case studies conducted in examining impact of population pressure on the environment.

An Ethiopian Highland Reclamation Study [29] in the highlands of Ethiopia shows environmental degradation is most severe in the highlands, especially in the northern half of the country due to exponential growth in population, long history of settlement, primitive land-use practices which included clearing of vegetation cover for farming and fuel, and lack of innovation in farming practices. Amare [30] on his study on Gilgel Abbay catchment was found expansion of agriculture and settlement areas and decline of forest and wetland cover with increase of population in the catchment area.

Similarly, Gete [31] observed a reduction of forest cover in central Gojam from 27% in 1957 to 0.3% in 1995. Solomon [32] in western Ethiopia observed a similar trend from relatively extensive forest cover in the 1960s. The demographic argument, namely population growth, linking degradation with the action of the rural households in Wollo, is believed the consequent increase in the demand for food has pushed cultivation in to the more marginal and more fragile ecosystems; and the same process has led to the shortening or abandonment of fallow. The result is greater exposure of the land to the force of erosion, and greater loss of soil fertility [33].

The empirical evidence on the highlands of Nile basin in the period between 1950 to 2000, where the population in the Ethiopian highlands is estimated to have increased by a factor of 4, from about 16 million to about 65 million, shows intensification of land use in the rain-fed highlands, resulting in shortening and eventual abandonment of fallow periods, expansion of cultivation land into grazing land, and wherever forests existed, continued deforestation, particularly in the western parts of the highlands [34] . This is consistent with the premises that the larger the family (and hence the smaller its land assets), the greater its dependence on environmental resources, such forests and woodlots, grazing lands, wet lands, etc.

The analysis of land cover change data in lake Tana over four different period and population dynamics in 1984, 1994, and 2007 reveals that population is one of a driving force for environmental change (table 1). Although population growth was declining, it was increasing rapidly and brought the scarcity of land, deforestation, over use of lake's water and soil erosion in the catchment. As shown in (Table 1) from 1973 to 2008, there was a dramatic expansion of agricultural land followed by bush and wood land but forest land, wetland and grass land showed a reduction in aerial coverage and it is clearly shows agricultural land increases at the expense of other lands and leading to use marginal lands and accelerate land degradation as indicated that bare lands expanded. This probably explained by exerted population pressure resulted from increased population growth trend in the Woreda more or less in similar period of time (table 2).

Table 1: Land use change in Lake Tana Woreda from 1973 to 2008.

Land class	Years			
	1973	1986	1995	2008
Forest	1.2	0.6	0.4	0.3
Wood and bush land	3.1	5.1	7.6	7.7
Grass and bare land	20.6	13.9	11.6	9.3
Farm land	26.1	34.9	36.3	41.2
Wetlands	38.3	38.4	38.1	35.9
Lake Tana	10.7	7.2	5.8	5.6
Total	100	100	100	100

Source: Amare and Ramesware [10].

Table 2: Population Trend in Lake Tana Woreda from 1984 to 2007.

Population size	**Years**		
	1984	1994	2007
Female	284031	427182	577557
Male	296227	436250	585399
Total	580258	863432	1162956

Sources: CSA [35] [36] [28].

Contrary to the above local study's findings, the study conducted in Wollo by Dessalegn reveals that although he recognize the force behind large scale land degradation in the 1960s' are enormous, however, he argued that the worst enemy of environmental protection programs in this country was not peasant agriculture, nor population pressure, but policy related to rights to land and environmental resources [37]. An important option suggested by Dessalegn to reduce this pressure is that land users should be able to move out to other small towns and urban areas looking for employment without the fear of losing their property. This is not possible at present because of the current land policy where farmers lose their land rights if they move to urban areas restricting optimal utilization of land and mobility of labor. The land policy should take population dynamics and free movement of people into account.

VI. CONCLUSIONS AND POLICY IMPLICATIONS

This paper have reviewed several dimensions of the relationship between population and environment, focusing on various demographic factors and offering empirical evidences on their relation to selected aspects of environment from the context of Ethiopia. Results from

[1]Local studies is important in the sense that the extent of environmental implication of population dynamics in different part of the country is different in such a way that the rate of population growth and the livelihood dependence on natural resources vary across space and time.

the reviewed documents and analyzed national and local data disclosed a substantial environmental degradation in Ethiopia. Total population also exhibited positive growth as a result of natural increase. Environmental degradation correlated with population growth, which in turn was driven mainly by fertility. This could have a negative side effect on environmental conditions in Ethiopia. The national and some local areas data on population growth and environmental degradation reveal the role of increasing population size is especially prominent as the major force driving the need to increase food production, and the environmental stresses on forests that stem from agriculture.

However, the relationship between population and the environment is even more complex than this paper suggests. Although the result presented in this paper highlights the impact of population dynamic on environmental degradation, some of the implications drawn from the previous studies conducted in different local areas witness that population growth "is not the only factor affecting the rate of resource degradation, and in many contexts it is undoubtedly not the most important factor. Other factors such as land tenure system, and weak agricultural extension services that will help intensification would be a huge array of obstacles for better resource management. The policy implications drawn from this paper are *encouraging policies enhancing sustainable intensification of land resources that would lessen the need for agricultural extensification that could latter reduce pressure on environmental resources.* In the short-run, family planning policy that enables couples to avoid unwanted pregnancy would reduce fertility and population growth that will result reducing pressure on environmental resources is recommended. Finally, this paper posed a concern to see the complex interaction of non-demographic factors in determining population's environmental influence for further research.

REFERENCES

[1] Dessalegn Rahmato, Yeraswork Admassie, Yared Mekonnen, 2007. Population, Health and Environment Integration in Ethiopia:Exploring the Opportunities and Challenges, Population Reference Bureau, Addis Ababa, Ethiopia.

[2] Botkin, D.B., Keller, E.A., 1995. Environmental Science: Earth as a Living Planet. John Wiley, New York.

[3] Malthus, T.R., 1960. Essay on Population (First essay in 1798 and second in 1803, republished 1960). Random House, New York.

[4] UNESA, 1994. Population and the Environment in Developing Countries. Literature survey and research bibliography. (ESA/P/WP.123). UN Population Division, Department of Economic and Social Affairs. The draft document is made available through UNPOPIN. New York.

[5] Mortimore, M., 1993. Population *Growth and Land Degradation. Journal of Geography*, 31:15–21.

[6] Boserup, E., 1965. The Conditions of Agricultural Growth: The economics of agrarian change under population pressure. Earth scan Publications Ltd, London.

[7] Berry, L., 2003. Land Degradation in Ethiopia: Its Extent and Impact. Commissioned by the GM with WB support.

[8] Simon, J., 1990. Population Matters: People, Resources, Environment and Immigration. Transaction Publishers, New Brunswick, New Jersey.

[9] MacKellar, Landis, F.,Lutz, W., McMichael,A.J., Suhrkein,A., 1998. Population and Climate change, in Steve Rayner and Elizabeth Malone, eds., Human Choice and Climate Change: The Societal Framework, Vol. 1, Columbus, Ohio: Battelle Press.

[10] Amare Sewenet, Kameswara, K., 2011. Impacts of land cover/use dynamics of Gilgel Abbay catchment of Lake Tana on climate variability, Northwestern Ethiopia. *Applied geometrics*, 4(3), 155-163.

[11] Assefa Hailemariam, Teller, C.H., 2005. Recent Demographic and Reproductive Health Trends of Ethiopia: Implications for the Future. Paper presented in Implementing Best Practices in Reproductive Health Conference organized by USAID April 3–4, 2005, Global Hotel, Addis Ababa, Ethiopia.

[12] PHCC, 1991. The 1984 Population and Housing Census of Ethiopia. Analytical Report at National Level. Population and Housing Census Commission. Transitional Government of Ethiopia.

[13] PHCC, 1999. The 1994 Population and Housing Census of Ethiopia. Results at Country Level, Volume II Analytical Report. Population and Housing Census Commission, Central Statistical Authority, Federal Democratic Republic of Ethiopia.

[14] PCC, 2008. Summary and Statistical Report of the 2007 Population and Housing Census. Population Size by Age and Sex. Population Census Commission,Federal Democratic Republic of Ethiopia. Printed by United Nations PopulationFund, Addis Ababa, Ethiopia

[15] Assefa Hailemariam, 1994. Population Dynamics and Development in Ethiopia. Proceedings: National Workshop on Integrating Population and DevelopmentPlanning. Ministry of Planning and Economic Development, Addis Ababa.

[16] Lori,M.H., 2000. The Environmental implication of population dynamics. RAND, Arlington. Pp. 116.

[17] Amare, S., 2012. Retrospective Analysis of Land Cover and Use Dynamics in Gilgel Abbay Watershed by Using GIS and Remote Sensing Techniques, Northwestern Ethiopia," *International Journal of Geosciences*, 4(7):1003-1008.

[18] Kebede Tesfaye, 1994. Theoretical considerations of demographic variables in development programs/project. In: Integrating Population and DevelopmentPlanning. A workshop proceedings, 5–9 May 1994. MoPED, Addis Ababa.

[19] NFFS, 1993. The 1990 National Family and Fertility Survey Report.Addis Ababa, Ethiopia: Central Statistical Authority.

[20] EDHS ,2005. Ethiopia and ORC Macro, Ethiopian Demographic and Health Survey 2005. Ethiopia and Calverton, Maryland: CSA andORC Macro. Addis Ababa.

[21] Sisay Asefa and Tesfaye Zegeye, 2003. Rural poverty, food insecurity and environmental degradation in Ethiopia: a case study from South Central Ethiopia. Paper presented at 2nd EAF/IDR International Symposium on Contemporary Development Issues in Ethiopia, July 11–13, 2003, Addis Ababa, Ethiopia. 21 pp Retrieved 25 October 2008 from http://www.eaf/idr/research /economic-sector-work-on-poverty-and-land-degradation-in-Ethiopia.

[22] Lakew Desta, Minale Kassie, S. Benin, J. Pender, 2000. Land degradation and strategies for sustainable development in the Ethiopian highlands: Amhara Region. Socio-economics and policy research working paper 32. ILRI, Nairobi, Kenya. 122 pp.

[23] Bezuayehu Tefera, Gezahegn Ayele, Yigzaw Atinafe, M.A. Jabbar, Paulos Dubale, 2002. Nature of causes of land degradation in Oromiya Region: A review. Socio-economic and policy research working paper 36. ILRI (International Livestock Research Institute), Nairobi, Kenya. 82 pp.

[24] Markos Ezra, 1997. Demographic response to ecological degradation and food insecurity: drought prone areas in North Ethiopia. Doctoral Dissertation, University of Groningen, The Netherlands: PUDOC publication series.373 pp.

[25] Lambin, E.F, Geist, H.J, Lepers E., 2003. Dynamics of land use and land cover change in tropical regions. *Annual Review of Environment and resources*, 28: 205–241.

[26] Gray, L.C. 2005. What kind of intensification? Agricultural practice, soil fertility and socioeconomic differentiation in rural Burkina Faso. *Geographical Journal*, 171: 70–82.

[27] FAO, Global Forest Resources Assessment 2005, Main Report, Rome.

[28] CSA (Central Statistical Agency), 2007. National population and housing Censes, Addis Ababa, Ethiopia.

[29] Amare Sewnet, 2010. Population and Land Cover and Use Dynamics in Lake Tana Catchment: The Case of Gilgel Abbay Catchment,Upper Blue Nile, Northwestern Ethiopia, PhD Thesis AndhraUniversity, Department of Environmental Sciences, India

[30] Gete Zeleke**,** 2000. Landscape Dynamics and Soil Erosion Process Modeling in the Northwestern Ethiopian Highlands [PhD thesis]. Berne, Switzerland:University of Berne

[31] Solomon Abate,1994. Land Use Dynamics, Soil Degradation and Potential for Sustainable Use in Metu Area, Illubabor Region, Ethiopia. African StudiesSeries A13. Berne, Switzerland: University of Berne.

[32] McCann,J., 1984. From Poverty to Famine in Northeast Ethiopia: A Rural History 1900-1935. Philadelphia, University of Pennsylvania Press.

[33] Hurnl, H., Kebede Tato, Gete Zeleke, 2005. The Implications of Changes in Population, Land Use, and Land Management for Surface Runoff in the Upper Nile Basin Area of Ethiopia. *Mountain Research and Development*, 25 (2): 147–154.

[34] CSA (Central Statistical Authority), 1984. "The Population and Housing Census of Ethiopia; Results at a Country Level," Office of Population and Housing Census Commission, Central Statistical Authority, Addis Ababa.

[35] Central Statistical Authority (CSA), 1994. Population and Housing Census of Ethiopia. Results for Benishangul Gumuz Region. Ethiopia, Addis Ababa.

[36] Dessalegn Rahmato, 20001. Environmental Challenge and State Policy in Ethiopia: Lessons from past experience. FSS Monograph series 2, Forum for Social Studies, Addis Ababa, Ethiopia.