THE RELATIONSHIP BETWEEN LAND USE, POPULATION, ECONOMIC DEVELOPMENT AND PRODUCTIVITY IN AFRICA

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Introduction

Economic development means not only a long process of structural transformation of social production through rising gross domestic product and income per capita, but also a long process of structural transformation in material inputs through reallocating natural resources (Cipolla, 1962). Land, as a crucial element and a key factor of resource inputs in social production, is always the most telling witness of such transformations.

Land use refers to human activities that transform land cover. Land cover refers to the suite of natural and man-made features that cover the earth's surface (Wessels et al, 2004). Land use change studies in relation to economic factors continue to attract attention all over the world. For instance, studies done in Austria reveal changing patterns in the economy and energy metabolism resulted in massive changes in landscapes and ecosys//tems and sustainability problems in the 19th century (Krausmann et al 2002). Studies done in United Kingdom show that change in energy sources played a great role in transforming land use from small holder agricultural lands to large scale mechanized agricultural lands (Schandl & Niels, 2002). The study found out drivers of land use change to be human population, energy source, cereal yield and urbanization.

Although several studies on land use and economic development have been done in Africa, less attention has been paid so far to the correlations between economic development, population, land productivity and land use change. With the increasing economic development in the continent, land transformation is expected to take place dramatically. Changes in land use alter the production ecology of ecosystems and this may result in changes in carbon flows (Gielen, 1998). Initial efforts aimed at modeling land use change have focused primarily on biophysical attributes (e.g. altitude, slope or soil type), given the good availability of such data. Incorporation of data on a wide range of socio-economic drivers of change is however required (Turner et al., 1995; Musters et al., 1998; Wilbanks and Kates, 1999). Incorporation of social, political and economic factors is however hampered by a lack of spatially explicit data and by methodological difficulties in linking social and natural data. In this study, we use statistical data to model possible drivers of land use change across Africa.

Africa is the second largest continent in the world. As such, material dynamics in Africa play an important role in many aspects of environment systems including climate change. Understanding material metabolism in the continent is therefore important in formulating future land use policies.

Methodology

The initial phase of this research will employ statistics followed by remote sensing. In this paper, only statistical part of the method was employed. Statistical data was acquired from the FAO and World Bank databases. Data on drivers of land use change such as GDP, population and productivity was extracted and used to develop a database (figure 1). Statistical analysis of the data was then done and results interpreted accordingly. In some cases, due to the high number of African countries, the continent was divided into Eastern (E_AFR), Middle (M_AFR), Western (W_AFR), Southern (S_AFR) and Northern (N_AFR) for ease of analysis. Correlation was done with the aid of SSPSS.

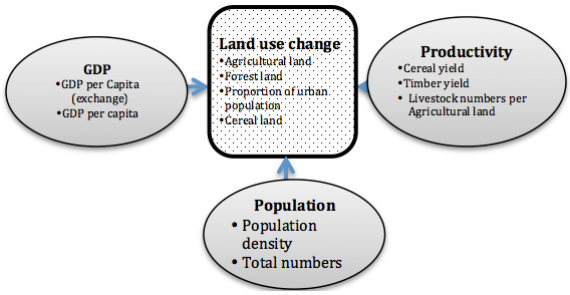

Figure 1: Database Framework

Results and Discussion

Although the proportion of forest area among the East African countries is lower than central and West African countries, the proportion of timber production in East Africa is higher compared to Middle and West African counterparts (figure 2). This may be due to the convenience (low cost) of extracting timber in Eastern Africa because of the advanced infrastructure.

When the per capita agriculture land was compared among different African countries, results show that Namibia has the highest per capita agricultural land in Africa. This is due to the low population of the country in proportion to the available agricultural land. However, although the per capita land is high, cereal productivity per capita is very low as compared to other African countries. This means that the country does not rely on cereal production for its economy but is a net

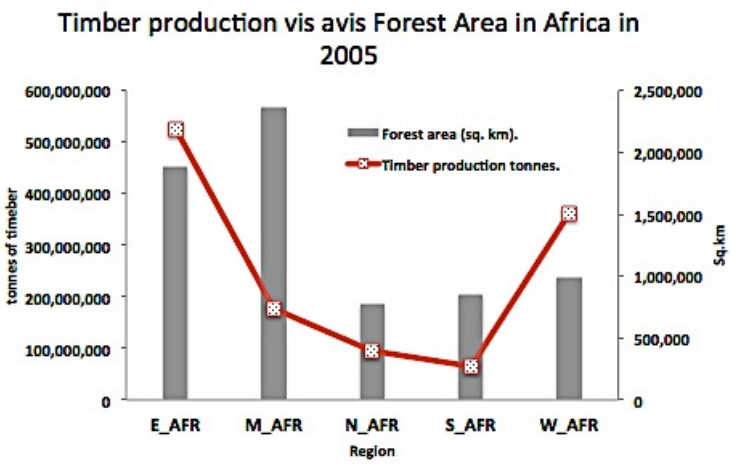

Figure 2: Timber production in Africa

importer of cereals for its population. Further analysis reveals that the total land area of African countries determines the size of their agricultural land. Similarly, the size of agricultural land has positive impact on the population size of Africa. Large agriculture land supports big population.

Cereal productivity various across African countries with high productivity experienced in countries like Egypt and South Africa and low productivity in Sudan and Niger. Egypt's production can be attributed to the available irrigation water throughout the year while South Africa uses fertilizer effectively. Sudan has low production because of instability in that country that affects human labour availability. There is generally high cereal productivity in Eastern Africa and Western Africa. The Northern Africa show very low cereal productivity. This is may be due to low soil fertility and low rainfall in Northern Africa except in Egypt where irrigation is highly advanced.

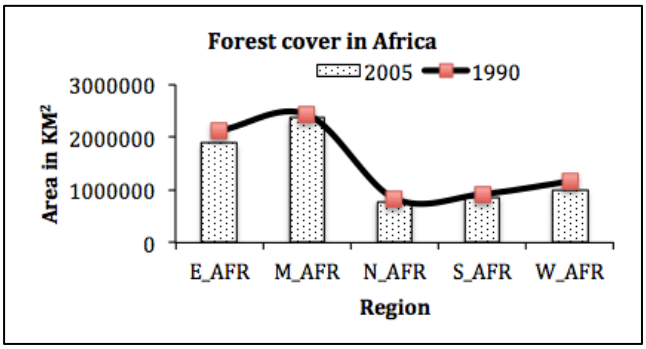

Figure 3: Forest cover, Africa.

Using Pearson Correlation, the total population was found to have no influence on the size of forest land in Africa. However high population density was found to have slightly negative impact on forestland. Between 1990 and 2005, Africa experienced10.4 % increase in agricultural land (table 1) and 8 % contraction in forest land. On correlation, the size of the land has no influence on GDP of countries in Africa. This may be due to other factors that generate income e.g. underground mining and offshore oil exploitation.

Region	2005	1990	Change (km^2)	Change
E_AFR	2984760	2436390	548370	22.5%
M_AFR	929550	922200	7350	0.8%
N_AFR	2369690	2186760	182930	8.4%
S_AFR	2253875	2224460	29415	1.3%
W_AFR	2918580	2610750	307830	11.8%
Total	11456455	10380560	1075895	10.4%

Table:1 Change in Agricultural land from 1990 and 2005.

Conclusion

Various factors influence land use on the African continent. The most significant driver of land use is cereal production. Countries whose economies are dependent on agriculture have more than 60 % of their land classified as Agricultural land. Although the average agricultural land area for the whole world is 37%, most African countries have their agricultural land area above the global average. This means that most African countries still rely on agriculture as the main driver of economic activity. However, with increasing GDP, land use structure is likely to change and tilt the balance. Most countries are now industrializing. Although land use policy was not used during this analysis, it is believed that land use policy has influence on the land use. Land that's not protected is likely to undergo tremendous changes with the increasing human population. Remote sensing data to be used in the second phase of this research will corroborate the statistical findings. At the rate of 8% loss in forest cover, if no measures are taken, Africa may lose its entire forest in the next 187 years. Hence policy shift is critical to increase sustainability of resources on the continent. The high dependency on Agriculture should be evaluated and industrialization promoted to reduce this dependency. With increasing industrialization, there may be increase in forest cover in future. As studies elsewhere show, with increasing income through industrialization, countries tend to shift towards environment protection (Schandl & Niels, 2002). The sooner this happens on the African continent, the better.

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