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ANALYSIS OF CLIMATE CHANGE INDUCED FORCED MIGRATION IN SUB-SAHARAN AFRICA

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Abstract

This article examines how climate change affects international migration and its economic implication on Sub-Sahara Africa, especially the implications on political and social landscapes as well as how it induces poverty, land loss and ethnic clashes. Precipitation patterns are expected to change, where water availability may fall by 20-30%, under a conservative 2°C increase by 2100 leading to stressed local freshwater supplies, reduced crop yields and desertification. Increase in temperature is found to be associated with a 2.66% reduction in the growth of agricultural output, leading to economic growth reductions average of 1.3% points for each degree of warming. Due to land loss for farming and grazing, political instability has increased since the 1980s with several communal clashes occurring in dispute for the remaining arable land. Thus a 54% increase in armed conflict within the sub-Saharan Africa has been linked to the resulting mass migrations.

Keyword: *Climate Change; Migration; Economic; Social Landscape; Conflicts; Land.*

1. Introduction

Migration, as noted by Castles (2002) involves a 'complex patterns of multiple causality, in which natural and environmental factors are closely linked to economic, social, and political ones'. According to Rwamatwara (2005), even though it is difficult to conceptualize, let alone to measure the degree of voluntariness in regard to migration processes,

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the generally agreed interpretation however, is that voluntary migration concerns displacements in search for economic opportunities (Van Hear, 1998). Forced migration, by contrast, is associated with the threat and/or fear that force people to flee their place of residence in search for security and safety (Deng, 1993).

Forced migrations can also be divided into two categories depending on the causes of displacement such as natural disasters on the one hand and migration caused by political violence and/or armed conflict, also known as man-made displacement as well as migration in response to repressive state policies and persecution, that is, refugee migration in a narrow sense, as defined by international humanitarian law, on the other (Sen, 1981).

Following Boano (2008), much of the literature in this area is based on the presumption that climate change results in a reduction of essential resources for livelihood, such as food or water. This may have one of two consequences: those affected by the increasing scarcity may start fighting over the remaining resources; or people may be forced to leave the area by fleeing across international borders or becoming internally displaced. As such, when the migrants encroach on the territory of other people, who may also be resource constrained, the potential for conflict and violence rises (Nordas and Gleditsch, 2007). Barnett and Adger (2007) reviewed a broad range of studies, focusing particularly on countries where a large majority of the population is still dependent on employment in the primary sector, assuming that if climate change results in reduced rainfall and access to the natural capital that sustains livelihoods, poverty will be more widespread, which may lead to increased grievance and recruitment opportunities for rebel movements.

Again, Raleigh and Urdal (2007) found that environmental and demographic variables have a moderate-to-low effect on the risk of civil conflict, but local freshwater scarcity significantly increases the risk of conflict. Reuveny (2007) have emphasised that migration may lead to conflict in host communities citing the Bengali immigration from the plains into the Chittagong Hills and Assam for example. Yet, Suhrke (1997) argued that this case is unique and that there is in fact no systematic evidence for a general link between migration and conflict.

As such, migrants may also be valued for their skills and for their contribution to cultural variability judging from a study by Salehyan and Gleditsch (2006) which indicated that most countries with an influx of refugees since the 1950s have remained peaceful.

Over 42 million people across the world were forced to flee due to disasters triggered by sudden-onset natural hazards in 2010, according to a new study by the Norwegian Refugee Council (NRC)'s Geneva-based Internal Displacement Monitoring Centre (IDMC). In 2009, 17 million people were displaced by such disasters, and 36 million in 2008. The number of natural disasters reported has doubled from around 200 to over 400 a year over the past two decades. In 2010, over 90 per cent of disaster displacement within countries was caused by climate-related hazards, primarily floods and storms. While the precise scale, location and timing of population movements are uncertain, there is growing evidence that they will be substantial and will increase in the years to come. Climate change acts as an impact multiplier and accelerator to other drivers of human mobility. Although, most displacement is likely to be internal, there will also be external displacements.

Knowing exactly how many people would possibly have no choice than to relocate from their present place of habitation to another, just to escape impacts of climate change, may benefit planning and policy in sub-Saharan Africa. Although globally, a daunting estimate of 200 million climate migrants by 2050 has become popular (see Brown, 2008; Myers, 2005; Stern, 2006), empirical studies on how this would play out at the local-to-regional scale is limited. Furthermore, even though studies have shown that climate change is likely to result in flooding and drought (Christensen et al., 2007; Igor and Pao-Shin, 2002; Hulme, 2001; Le Barbe et al., 2000) which especially would cause the forced migration of populations, other possibilities that climate change will make some places better able to sustain larger populations cannot be ignored.

While studies have indicated that the "fertilization effect" of more CO_2 in the atmosphere could increase crop yields and the density of vegetation in some areas (USGCRP, 2000; Khandekar, 2000; Hansen et al., 1981), others have suggested that altered rainfall patterns may mean that rain might increase in areas previously suffering water stress (Kunstmann

and Jung, 2005). For example, Hoerling et al. (2006) predicts that a warmer north Atlantic and hotter Sahara will trigger more rain for the Sahel.

From a protection perspective, there is no compelling reason to distinguish between displacement due to climate change and other disasters. It is not inconceivable then that there might be migration in order to take advantage of the effects of climate change. In other words, climate change might provide both "push" and "pull" for plausible population displacement in the future. Therefore, the role of climate change in population displacement cannot be assumed to be a linear relationship of cause and effect, of environmental "push" and economic "pull" (Brown, 2008).

The non-climatic drivers thus remain a key variable, since it is population growth, income distribution and government policy that push people to live on marginal lands in the first place. Invariably, a community's vulnerability to climate change is not a constant, but can be increased or decreased for reasons that may have nothing to do with greenhouse gas emissions (Pielke et al, 2007; IPCC 2001; Khandekar, 2000; Lonergan, 1998). In this sense it is the non-climatic drivers (which put vulnerable people in marginal situations) that can be as important a determinant of the problem as the strength of the "climate signal" itself (Brown, 2008).

It follows therefore that adaptation to climate change has to be broader than tackling the marginal increased impact of anthropogenic climate change. Focusing on the impacts of climate change without factoring in the local context may lead to some bizarre policy distortions, since anthropogenic climate change only exacerbates existing environmental, economic and social vulnerabilities. This paper therefore attempts to: develop an empirical model linking both climatic and non-climatic conditions to human populations in Sub-Saharan Africa; predict future populations based on prevailing climatic and non-climatic indicators; and, assess the overall impact of climate change on forced migration using GCM projections.

This paper aims to contribute to the complex issues of the migration (displacement)-environment nexus, highlighting the emergence of the term environmental refugee, and the debate that surrounds it. It does not however intend to provide a comprehensive discussion of what

constitutes environmentally forced migration and as such remains open for further revision and additional research. We explored three main dimensions of the debate focusing on the notion of environmental refugees, by;

(i) exploring the terminology environmental refugee and appropriate classifications under such a definition;
(ii) analyzing the real world applicability of such a definition – whether such people even exist? If so, how many? Can environmental factors be scientifically identified as a root cause of displacement?
(iii) exploring the issue of protection for environmental-induced displaced people.

2. Methodology

Since this paper is based on the sub-Saharan Africa, forty-eight (48) countries were selected across the continent leaving out the northern Arabic countries based on the regional differences which have been identified in the vulnerability to climate variability and change from existing studies. In all, about thirty-nine (39) variables were selected and divided into eight (8) groups according to targets and similarities in other to enhance empirical analysis.

The General Demographic variables included Land area (thousands of km^2) derived from FAO (2008); as well as Population Density (pop / km^2), Urban Population for 2009 (% of total), Life expectancy at birth (years) for 2009, the data for all which were sourced from UN, Department of Economic and Social Affairs, Population Division, *World Population Prospects, The 2008 Revision, ADB Statistics Department, Various domestic authorities and IMF World Economic Outlook (March 2010)*, and Proportion of people Undernourished in total population for 2004-2006 sourced from FAO, *The State of Food Insecurity in the World 2010*.

The Economic Indication variables includes Gross National Income (GNI) per capita (Constant 2005 PPP$) as at 2011 and Population below the International poverty line of $1(%) obtained from Domestic authorities and World Bank (Povcal 2009), *World Development Indicators, online Database, Country DHS*, Annual real GDP growth (average over 2001-2009) collected from ADB Statistics Department, Various domestic authorities; IMF *World*

Economic Outlook 2009, as well as Human Development Index (2011) and Multidimensional Poverty Index both obtained from the Human Development Report (2011).

Livelihood related variables used in the analysis include Water supply coverage (%) for 2006 and Sanitation coverage (%) for 2006 both of which were extracted from the WHO, 2009, Joint Reporting Form and WHO regional offices reports, Food availability (Kcal/person/day) 2003-2005 derived from FAO (2010), Unemployment rate obtained from the sixth edition of ILO KILM database, and Perception of overall life satisfaction (0, least satisfied) extracted from Gallup (2011).

Variables categorized to describe Perception of Climate Change among the residents of the various countries all of which were derived from Gallup (2011) include:

(i) Perception that humans cause global warming (% yes),
(ii) Perception on global warming threat (% serious),
(iii) Percentage of population active in environmental group,
(iv) Satisfaction with govt. to reduce emissions (% of population satisfied),
(v) Satisfaction with actions to preserve environment (% of population satisfied),
(vi) Satisfaction with air quality (% of population satisfied), as well as
(vii) Satisfaction with water quality (% of population satisfied).

Migration Indication variables such as Annual immigration growth rate (%) mean from 1960-2005, Emigration rate (%) between 2000-2002, Stock of refugees share of international emigrant stock (%), Stock of refugees share of international immigrant stock (%), and International movement rate (%) between 2000-2002 were all obtained from the Human Development Report (2009). The remaining variables which although were not included in the analysis but was employed in explaining parts of the findings of this paper includes the stock of immigrants between 1960 and 2010 derived from the Human Development Report (2009) as well as the crude birth and death rates involving 5-yearly projections from 1960-2050 was obtained from UN (2007).

3. Result and Discussion

3.1. Demographic issues relating to international movement

International migration, the movement of people across international boundaries, continues to be one of the most important issues of the global policy agenda for it generates enormous economic, social, and cultural implications in both sending and receiving countries. According to a recently published report of Global Commission on International Migration (GCIM), today, there are nearly 200 million migrants internationally around 60% of which are in developed countries, and the other 40% in developing countries, the report also acknowledges that almost one of every 10 persons living in developed countries is a migrant. The more developed regions receive each year about 2.3 million migrants coming from the less developed regions, accounting for two thirds of their population growth.

The patterns of the flow of people between countries are widely influenced by International economic disparities, poverty and environmental degradation, combined with the absence of peace and security and human rights violations are all factors affecting international migration. Today, it is estimated that there are nearly 200 million migrants are living in countries in which they were not born. Around 60 % of all recorded migrants are now to be found in the developed countries, and the other 40% in developing regions. According to the most recent UN statistics on international migration of 2015, Asia has some 49 million migrants, Africa 16 million and the Latin America and Caribbean region 6 million.

It is also worth to note that the composition and concentration of stock of migrants considerably differ from those of the past. A UN publication on Total Migration Stock, noted most of the migrants are concentrated in a small number of countries, 75% are found in just 28 countries. Another interesting observation of the report is that 49% of total migrants are women. Finally, report concludes, all countries are now affected by migration and many, if not most, can be categorized as countries of "origin, transit and destination" (fig. 1).

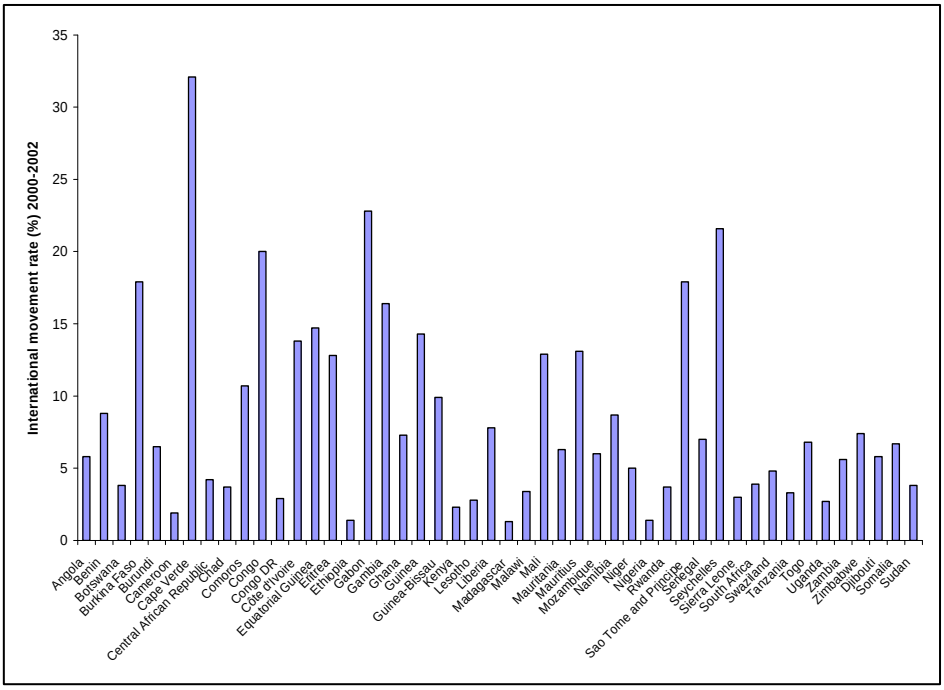

Fig. 1. International Movement Rates by country

The countries showing high rate of international movement are countries with high dependence on the environment for survival; who are mostly agricultural dependent countries in which drought and irregular rainfall pattern affect the crop production and livestock production which in most cases results to crisis in managing the available resources, which lead to war or political crisis making huge number of force migrant across the international borders. Those with low migrant do have other natural resources to fall back on, countries like Nigeria, Angola, and Ghana etc. relying on crude oil, gold and other mineral resources for sustainability of the countries.

3.2. Economic Impacts on Migration in Africa

In most sub-Saharan Africa economies rain-fed agriculture is very important. Changes in rainfall therefore have a critical effect on income

from agriculture. The decline in rainfall has led to increases in rural to urban migration (also Findley 1994). The agriculture sector employs 65% of Africa's labour force and the sector's output has increased since 2000, mainly due to an expansion of agricultural area (World Bank 2013). Yield potential remains higher than actually achieved, with inadequate water and nutrients being the major limiting factors (Mueller et al. 2012). Agricultural production in Sub-Saharan Africa is particularly vulnerable to the effects of climate change, with rain-fed agriculture accounting for approximately 96% of overall crop production (World Bank 2015). The production of crops and livestock other than pigs in Sub-Saharan Africa is typically located in semiarid regions (Barrios et al. 2008). In Botswana, for example, pastoral agriculture represents the chief source of livelihood for over 40% of the nation's residents, with cattle representing an important source of status and well-being for the vast majority of Kalahari residents (Dougill et al. 2010).

Relative poverty, which often limits adaptive capacities of the local population and thus increases vulnerability, is generally highest in highland temperate, pastoral and agro-pastoral areas (Faures and Santini 2008). Higher food prices leading to currency depreciation and conflict and emerging security threats have been identified as a key risk to economic growth in the region (World Bank 2013). Several historical case studies have identified a connection between rainfall extremes and reduced GDP because of reduced agricultural yields. Kenya suffered annual damages of 10-16 % of GDP, not accounting for indirect losses, because of flooding associated with the El Nino in 1997–1998 and the La Nina drought 1998-2000.

The majority of flood losses were incurred in the transport sector, and the drought event lead to a 41 % decline in hydropower production and high costs to industrial production and agricultural losses (World Bank 2004). Similarly, historical temperature increases have had substantial negative effects on agricultural value added in developing countries. Increase in temperature in developing countries has been found to be associated with 2.66 % lower growth in agricultural output, leading to estimates of economic growth reductions by an average of 1.3 percentage points for each degree of warming (Dell and Jones 2012) and reductions in export growth by 2.0-5.6 percentage points (Jones and Olken 2010).

The majority of migration in response to environmental change worldwide occurs within country borders (Tacoli 2009), and much migration is from rural to urban areas. This trend may be exacerbated by the impacts of climate change as they place growing pressure on rural livelihoods (Adamo 2010). Africa's rate of urbanization, already the highest in the world, is expected to increase further, with as much as half the population expected to live in urban areas by 2030 (UN-HABITAT 2010). Patterns of urbanization in Senegal, for example, have been attributed to desertification and drought, which have made nomadic pastoral livelihoods less feasible and less profitable (Hein et al. 2009). While migration in general can be seen in many cases as an adaptive response to local environmental pressures (Tacoli 2009; Warner 2010; Collier et al. 2008), it can bring with it a whole set of other risks – not only for the migrants but also for the population already residing at their site of relocation.

Repercussions can arise from tensions between ethnic groups, political and legal restrictions, and competition for and limitations on access to land. In Niger Republic for example the incident of cattle rustler from Niger trying to steal cattle's from other, who are in that profession moving into the northern states of Nigeria causing havoc by feeding their cattle's vegetation that are already scarce and diminishing due to drought and desertification causing inter rivalry and tension. There are increasing reports of clashes of Fulani herdsmen moving downwards looking for vegetation causing heighten tensions among local farmers and the communities, loss of life and property has been recorded. Some state governments in Nigeria have banned the activities of cattle herdsman in some respective state (fig. 2).

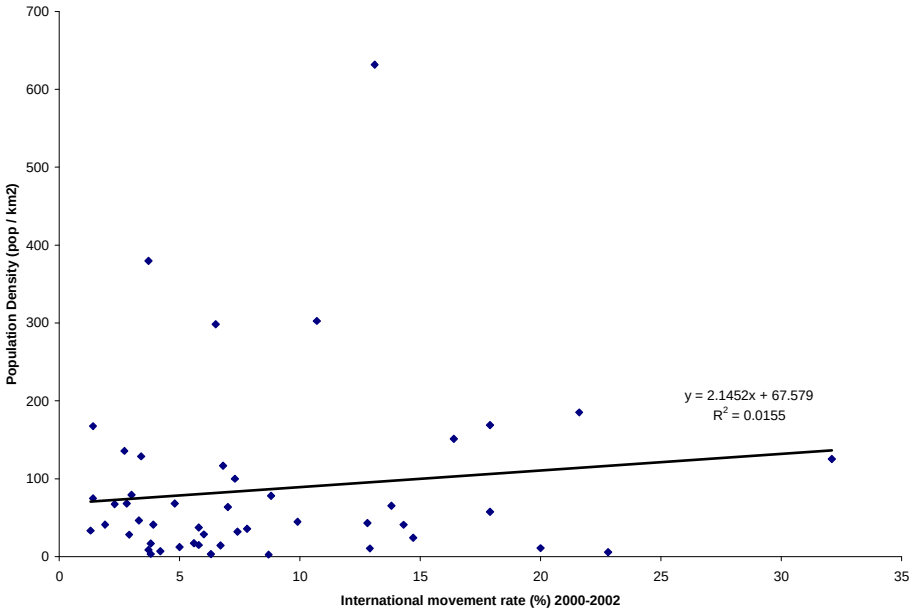

Fig. 2. Relationship between population density and international movement rates

There is a strong indication that climate change affected sub-sahara Africa with high population density tends to moves to area with better economic and political stable countries. Through internal migration, households seek to diversify their portfolio of economic activities in order to ensure survival or to improve their standards of living (Ellis, 1998). Migration is used as a risk management strategy. In Burkina Faso labour migration has been an off-farm livelihood strategy for drought-affected farmers since the 1970s (Nielsen and Reenberg, 2010). Empirical evidence shows the positive economic effects of internal migration on income. In Tanzania, migration added 36 percentage points to consumption growth between 1991 and 2004, according to one study (Beegle et al., 2011). However, positive effects depend on the receiving province's characteristics. Benefits of internal migration only arise under certain conditions. Income inequality is reduced only through migration to provinces with growing industries and labour markets (Phan and Coxhead, 2010). Fig. 3 shows a strong correlation between the numbers of people migrating from sub-Sahara

Africa due to land degradation which not suitable for the agricultural dependent region.

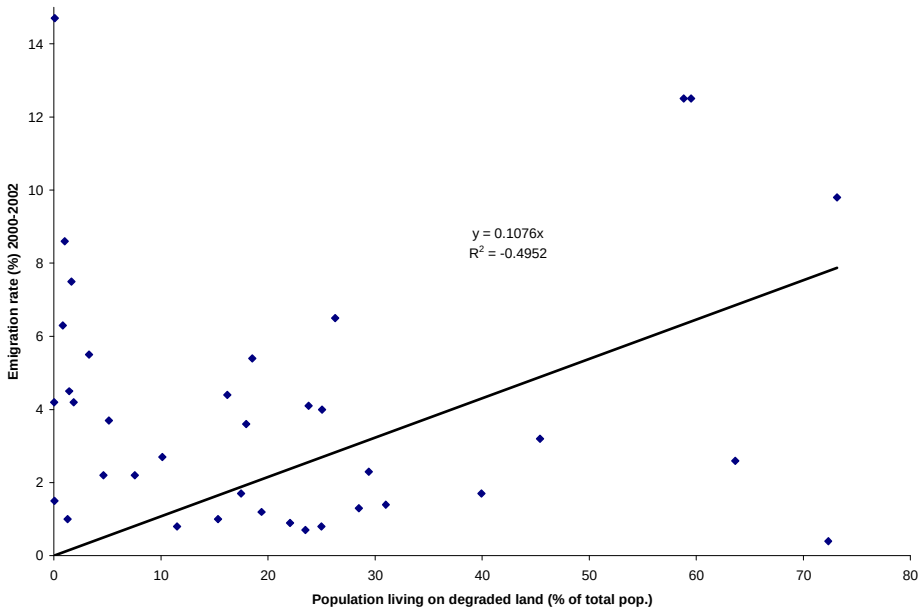

Fig. 3. Emigration rate by populations living on degraded land

3.3. Socio-Political Factors of Trans boundary Flows of People

Climate change has repeatedly been called a major threat to sub-Sahara Africa. Indeed, sub-Sahara Africa has time and again been considered the continent that will be affected most negatively by climate change owing to the combination of severe climate-related impacts, economies that are highly climate-dependent, and countries that have the least capacity to adapt. For example, Cameroon, Chad, the DRC and Nigeria all have high export levels consisting mainly of natural resources. These resources (or natural capital) are estimated to contribute about 26 per cent and 13 per cent to the total wealth of low-income and middle income countries respectively, which, in the main, are located in Africa. The comparative percentage for industrialised nations is just two per

cent. The results reveal that temperature can affect agricultural yields through increases in both crop and surface water evapo-transpiration, resulting in heightened water stress in the absence of irrigation. The combined effect of these mechanisms could be expected to reduce African staple crop yields by 10 to 30 per cent for every degree Celsius (°C) of warming. This is an important finding in the light of the heavy dependence of sub-Sahara Africa countries on agriculture and the production of primary commodities.

Recent predictions suggest an increase of 54 per cent in armed conflict in sub-Saharan Africa by 2030 compared to the 1980–2000 period. Concurrently, the risk of violent conflict and climate-induced armed conflict is considered high for Africa. The climate change-linked spatial and temporal changes in rainfall patterns and frequent droughts make the survivability of African pastoralists in arid environments particularly difficult. The fighting between pastoralists and farmers in the Oromia and Ogaden regions of Ethiopia, inter-clan fighting in Somalia and increased fighting during drought periods in northern Nigeria all indicate the link that exists between the human impact of climate change and the threat of violent conflict. Conflicts between pastoral communities in the arid and semi-arid borderlands of northern Kenya, southern Sudan and southern Ethiopia are linked to competition over access to pasture and water, livestock raiding and the heavy presence of small arms. In such regions, inter-annual and inter-seasonal variability in rainfall patterns determines pastoral mobility and the use of fall back grazing areas, inter-community relations, altered land tenure arrangements and conflict, all of which lead to overgrazing of excessively used rangeland.

The availability of communal rangeland resources across national borders and sporadic pastoralist conflicts over key natural resources are common features in dry lands. Although the availability of resources may seem the natural cause, pastoral conflict may be triggered by the absence of good institutions and external interference. It is not drought but the coming of the rains that is associated with greater concern about conflict, and a strong pointer to the role institutional governance can play in the use of natural resources and access to pastoral lands. While this remark indicates that pastoralists do not fight during a time of

scarcity, but during periods of plenty, loss of life because of the widespread use of sophisticated firearms and the disruption of livelihoods remains a major concern for security policies. Fig. 4 shows strong indication for international movement in relation to land area, the closeness of the sub-Sahara Africa to Europe makes it easy for the international movement.

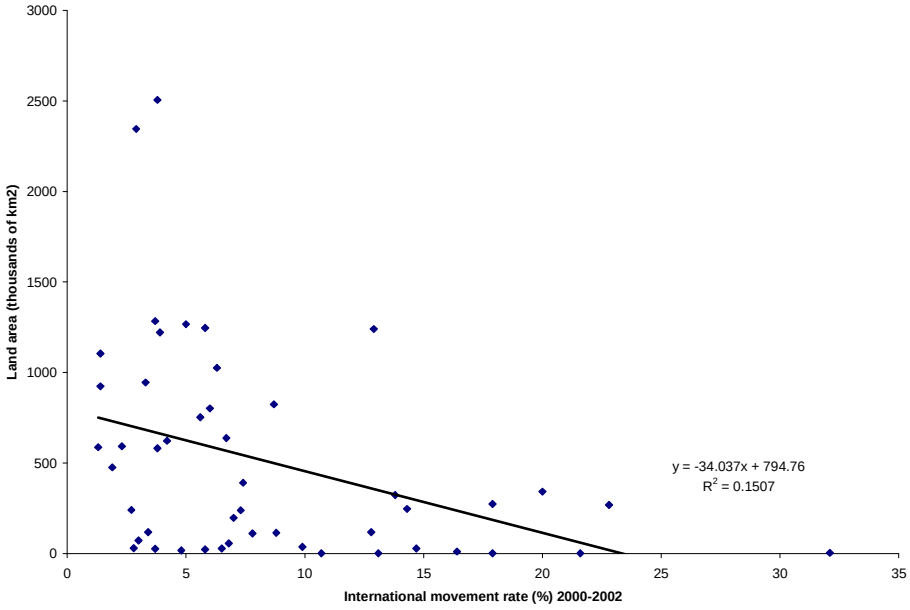

Fig. 4. Relationship between land area and international movement rate

3.4. Perceptions of Climate Change by Sub-Saharan Africans

There is presently enough evidence to say that climate change is indeed occurring. Typical impacts at the global level include the rising global average temperatures of both air and sea, the melting of glacier and polar ice and the rise in the average global sea levels. In the sub-Sahara region, precipitation patterns are expected to change, where water availability may fall by 20-30%, under a conservative 2 °C increase by 2100 (Zachariadis, 2012) leading to stressed local freshwater supplies, reduced crop yields

and desertification. In addition, the frequency and intensity of floods will also increase since rainfall is expected to become concentrated into more heavy events. Fig. 5 and 6 shows there is a strong perception that human activities cause global warming and which induces large scale emigration during the time of natural disaster, drought and heavy rain fall.

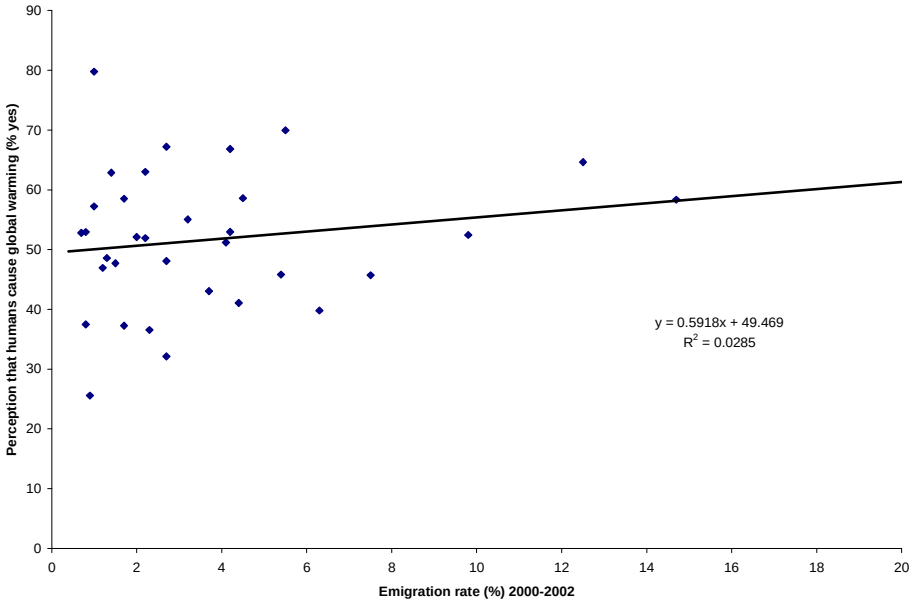

Fig. 5. Emigration rate by perception of global warming due to human activities

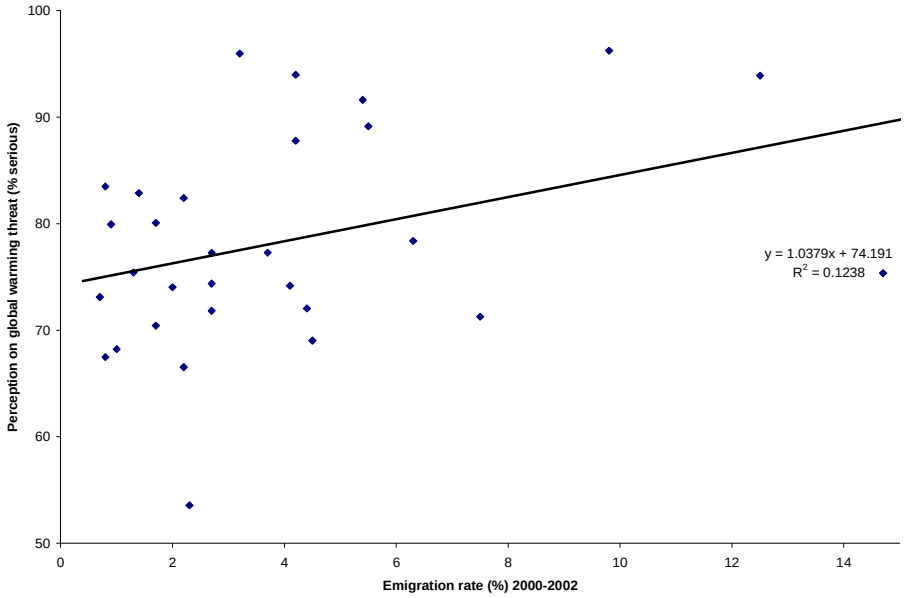

Fig. 6. Emigration rate by perception of global warming threat

3.5 Climate Change-Migration Relationships

A great deal of the academic literature that addresses climate-migration is based on traditional migration theory, which puts forward that drivers of migration can be broken into five broad categories. These include factors that promote out-migration involving environment, political instability, conflict, lack of economic opportunity, among others. Factors that draw in-migrants such as economic opportunity, demand for resources, and political stability, as well as, the so called "network" factors, which either facilitate or hinder the move between the two places. Such networks entail family ties, ease of transport, legality of migration and so many others; while, national policies that hinder or encourage movement and the personal goals or motivations of the migrant may also be important determinant considerations. Fundamental to the theory of climate-migration is the postulate that changes in the environment can serve as a potential contextual driver

that will encourage individuals to leave their homes as environmental stresses make living in one place no longer feasible or desirable. However, these factors and their interactions are highly complex, poorly understood, and context specific. Because of the variety of different reasons for migration, it is often difficult to isolate any one driver as necessary or sufficient. For example, land degradation might negatively impact economic opportunity and influence out-migration – in this case, is the driver the environment, or is it lack of economic opportunity? Research in these directions is necessary at further specific scales especially related to local-to-regional and national surveys.

Some have suggested that the climate-migration literature has put too much weight on the significance of the environment as a driving factor of out-migration. For example, Brzoska and Frohlich (2015) argue that the emphasis on environmental factors as drivers of migration is in fact selective and inconsistent with migration literature. The implications of this are substantial: if the environment is not the significant a contextual factor that some climate-migration literature assumes it to be, the potential number of those displaced by climate change might be markedly lower than current estimates.

In contrast, Reuveny (2007) argues that areas that depend more on the environment (i.e., depend on agriculture for livelihood) will see more environmental migration. This highlights the importance of local context in determining how important environmental factors maybe as drivers of migration. Fig. 7 the high number of deaths shows a strong relationship with emigration due to climate change bringing different diseases due to non-availability of clean water and livelihood. Also in the same vein, Fig. 8 with a second order polynomial shows the high correlation between the population affected by natural disaster and emigration. The number of natural disasters in Sub-Sahara Africa has led to exodus of both local and international migration.

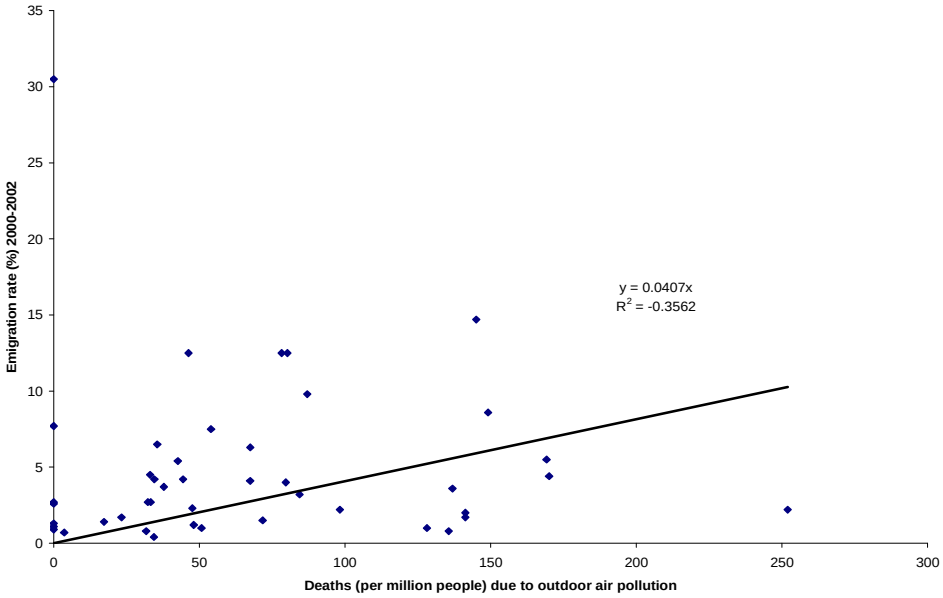

Fig. 7. Relationship of emigration rates to deaths due to outdoor air pollution

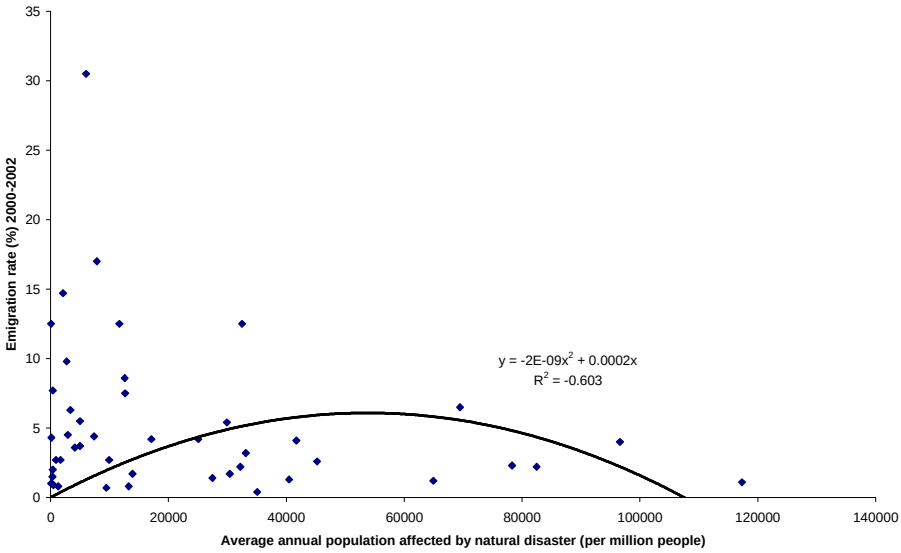

Fig. 8. Emigration rates due to population affected by natural disaster

4. Conclusion

Climate change does have consequences in terms of human migration and mobility, and its impact can be expected to increase. But, given the complexity of the relationship between environmental change and migration, it is worth recalling that climatic or natural hazards do not automatically lead to displacements. At present there appears to be no clear consensus as to how substantial an impact climate change will have on worldwide conflict or the role that migration may play as a part of that pathway. Despite this uncertainty, it is clear that climate change is one of the most significant threats that mankind will need to address in the coming decades, and the potential impacts of climate variability and change on force migration and conflict will remain an important area of research and policy planning.

This paper highlighted the magnitude of the phenomenon of forced migration on the African continent, sub-Sahara Africa has a region battles with high population and been the region on the continent Africa with unstable political landscape. The article insisted on the negative effect of the phenomenon of forced migration on socio-cultural, economic, ecological, demographic and political settings of the communities across the continent, bringing about of man power, brain drain, poverty and likely disappearance of the region on the historical geography due to force migration. Proper mitigation and adaptability must be solely adopted to the survival of the region

The paper encourages more research work should be carried out on these areas of climate change and force migration for better understanding the magnitude of the effect, it has directly or indirectly on sub-Sahara Africa.

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