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Climate Change and Population Dynamics: A Conceptual Framework

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Abstract: The relationship between climate and the population basic parameters is a two-way relationship, each affecting the other. Climate change impacts mainly the livelihood of people. On the other hand, the impacts of people on climate are rather slow and cumulative, and can result in catastrophic levels, through the irrational use of the natural resource base if left unbarred. Climate change is a phenomenon of particular importance in developing countries, where the livelihood of people is based on environmental contributions. The problem with developing countries is not only environmental, but also low investment in all sectors of the economy including health, educational facilities and particularly lack of political will to cater for the poor and the disadvantaged. Most of the budget in these developing countries goes to the military expenditure leaving the little to human development.

Key words: Climate change, impacts on livelihood, developing countries, human development.

المستخلص: العلاقة بين التغير المناخي والسكان علاقة ذات اتجاهين، من حيث التأثير المتبادل بينهما. تظهر هذه العلاقة بوضوح في الدول النامية جيث يعتمد معظم السكان في معيشتهم على الموارد الطبيعية المتأثرة بالظروف البيئية. المشكلة في الدول النامية لا تقتصر فقط على المشكلة البيئية التي تبرز بوضوح في المناطق المدارية الجافة، ولكن تشمل كذلك ضعف الاستثمارات في كل القطاعات الاقتصادية والقطاعات الصحية والتعليمية. على وجه الخصوص، تبدو المشكلة أكثر وضوحا في ضعف العزيمة أو الإرادة السياسية للاهتمام بالشرائح الفقيرة التي تمثل غالبية السكان. ونجد أن معظم موارد هذه الدول تخصص للإنفاق العسكري والتسليح بالدرجة التي تكاد لا تترك الا النذر اليسير للتنمية البشرية.

كلمات مفتاحية: التغير المناخي، التأثير على مناشط الحياة، الدول النامية ، الفقراء، التنمية البشرية

1- Introduction:

The relationship between climate change and the population basic parameters is a two-way relationship, each affecting the other. Climate's impacts on people are through its crucial effects on their livelihood systems, but not on them as species because the human being is the most adaptive of all creatures even to extreme climatic conditions. On the other hand, the impacts of people on climate are rather slow and cumulative, and can attain catastrophic levels, through the irrational use of the natural resource base if left unbarred, thus, keeping the population parameters –spatial distribution and movement, birth rate and mortality rate – within the required bounds requires the sustainability and enhancement of comprehensive development which, in turn, necessitates the sustainability of enabling climatic conditions. This is of particular importance for tropical and sub-tropical regions where most of the under-developed countries are located, and the livelihood systems are essentially environment-based. This does not only mean that such under-development is due singularly to climatic conditions, but also to a multiplicity of interactive factors including low rate of investment, poor expenditure on food production and health and education services, lack of political commitment towards the

disadvantaged and destitute, lack of social justice, political instability, lack of security, and rising expenditure on the military sector. The outcome of these factors is a low level of human development. An example is the Sudan which ranked 154, with an index value of 0.379 in 2010 (UNDP, 2010), and a low level of human development (Table1).

Table (1): Some Human Development Indicators in the Sudan, 2010

Indicator	Value
Life expectancy at birth	58.9
Mean years of schooling	2.9
Expected years of schooling	4.4
Gross national income (G N I) per capita (U S D)	2051
G N I per capita rank minus HDI rank	-22
Population living in degraded land	40%
Population without access to safe water	43%
Population without access to sanitation	60%
Poverty rate among rural population	57.6%
Poverty rate among urban population	26.5%

Source: U N D P (2010), Human Development Report, N.Y., UNDP

The relationship between development and population has been the core concern of researchers and local, regional and international organizations and conferences for about a century, and yet it seems that there is more to come. This reflects the complexity and multi-sidedness of the issue, and the gravity of the political and socio-economic constraints on the way to strike a balance between the well-being of the human society and the well-being of the natural environment with its climatic constituent.

This paper attempts to sketch a general conceptual framework for the relationship between climate change and population dynamics in the tropical and sub-tropical, under-developed countries because, although each of them has its own specifities, they have a number of climatic, socio-economic, demographic and political commonalities. Furthermore, most of these countries are the least contributors to climate change (i.e. in the Sudan per capita emissions of carbon dioxide was 0.3 tons in 2006) , their communities are the most vulnerable to it, are the hardest hit by its impacts, and have the poorest adaptive mechanisms to the impacts of climate change. This makes generalizations possible, as well as the relevance of a general conceptual framework. Also, because linkages between climate change and population dynamics involve a variety of internal and external socio-economic and political issues, the focus of this paper is on the direct linkages between the two categories, with some examples from the Sudan. But, certainly we have to recall the global nature of climate change and its impacts across states and all socio-economic differentiations, as well as the responsibility of the developed industrial states.

2- Climate change and its impacts:

2-1- Climate change:

The exact and detailed particularities of the impacts of the greenhouse gas emissions are not yet conclusively determined, and they are still being researched, and various scenarios computed. Nevertheless, climate change is now a scientifically established fact, and has already started to cause grave risks; some of which may be potentially catastrophic and can be a serious threat to the human civilization. IPCC(2007) states that global warming has already started to manifest itself in a number of ways: decreased frost and lower frequency of cold nights and cold days in temperate climatic zones; drought has become longer and more intense than before and rainfall has become less in amount and duration in tropical and

sub-tropical climatic zones. The IPCC Fourth Assessment has identified the Sudan (our example) as a " hot spot of key future climate impacts and vulnerabilities in Africa … Based on the climate scenario analysis of the First and Second National Commissions, the average temperatures are expected to rise significantly compared to base expectations, while projections of rainfall under climate change conditions show sharp deviations from the baseline expectations.

It is true that climate –related risks and vulnerabilities are partially the product of natural physical processes, but it is truer that they are mostly the consequences of human choices and the irrational practices and actions of the people in their interaction with their ecosystems. The adverse impacts of climate change are already being experienced by the poorest and most vulnerable communities؛ some 267 million persons were affected by climate disasters during the period 2000-2004, and over 98% of them are in under-developed countries (I B O N, 2009). Climate change will continue to be one of the major factors that would shape the prospects for human development during this century through its impacts on general ecology, rainfall, temperature, and the weather system.

2-2- Impacts of climate change:

People live within the ecosystem which is an interdependent functioning system constituted by plants, animals and micro-organisms, and climate is a natural part of it. Although the natural equilibrium of the ecosystem is generally distorted by the excessive and irrational human intervention and interaction, climate has the potential to change ecosystems and many of the resources and services they provide to each other as well as to society. It is predicted that global warming would lead to massive extinction of species, especially micro-organisms, increased and intense drought and desert encroachment which will aggravate the environmental crisis, reduce biodiversity, and possible collapse of biological and ecological systems. Drought-affected areas in sub-Saharan Africa (including the Sudan) could expand by 60-90 million hectares (UNDP, 2007). This is an expansive process because ecological deterioration and lower bio-productivity leads to the use of more fragile ecosystems, and hence desertification. Marine ecosystems are no exception; 50% of the world coral reefs have already suffered bleaching as a result of warming seas; and increasing acidity of the seas and oceans is a long term threat to marine ecosystem (UNDP, 2007). In Sudan coral reefs of the Red Sea are one of tourist attractions to the country.

The deterioration of the bio-productivity of the ecosystem in Sub-Tropical Africa has considerably reduced the supportive capacity of the rural economy upon which most of the population depends. This failing rural economy has driven most of these communities into poverty and destitute; about one billion persons are living at the margin of survival on an income of one dollar per day, and 206 billion people (40% of the world population) on two dollars per day (most of the under- developed countries, including the Sudan); by the year 2050, loss in revenue is estimated at 26% in Sub-Saharan Africa (including the Sudan), (UNDP, 2007).

The chain of impacts triggered by climate on human development and on the population dynamics may be briefly outlined as below.

2-2-1- Population movement:

The geographical distribution of population is being altered by the

various impacts of climate change which are expected to force a billion persons to leave their homes during the coming 50 gears (IBON, 2009). Migration is external or internal, permanent or temporary. Internal migration is almost entirely from rural areas to urban centers because of the combined effects of the rural-pushing and urban –pulling forces pertaining to, among others ,employment opportunities and higher incomes , and basic services. This rural-urban migration has serious impacts on both the sending and receiving areas. The countryside will be losing the young and more educated males, i.e. the more productive people, further depressing the rural economy, increasing rural poverty, and strengthening the push forces. This affects the age and sex composition in both the urban and rural areas leading to more males in the urban, and females and more elderly and children in the rural. Rural migrants face the problem of adaptation to a new mode of life, new occupations, values and social relations. The receiving urban centers will face a number of challenges and problems such as more squatter and informal settlement , social ills like crime and theft, child labour, more pressure on already ailing public facilities and services, dramatic increase in the cost of housing , street crowdedness and car accidents , and general deterioration of the urban environment.

Women and children are more vulnerable to climate change under the condition of unequal division of family labour, and bear a large share of the burden of adaptation. Women are responsible for 80% of total production in many African countries (IBON, 2009). They interact daily with the environment: fetching water under heavier stress of water shortage, collecting fuel wood from further areas, herding animals over longer distances in addition to domestic responsibilities, e.g. cooking, washing and taking care of children. Sometimes husbands stay in receiving areas for long periods, while wives and daughters take full responsibility of all household affairs. Children are also vulnerable to climate change. 10 million children who are under 5 years age die annually of preventable diseases most of which are temperature –sensitive, like malaria and diarrhea. Rising temperature provides the ground for a higher number of cases.

The major climate –related reasons for the spatial movement of people include: Desertification, drought and rainfall variability leading to crop failure or serious decline in productivity, lower income and eventual poverty pushes farming individuals or families to migrate in pursuit of a better livelihood in urban centres. This is true of almost all under-developed countries.

a) Deterioration of the ecosystem, especially the decline of rainfall, has seriously impacted on animal herders. The density of the natural vegetation has declined and nutritious species have been replaced by unpalatable species, leading to a lower value and a less carrying capacity of the rangeland while the number of animals gets bigger .This situation forces pastoralists to move with animals over larger areas and for longer periods in search of pasture and water. The Sudan is a good illustrative example.
b) Submergence of Low Island–states and coastal regions resulting from the rise of ocean and sea levels caused by the melting of ice sheets in the Polar Regions, and the

expected floods would lead to the displacement of people. This will be a large – scale population movement because seal / lake shores and river banks are densely populated (about 40% of the world population live in coastal regions), especially in countries where rainfall is meagre as in large areas in Africa and the Middle East.

c) Decline of bio-productivity, as a result of climate change, has intensified competition over natural resources by different users. This resulted in armed conflicts, (as in the Sudan) between herders and herders on one side, and herders and farmers on the other, and created an atmosphere of insecurity .The impact on population movement is still negligible, but with more erosion of the resource base, intensified competition, more frequent and more violent conflicts and less stability and security, increasing numbers of people will move to other areas where security and safety are assured.
d) The serious deterioration/ collapse of the rural economy is one of the major causes of the decline of the national economy , and poverty is no longer a rural phenomenon only, but has also become an urban feature in under- developed countries . External migration is gaining momentum to rich industrial and petro- countries. It is expected to increase involving rural and urban residents, ranging from highly qualified professionals to unskilled workers.

2-2-2- Mortality:

Mortality rate is generally high, particularly among children and women, in under-developed countries. It is a product of poor health and insufficient medical services and the low level of human development. The main climate– related factors pertaining to mortality include:

a) Food insecurity, malnutrition and climate –induced poverty are the major factors responsible for the high mortality rate, especially among children. 28% of all children in under-developed countries are under- weight or stunted; and about 10 million children die annually before the age of five in poor families (UNOP, 2007). The trend is moving upward.
b) The poor public medical and health services, and the high cost of the private ones for poor families.
c) The suitable environment (climate for the spread of killer diseases); according to UNDP (2007) the malarial annual cases amount to 350-500 with about one million fatalities, 80% of which occur in Africa .
d) The use of excessive chemical pesticides and fertilizers in agriculture to counteract the impact of environmental deterioration; the result is that people eat products with a high concentration of chemicals which are assumed to cause fatal diseases, e.g. cancer.
e) Climate – induced drinking water deficit is pushing increasing numbers of people in dry lands (particularly animal herders) to use open water sources (hafirs) where water is contaminated through use of animals (western Sudan is an example).
f) Floods could claim human lives.
g) Drought and high temperatures increase the risk of fires in dry grass and, in huts built of wood and straw.
h) Lives may be lost during armed conflicts over natural resources.

2-2-3- Birth rate:

A large family had long been regarded as a symbol of social status and prestige. The need for family labour was also a reason. This is increasingly changing and families are becoming smaller. Climate-induced poverty is the major cause of the decreasing birth rate:

a) The high cost of marriage, and of building and bringing up a family.
b) Having only one wife instead of more than one as was the case for many men.
c) Late marriage (at the age of about 25 -35 years instead of less than 25).
d) Higher rate of divorce.
e) Long absenteeism of husbands working abroad and leaving their wives behind.

3- The Strategies for combating climate change

3-1- A common responsibility:

The international contention is that global warming and climate change are variably accounted for by all countries, and that the accruing impacts do not differentiate between countries, economies or communities. So the responsibility is common but differentiated .The responsibility is twofold: the responsibility of causing climate change, and the responsibility of combating it.

Industrial developed countries are the main contributors to global warming and climate change ; their contribution accounts for 80% of the world carbon dioxide build up in the atmosphere ,and for 60% of the world annual carbon dioxide emissions , giving a high per capita value ; in the USA ,for instance , the per capita emissions is 20 times higher than in India , 17 times and 7 times higher than in Brazil and India, receptively (IBON,2009). These industrial countries have created the problem by emitting greenhouse gases for many decades and thereby becoming richer and wealthier. The case is different for the under –developed countries; first, their contribution is limited; secondly, in these countries – including china, India and Brazil which are considered as big contributors– the emissions result from the provision of basic human needs for a vast growing population, and are the hardest hit by the impacts while having the weakest capacities to manage these impacts.

The responsibility of combating the carbon emissions is common but unequal .The combating strategy involves mitigation and adaptation. Industrial countries are more responsible to combat the global warming because they are major contributors, and have the required financial and technical capacities to mitigate or reduce, i.e. reduction of the greenhouse gases emissions. This will be achieved by reducing energy consumption and switching to clean types of energy, e.g. solar, wind, geothermal, hydro and tidal energy. In addition to mitigation, these countries can also develop effective adaptations.

Under-developed countries lack the required funding and technical know-how which could be provided by rich countries to enable these countries play their role in mitigation and adaptation. These countries have to focus now on enhancing the resilience of the more vulnerable communities by promoting the available adaptations, and introducing new ones.

3-2- Adaptations to climate change:

Adaptation has been defined by IPCC (2001) as "adjustments in ecological, social or economic systems in response to actual or expected stimuli and their effects or impacts" This definition refers to changes in processes,

practices and structures to moderate potential damages or to benefit from opportunities associated with climate change." It is, therefore, a package of adjustments to reduce the vulnerability of people to climate change, and to promote sustainable development. Adaptation – whether reactive or anticipatory- should take into account the conditions of the local environment and the needs of the local people, and integrate all its measures into development and poverty reduction processes. It is important to integrate climate change as a cross-cutting issue in development plans because it tends to exacerbate existing socio-economic and political stresses, especially where people depend heavily on climate–vulnerable sectors such as agricultural, animal, forest and water sectors. Such integration or mainstreaming will ensure that climate change adaptation and poverty reduction are implemented hand-in–hand, and will reduce vulnerability, increase adaptive capacity and realize sustainable development. To this end, the N.I. (2012) has identified five steps :

a) Creation of a country climate profile.
b) Preparation of an institutional map.
c) Engagement of shareholders.
d) Assessment of climate change risks and opportunities.
e) Building the capacity of stakeholders.

4- Conclusion:

Given the number of summit conferences held to address the problem of global warming, the convergence and divergence on the required practical actions, and the nature of the capital-driver world economic system and of national governments in the under- developed countries, it seems that high hopes and optimism would be kept within bounds.

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