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Development Process, Planet Earth Resources And Environmental Change

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Abstract

This paper provides an exploratory account of the vital importance of understanding the role of the Planet Earth as a complex system and as reservoir of natural resources essential for human development from local, through national, to global levels. Its analytical framework is the political ecology discourse, which holistically interrogates natural resources, resource use systems, forms of ownership and labour regimes as well as types of commodity chains to underscore the role of power and wealth relations in explaining human well-being and environmental health with a view to equitably allocate scarce resources among and between competing individuals, groups, classes and institutions. Aware that environmental change is inevitable given the forces of both nature and humankind, and that the current unequal terms of trade at the local level, as well as between the developed and developing countries, are in disfavour of smallholders, the paper argues that these should be the burning issues of concern to the new generation of geographers. It advances that a consortium of committed scholars composed of social scientists, on the one hand, and the natural scientists and technologists, on the other, coupled with community-based development partners should be instituted. The paper concludes by advocating citizens' protection against natural resource use systems subjected to extreme socioeconomic-political-ecologic vicissitudes to be treated by the government as human rights issues.

General Introduction

Like in other developing countries, the second decade of the 21st century continues to witness a more articulated integration of the economy of Tanzania into that of developed countries under the umbrella of neoliberal globalization. This situation is exacerbated by extreme global environmental change. It may be advanced that it is yet another period in history where, at the community level, access to, ownership and control over the abundant Planet Earth resources and attendant goods, services and waste there-from are predominantly a function of power and wealth relations (Boyce, 2002).

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It should be acknowledged on the outset that fighting absolute poverty in Tanzanian type of economies, coupled with adapting to the vicissitudes of environmental change, is one of the core development agenda being addressed. It seeks to build a global community that transcends meeting basic needs to one that is typified by self-sustaining growth and development. As correctly stated by Martinez-Alier (2002), it is evident that rampant consumerism in contemporary rich societies, coupled by the desire for higher profits, underlie the perpetuation of underdevelopment and disastrous environmental change in the poor countries of Sub-Saharan Africa (SSA). This state of affairs in the Sub-region is reflected by, amongst several indicators, absolute poverty, famine, powerlessness, civil strife, low level technology, unfavourable terms of trade and environmental degradation.

The current environmental change impacts are obviously putting the human development process of the poor at a greater risk than ever before as articulated in the UN's seventh Millennium Development Goal (MDG), which calls for promoting environmental sustainability. Obviously, for SSA the changing climate and soils threatens, in unique ways, contemporary and future livelihoods of natural resource-based societies—the so-called ecosystem people and their natural resource base. Even though for a community to live within the carrying capacity of its ecosystem is a desirable behaviour; and even though livelihood means are not static given sporadic inventions and innovations that enhance productivity, the current national and global initiatives to enhance human well-being and environmental sustainability have not been comprehensive enough for three main reasons.

First, there is a lack of an organic link between meeting community requirements through local level development projects and programmes, on the one hand, and the functioning of the international market, on the other; a feature that has partly been intricately undervaluing export goods and services and vice-versa. Second, development interventions in the biophysical environment are not nihilistic in approach—e.g., targeting the breeding a drought tolerant crop in a water deficit (drought-prone) environment for increased yield is a stand-alone mitigation strategy. And, third, in the process of environmental change, there is a lack of identification of positive aspects of change in the disastrous situation. It should be borne in mind that an emerging extreme event being developmental might provide an opportunity for community well-being when tactically mainstreamed in the short- and long-term development plans. In fact, divorcing disaster risk-reduction and resilience-building in development planning is a major gap in the search for sustainable development. These features are key attributes at community and international levels that should be discerned in an integrated and holistic search for community development and environmental sustenance. It is

against this background that research directed towards adoption, adaptation and mitigation measures and strategies against such extreme destructive and/or interruptive natural and human caused processes have to be pegged.

In addition to providing an exploratory account of the vital importance of understanding the role of the Planet Earth as a system and as stock/reservoir of natural resources essential for human development, this paper advances that environmental change is derived from extreme natural-cum-human induced process in the hydrological cycle that is a sub-system of the Planet Earth, as well as the soil subsystem that translates into multiple related hazards and development opportunities. It further articulates a robust approach directed towards a better understanding of development processes based on intricate linkages between community wellbeing under environmental change impact on Mother Nature and her natural resources, on the one hand, and neo-liberalism/globalism, on the other (Rugumamu, 2004).

The main thrust on environmental change in Tanzania is on climate and soil change processes, where major human development activities are strongly and intricately linked to natural resource endowments, as well as to foreign inputs and markets that are predominantly influenced by the relationship between communities, the state and transnational corporations (TNCs) (Albo, 2006; Mruma et. al., 2009; Balati, 2009). In this regard, an integrated research approach to the functioning of Planet Earth resources under globalisation is advocated as a better way of understanding how local and regional impacts become global-scale environmental change issues/crisis.

The analytical framework guiding the paper is the political ecology discourse, which holistically interrogates natural resources, land resource use systems, forms of ownership and labour regimes, as well as types of commodity chains, so as to underscore the role of power and wealth relations in explaining human wellbeing and environmental health (degradation). The aim is to seek for equitable allocation of scarce resources among and between competing individuals, groups and classes (Blaikie, 1985; Boyce, 2002; Martinez-Alier, 2002). This framework is to be buttressed in natural resources use systems, and operationalised in the realm of social and natural sciences at the local level with a global perspective. Indeed, this is a paradigm shift that seeks to defeat the thesis that poverty, powerlessness and environmental degradation in SSA begin and end with the local natural resource users themselves and the endowed resources, including supernatural beings. This misconception of reality, rooted in the colonial ideology, leads to seeking for palliative solutions; and indeed the intensification of poverty, powerlessness and environmental degradation cycle that should be laid to rest forthwith as clearly postulated by Pelling (2003).

It is against this background that this study advances the exploration of the intra- and inter-relationships and processes within and between components of Mother Nature that transcends academic specialisation as revealed by the Planet Earth System Model (PESM). It simply employs the concept that helps to unveil and timely mitigate against socioeconomic, political and environmental risks involved in various natural resource use systems under neoliberal globalism in Tanzanian type of economies. This premise, therefore, seeks to divorce abstracted empiricism by investigating real lifestyles of Tanzanians and their development partners, as well as their production and distribution patterns as a basis for understanding the various political, socioeconomic and ecological process-response relationships that arise from their common investments. This means that at global level, the nature of the unequal power and wealth relations between smallholder producers and their business/development partners has to be addressed and redressed in the pursuit of equity for community well-being, and for the quality sustenance of the natural resource base.

Thus, the paper advocates the application of a trans-disciplinary research that holistically integrates the Planet Earth's spheres in order to understand how the system really functions. The approach fits 'hand in glove' with the investigation of environmental change impacts on local community functions and their global ramifications. It is further envisaged that this approach would direct a viable search for a bottom-up cum-top-down formulation of natural resource-based community development and environment management plans and strategies in Tanzania. The set bottom-line is a democratic and participatory planning process, coupled with strategic decision-making for sustainable development. This is a long-term global perspective and an integrated approach to managing human capital, land resource uses, and the biophysical environment. Propagating a democratic and participatory perspective is to be measured in the context of constituting a quality trans-disciplinary team and a pertinent multiple-sector stakeholders. The consortium would work in unison with small-scale land resource users in designing, implementing, monitoring and evaluating local level case studies on natural resource-based projects and programmes for poverty alleviation, political empowerment, economic growth and nature conservancy that spatially have global dimensions.

Towards Understanding Planet Earth Resources and Environmental Change

The United Nations has proclaimed 2008 to be the International Year of Planet Earth (IYPE) (Rugumamu & Ikingura, 2009). This was spearheaded by the United Nations Scientific and Cultural Organisation (UNESCO). Three years—namely 2007, 2008 and 2009—were designated to raise greater

awareness and understanding of the role of geosciences for human life and prosperity. Mother Nature, a reservoir of potential and contemporary natural resource base, forms the core of human development in the Planet Earth as an open system. There is need for geographers to seriously reflect on the application of the principles of thermodynamics and the general systems theory of non-equilibrium for a better understanding of the PESM, which postulates that the emergent properties in the model are those of a whole which cannot be reproducible to the sum of the effects of isolated components, and that these are not present at the lower level, nor can they be explained or reduced to the components that interact to generate it. In this regard the product is not a sum of the separate elements.

This, in essence, is the complex nature of Mother Nature, the stock of natural resources wherein humanity's survival and that of life itself depends on maintaining a functioning dynamic earth system. In this regard, activities that impact on this disequilibrium are a matter of international concern—the changing environment being the case in point. As noted above, the PESM, adapted from Harding (2003), is employed as a conceptual framework to diagrammatically demonstrate the intricate inter- and intra-linkages and processes inherent in the major components of Mother Nature and her natural resources under the influences of human activities (Fig. 1).

Based on the concept of spherisation, the PESM provides a more satisfactory 'conceptual framework' for a better understanding of the relationships of the key component parts of the Planet Earth within which their interactions can be discerned. It thus unveils the complex and dynamic changes (process-response) in the major Components of Mother Nature (Planet Earth in Our Hands, 2007), leading to human adaptation which results in community and environmental well-being or otherwise. In a nutshell, the model explicates the functioning of the integrated attributes of the exosphere (outer space including the sun), atmosphere (gases/ liquids/solids), hydrosphere (snow and ice, oceans, seas, lakes and other surface water bodies), lithosphere (geologic and geomorphologic components), biosphere (living organisms), pedosphere (land/soil), anthroposphere (humans and their activity processes) in a disequilibrium (Fig. 1).

These components' dynamic relationships, namely, inter-actions, intra-actions as well as processes exacerbated by past and present human activity processes (increased natural, human-induced and human-made disasters, resources degradation, emissions of greenhouse gases and ozone depletion) result in cumulative severe environmental impacts with frequent adverse consequences on human health, land use systems, ecosystems and biodiversity as cited by Mugurusi (2009) as well as on landscapes as noted by Hambati and Rugumamu 2006, for example. These

are, in essence, a function of exploitative resource use systems under the currently globalised economy (Blaikie, 1985; Boyce, 2002; Rugumamu 2004; Wisner, et.al.2005) the fact that there are no two humanly occupied parts of the Planet Earth that are exactly alike, notwithstanding. The role of culture, innovation and the being of a natural resource exhibit themselves in this regard. It is in the interest of this debate, therefore, to unveil communities and areas wherein resource users and their development partners would manipulate their (resource-limited) smallholders' environment by employing appropriate science, technology and innovation as well as by ensuring equitable distribution of the surplus for improving their (smallholders') livelihoods and for the sustenance of the integrity of Mother Nature.

To better understand why some communities act more positively to conserve environmental quality more than others calls for examining how social decisions are governed by the distribution of power and wealth at local, national and international scales. Furthermore, to better understand the forces behind an individual or community to respond to environmental change by way of adaptation to and/or mitigation against extreme events (hazards/disasters) also calls for an assessment of the actor(s)' knowledge, skills and perceptions of the phenomenon in wider political socioeconomic-ecologic dimensions. Indeed, it need not be overemphasized that, in reality, the environmental change issue is complex because of an enormous number of factors/players and the variety of their relationships/processes—an area of current intellectual concern to professional geographers.

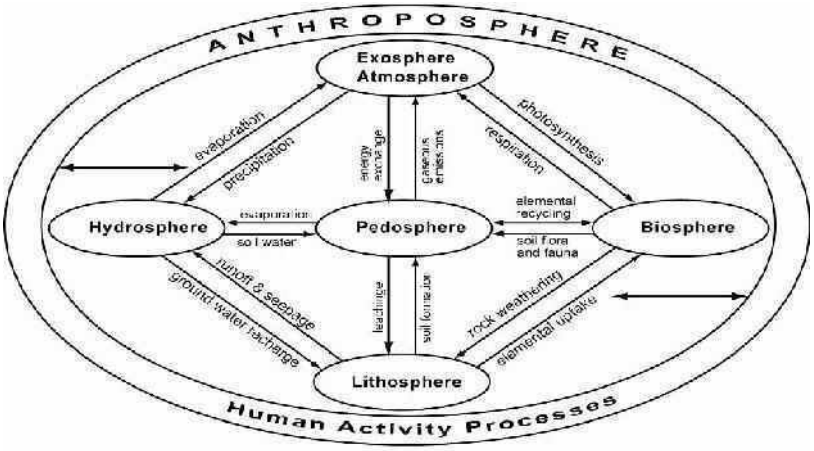

Figure 1: ***The Planet Earth System Model***
Adapted from Harding 2003

Situating Climate within Environmental Change of the PES

This section points to key facets on climate within the environmental change of the PES as postulated in a complex subsystem referred to as the hydrological cycle (Fig. 2), which is a component of the ESM (Fig. 1). This positioning is a robust framework in so far as it creates the basis for a better understanding of the importance and implications of the cycle's structure and function in relation to climate change and society in particular, and the entire biophysical environment in general (c.f. to decipher similarity, compare and contrast the two diagrams). Given the complexity that climate and pertinent hydrometeorological changes are of local scale with regional and global ramifications, it is difficult to predict their behaviours. It common knowledge that the present rate of climate change is faster than anything witnessed before, hence defeating adequate lead-time for appropriate measures to reduce the risk of loss of life and property damage. This might be one of the many reasons underlying the current debate on the threat of the changing climate to the human race. The issue at stake, however, is that whatever change (physical/biogeochemical/social) in one component of Planet Earth, triggers changes on the rest. Thus, although climate change is an obvious global phenomenon characterized by extreme destructive climatic events, and now a buzz word in academia and politics, the genesis of this disaster is still contentious as emphasis is only on the term 'climate' and not on 'climatic'.

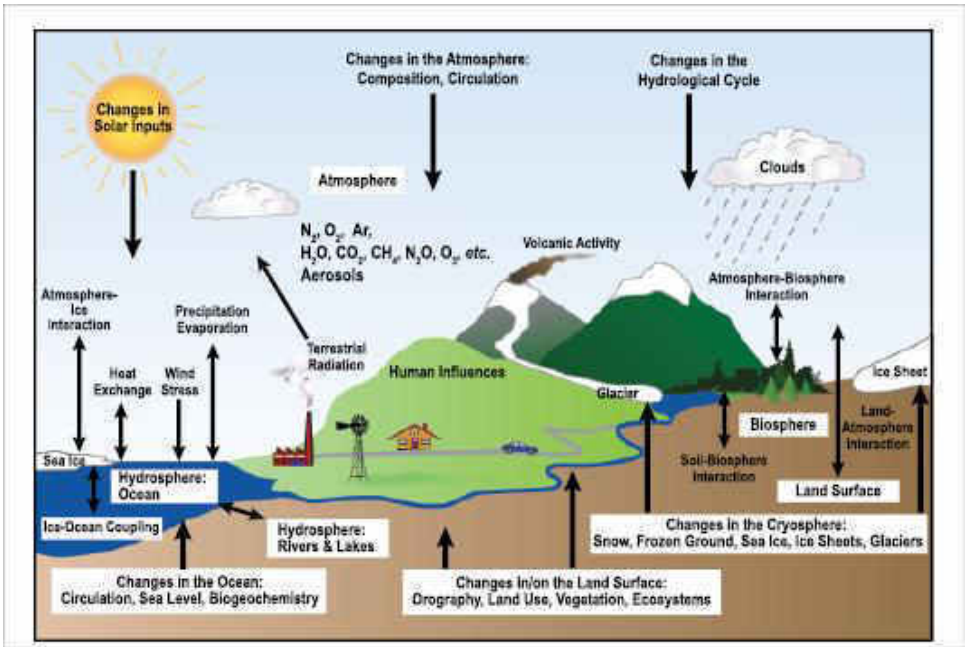

Figure 2: ***Schematic View of the Components of the Climate Subsystem, Their Processes and Interactions*** (IPCC AR4/wg1).

In this case the two terms are deliberately used interchangeably for the sake of consensus in purpose—mainstreaming the hazard/threat in the short- and long-term development projects and programmes. Thus, unlike in other studies, this paper takes a modest stance of a middle-ground approach that recognizes recurring and cyclic catastrophic events every 1500 years (Singers & Avery, 2005); now coupled with the atmospheric greenhouse gases (GHG) conception (IPPC, 2007). The GHG effect ought to be conceived in consideration of the 'carbon sinks' in the major components of ESM. It should thus be noted that at global level, the budget of these gases is predominantly dependent on their solubility to water (hydrosphere), the CO_2 locked up in forests (biosphere), in the soil (pedosphere) and/or those rocks in the geosphere that bind carbon in the deposits of coal, oil, gas, limestone and volcanoes that spew enormous amounts of GHG (Fig. 2). This view, therefore, does not deny physical evidence based on the atmospheric GHG contributing to global warming, as well as variation and change in the weather and climate now being witnessed globally.

Climate is a complex, interactive subsystem of the PES consisting of the exosphere (sun-outer space), atmosphere, pedosphere, hydrosphere, lithosphere/geosphere (geology and geomorphology), biosphere (living organisms) and anthroposphere (humans) as shown in Fig. 2. The atmospheric component of the climate system characterises climate; which is often defined as "... average weather condition at a given time and a given place." Based on the principle of thermodynamics and the general systems theory, it is the emergence of the PES in the context of atmospheric elements (and their variations): solar radiation, temperature, humidity, clouds and precipitation (type, amount, frequency and intensity), atmospheric pressure, and wind (speed and direction). Climate is usually described in terms of the mean and variability of temperature, precipitation and wind over a period of time, ranging from months to millions of years (the classical period is 30 years).

In meteorological studies, climate denotes the degree of variability of weather, and it includes not only the atmosphere but also the hydrosphere, pedosphere, biosphere; and such extraterrestrial factors as the sun, which in the PES' subsystem is known as the hydrologic cycle (Fig. 2). Basically, it is solar radiation that powers the climate subsystem (Fig. 2). The importance of the exosphere-atmosphere interface is reflected in the change of radiation balance of the Earth surface first, by changing the incoming solar radiation (e.g., by changes in Earth's orbit or in the sun itself); second, by changing the fraction of solar radiation that is reflected (e.g., by changes in cloud cover, atmospheric particles or vegetation); and third, by

altering the long wave radiation from Earth back towards space (e.g., by changing GHG concentrations). Climate, in turn, responds directly to such changes, as well as indirectly through a variety of feedback mechanisms. It is in this context that climatic—rather than climate—change is a classic terminology to employ in the current thinking, the severity and frequency of the disasters notwithstanding.

In this regard, it may be discerned that climatic change—or climate change—results into extreme events referred to as meteorological hazards/ disasters and adversely affects Nature and natural resources. The development-climate change-natural resource degradation nexus is buttressed in this premise (Boyce, 2002). This paper argues that whereas hazards are created by Nature, disasters are human-made; and it is this premise that envisions adaptation to, and mitigation against disasters as a major component in the development process.

Situating Soils within the Environmental Change of PES

As mentioned earlier, UN General Assembly adopted a resolution, spearheaded by the FAO, designating 2015 as the International Year of Soils (IYS). The season was referred to as the year of seeking awareness to promote global understanding of the importance of soil for food security and essential ecosystem functions on the PES.

Soil, as a subsystem of the PES (Fig. 1) has to be understood in the context of identification of the main functions that interact with each other. In essence, to understand soils functioning, it is imperative to know the main elements, forces and interactions that propel the processes that allow the soil subsystem to fulfil its roles.

Conventionally, soils directly or indirectly originate from the interaction among parent rock, climate, and organisms over space and time. All these general factors (Fig. 3) were recognized in 1898 by Dokuchaev, the father of pedology (Buol et.al., 1973). In and by itself, however, a unit of soil, a pedon, may be referred to as an open system as it meets the basic requirements. Basically soils constitute the pedosphere, which is a function of a complex interplay between the atmosphere, biosphere, hydrosphere, geosphere and anthroposphere over time and space.

As highlighted in the declaration of the IYS, the USDA NRCS (2015), quoting the Agriculture Secretary, reported that the US celebrated the occasion for this living and life-giving resource. Basically, the soil subsystem's importance lies in the realm of healthy soils for food security, ecosystem functions and resilient farms and ranches. These key functions

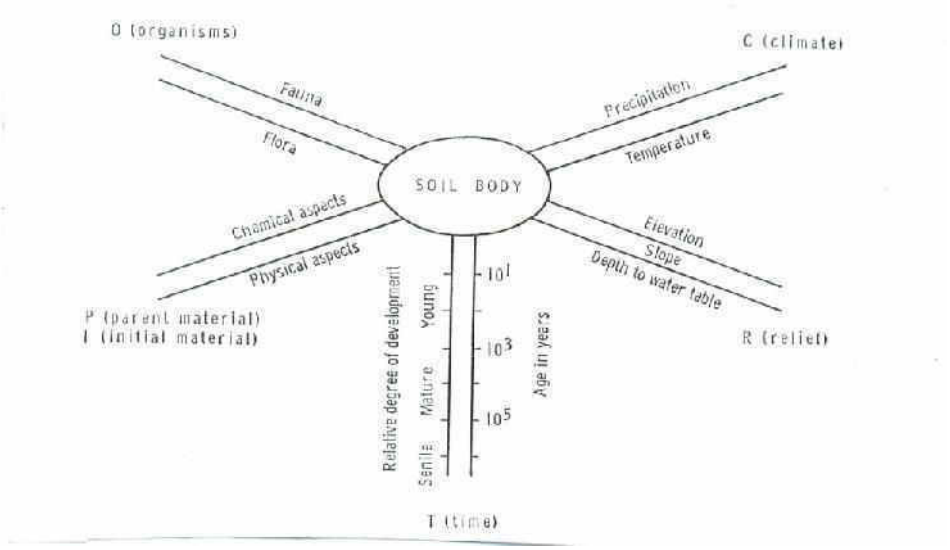

Figure 3. External Factors of Soil Formation
Adapted from Buol, et.al. 1973.

could be paraphrased to include: regulate flows of water, air, and energy on PES; re-cycle raw materials and by-products; serve as medium for plant growth; serve as medium in human engineering construction; respond to management; and resist degradation, thus supporting biological productivity. That food insecurity is one of the poverty indicators, research directed towards enhancing people's awareness on their role in promoting healthy soils for increased yield of crops and fodder cannot be over-emphasised. This would form an interface between economy and ecology.

Environmental Change Impacts on the Economy and the Biophysical Environment

This subsection sets out to demonstrate the dominant role played by human activity processes (anthroposphere) in sustaining non-equilibrium in the Planet Earth system (Fig. 1). It should be pointed here that the adverse impacts of meteorological and soil sub-systems on the economy and biophysical environment is a complex catastrophe and resource. Notably, like other types of disasters, over and above being destructive, they also provide opportunities for human well-being and hence development. This point of view is substantiated by the fact that cultural, political and socio-economic growth is generated by a technological change that is favoured by capital replacement, which is always needed after a disastrous event. This fact, however, does not mean that a disaster is a 'one-off' event. Hence, given that the livelihoods of most people in the SSA, and indeed in Tanzania, appear to

be predominantly dependent on the changing conditions of Mother Nature and natural resources, the need for monitoring possible positive impacts of environmental change cannot be overstated. As a disaster strikes, built-in adaptive capabilities and hence development measures in Tanzanian type of economies are almost always forgotten. This behaviour tends to create a political, socio-economic and cultural dependency syndrome, a tendency that should be crushed down forthwith after conducting scientific research.

Community development is pivoted on environmental resources and, in this sense, land resources. Further, as noted by FAO (1976), the term land is conceptualized as part of the Earth's surface whose attributes include the atmosphere, which forms a continuum into the soil resource base where plants and animals live, including rivers, lakes and oceans below that are geologic/mineral resources; and other cyclic or predictable phenomena including past and current human activities, in so far as they impact the land. In other words, Planet Earth is endowed with heterogeneity of land resources that define and spell its very existence for both the poor and the rich. Therefore, it is indisputable to state that when any of the climate parameters change, the balance in the hydrologic cycle and functions of all other Planet Earth/land resource components are tilted into disequilibrium. Being a global process, a change in any link in one of the sub-systems of the ESM may be felt in distant places at different times, and in seemingly unrelated ways.

This subsection advocates the paradigm that the driver of global change is pivoted on everlasting changes in way of lifestyles given that the human race is the most intelligent species in the PES. Multiplications and variations in resource use systems characterise humans and landscapes, altering them in myriad ways and directions. They are some of the changes that pose risks to humans and the environment, leading to cumulative disastrous conditions of local, regional and global dimensions (UNISDR, 2001; IPCC, 2007). Studies at local, regional and global spatial and socioeconomic political scales point to this disequilibrium, and the complexity of the resulting cumulative consequences within the context of human-biophysical environment relationship. It is worthwhile noting at this juncture such studies should strive to think globally and act locally, hence, a call for broader spatiotemporal and political socioeconomic evidence rather than on-site conditions.

Analysis of on-site conditions reveals that a change in the major parameters/characteristics of climate and soils has adverse effects on conventional systems of farming, livestock keeping, fisheries, mining and food security. It should be noted that spatially, culturally and socioeconomically, farming systems range from rain-fed solar energy based subsistence systems to highly productive modern-day farming typified by

heavy dependence on auxiliary energy and artificial nutrient sources. Given that the dominant mode of agricultural production in SSA is subsistence livelihoods, either too much or scanty rainfall or prolonged drought will combine with vulnerabilities of land users to cause famine and related compound disasters. Climatic and soils changes almost always go with prevalence of human, crop and livestock pests and diseases. Such consequences in a sub-region that produces what it does not consume and is renowned for acute food shortages are too enormous for the future generation. It is in this context that the paper calls upon serious scholars, smallholders and their development partners to embark on risk-sharing by capitalizing on gained knowledge and experience about the ever-changing Planet Earth resources in order to create novelty in resource use systems for the well-being of communities and the pristine Mother Nature.

Being the major components of land, climate and soils have since been factored in the age-old land use planning approaches from the 19th century's population carrying capacity of land, through the 20th century's land capability classification system, to the 21st century's ecological footprint model.

One could safely state that all these approaches, including those designed by international institutions like the UNFAO/UNESCO (FAO, 1996) are essentially mechanistic in perspective and devoid of human or plant perceptions. It is imperative to note that climatic variables (e.g., moisture, temperature, and wind) and soil health (e.g., organisms, minerals, moisture, gases, etc.) are perceived differently by various sections of land users. Multiple use per unit area and/or varied resource use in other areas, several types of products of specific land use types, and/or property rights attached to resources and the people to whom such rights are vested, for example, may serve as coping mechanisms and/or mitigation measures in environmental change. This is an academically rewarding area calling for an in-depth study on integrating social and natural sciences, technology and innovation with grassroots initiatives in grappling with diversifying PE and her resources from local to regional and global scales (Mugurusi, 2009).

Climatic change is being witnessed in the decreasing water resource base, yet rainfall should not continue to be the most important water resource for Africa's well being. A fresh water stress around rural settlements and urban areas is now being felt in SSA countries, which are resorting to groundwater sources. Water shortage is adversely affecting livelihoods and will exacerbate water related multiple development initiatives, including irrigation, health, fishing, industry, etc. (Mugurusi, 2009). There are, however, local technologies directed towards rain-making amongst African communities, yet their viability remains parochial and so is the latitude of rain-seeding technology of western societies.

Further, both climatic and soil changes have a direct bearing on plants and animals, especially as regards species abundance and diversity, a feature being witnessed today in SSA. It should be appreciated that effective natural resources management is the basis for enhanced health and quantity of the ecosystem services that promote carbon sequestration and biodiversity services. Currently, the sub-region is witnessing declining wetlands, grasslands, woodlands and forest areas under the process of de-vegetation; which may lead to cumulative adverse consequences such as desertification, environmental refugees, and resource.

Regarding natural resource use systems under globalization, the search for a better understanding of resources based community development in the current socioeconomic and political milieu is worth pursuing. The current wealth greed by a segment of the global community, coupled with resource grabbing of the never-expanding African biophysical environmental resource base, which is perpetuated by both local and international 'investors', is a case in point. There is an urgent need to examine how political decision-making processes in natural resources use are governed by the distribution of wealth and political power relations in the context of Tanzania and other SSA countries.

Taking Tanzania as a case in point, most communities at subsistence level belong to one or a combination of the following categories of natural resource users: smallholder farmers, livestock and bee-keepers, artisanal fishermen/women, small-scale miners, and hunters-cum-gatherers. In essence, these communities are a vulnerable segment of the African society that predominantly depend on a complex set of rudimentary tools as well as traditional knowledge and skills base, popularly referred to as traditional/ local environmental knowledge systems (TEKS) (Rugumamu, 2003). Mining, for example, may be carried out on arable, pasture and forest lands, including settled areas and along river courses, thus resulting in multiple land uses, multiple user roles, as well as multiple produce and a myriad of socioeconomic ecological consequences.

As reported by Olago et. al. (2007), a change in climate variables, other things being equal, triggers adverse effects on other resources; all of which have a bearing on natural available resources. The above non-market based categorisation, however, is very rare given that most individual resource users and households have been globalised to varying degrees, and are susceptible to being exploited by inefficient market systems (Rugumamu, 2004). The issue is complicated by the fact that access to, ownership of and control over the pertinent resources by smallholders is subject to the existing rules and regulations that empower the powers that be to revoke

customary and even modern-day access and ownership rights that run parallel in Tanzania. This is yet another area where serious researchers on community well-being and environmental sustainability would delve in seeking to understand the socioeconomic political cultural milieu in which the powers that be are functioning.

The current trend in natural resource use systems is typified by market exchange which better characterizes the majority of Tanzanians (about 80%). One such resources use system may be described as smallholder market driven maize farmers who rely on semi-advanced technology characterized by improved seed varieties, ox-driven or plough/hired tractors, industrial fertilizers and pesticides, with or without extension services. To some degree this category is applying modern imported farm inputs – the so-called modern-day environmental knowledge systems (MEKS) (Rugumamu, 2003 & 2004). It is common knowledge that unequal terms of trade existing between Tanzanian smallholder producers and their business partners—local, national and international—lie at the centre stage of underdevelopment and natural resources/environmental degradation and soil erosion (Blaikie, 1985).

It is these use systems that in various ways strongly expose the intensity and magnitude of globalization—the ramifications of the international economic systems—neoliberalism (Brand, 2009). In this context, the search for a better understanding of the root causes of the risks posed by the current power and wealth relations between the centre of the world system and its periphery has to be pegged and interrogated by serious geographers. It is evident that the consequences of these political, socioeconomic and cultural relationships span local level decisions, and have a strong bearing on national and international forces through globalisation. The central project in this regard should be searching for an integrated and holistic approach toward creating, sustaining and even promoting an acceptable standard of living of Tanzanians who are potentially capable of mitigating against current and future cultural, political, socioeconomic, and ecologic tresses from the community level upward.

Globalised Development, Natural Resources Endowment and Environmental Change

The proceeding subsection seeks to synthesize the above issues by integrating development processes into natural resources endowment and environmental change under globalization. Basically this is a complex process. The ESM, for instance, is gleaned as an intricate interplay of human activity processes (anthroposphere), coupled with a delicate disequilibrium of other Mother Nature's components that are dominated by

the hydrological and soil subsystems (Figs. 1, 2, 3), which impact on the dynamic ecological and economic subsystems, the scale notwithstanding. One may argue, however, that not all the cultural and biophysical processes have regional or global ramifications to call for the formulation of global convections. The thrust of this subsection is on how to integrate natural resources endowment and environmental change into community development under neoliberal globalization for equitable and rational sharing of benefits between the majority poor and their minority rich partners. This perspective paves the way for conceiving adaptation and mitigation measures against environmental change, poverty and resource degradation as being mainstreamed into community development processes with a national and international dimensions. The object here is on putting the local people and their naturally endowed resources back at the centre of the national and international development planning and management processes. In this regard, there is need to harness traditional knowledge and local institutions in the fry, and promote what may be referred to in the development arena as 'think locally and act globally'.

In this subsection, two issues are advocated based on the political ecology framework. First, by pursuing an integrated and holistic approach buttressed in trans-disciplinary and multi-institutional partnership, as well as on spatiotemporal domains, we postulate a democratic participatory assessment of the state of vulnerability/resilience and risk and capabilities of communities and their Nature and natural resources (under climate and soil changes) including underlying political socioeconomic-ecological drivers. Second, using the same approach the ensuing output is deemed to inform plan formulation, implementation, monitoring and evaluation of development projects and programmes directed toward achieving sustainable community development and environmental health. The anticipated output is expected to promote dynamic, inclusive and sustainable development that positions a local community strategically as part and parcel of a global community in terms of power and wealth relations.

In this regard, the envisaged starting point would underpin the diagnosis of cultural political socioeconomic conditions of individuals, communities, societies, and ultimately nations. This would be followed by the analysis of the attendant nature and socioeconomic status of local, sub-national, national, sub-regional, regional, and international organisations/ institutions (partners) that inform the global system. The nature and characteristics of climate and soil changes in specific geographic areas and periods, as well as their cumulative impacts and ramifications on other PES, and especially on the human activity processes of communities and land use systems, would then be determined. In essence, this is an integrated and holistic framework

directed towards understanding the reality that would inform measures and strategies for poverty reduction and environmental disaster risk-sharing, and indeed reduction of adverse impacts.

The development process advocated is the one by which people seek to resolve the paradox between reach and grasp; between promise and actuality; between dreams of democracy and plenty and realities of poverty and powerlessness. It is conceived in development geography that the paradox is embedded in the social institutions that govern global production and distribution.

This model thus unveils types of commodity chains at local and national levels against those at the sub-regional and international settings as a basis for attaining a win-win-win situation in the equitable sharing of benefits, and in investing in Mother Nature and natural resources as well as in human capital. Basically, initiatives directed towards poverty reduction and the narrowing of inequalities of wealth and power among and between nations can enhance environmental quality by reversing community-based land degradation, including limiting the rich from excessively benefiting from natural resource exploitation of the poor.

To this end, a consortium of committed scholars composed of social scientists on one hand, and natural scientists and technologists on the other, coupled with community-based development partners should be instituted. Social scientists have a role of unveiling the thesis that, because humans are a part of the PE, they have the responsibility and capacity to sustain and/or enhance the integrity of Mother Nature and natural resources by investing in it innovatively, the ever-changing climate and soil subsystems notwithstanding. This means that, being aware that resource uses are social processes, this subgroup should facilitate communities to assume political power and thus influence the production and exchange relations along with honest business and/or development partners (states and TNCs), in order to strike a rational deal in business ventures (Lister, 2000). This arrangement could be referred to as a bottom-up-cum-top-down approach, or a rational and effective public-private partnership (PPP)). This would be in line with the 8th UN MDG that advocates developing a global partnership for development.

In essence, a part of the surplus accruing from the production systems' goods and services, over and above being equitably and rationally shared to meet the real necessary requirements of the natural resource users (smallholders) and their honest development partners, would be directly invested in the rehabilitation of Mother Nature, and the remaining be

could be channelled into supporting research directed towards enhancing human wellbeing and environmental quality beyond the current resilience levels of containing socioeconomic, political and natural shocks. When investment is directed to building a knowledgeable society in the context of human capital, the issue of poverty, powerlessness and environmental degradation is almost fully addressed. The success of this endeavour calls for the formulation and operationalisation of non-structural measures and strategies that have a community face as they bring on board both gender and class issues in resource rights.

The natural scientists and technologists sub-group should seek to ameliorate the TEKS under the umbrella of the culture currently employed by communities in some resource utilisation systems to serve as a pivot for the contemporary MEKS. In the same vein, these scholars have a duty to empower resource users to systematically make wise decisions about resource use and management under the influence of the changing climatic conditions. This initiative would entail the change and/or improvement in resource users' produce, productivities and yields by employing appropriate technologies and innovations that conserve and/or enhance the quality of Mother Nature's components; and by the same token should empower communities to formulate and operationalise structural measures that have a community face.

It is in this regard that social and natural scientists and technologists should design communication systems for smallholders that are directed towards wisdom of adaption of both technologies and content to meet specific information needs (FAO, 1996; PRB, n.d.). To this end, a sustainable development that takes into account the necessities of current natural resource users and their development partners, without compromising those of the future generations and of components of Mother Nature, will have to be advocated, achieved and enhanced. This is all about community empowerment both economically and politically for self-development and for environmental conservancy.

Conclusions and Recommendations

The second decade of the 21st century has witnessed a protracted extensive and intensive utilisation of Tanzania's natural resources, especially in the fields of arable and pasture lands, forestry, water, aesthetics, fisheries and minerals. Central to the resource use issue is the question of smallholders' access to, ownership of and control over Planet Earth resources for optimal investment and subsequent rational and equitable shearing of the benefits, which largely remain a socio-political concern of a constitutional dimension. Incidentally, the commoditization of the above goods and services are increasingly more dependent on TNCs than ever before. Thus, this paper

advocates that an integrated and holistic approach that recognizes complexity in the integrity of Mother Nature's components (resources) and the role of local communities, and the State in the democratisation process, coupled with the risks of globalisation be employed in formulating integrated community-based Planet Earth resources development projects and programmes.

In such initiatives the local communities, government and their genuine development partners ought to be in command of short- and long-term investments in the production and exchange activity processes at all spatial and institutional scales. The viability of projects and programmes is much dependent upon knowledge of alternative funding mechanisms—both local, national and global—in so far as the market forces tend command. This is a robust approach capable of ensuring that future investment policies will guard against exclusion of resource-limited smallholders, resources overexploitation, and shall compensate local communities for productivity decline due to environmental degradation and/or resource depletion, as well as market failures. To this end, the need to invest in political ecology informed research and development (R&D), a domain of professional geographers, cannot be overemphasized for it forms the engine of positive change.

Aware that environmental change is inevitable given the forces of both Mother Nature and humankind, and that the current unequal terms of trade at the local level, as well as between the developed and developing countries are in disfavour of smallholders and are up-scaling, then these should be the burning issues of concern to all serious geographers of the day. To this end, it is worth stating that the protection of citizens against natural resource use systems subjected to extreme socioeconomic, political, and ecologic vicissitudes should be treated by governments as human rights issues. This, too, is an area calling for prominence in a democratically written constitution. There is, therefore, an urgent need for empowering communities politically and economically to enable them define their destiny; in addition to promoting community-based science, technology and innovation. It is in this context that natural resource use systems that meet individual and community necessities and aspirations, including environment health, should form local, national and international development agenda. Here, global environmental change, political will and a new world economic order should enhance Mother Nature and natural resources resilience and community well-being instead of causing multiple cultural, political, socioeconomic, ecologic hazards, disasters and emergencies.

It is prudent, at this juncture, to state that more attention should be paid to the formulation of community-based development projects and programmes directed towards a green economy that has built-in disaster risk-reduction measures. In a nutshell, the proposed activities will help to

reinforce to the Tanzanian public the message of sustainable self-development through wise uses of Nature and natural resources for the benefit of the current and future generations. This is a paramount challenge for geographers in the Second Decade of the 21st century to put into the fry of their professionalism.

References

Albo, C. 2009. The Crisis of Neoliberalism and the Impasse of the Union Movement. *Development Dialogue,* 51: 119-131.

Balati A.A. 2009. The Geopolitics of Globalization and the Dilemma of Development in Africa: The Case of Inequitable Global Policies of Mineral Resource Use. In W. Rugumamu & J. Ikingura. *Proceedings of the International Year of Planet Earth*. UNESCO..

Blaikie, P. 1985. *The Political Economy of Soil Erosion in Developing Countries*. Longman Group Limited.

Boyce, J. K. 2002. *The Political Economy of the Environment*. Edward Elger, UK.

Brand, U. 2009. Environmental Crisis and the ambiguous Post-neoliberalising of Nature. *Development Dialogue*, 51: 103–118

Buol, S.W., F.D. Hole & R.J. McCraken. 1973. *Soil Genesis and Soil Classification*. The Iowa State University Press.

FAO. 1976. *A Framework for Land Evaluation*. Rome 22.

—. 1996. *Guidelines for Land Use Planning*. FAO Development Series 1.

Hagget, R.J. et. al. 1976. Conceptual Models in Pedogenesis: A Discussion. *Geoderma,* 16: 251–266

Hambati, H. & W. Rugumamu. 2006. Towards Sustaining Land Use Systems: Environment and the Land Use in Northern Tanzania. In A. A. Komba (ed.). *Sustainable Development and the Environment in Tanzania: Issues, Experiences and Policy Responses*. Dares Salaam: OSSREA Tanzania Chapter.

Harding, J. 2003. Community Coping Strategies http//unfccc.int/files/adaptation.

IPCC. 2007. Climate Change Impacts, Adaptation and Vulnerability, Contribution of Working Group 11. Cambridge University Press Cambridge. IPCC Planet Earth in Our Hands, 2007 International Year of Planet Earth. UNESCO. Paris.

Lister, S. 2000 Power in Partnership? An Analysis of the NGO's Relationship with its Partners. *Journal of International Development*, 12: 227–239.

Martinez-Alier, J. 2002, *The Environmentalism of the Poor*. Edward Elger .Northampton, Mass. USA.

Mruma, A.H., A. Minde, P. Semkiwa & E.B. Temu. 2009. Appraisal of the Stratigraphy and Mineral Resources Potential of Tanzania. In W. Rugumamu & J. Ikingura (ibid.).

Mugurusi, E.K. 2009. Climate Change and Sustainability in Africa. In W. Rugumamu & J. Ikingura (ibid.).

Olango, D.O., M. Umer, S., P. Ringrose, P. Huntsman-Mapila, E.N Sow & B. Damnati. 2007. Paleoclimate of Africa: An Overview Since the Last Glacial Maximum. In O. L. Olango & E. Niang. *Global Change Processes and Impact in Africa: A Synthesis*. East African Publishers.

Pelling M. 2003. *Natural Disasters and Development in a Globalising World*. London: Routledge.

Population Reference Bureau (PRB). (n.d.). Strategies for Sustainable Development: Case Studies for Community-Based Population, Health and Environment Projects: A Teaching Guide. www.prb.org.

Rugumamu, W. 2003. Combining Traditional Knowledge and Expert Assistance in Environmental Planning and Management: A Case of Msimbazi Flood Hazard in Dar es Salaam City, Tanzania. *Journal of the Geographical Association of Tanzania,* 30: 78–89.

—. 2004. The Utilisation of Africa's Environmental Resources and the Challenges of Globalisation: A Case Study from Eastern Africa. *African Journal of International Affairs*, 7(1&2): 12–23.

Rugumamu, W. & J. Ikingura (eds.). 2009. *Proceedings of the International Year of Planet Earth*. Dar es Salaam: UNESCO.

Singers, S. F. & D. T. Avery. 2005. The Physical Evidence of the Earth's Unstoppable1500-Year Climate Cycle. Htpp//www.nepa.org/pub/st.

United Nations International Strategy for Disaster Reduction (UNSDR). 2001. *Targeting Vulnerability. Guidelines for Local Activities and Events*. UNISDR. Geneva, Switzerland.

United Nations Millennium Development Goals. http://www.un.org/millenniumgoals.

United Republic of Tanzania (URT). 1995. *National Land Policy*. Dar es Salaam: Government Printer.

USDA Natural Resources Conservation Services. 2015. International Year of Soils. FAO Webpage & http://www.nrcs/usdagov/soils/yos/

Wisner, B., P. Blaikie, T. Cannon & L. Davis. 2005. *At Risk: Natural Hazards, People's Vulnerability and Disasters.* London and New York: Routledge.