

CLIMATE CHANGE: CAUSES AND CONSEQUENCES AND THE ISSUES OF SOCIAL COLLAPSE

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ABSTRACT

Man, in the process of meeting his basic needs, has engaged in several unsustainable practices which are currently negatively affecting and changing the climate. The impact of human activities on the climate, therefore, has raised serious concerns and consequences that cannot be generally disregarded. The Intergovernmental Panels on Climate Change (IPCC) and the United Nations Framework Convention on Climate Change (UNFCCC) have identified climate change as the greatest threat of the century and reported that the earth's average temperature has risen by 0.74⁰ C. Both natural and human causes of climate change including the earth's orbital changes, solar variations, ocean currents, volcanic eruptions, et cetera were reviewed. Some measures identified to have potentials to bring about climate change mitigation including the use of renewable/clean energy, carbon capture & storage (CCS) technology and trading plants for carbon as carbon tracking devices; breeding of fuzzy-leaved crops and irrigation as techniques for cooling the atmosphere. The paper concludes that to avert the ongoing trend of negative impacts, it is evident that humans have major role to play in creating a positive climate change. It is therefore the aim of this paper to saliently look at the causes and consequences of climate change and the issue of social collapse.

Keywords: Climate change, causes, effects, mitigation, social collapse

Introduction

Climate change requires emergency preparedness and attention because of its effects/impact on livelihood and sustenance of humankind. However, recent history is replete with various accidents and mishaps, which reveal the lack of preparedness of the various states to deal with emergencies. Perhaps, the biggest challenge in the nation's fight against climate change is lack of awareness and knowledge about this phenomenon as per its causes and effects (Olorunfemi, 2010).

Climate change which according to the United Nations (2022) refers to long-term shifts in temperatures and weather patterns is presently a major topical issue of our time that is impacting human lives and health in a variety of ways.

Human lives and the essential ingredients of good health (clean air, safe drinking water, nutritious food supply, and safe shelter) which are directly linked to the climate are grossly and adversely affected by these distortions of the climate which though there are natural agitation forces but without gainsaying on the long-term trend are mostly caused by human activities on the earth surface (Hayhoe *et al.*, 2018).

Nigeria's climate has been changing, evident in increase in temperature; variable rainfall; rise in sea level and flooding; drought and desertification; land degradation; more frequent extreme weather events; affected fresh water resources and loss of biodiversity (Elisha *et al.*, 2017; Ebele and Emodi, 2016; Olaniyi *et al.*, 2019). The durations and intensities of rainfall have increased, producing large runoffs and flooding in many places in Nigeria. Rainfall variation is projected to continue to increase. Precipitation in southern areas is expected to rise and rising sea levels are expected to exacerbate flooding and submersion of coastal lands (Akande *et al.*, 2017; Ebele and Emodi, 2016). Droughts have also become a constant in Nigeria, and are expected to continue in Northern Nigeria, arising from a decline in precipitation and rise in temperature. Lake Chad and other lakes in the country are drying up and at risk of disappearing (Elisha *et al.*, 2017). Temperature has risen significantly since the 1980s. Climate projections for the coming decades reveal a significant increase in temperature over all the ecological zones (Akande *et al.*, 2017).

Causes of Climate Change

Researchers have attributed climate change to natural and man-made (anthropogenic) causes (Ani *et al.*, 2022; Ochang, 2023). Natural phenomenon linked to alteration of the climate of an area according to Ochang (2023) includes changes occurring within the sun which can result in the change in the intensity of the sunlight that gets to the earth. Carbon dioxide (CO₂) is identified as one of the gases that trap heat in the earth's atmosphere preventing the exit of the heat from the atmosphere thereby raising the temperature of the earth. This is termed "greenhouse effect" or "global warming" (Enete, 2000; IPCC, 2012; Ani *et al.* 2022; Ochang, 2023). Others gases apart from

Carbon dioxide that have been identified to cause global warming include methane (CH₄), nitrous oxide (N₂O) and water vapor (H₂O(g)). Synthetic compounds that also contribute to global warming include fluorinated gases like Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs), Sulphur hexafluoride (SF₆) and Nitrogen trifluoride (NF₃). IPCC (2014) maintained that the main cause of the climate experienced today is the expansion of greenhouse effect.

The natural variability and climate change fluctuations of the climate system have been part of the Earth's history however, there have been changes in concentrations of GHGs in the atmosphere growing at an unprecedented rate and magnitudes in recent years (Crowley, 2000; Paehler, 2007). The causes of climate change can be categorized into two:- **natural and man-made causes** (Crowley, 2000; Paehler, 2007).

(a) Natural causes

The earth's climate is grossly influenced and changed through natural causes such as ocean current, volcanic eruptions, the earth's orbital changes and solar variations

i) Ocean current

The oceans have been shown to be the major component of the climate system. Ocean currents move vast amounts of heat across the world. Changes in ocean circulation may affect the climate through the movement of CO₂ into or out of the atmosphere (Brown, 2010; Hoffman, *et al.*, 2010; Shanta, 2010).

ii) Volcanic activities

Volcanic eruptions are known to throw out large volumes of sulphur dioxide (SO₂), water vapour, dust and ash into the atmosphere. It is known that large volumes of gases and ash can influence climate patterns for years by increasing planetary reflectivity, causing atmospheric cooling. Because these reflect solar energy back into space, they have a cooling effect on the earth's surface (Ammann, 2010; Paehler, 2007).



Explosive Volcanism; Source: istockphoto / loops7

iii) Earth's orbital changes

The earth makes one revolution around the sun once a year, tilted at an angle of 23.5° to the perpendicular plane of its orbital path. Slow changes in the earth's orbit lead to small but climatically important changes

in strength of the seasons over tens of thousands of years. Climate feedbacks have been shown to amplify these small changes, thereby producing ice ages (Crowley, 2000; Paehler, 2007; Perkins, 2010).

iv) Solar variation

The sun is known to be the source of energy for the planet's climate system. Although the sun's energy output appears constant from an everyday point of view, small changes over an extended period of time can lead to climate changes. As the sun is the fundamental source of energy that is instrumental in our climate system, it would be reasonable to assume that changes in the sun's energy output would cause climate to change. But studies by Crowley (2000) and Paehler (2007) have shown that if this were so it would be expected to see warmer temperatures in all layers of the atmosphere.

v) Cloud's contribution

Perkins (2010) reported that global satellite analysis supported by climate models have revealed that cloud cover accentuate warming because as earth's average temperature rises, clouds will accelerate global warming by trapping more heat. Dessler (2010) analyzed satellite data gathered between 2000 and 2010 to estimate the short-term variations in the amount of visible and infrared radiation emitted to space.

b) Man-made/Human causes

Enete (2000) stated that human being has continually uttered the concentration of greenhouse gases and aerosol, both of which influence the climate. Kelechi and Vincent (2021) stated that human industrial and agricultural activities have led to expanded emissions of these gases into the atmosphere thereby resulting to an expanded greenhouse effect. It has been shown (Paehler, 2007) that climate is changing due to man-made greenhouse gases from burning fossil fuels for electricity, cars, trains, aircrafts, homes, flaring of gas at the oil fields like in Nigeria et cetera. Furthermore, land-use and deforestation add pressure to greenhouse gases.

Consequences of Climate Change

Climate change is having serious and unpredictable impacts on the world. These are being felt by both developed and developing countries. These impacts are currently being experienced on agricultural production, health, biodiversity, social, economic, manufacturing and energy sector, etc.

Consequences on Agriculture

The concern with climate change is heightened given the linkage of the agricultural sector to poverty. It is anticipated that adverse impacts on the agricultural sector will exacerbate the incidence of rural poverty. Climate change has the potential to affect African agriculture in a range of ways leading to an overall reduction of productivity which could result to a loss in GDP of between 2% to 7% in 2100 in the Sahara and 2 to 4% in Western Africa (PACJA, 2009). Water deficits may also depress crops and livestock production and

hence, food supply necessitating imports (Usuman and Dije, 2013).

Available evidence has shown that the coastal regions will be hit as climate change upsets ocean currents and fisheries (Idowu *et al.*, 2011). Major changes on fish spawning patterns have already been observed. In the coastal zone, the loss of mangroves as sea level rises will have serious repercussions for fishing as mangroves acts as a sanctuary for young fish to mature (Okali, 2004). Increases in the severity of storms will threaten fishing vessels and crew thereby affecting the fish farmers on board. The viability of inland fisheries is threatened by increased salinity and shrinking rivers and lakes (BNRCC, 2011).

Consequences of Climate Change on Water Resources, Wetlands and Fresh Water Ecology

Climate change will affect the nature and characteristics of freshwater resources. Changes in weather and climate have been known to profoundly influence water resources, a factor that increases the vulnerability of human to infection (Chidi and Ominigbo, 2010). About 25% of the contemporary African population experience water stress, while 69% live under conditions of relative water abundance (Vörösmarty *et al.*, 2005). But abundance does not necessarily mean availability. It has been estimated that a rise in sea level by up to 59cm by 2100 will see several of coastal regions being submerged in water. Such events will no doubt, disrupt the life and activities of the inhabitants as well wreak great havoc on the ecological balance (Onyeka and Adaobi, 2008). UNEP alerts that globally, wetlands have been reduced by 56% and will reduce more by 2100 (UNEP, 2007). It is estimated that one third of all endangered species are dependent on wetlands (Asibor, 2004).

Since the mid-sixties (40) years rainfall has decreased by about 15 to 20 % in average over west Africa and run off have decreased by about 30 to 50% or more over most rivers (Oyebande *et al.*, 2002).

Consequences of Climate Change on Health Sector

Climate change will increase threats to human health thereby affecting their productivity. Already a study by the World health Organization shows that climate change is the cause of 150,000 deaths every year (Nkemdirim, 2023). Heavy rainfall events can also carry terrestrial micro-biological agents into drinking water sources which eventually lead to outbreak of Cryptosporidiosis, giardiasis, amoebiasis, typhoid and other infections (Lisle, 1995; Rose, 2000). Recent evidence showed that typhoid is mostly triggered in high temperature and increased humidity over the years is a proof of climate change.

Consequences of Climate Change on Energy Generation and Supply

Energy services are necessary inputs for every nation's development and growth. And also the fuel driving the engine of growth and sustainability development is a nation's access to reliable and adequate energy (Oyedepo, 2012).

Energy services and resources in Africa will be increasingly be affected by climate change in trends, increasing variability, greater extremes and large inter-annual variations in climate parameters in some regions (US Department of Energy, 2013). Climate change is also expected to negatively impact the already limited electrical power supply through impacts on hydroelectric and thermal generation coupled with service interruptions. It is also expected to result from damage to transmission lines and substation equipment impacted by sea level rise, flash floods and other extreme weather events (Abiodun, 1973).

Impact of Climate Change to Other Various Sectors

Many other sectors are anticipated to be influenced by climate change that may lead to sea level rise, drought, floods etc. and transport sector, tourism, energy and utility will be among most the worst hit as they are directly affected. Tourism especially the beach based tourism will be negatively affected, the beaches and lagoons will be taken over by water due to sea level rise as in the case of Lagos bar beach and Lekki Island (DFID, 2009). The transport systems will not escape the effects of global warming and climate change. For example, higher sea level rise may require costly changes to other ports and coastal roads and railways as the current means of communications along the coast may be covered by the intruding sea water or washed away by erosion. Changes in lake and river levels would also affect inland navigation (Abiodun, 1973).

Climate change impact has caused the Nigerian Government a huge sum of expenditure. The Federal Government has disbursed N3bn from the Ecological fund in the last two years. The fund was established to ensure adequate provision of pools of funds to address ecological problems such as flood, soil erosion, desertification and general environmental hazards. A breakdown of the figures indicated that N2.3bn was disbursed for erosion, flood and pollution control and N765m was disbursed for the provision of incinerators for six teaching hospitals and three Federal Medical Centers (Emeka, 2010). Also a huge amount of funds is been spent by the government in the treatment and resettlement of victims of increasing environmental disaster linked with climate change. Today 80% of all the government revenue and 97% of Nigerian foreign exchange come from Niger delta oil. Some hydrological modeling estimates that a 3 feet sea level rise could put nearly all the Delta's

onshore oil fields under water (Onofeghara, 1995). The DFID study concluded that without a strong adaptive and mitigation response climate change would cost the country between 6% and 30% of its GDP by 2050, worth between \$100billion and \$460 billion (DFID, 2009).

Rising sea level

Sea-level rise is one of the most significant effects of climate change. High projected rates of future sea-level rise have captured the attention of the world. Particularly, countries which are located in low-lying areas as well as small islands are concerned that their land areas would be decreased due to inundation and coastal erosion and, at worst, a large proportion of their population may be forced to migrate to other countries. The level of the sea varies with time and space due to physical processes, such as tide and waves. Mean sea level at a given position is defined as the height of the sea surface averaged over a period of time, such as a month or a year, long enough that fluctuations caused by tide and waves are largely removed. Work has shown that if sea-levels should rise by a metre or more, then many coastal marshes would be submerged by seawater, even those that continue to accrete sediment (Hoffman *et al.*, 2010; Walton Jr & Dean, 2010)

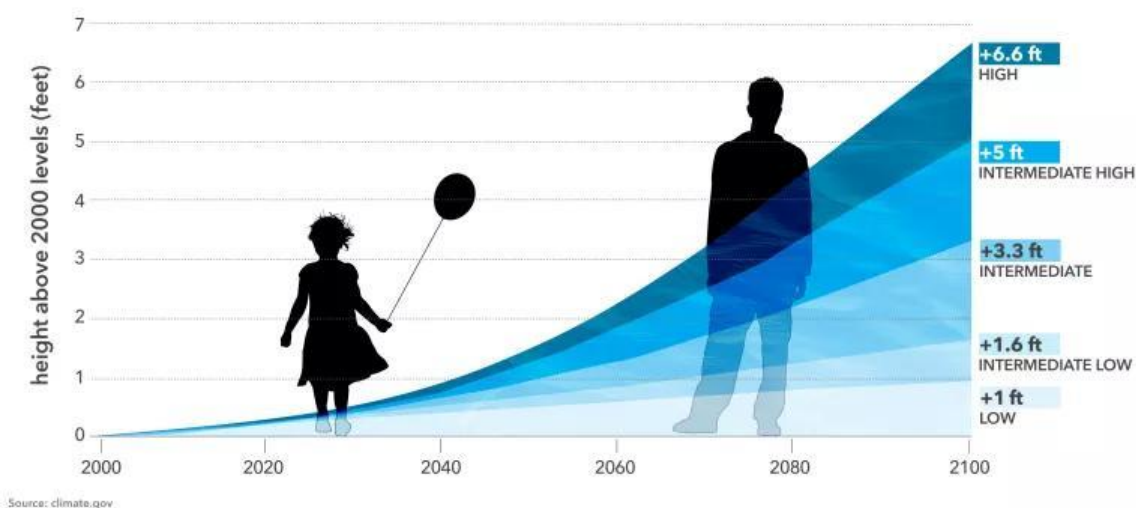


Glacier melting. Source: Ansel Adams, 2005

Sea level rise data

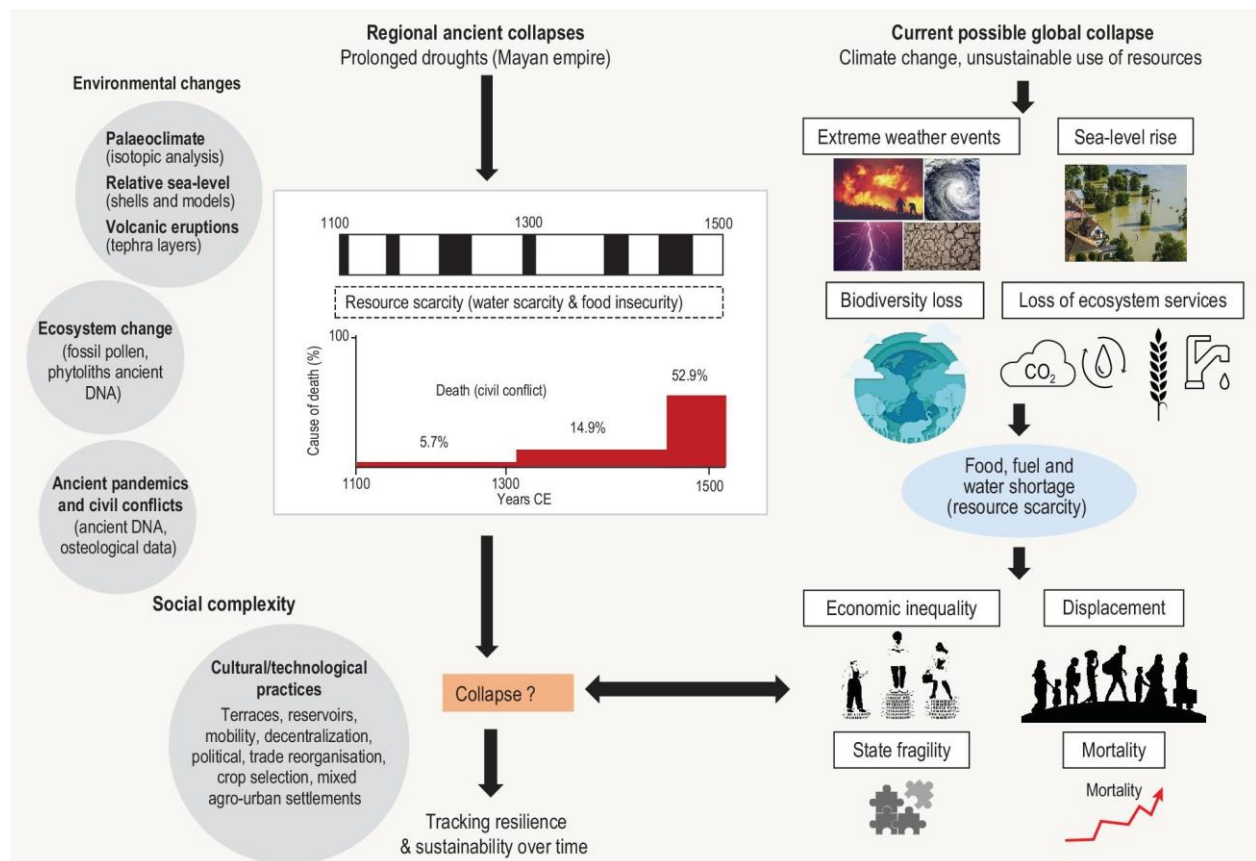
In their [staggering 2022 report](#), U.S. agencies, including the National Oceanic and Atmospheric Administration (NOAA), give a range of five possible sea level rise scenarios based on future rates of greenhouse gas emissions, featured in the sea level rise graph below. These scientists project that global mean sea levels will rise almost 1 foot (0.28 meter) above 2000 levels by 2050—and above 3 feet (1 meter) by 2100. This is our “intermediate” scenario. And if we fail to take significant action on climate change, as projected in the “high” scenario, sea levels could rise as much as 6.6 feet (2 meters) on average by the end of the century.

Projected Global Sea Level Rise to the Year 2100



Future sea levels through 2100, based on the five future pathways described in the NOAA’s 2022 report, *Global and Regional Sea Level Rise Scenarios for the United States*. These pathways differ depending on future rates of greenhouse gas emissions and glacier and ice sheet loss. The “low” scenario is based on the world sharply lowering emissions, while the “intermediate” and higher scenarios are associated with higher global emissions. Human figures are added to show the relative height of sea level rise.

Source: Sweet *et al.*, 2022.

**Figure 1.**

This diagram shows the interconnected nature of climate change, unsustainable use of resources, and civil unrest. It also highlights the relevance of ancient technologies and management strategies to mitigating the consequences of the complexity of climate change.

Source: Peñuelas (2023).

Table 1

Summary of Climate Change impacts on animal, crop, environment, and human subcategories.

Animal impact		Crop impact		Environment impact		Human impact	
Increased incidence	parasitic	Improved pod physiology		Declined vegetation cover		Migration burden of women	
Flooding of fish farm		Increased pest incidence		Changes in soil properties		Reduced women productivity in farming	
Reduced meat yield		Increased disease incidence		Increased transport fare		Decline in occupational activities	
Shift in migration		Seedlings dry up		Gully erosion		Increased malaria incidence	
Reduced birth frequency	birth	Decreased root length		Reduced number of rain days		Reduced household income	
Increased abortion		Decreased soil fertility		Decreased house rent		Destabilization of settlement	
Low fish yield		Poor yield		Groundwater overdraft		Heat rashes	
Reduced feed intake		Poor weed control		Heat stress		Increased fever	
Increased disease distribution	disease	Shortage of varieties		Flooding		Increased cholera incidence	
Increased disease condition	disease	Reduced grain availability		Drought		Induced occupational stress	
Rivers and streams dry off		Poor germination		Soil salinization		High probability of hypertension	

Animal impact	Crop impact	Environment impact	Human impact
Disruption of heat period	Crop destruction	Sea level rise	Increased thermal sensation
Reduced egg yield	Crop withering	Reduced aesthetic quality	Increased catarrh among children
Reduced birth rate	Increased decay of plant materials	Road inaccessibility	Forced migration of residents
Reduced growth rate	Declined forest resources	Desertification	Reduced household health status
Changes in spawning time	Increased storage loss	Shorter harmattan period	Increased skin infection among children
	Poor growth rate		Conflicts with herdsmen
Decreased juvenile availability	Ineffectiveness of agro-chemicals	Migration of wildlife	Increased common cold
	Increased weed population		

Climate change and Social collapse

Climate change poses great challenges to community development such as flooding, dew, humidity. Haze and cloud, to mention few. Climate change is a global challenge affecting every segment of the society. It appears people in the rural areas are better off because they live closer to nature. Climate change has affected virtually every human life in contemporary society and has also brought daunting challenges to virtually all facets of life in contemporary society, including, of course, economic development (Fatile, 2013). Climate change results in fundamental transformation of physical and social life of people.

Climate change may worsen existence social, economic and political challenges, particular for those societies that are dependent on resources that are sensitive to climate change (Buhari, 2015). These climate challenges could throw already stressed resources such as land and water into even shorter supply.

These impacts on social and human systems includes; increased poverty as a result of occupational displacement like destruction of farmlands and businesses by some climate change incidences like flooding and storms. Migration from climate change impacted areas results in resource struggle and conflict among immigrants and residents. These are evident in farmer herder clashes/ conflicts of interest in some areas in the north central, northeastern and southern part of Nigeria, which had been traced to loss of biodiversity and other ecological resources in the area (Ani *et al.*, 2022).

Societal collapse and the threat to civilization

Civilization collapse is the loss of societal capacity to maintain essential governance functions, especially maintaining security, the rule of law, and the provision of basic necessities such as food and water.

Civilization collapses in this sense could be associated with civil strife, violence, and widespread scarcity, and thus have extremely adverse effects on human welfare. Such collapses can be wider or narrower in scope, so three representative scenarios are considered. In a speech about climate change from April 4th of this year, UN General Secretary António Guterres lambasted “the empty pledges that put us on track to an unlivable world” and warned that “we are on a fast track to climate disaster” (United Nation, 2022). Although stark, Guterres’ statements were not novel. Guterres has made similar remarks on previous occasions, as have other public figures, including Sir David Attenborough, who warned in 2018 that inaction on climate change could lead to “the collapse of our civilizations” (UNFCCC, 2022). In their article, “World Scientists’ Warning of a Climate Emergency 2021”—which now has more than 14,700 signatories from 158 countries—William J. Ripple and colleagues state that climate change could “cause significant disruptions to ecosystems, society, and economies, potentially making large areas of Earth uninhabitable” (Ripple *et al.*, 2020). Because civilization cannot exist in unlivable or uninhabitable places, all of the above warnings can be understood as asserting the potential for anthropogenic climate change to cause civilization collapse (or “climate collapse”) to a greater or lesser extent. Yet despite discussing many adverse impacts, climate science literature, as synthesized for instance by assessment reports of the Intergovernmental Panel on Climate Change (IPCC), has little at all to say about whether or under which conditions climate change might threaten civilization. Although a body of scientific research exists on historical and archeological cases of collapse (Middleton, 2017), discussions of mechanisms whereby climate change might cause the collapse of current civilizations has

mostly been the province of journalists, philosophers, novelists, and filmmakers.

Collapse Mechanisms

The scenarios described above are not predictions. An important starting question is whether there are plausible mechanisms whereby scenarios like the broken world or global collapse might occur, and if so, what might be done to counteract them. Several mechanisms that might cause global collapse or a broken world have been discussed. We group these into three types: *direct impacts*, *socio-climate feedbacks*, and *exogenous shock vulnerability*.

However, this does not mean that the risk of climate collapse is overstated. To the contrary, it suggests that collapse could result from climate impacts to which global civilization might have adapted.

In-depth connections between climate collapse mechanisms and scientific literature on social, economic, and political aspects of climate change are quite limited. Moreover, discussions of socio-climate feedbacks and exogenous shock vulnerability mechanisms tend to focus on collapse risks without considering historical cases of successful adaptation to environmental challenges of similar magnitude as some potential climate impacts.

Way Forward to Societal Collapse

Given the above, two recommendations for how research on the risk of climate collapse can more fruitfully proceed are needed. First, more scientific effort be devoted to studying socio-climate feedback and exogenous shock vulnerability climate collapse mechanisms. Among other things, this involves greater attention to pathways whereby direct climate impacts might interact with social, economic, and political factors to threaten societal collapse. Second, collapse mechanisms should be systematically examined in tandem with causal processes involved in successful adaptation to environmental challenges as well as economic forces and policies that could drive a green transition.

Mitigation Measures

Climate Change Mitigation
Renewable/clean energy: The energy sector is the most important sector for climate change mitigation. It is important to control greenhouse gases by moving towards renewable energy development. Despite movement towards the development of policy and legislation in support of renewable energy, there are few existing renewable energy projects (Dioha and Emodi, 2018; Elum and Momodu, 2017). The vast majority of renewable energy consumption that do exist are derived from hydropower (Achike & Onoja, 2014; Dioha and Emodi, 2018; Elum and Momodu, 2017). The development of solar energy is new in some developing countries, with growing interest from investors. The bioenergy industry could receive a boost from a persistent increase in the production of sugarcane, maize and cassava. It is necessary to

develop innovative financing schemes that will reduce the cost of low carbon technologies for consumers in addition to making it a profitable project for investors (Dioha and Emodi, 2018). Other sectors/lifestyle choices: There is a need to encourage sustainable lifestyle choices. These include less meat consumption, phasing out of inefficient appliances, and greater access to and use of public transportation. Public infrastructure and services for effective waste reduction also need to be encouraged (Dioha and Emodi, 2018). Tree planting/reforestation: Reforestation in Nigeria is only about 10 percent of the deforestation rate (Elum and Momodu, 2017). There is an urgent need for a more aggressive tree planting.

Recommendation

The fight against climate change should involve stakeholders at all levels ranging from policy makers to household units; National and international Policies designed to mitigate climate change should be strictly adhered to; assessment and vulnerability mapping should be carried out regularly to gather sufficient data to challenge impacts of climate change; frameworks should be designed to combat the negative effect of climate change.

Conclusion

Although, climate change and its consequences have become one of the greatest threats facing mankind today, it is sadly true that the exploitations and exploratory activities of man himself are the major causes of this increasing effect on the climate and earth's temperature thereby making the livable environment unhealthy and unlivable. To avert the ongoing trend of negative impacts, it is evident that humans have major role to play in creating a positive climate change.

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