

Causes, Effects, and Predictions of the Global Climate Change: 2012–2026

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ABSTRACT

This paper discusses the causes, effects, present state, reality, aspirations, and predictions of climate change from 2012 to 2026. It was noted that despite climate being a natural occurrence, humans are the major cause of the changes in climate through diverse activities such as the emission of greenhouse gases (CO₂, CH₄, CFCs, N₂O), and deforestation. These causes have led to the current state of the climate which has led to extreme global temperatures and weather conditions such as floods. The study propounded some remedies to the climate crisis including early warning and sensitization through Environmental education, climate action and finance, and climate mitigations and adaptations. The discussion of the study could help in planning activities in organising an initial educational sensitization programme about climate change.

1.0 Introduction

Climate change refers to the change in the environmental conditions of the earth. This happens due to many internal and external factors. The causes of climate change are more humanly induced than natural. Many of the extreme weather events that we are experienced in most African countries have become more intense due to anthropogenic activities such as deforestation, and greenhouse gas emission (Olatunde-Aiyedun, 2021). World Meteorological Organization (WMO) highlighted the huge gap between aspirations and reality, with emphasis on the need for much more ambitious action, to reduce the devastating effect of the physical and socioeconomic impacts of climate change. The WMO reported that greenhouse gas concentrations continue to rise to record highs. Fossil fuel emission rates

are now above pre-pandemic levels after a temporary drop due to covid-19 lockdowns. It was emphasized that the ambition of emissions reduction pledges for 2030 needs to be seven times higher to be in line with the 1.5 °C goals of the Paris Agreement.

It has been reported that the past seven years were the warmest on record, with a 48% chance of the annual mean temperature to 1.5°C higher than the 1850-1900 average, in the next 5 years. Cities that host billions of people are majorly faced with increasing socio-economic impacts and are responsible for up to 70% of human-caused emissions. However, the most vulnerable populations suffer the most from extreme weather conditions in different parts of the world (WMO, 2022). Some climate impacts that these vulnerable populations include: Floods, droughts, heatwaves, extreme storms, and wildfires, which have been predicted to be worse in the future, breaking records. Heatwaves in Europe. Colossal and flash floods in Pakistan and Nigeria. Prolonged and severe droughts in China, the Horn of Africa, and the United States. There is nothing natural about the new scale of these disasters. They are the price of individual inhumanity to the environment. It is more important than ever that we scale up action on early warning systems to build resilience to current and future climate risks in vulnerable communities. The education section could be helpful in awareness creation about the detriment of unsustainable human activities that causes the adverse effect of climate change, as well as render solutions to the impact.

United Nations' 2030 Agenda and the Sustainable Development Goals (SDGs). For any nation to be a transformed and prosperous society, the tackling of climate change must be prioritized with a modern, resource-efficient, and competitive economy, which has no net GHG emissions in 2050 and where economic growth is separate from resource use. It also aims to protect, preserve and enhance the natural environment, and to protect the health and well-being of individuals health from the risks and impacts associated with changes in the environment (UNDP, 2015). Climate change does not know borders, contributing to the fast deterioration of the environment. An effective approach to facing climate change challenges is through cross-border cooperation. Cross-border cooperation could be the catalyst to stop ecosystem degradation and develop the basis for a more sustainable development paradigm (Vulevic, et al., 2021).

Objective of the study

The main objective of this review paper is to:

- (i) highlight the major causes of climate change
- (ii) assess the impact of climate change
- (iii) highlight the state of climate change from 2012-2026
- (iv) determine the involvement of climate change in cities
- (v) assess the involvement of the climate change movement; and
- (vi) determine the remedies for climate change

2.0 LITERATURE REVIEW

2.1 CAUSES OF CLIMATE CHANGE

1. Greenhouse Gas (GHG) Concentrations in the Atmosphere

Levels of atmospheric carbon dioxide (CO₂), methane (CH₄), Carbonflouorocarbon (CFCs), and nitrous oxide (N₂O) continue to rise. The temporary reduction in CO₂ emissions in 2020 during the pandemic had little impact on the growth of atmospheric concentrations (what remains in the atmosphere after CO₂ is absorbed by the ocean and biosphere). Data from all global locations, including flagship observatories at Mauna Loa (Hawaii, USA) and Cape Grim (Tasmania, Australia) indicate that levels of CO₂ continued to increase in 2021 and 2022. In May 2022, CO₂ concentration at Mauna Loa reached 420.99 ppm (419.13 ppm in 2021) and at Cape Grim 413.37 ppm (411.25 ppm in May 2021). Global fossil CO₂ emissions in 2021 returned to the pre-pandemic levels of 2019 after falling by 5.4% in 2020 due to widespread lockdowns. Preliminary data shows that global CO₂ emissions in 2022 (January to May) are 1.2% above the levels recorded during the same period in 2019, driven by increases in the United States, India, and most European countries. Despite a strong fluctuation in global emissions

over the past two and a half years, fossil CO₂ emissions fell significantly in 23 countries (many European countries, Japan, Mexico, and the USA) during the pre-pandemic decade of 2010–2019. A quarter of GHG emissions from land-use change are associated with the trade of food between countries, of which more than three-quarters are due to land clearing for agriculture, including grazing.

2. Deforestation

Deforestation is the loss of tree cover, usually as a result of forests being cleared for other land uses such as farming or ranching. Some limit the definition of deforestation to the permanent conversion of forests to another habitat. Others add to this definition by including the conversion of natural forests to artificial forests such as plantations. Trees may be cut down to clear lands for building houses, industries, and factories, for growing crops, for grazing cattle, sheep, horses, etc. Deforestation could lead to soil erosion, flooding, and desertification. There is increasing evidence that climate change is affecting forests and forest ecosystems in Africa, as well as the livelihoods of the forest-dependent communities and the national economic activities that rely on vegetation services.

3. Hunting of Animals or Wildlife (Loss of Biodiversity)

Biodiversity is the variability among living organisms, including the genetic and structural differences between individuals and within and between individuals and within and between species. The world's biodiversity has a total of 1,263,500 species of plants and animals. It provides us with all the necessities of life and sustains and nourishes us. Biodiversity plays a direct role in climate regulation. Climate always changes resulting in evolutionary changes in the species. Millennium Ecosystem Assessment (MEA) predicts climate change to be the principal threat to biological diversity. The average global temperature has increased by 0.6°C since the mid-1800s and is predicted to rise by 1.4 - 5.8°C by the year 2100. The global mean sea level has risen by 10 to 20cm (8) and may further rise to 88 cm. The thickness of Arctic ice has decreased by about 40%. Many areas are facing the problem of water shortage. Climate change has resulted in the extinction of animals like the golden toad and the Monteverde harlequin frog. More frequent heat waves of longer duration and greater intensity are projected globally. Extreme climatic events (heat waves, storms, and hurricanes) and tropical vector-borne diseases (malaria) are predicted to increase which leads to loss of biodiversity. One million of the eight million species on the planet are at risk of extinction. Forests and oceans are polluted and destroyed (IPCC, 2018).

2.2 IMPACT OF CLIMATE CHANGE

The impact of climate change includes but is not limited to the following:

- 1. Sea level rise:** Sea level rise is increasing along the African coastlines at a higher rate than the global mean rate, especially along the Red Sea and southwest Indian Ocean where the rate is close to 4 mm/year. This is likely to continue in the future, contributing to increased frequency and severity of coastal flooding in low-lying cities and increased salinity of groundwater due to seawater intrusion. By 2030, 108-116 million people in Africa are expected to be exposed to sea level rise risk.
- 2. Flood:** Flood is a consequence of climate change that occurs as a result of an overflow of bounty of water that submerges land and stream of tide onto land or floodplain and flood happens when the geomorphic balance in the waterway system is broadened/troubled. A flood can happen in any place and at any time on the planet. Flash floods usually happen when there is excess rainfall thereby leading to the river overflowing its boundaries. One major example is the 2022 flood disaster in Nigeria from September to October, where over 25 states out of the 36 states in Nigeria were affected by the flood. This led to the loss of lives and over 1.3 million populace were displaced, making it the worst climate crisis since 2012 (Aiyedun, 2020).
- 3. Drought:** Drought in East Africa has worsened following consecutive failed rainy seasons combined with heightened conflict, related population displacement, and COVID-19 restrictions. High food prices impeded food availability and access, leaving more than 58 million people in conditions of acute food insecurity. The situation is worsening this year,

especially in Ethiopia, Somalia, and parts of Kenya. Southern Madagascar is also suffering from acute drought.

- 4. Extreme Weather:** Africa warmed at an average rate of around +0.3 °C/decade between 1991 and 2021, faster than the warming from 1961-1990, at +0.2°C/decade. The year 2021 was either the third or fourth warmest on record for Africa. Severe Floods affected South Sudan, Nigeria, the Republic of Congo, DRC, and Burundi. South Sudan recorded the third straight year of extreme floods leading to elevated water levels of Lakes and rivers, resulting from the intense rainfall in 2020 and 2021. Many parts of Northern Africa experienced extreme heat, especially in Tunisia, Algeria, Morocco, and Libya. This was accompanied by wildfires. Sand and dust storms were a recurring problem.

Extreme weather events cause long-lasting socioeconomic impacts, especially in the most vulnerable communities, which are often also the least equipped to respond, recover and adapt. Successive tropical cyclones hit south-eastern Africa, causing devastation in Madagascar. The World Weather Attribution initiative found that climate change likely increased the intensity of the rainfall experienced due to these storms. As the atmosphere becomes warmer, it holds more water, which, on average, makes wet seasons and events wetter. With further emissions and rising temperatures, heavy rainfall episodes will become more common. In June and July 2022, Europe was affected by two extreme heat waves and drought. Portugal had a new July national temperature record of 47.0 °C, and for the first time on record, temperatures in the UK exceeded 40 °C. According to the World Weather Attribution initiative, human-caused climate change made the heatwave in the UK at least 10 times more likely. Summer heatwaves pose a significant risk to human health, especially to the elderly and infirm (Idowu, Ayinde, Michael, Olatunde-Aiyedun & Jacob, 2021). Other factors – such as socioeconomic conditions, urbanization (the urban heat island), and levels of preparedness – can also increase vulnerability. First reports indicate that the heatwaves led to several thousand deaths.

- 5. Hazards:** Droughts and floods are the top concern. In the past 50 years, drought-related hazards have claimed the lives of over half a million people and led to economic losses of over 70 billion USD in the region. More than 1 000 flood-related disasters were reported involving more than 20 000 deaths in Africa over this period. It is estimated that by 2050, climate impacts could cost African nations USD 50 billion annually.
- 6. Food Insecurity:** Increased temperature contributed to a 34% reduction in agricultural productivity growth in Africa since 1961 – more than any other region in the world. This trend is expected to continue in the future, increasing the risk of acute food insecurity and malnutrition. Global warming of 1.5 °C is projected to be accompanied by a decline of 9% of the maize yield in West Africa and 20%-60% of the wheat yield in southern and northern Africa.
- 7. Poverty:** Climate change increases the factors that put and keep people in poverty. Floods may sweep away urban slums, destroying homes and livelihoods. Heat can make it difficult to work in outdoor jobs. Water scarcity may affect crops.
- 8. Displacement:** Climate-related hazards continued to be a major driver of new displacement in Africa. Chronic floods and droughts, sea level rise, and extreme weather events all influence displacement patterns within borders and across international borders. Over the past decade (2010–2019), weather-related events displaced an estimated 23.1 million people on average each year, leaving many more vulnerable to poverty. Most refugees come from countries that are most vulnerable and least ready to adapt to the impacts of climate change. In 2021, around 14.1 million people were internally displaced in Sub-Saharan Africa, including around 11.5 million due to conflict and violence and 2.5 million due to disasters.

9. **Health Impact:** Ozone depletion has several serious potential environmental effects, including damage to human health. O₃ effects on the human body may increase all types of skin cancers and cataracts and suppression of immune. An unfortunate aspect of ozone depletion is that if the emissions of all ozone-depleting chemicals should stop today, the problem will remain with us for about another 100 years, because of the high residence time of CFCs in the atmosphere. This situation, however, should not prevent us from taking against further emissions of CFCs into the atmosphere. If action is not taken now, the problem would be further aggravated (Ojelade, Aiyedun & Aregebesola, 2019; Olatunde-Aiyedun, 2021).

2.3 CLIMATE CHANGE PROGRAMS

1. UN Environment Program (UNEP)

The United National Environment Program was founded in June of 1972 after the UN Conference on the Human Environment. It is responsible for several environmental issues concerning various UN agencies. Some of these responsibilities include: developing international environmental agreements, encouraging environmental science, and creating development policies with national governments. Experts of the UNEP have contributed to guidelines of treaties and policies in terms of potential contaminants. An enhanced mitigation action is needed to prevent the goals of the Paris Agreement from slipping out of reach. New national mitigation pledges for 2030 show some progress toward lowering greenhouse gas emissions, but are insufficient. The ambition of these new pledges would need to be four times higher to get on track to limit warming to 2°C and seven times higher to get on track to 1.5°C. Global warming during the 21st century is estimated (with 66% probability) at 2.8 °C (range 2.3°C–3.3°C), assuming a continuation of current policies, or 2.5°C (range 2.1°C–3.0°C) if new or updated pledges are fully implemented. Collectively, countries are falling short of meeting their new or updated pledges with current policies.

2. World Climate Research Program

Further research on tipping points will be crucial to help society better understand the costs, benefits, and potential limitations of climate mitigation and adaptation in the future. The Atlantic Meridional Overturning Circulation (AMOC) is an important driver of the distribution of heat, salt, and water in the climate system, both regionally and globally. Recent research suggests AMOC may be weaker in the current climate than at any other time in the last millennium. The melting of the polar ice sheets on Greenland and Antarctica is also considered a major tipping point and would have global consequences due to substantial additional sea-level rise for hundreds to thousands of years. Regional tipping points, such as the drying of the Amazon rainforest may have serious local consequences with cascading global impacts. Other examples include regional droughts which impact the global carbon cycle and disrupt major weather systems such as monsoons. The combined effects of higher temperatures and humidity in some regions could reach dangerous levels in the next few decades, with physiological tipping points or thresholds beyond which outdoor human labor is no longer possible without technical assistance.

3. International Union for Conservation of Nature (IUCN)

The International Union for Conservation of Nature was established in 1948 and is comprised of over 1,200 government and non-government members. Its mission is to promote nature conservation and sustainable use of natural resources around the globe (Ekpo & Aiyedun, 2019). This environmental organization also focuses on issues such as poverty, gender equality, and sustainable business practices to achieve its objective. This organization is responsible for publishing the IUCN Red List which categorizes biological species by their conservation status.

4. Intergovernmental Panel on Climate Change (IPCC)

The IPCC works under the UN as an intergovernmental and scientific organization, established in 1988 by the World Meteorological Organization and the previously mentioned UNEP. Its purpose is to offer the world an unbiased, scientific assessment of climate change and its effects. The IPCC reports are based on published literature by non-IPCC scientists voluntarily. In 2007, this organization, along with Al Gore, received the Nobel Peace Prize.

5. The Centre for Climate Change and Environmental Studies

The Centre for Climate Change and Environmental Studies is a non-governmental organization incorporated under the laws of the Federal Republic of Nigeria. Their aim is to combat climate change and global warming through research projects on the environment, tree-planting projects, and awareness campaigns on global warming. It also aimed to combat deforestation, erosion, drought, emission of Greenhouse gasses, CO₂ emission, and toxic chemicals from gas flaring due to oil exploration and oil spillage.

2.4 CLIMATE CHANGE HIGHLIGHTS FROM 2012-2026

1. The UN COP Agreement from 2012-2022

The UN COP26 conference gained a commitment to several key initiatives that could have a significant impact on global warming. The key commitments included: at least 100 countries (including Brazil) agreeing to end deforestation by 2030; Led by the US and EU—80 countries pledged to cut methane emissions by 30% by 2030; Although commitment could not be gained from China, the US, India, and Australia - 23 nations made new commitments to phase out coal power, including five of the top 20 users: Indonesia, South Korea, Poland, Vietnam, Chile, and Ukraine; India committed to attaining net zero by 2070 (COP26, 2021). The Intergovernmental Panel on Climate Change (IPCC) identified in its 2018 report that global emissions would need to be at net zero by at least 2050 to retain a “high confidence” level of limiting temperature increases to sustainable levels. The COP26 conference aimed to gain commitment for sustained progress towards the Paris Agreement and UN framework convention on climate change, by limiting increased global temperatures to 1.5°C above pre-industrial levels.

2. State of the Global Climate: 2018–2022

The most recent seven years, 2015 to 2021 were the warmest on record. The 2018–2022 global mean temperature average (based on data up to May or June 2022) +is estimated to be 1.17 ± 0.13 °C above the 1850–1900 average (Knez, et al., 2022). A La Niña event has had a slight cooling effect on temperatures in 2021/22 but this will be temporary. Around 90% of the accumulated heat in the Earth's system is stored in the ocean, the Ocean Heat Content for 2018–2022 was higher than in any other 5-year period, with ocean warming rates showing a particularly strong increase in the past two decades.

3. Global Climate Predictions for 2022–2026

The annual mean global near-surface temperature for each year from 2022-2026 was predicted to be between 1.1°C and 1.7°C higher than pre-industrial levels (1850-1900). The likelihood of the annual mean global near-surface temperature temporarily exceeding 1.5°C above pre-industrial levels for at least one of the next five years is 48% and is increasing with time. However, there is only a small probability (10%) that the five-year mean will exceed this threshold. The Paris Agreement level of 1.5°C refers to long-term warming, but individual years above 1.5°C are expected to occur with increasing regularity as global temperatures approach this long-term threshold (Knez, et al., 2022). There was a 93% probability that at least one year in the next five, to be warmer than the warmest year

on record, 2016 and that the mean temperature for 2022–2026 would be higher than that of the last five years.

2.5 CLIMATE CHANGE INVOLVEMENT IN CITIES

1. Urban Climate Change Research Network

Cities—home to 55% of the global population, or 4.2 billion people – are responsible for up to 70% of human-caused emissions while also highly vulnerable to the impacts of climate change such as increased heavy precipitation, accelerated sea-level rise, acute and chronic coastal flooding, and extreme heat, among other key risks. These impacts exacerbate socioeconomic challenges and inequalities. Cities have an important role in addressing climate change by implementing inclusive, urgent, and scaled-up mitigation action and increasing the adaptive capacity of billions of urban inhabitants. Now is the time to integrate adaptation and mitigation, coupled with sustainable development, into the ever-dynamic urban environment.

2. Rural Climate Change Research Network

Globally, by the 2050s, over 1.6 billion people living in over 970 cities will be regularly exposed to 3-month average temperatures reaching at least 35 °C (95 °F). Between March and May 2022, India experienced five heat waves with record-breaking temperatures reaching up to 49.2 °C (120.5 °F). With half of Delhi’s population living in low-income settlements and highly vulnerable to extreme heat, this heatwave led to devastating socioeconomic and public health impacts. Low-lying coastal cities and settlements, such as Bangkok (Thailand), Houston (USA) and Venice (Italy), Lokoja (Nigeria) are highly likely to face more frequent and more extensive coastal flooding due to sea-level rise, storm surges, and subsidence (Aiyedun, 2020).

2.6 REMEDIES FOR CLIMATE CHANGE

Over the last 20 years, governments have intensified their consideration of the threats posed by climate change, by gradually implementing strategic action measures to combat such change, and in parallel, by advancing scientific knowledge on climate change.

Mitigation (cutting emissions) and adaptation (preparedness for inescapable circumstances) are two aspects of dealing with climate change. Both of these challenges are multidimensional.

1. Mitigation

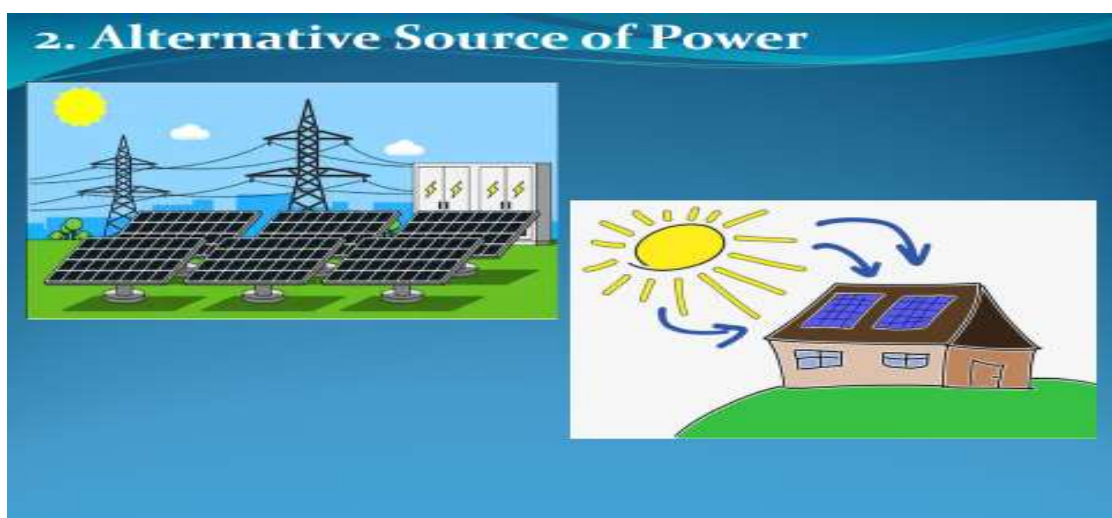
i. Climate action through Afforestation:



ii. Proper Waste Disposal:



- iii. **Climate action using Alternative Source of Power (Green Energy):** Green energy is a type of energy produced conventionally with a reduced amount of negative environmental impact. Green energy is sometimes called renewable energy. Renewable energy application has become an essential ingredient with a significant role in the expedition for GHG reduction and increasing the chance for sustainable development. Many countries have introduced and financed green energy programs to generate and consume power with minimum pollution. Green energy portfolio standard (GEPS) involves the use of regulation to boost the generation and consumption of energy from greener sources with the minimum rank of pollution propensity. In some countries where green energy portfolio standard is strongly advocated, compulsions are placed on electric power generation companies to provide a certain percentage of the national electricity demand from renewable sources as a strategic measure to lower emissions. Intergovernmental Panel on Climate Change (IPCC, 2020) directs countries to communicate their emissions from all sorts of energy-related activities. Advocates of GEPS listed the benefits among which are innovation, pollution control and competition can eventually lower the per unit price of renewable power. Sustainable development of green energy can provide numerous environmental benefits alongside fossil conservation for future generations.



- iv. **Clean Development Mechanism:** Clean development mechanisms involve the massive deployment of renewable energy technologies for power generation and carbon dioxide sequestration to promote the concept of sustainable development. Besides the GHG mitigating

potential of renewable energy resources, the energy security guarantee is swiftly becoming a reality with the exploitation of different renewable energy resources. A clean development mechanism is a fundamental idea of the Kyoto Protocol under the canopy of the United Nations Framework on Convention on Climate Change (UNFCCC, 2020). Developing countries are more actively involved in the development of renewable power generation in line with the proposed CDM. In 2009, developing countries hosted 53% of global RE power generation. The initial idea behind the institution of CDM is to strategically lower the level of emissions due to energy generation and consumption to a sustainable intensity. However, it was envisaged that emission reduction mechanisms will be financed by the industrialized nations whereby the fund will be given to developing countries as sponsorship for renewable energy programs. After a decade and more, a good implementation result is yet to be seen, and gain in the global pace of renewable power exploitation is not in line with the realistic and expected level (Adams, S.O., Zubair & Olatunde-Aiyedun, 2022).

To reduce greenhouse gas emissions, changes are required in power grids, buildings, transportation, land use, and industry. Given a better knowledge of climate and catastrophic occurrences, adaptation necessitates disaster management and resiliency. Presently, Machine learning (ML) has gained popularity as a versatile tool for technological advancement. Artificial Intelligence (AI) and ML techniques can contribute to reducing emissions in several ways such as by speeding up the development of low-carbon technologies, better demand predictions, reducing system waste, remote sensing, improving energy efficiency, vehicle emission estimation from smartphone GPS traces, single building optimization, identifying behavioral patterns, and planning and operating low-carbon infrastructure by avoiding open burning.

- v. **Climate action through the use of ICTs:** Climate change mitigation and adaptation can be more efficient and successful with the use of ICTs if integrated strategically; it contains knowledge centers, mobile phones, and interactive media. Educating and raising awareness at the community level, sharing theoretical and practical knowledge, and empowering people to have access to knowledge and relevant data, can assist vulnerable populations in reducing the risk of climate change. Micro-sensor Wireless Network is among the most prominent technologies in the twenty-first century, with a wide range of applications. Commercial or human-centric applications, robotics, military applications, and environmental monitoring are all using the applications of wireless sensor networks. Sustainable Environmental Management Information System (IS) can maintain the decision-making process for supportable climate control and develops Earth-friendly design. The emergence of big data and AI/ML techniques allows climate solution research to design policy and its implementation at the building and household scale, street, and urban areas, modified to specific circumstances but scalable to worldwide mitigation possibilities.

Way Forward

- i. **Climate Services:** There is an urgent need to improve climate education providers in Africa. Currently, 28 countries provide climate services from basic (Education) to essential level (Industries), and only 9 have provided those services at a full level. For instance, only 4 countries are providing end-to-end drought and flood forecasting or warning services at a full/advanced capacity level.
- ii. **Early Warning Systems:** In Africa, the rate of implementation of the Multi-Hazard Early Warning System (MHEWS) is lower than in other regions, with only 4 out of 10 people covered. There is a need to fill the capacity gap in collecting data for basic hydro-meteorological variables which underpin better climate services and early warning through all forms of education to save lives and livelihoods. So far, the global policy response has mainly focused on mitigating climate change by reducing anthropogenic emissions of greenhouse gases (GHG). With 3.3 to 3.6 billion

people living in contexts that are highly vulnerable to climate change, it is more important than ever for the international community to take ambitious action to not only mitigate emissions but also adapt to climate change, particularly extreme weather and compounding events, which can lead to long-lasting socioeconomic impacts. Early warning systems are effective adaptation measures that save lives, reduce losses and damages, and are cost-effective. Less than half of countries in the world have reported the existence of Multi-Hazard Early Warning Systems (MHEWS), with coverage particularly low in Africa, Least Developed Countries, and Small Island Developing States.

- iii. **Climate Finance:** A top international priority is to ensure that everyone on Earth is protected. CO₂ emission resulting from the combustion of petroleum products contributes a substantial quantity of Greenhouse Gas to the atmosphere. As a critical factor towards development, secure access to modern energy is essential for development. With the current global acknowledgment of the need to reduce emissions from energy, financing low-carbon energy can be used as a strategy to reduce Greenhouse Gas emissions. Many financing initiatives exist for funding energy projects but financing low-carbon projects are indispensable, especially in countries where oils are the major source of income and energy production. A driven economy by low-polluting energy technologies reduces the vulnerability of human environmental sustainability. This envisioned low carbon economy can be harnessed by unlocking the untapped renewable energy resources potential. Optimization of renewable sources for energy application provides noteworthy opportunities to spread out and upgrade the energy infrastructure, especially in rural communities due to their diversity. Via this strategic measure, the solution to energy poverty in developing regions can be provided by decentralization of the renewable energy systems. In some countries, an emissions trading scheme (ETS) through carbon taxation is already implemented to control and monitor emissions.
- iv. **Collaboration and Partnership:** There is a need for collaboration across diverse sectors in finding solutions to the climate crisis. These may include NGOs, government (Ministries, Agencies, Departments), Private, and Education (formal, informal, and non-formal), among others.
- v. **Climate Action through programme participation:** There is a need for collective participation in climate programmes through volunteerism, internship, and establishment of climate NGOs. Climate action requires a collective effort, just as the saying that a single tree cannot make up a forest.
- vi. **Climate Justice:** Climate change is a major problem that affects patterns and structures through changes in climatic variables worldwide and has become the central topic in making environmental-related policies, mostly to cater for the necessary mitigation and adaptation strategies. This can be an underlying cause of climate change in several ways. For example, governments can fund and determine where roads are built; determine land rights and uses that affect forest clearing; influence enforcement of environmental laws; and affect deforestation through tax policies, production subsidies, and other institutional choices (immigration and development policies).
- vii. **Environmental Education:** Education has been identified as a fundamental tool not only to create awareness and develop adaptations. Environmental Education aims at awareness creation on mitigation, and adaptation to climate change in Nigeria. There is a need to influence the attitude of people while at a younger age, that is, at school or tertiary level because having the right attitude is likely to help society and those in positions of making decisions relating to climate change. The contribution of geography as a subject in understanding climate change at the tertiary level has

been also been recognized. Climate action in schools should support the following recommendations:

- a) Universities should offer Environmental Education programs, as well as inculcate environmental education as a general studies (GST) to promote the right attitude towards sustainable use of environmental resources and acquire environmental literacy on climate adaptation and mitigation measures. Governments should take the necessary steps to make it a part of the curriculum.
- b) School teachers should be provided with the necessary advanced level of educational and hands-on training from scientists from local research bodies on climate change
- c) Governments have a critical role in combating global warming from the legislative and policy perspective, but to ensure the targets set for 2050 have a realistic chance of being achieved, we need change at a societal level. The IS and technology industry has a critical role to play in the monitoring of progress toward net zero, but also a pivotal role in the development of innovative solutions to better manage emissions and offer people alternatives to current carbon-based practices.
- d) Climate change should not only be a course in general students where it will be compulsory for all students to offer and pass before graduating successfully from a university, but students should inculcate the right attitude of becoming ambassadors for sustainable living by responsibly making use of technologies in a way that helps reduce carbon emissions.
- e) Higher education institutions can provide knowledge and resources to learners and create awareness, inspiring the next generation to navigate the complexities of climate change.
- f) Education and training can encourage learners to think about technological and behavioral changes to reduce and mitigate environmental impact within their local sphere of influence and macro level.
- g) Stakeholders to accelerate carbon-neutral business practices and build environmental resiliency. Several universities are forming coalitions committed to climate action, such as the University Climate Change Coalition, to leverage scientific knowledge and expertise for climate change solutions.

Conclusion

Climate change is one of the biggest challenges in the world. Fossil fuels – coal, oil, and gas emission into the atmosphere are by far the largest contributor to global climate change, accounting for over 75 percent of global greenhouse gas emissions and nearly 90 percent of all carbon dioxide emissions. As greenhouse gas emissions blanket the Earth, they trap the sun's heat. This leads to global warming and climate change. Climate change is already impacting health in a myriad of ways, including the loss of lives, and illnesses from increasingly frequent extreme weather events, such as heatwaves, storms, and floods, the disruption of food systems, increases in zoonoses and food-, water- and vector-borne diseases, and mental health issues. The more we reduce emissions right now, the easier it will be to adapt to the changes we can no longer avoid. Mitigation actions through Environmental Education would help to sensitize individuals on early warning signs of climate crisis.

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