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EFFECTS OF CLIMATE CHANGE ON PLANTS AND ANIMALS

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ABSTRACT

The work examines the effects of climate change on plants and animals. Which human activities are believed to be responsible for the emissions of greenhouse gases that affects the plants and animals. These gases exist naturally, but humans add more carbon dioxide by burning fossil fuels for energy production eg .coal, oil, and natural gas and by cutting down forests that help in absorbing the carbondioxide. Nigeria greenhouse gas (ghg) emissions for 2018 was 320,860.83, for 2019 was 332,247.04 and for 2020 was 322,336.50. Within Africa, more than 60 percent of the continent's carbon emissions are produced by just three countries – South Africa, contributing 435.9 million tonnes, Egypt, with 249.6 million tonnes, and Algeria, responsible for 176.2 million tonnes. The U.S. Environmental Protection Agency has reported a net emissions increased by 35 percent from 1990 to 2010 worldwide and a seven percent increase in greenhouse gas emissions from 1990 to 2014, with Carbon dioxide accounted for three-fourths of all these emissions. Greenhouse gases act like a blanket. The thicker the blanket, the warmer our planet becomes. it is predicted that averagely over the next 20 years, global temperature is expected to reach 1.5°C of warming. This assessment is based on improved observational datasets that assess historical warming, as well as progress in scientific understanding of the response of the climate system to human-caused of greenhouse gas emissions. The report projects that in the coming decades, climate changes will increase in all regions, there will be increasing heat waves, longer warm seasons and shorter cold seasons. And that at 2°C of global warming, heat extremes would reach critical intolerance thresholds for plants and animals.

Keywords: *Climate, Greenhouse Gases, Global Warming, Animal and Plant.*

INTRODUCTION

Climate change is the significant variation of average weather conditions becoming, for example, warmer, wetter or drier–over several decades or

longer. It is the longer-term trend that differentiates climate change from natural weather variability. The Scientists around the world have reached an overwhelming consensus that climate change is real and is primarily caused by human activities. Respected scientific organizations such as the National Academy of Science, the Intergovernmental Panel on Climate Change (IPCC) and World Meteorological Association (WMA) have all identified climate change as a threat caused by humans, which must be addressed immediately (IPCC 2021). Greenhouses gases, such as carbondioxide and trap heat affect the atmosphere. These gases exist naturally, but humans add more carbon dioxide by burning fossil fuels for energy production eg .coal, oil, and natural gas) and by clearing forests. Greenhouse gases act like a blanket. The thicker the blanket, the warmer our planet becomes. At the same time, the Earth's oceans are also absorbing some of this extra carbon dioxide, making their water more acidic and less hospitable for living organisms in the sea and oceans. Nigeria greenhouse gas (ghg) emissions for 2018 was 320,860.83, for 2019 was 332,247.04 and for 2020 was 322,336.50. Within Africa, more than 60 percent of the continent's carbon emissions are produced by just three countries – South Africa, contributing 435.9 million tonnes, Egypt, with 249.6 million tonnes, and Algeria, responsible for 176.2 million tonnes. As a result of its relatively low economic development, Nigeria's GHG emissions remain relatively low. The total GHG emission in (2016) from various sectors (agriculture, electricity, forestry, industry, oil and gas, transport, waste etc) of 2016 was (481.02 MtCO2e) of CO2-equivalent (Figure 1).

Heat wave is generally defines as a prolonged period of excessively hot weather. In 2022, the IPCC released its sixth assessment report examining the impacts of global warming on ecosystems, biodiversity and humans. The findings were grim. It found that climate change will increase all over the world, with 1.5°C, heat waves, longer warm seasons, shorter cold seasons, and extreme weather events will increase The increase in global temperature is significantly altering our planet's climate, resulting in more extreme and unpredictable weather. For instance, heat waves are becoming more frequent and many places are experiencing droughts followed by intense rainfalls. Global temperatures have increased in the past century and the top 10 warmest years recorded, all occurred since 1998. The U.S. Environmental Protection Agency has reported a net emissions increased by 35 percent from 1990 to 2010 worldwide and a seven percent increase in greenhouse gas emissions from

1990 to 2014, Carbon dioxide accounted for three-fourths of all these emissions. The Climate change and over-exploitation of natural resources are the consequences of poor development and the major challenges of our times. In the last 100 years average global temperature has increased by 0.74°C, rainfall patterns have changed and the frequency of extreme events increased. Change has not been uniform on either a spatial or temporal scale or the range of change. The change in climate and weather has also been variable. Change in climate has consequences on the biophysical environment such as changes in the start and length of the seasons, glacial retreat, decreased in Arctic sea ice extent and a rise in sea level. These changes have already had an observable impact on biodiversity at the species level, in term of populations and ecosystem level in terms of distribution, composition & function. The report shows that emissions of greenhouse gases from human activities are responsible for approximately 1.1°C of warming since 1850 and it is predicted that averagely over the next 20 years, global temperature is expected to reach 1.5°C of warming.

This assessment is based on improved observational datasets that assess historical warming, as well progress in scientific understanding of the response of the climate system to human-caused of greenhouse gas emissions. The report projects that in the coming decades, climate changes will increase in all regions, there will be increasing heat waves, longer warm seasons and shorter cold seasons. And that at 2°C of global warming, heat extremes would reach critical intolerance thresholds for plants and animals. The UN chief said that 2023 will be the hottest year on record. And that it would require industrialized nations to join together immediately to slash greenhouse gases roughly in half by 2030 and then stop adding carbon dioxide to the atmosphere altogether by 2050s. And that if these two steps are taken, the world would have about a 50 percent chance of limiting warming to 1.5 degrees Celsius. Climate change has affected the world in many ways, including threatening plants life and reducing plant growth. There was 37 percent increase in the warming effect of greenhouse gases from 1990 to 2015, increasing rainfall events in certain areas, droughts in others, raising sea surface temperatures among other things, extending crop growing and ragweed pollen seasons. Changes in leaf and bloom dates have been observed. Minimum, maximum or average temperatures affect plant growth and distribution. Seasonal cycles also affects plants succession, however, the timing of when regions warm up in the spring and cool down in the fall is

changing. For example, warmer weather is setting up late during the spring in many places at high latitudes, where it is staying warmer later into the fall. Arctic areas are warming up the fastest, triggering a change in Arctic trees and vegetation growth, which are dependent on summer warmth. Global warming also intensifies rainfall, flooding, hurricanes and droughts, changing precipitation patterns that affect plants growth, the amount of moisture in soils, nutrient runoff and water retention. Rainfall impacts the balance of plant types around the globe. Shifts in climate patterns also alter soil type, affecting which plants thrive and which don't in certain regions. As a result, some species of plants are left behind; particularly the ones that have long life cycles and disperse more slowly, such as arctic and alpine plants. The adaptability rates can cause some species to be lost, and others to move. There is also the impact of invasive species, which adapt more quickly to the environmental conditions where native species struggle.

Temperature, rainfall and the length of day affect the timing of plant life cycle phases. Seasonal variations also impact the phases, but climate change is altering temperature and rainfall patterns, extending growing seasons and shifting them. The effect of climate change on animal health is either direct or indirect primarily due to changes in environmental conditions, which include air, temperature, relative humidity, precipitation, frequency and magnitude of extreme events (i.e., heat waves, severe droughts, extreme precipitation, and coastal floods Foras, (2010). The direct effects of climate change on animal health include temperature-related illnesses. While the indirect impacts follow more intricate pathways which include the influence of climate on microbial density. In a study in Indian, Purusothaman et al. (2008) reported an increase of mortality in Mecheri sheep during summer season. Hahn et al. (2002) described the impact on livestock from distribution of vector-borne diseases, water shortages and food-borne diseases (Lacetera 2019) a weeklong heat wave in the mid-central United States during July 1995. It was also reported that during the severe and prolonged heat waves which occurred in Europe during summer 2003, over 35,000 people and thousands of pigs, poultry, and rabbits died in the French regions of Brittany and Pays-de-la-Loire (http://lists.envirolink.org/pipermail/ar-news/Week-of-Mon-20030804/004707.html). Vitali et al. (2015) in their study reported that summer mortality in dairy cows was greater during days of heat wave compared with days without heat wave. Furthermore, the risk of mortality continued to increase during the three days after the

end of the heat wave. Mortality also increased with the length of the heat wave. Considering deaths stratified by age, cows of 28 months old were not affected by heat waves, whereas all the other age categories of cows (29 to 60, 61 to 96, and >96 months) showed a greater mortality when exposed to heat waves. The risk of death during heat wave was higher in the early summer months. The highest risk of mortality was observed during heat wave in June. Most animals live successfully in areas with some specific climate conditions, such as moderate temperature and rainfall patterns, that enable them to thrive. Any change in the climate of an area affects the animals living there, as well as the entire ecosystem. Some animal species respond to warmer climate by a migration to cooler locations. For example, some North American animals moved farther north or to higher elevations to find suitable places to live. Climate change also alters the life cycles of animals. For example, as temperatures get warmer, some animals are awaking from hibernation sooner.

Animals migrating

Birds migrating

As the Earth gets warmer, animals that need to live in cold places, like mountaintops or in the Arctic, might not have a suitable place to live. If the Earth keeps getting warmer, it is predicted that up to one–fourth of all the animals on Earth may become extinct within 100 years. Every animal plays a role in the ecosystem (for example, as a source of food, a predator or a pollinator), so losing one species can affect many others. Just like people, plants and animals adapt to climate change. Many types of birds in North America adapt or migrate further north as the temperature got

warms. People can help these birds adapt by protecting and preserving their habitats. An international team of researchers led by two Villanova University biologists have discovered that climate change is dramatically altering terrestrial plant communities and their ecosystems at such a rapid pace that having a stable baseline from which to conduct experiments is becoming very difficult for researchers. In an article titled "Ambient Changes Exceed Treatment Effects on Plant Species," just published in the journal of *Global Change Biology*, lead author Adam Langley, Ph.D. and co-author Samantha K. Chapman, Ph.D., both associate professors in Villanova's Department of Biology, together with a team of 16 researchers, documented findings that compared the abundance of ambient (growing in natural conditions) plants to plants in plots experimentally treated with elevated carbon dioxide, nutrients, water and warming to simulate future environmental changes. The researchers compared the change in abundance of ambient plants to the treated ones. Using a database of long-term global change studies over a 30-year period, the team estimated trends in plant abundance for 791 plant species in ambient and treated plots across 16 long-term global change experiments, yielding 2,116 experiment-species-treatment combinations. The results were surprising. For most species (57 percent), according to the article, the magnitude of ambient change was greater than the magnitude of treatment, which affects the result expected by the researchers.

A preponderance of evidence suggests that the ongoing climate change is dramatically altering terrestrial plant communities, The publication of the *Global Change Biology* article is regarded as particularly timely given date of October, 7th , 2018 release of The United Nation's Intergovernmental Panel on Climate Change (IPCC) report on climate change. The IPCC report stated that we are already halfway to the 1.5 degree Centigrade, warming threshold, above which will have a severe global effects. Langley said. "With the current policies we are likely to surpass that threshold in the next 20 years."This signals that even more dramatic changes in plant communities would be expected in the coming decades, Locally, many plant species we are used to, will vanish from the surface of the earth, though new ones will take their places, "One key thing from the IPCC report that supports the findings is that changes across many ecosystems are happening faster than expected," Chapman agreed that plants are shifting under scientific feet as they are trying to predict the future." The article points out that human are altering many factors that control plants success. For instance, ambient carbon dioxide

concentration in the atmosphere is now about 50 per cent higher than it was in preindustrial times. By the end of this century the amount of carbon dioxide in the atmosphere may triple the preindustrial level, according to Langley. Plants are the base for food web and drive the carbon cycle, nutrient cycles and water cycles on which we rely. When plant species change, everything else in the ecosystem will follow. Scientists are trying to simulate how the future earth will look like, with global change, as climate change and nutrient pollution are changing ecosystems so fast, it's tough to do experiment on top of those changes. In the face of the ongoing environmental change, our experiments may be like 'rearranging deck chairs on the Titanic'." future projected changes in climate are very large. IPCC AR4 suggests that approximately 10% of species assessed so far will be at an increasingly high risk of extinction for every 1°C rise in global mean temperature, within the range of future scenarios modeled in impacts assessments (typically <5°C global temperature rise). Aquatic freshwater habitats and wetlands, mangroves, coral reefs, arctic, alpine ecosystems and cloud forests are particularly vulnerable to the impacts of climate change. Mountain species and endemic species have been identified as being particularly vulnerable because of the narrow geographic and climatic ranges, limited dispersal opportunities, and the degree of non-climate pressures. Potential impacts of climate change on genetic diversity are little understood, though it is thought that genetic diversity will increase the resilience of species to climate change. Burning coal releases 70% more carbon dioxide than natural gas. Burning fossil fuels such as coal, oil and natural gas to generate energy has greatest impact on the atmosphere than any other single human activity. Globally, power generation is responsible for about 23 billion tones of CO2 emissions per year – in excess of 700tonnes every second. For instance coal alone cause damaging to the atmosphere by releasing 70% more carbon dioxide than natural gas for every unit of energy produced.

Coal plant in China

Many studies highlight the individualistic nature of species' responses to climate change, which may likely have a large impact on future composition of the ecosystems. Structure of ecosystems may also change. Modern work suggested that this may have an impact on ecosystem function. For example, increase in net primary production as observed in northern Europe with decrease in areas where water is a limiting resource. Changes in productivity are likely to change services such as nutrient cycling due to changes in litter fall. Other potential changes to ecosystem services due to climate change, include changes in the provisioning

services (e.g. food, fibre, timber), carbon storage and sequestration, water regulation and disease regulation.

Changes in ecosystems as a result of climate change are likely to have significant and often negative social, cultural and economic consequences. However, there is still uncertainty about the extent and speed at which climate change will impact biodiversity and ecosystem services, the thresholds of climate change above the ecosystems are irreversible changed and the ecosystem may no longer function in their original form. So may reach a tipping point. Tipping points are points at which a system passes from one steady state to another. These are either climate tipping points or ecosystem tipping points. An example of the latter is Amazon forest dieback. To adequately address the climate crisis, people must urgently reduce carbon pollution and prepare for the consequences of the global warming, which the world is already experiencing. This can be done by combining global outreach with local expertise by means of:

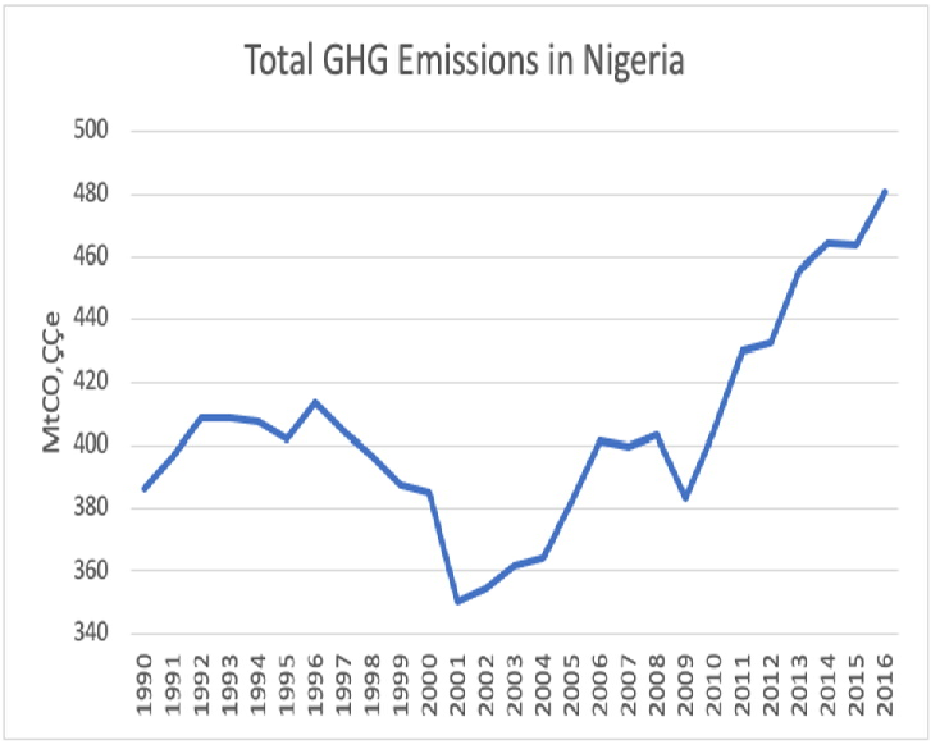
- Helping people and nature to adjust
- Adapt to changing climate
- Advances policies to fight climate change
- Fighting deforestation in our environment.
- Engages in businesses that reduce carbon emissions
- Challenge Nigeria government and people to prepare for extreme bad weather

As climate change worsens, dangerous weather events are becoming more frequent or severe around the globe. Weather condition is challenging cities to a transition toward 100 percent renewable energy and cities can address local climate threats by implementing practical measures that improve air quality, protect water supplies and reduce urban flooding. To avoid the worst effects of climate change, people need to dramatically reduce global carbon emissions, people must also prepare for the significant and unavoidable consequences of carbon emissions such as increasing temperatures, shifting precipitation patterns, ocean acidification, sea level rise and the increasing intensity and frequency of extreme weather events. Forests are home to many of the world's most endangered wildlife. Plants also protect the planet by absorbing carbon dioxide (CO2), a major source of pollution that causes climate change. People should fights climate change by saving the forests. To do this, people must:

- Ensure that global climate change experts have agreements to reduce forest destruction and degradation and to protect wildlife
- Work directly with countries, especially developing ones, to protect forests that benefit the livelihoods of local communities
- Use satellite images and aerial mapping technologies to track illegal logging
- Study the vulnerability of forests to climate change and explore ways to help them adapt.

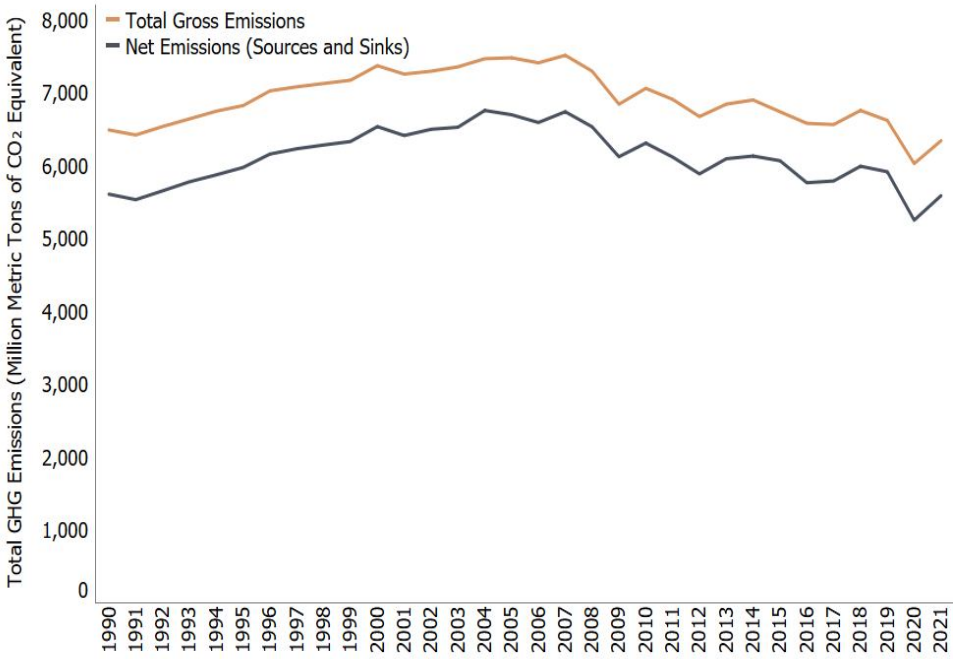
In Nigeria, 38.2 percent of GHG emissions came from the land-use change and forestry sector, followed by the energy, waste, agriculture and the industrial processes sector which contributed 32.6 percent, 14.0, 13.0 percent and 2.1 percent respectively to GHG emissions. Nigeria's total GHG emissions in 2016 (481.02 MtCO2e), the majority of its composition is comprised of carbon dioxide at 61.74 percent, followed by methane at 27.82 percent, nitrous oxide at 7.77 percent, and fluorinated gas at 2.66 percent. Since 1990, gross U.S. greenhouse gas emissions have decreased by just over 2%. From year to year, emissions can rise and fall due to changes in the economy, the price of fuel, and other factors. In 2021, U.S. greenhouse gas emissions increased 5% compared to 2020 levels. In 2020, there was a sharp decline in emissions largely due to the impacts of the coronavirus (COVID-19) pandemic on travel and other economic activity. In 2021, the increase in total greenhouse gas emissions was driven largely by an increase in CO_2 emissions from fossil fuel combustion due to economic activity rebounding after the height of the COVID-19 pandemic. In 2021, CO_2 emissions from fossil fuel combustion increased by 7% relative to the previous year. CO_2 emissions from natural gas consumption increased by less than 1 % relative to 2020. In a shift from recent trends, CO_2 emissions from coal consumption increased by 15% from 2020. The increase in natural gas consumption and emissions in 2021 is observed across all sectors except the Electric Power sector and U.S. Territories, while the coal increase is primarily in the Electric Power sector. Emissions from petroleum use also increased by 9% in 2021, and CO_2 emissions from fossil fuel combustion were 2% below emissions in 1990. Fig. 1&2 show greenhouse gas emissions.

Fig 1 Nigeria greenhouse gas emission 1990-2016



Source: Own manipulation of Climate Watch Data

Fig 2 Total U.S. Greenhouse Gas Emissions, 1990-2021



Note: All emission estimates from the *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2021*.

CONCLUSION

Nations should try to advance policies that reduce carbon pollution, support clean energy technologies, prepare for the effects of climate change, and curb deforestation. Make international level negotiations with government representatives from developed and developing countries. United States should play a constructive role in developing global climate agreements that will substantially reduce carbon pollution to avoid the worst consequences of climate change. Provide financial support to developing countries so that people and nature can successfully adapt. Combat forest destruction and protect wildlife. Help transition of developing countries by providing clean energy sources like solar energy.

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