

RCE
OGUN



RCE OGUN CLIMATE CHANGE ACTIVITY BOOK

For Secondary School



RCE OGUN

CLIMATE CHANGE ACTIVITY BOOK

FOR SECONDARY SCHOOLS

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RCE OGUN OVERVIEW

Introduction

RCE Ogun is one of the 168 Regional Centers of Expertise (RCE) in the world (www.rcenetwork.org). RCEs are networks of existing formal, non-formal and informal organizations that facilitate learning towards sustainable development in local and regional communities. The network of RCEs worldwide constitutes the Global Learning Space for Sustainable Development.

Our Vision

RCE Ogun aspires to create self-reliant, resilient, inclusive and environmentally friendly communities through formal and informal trainings, enlightenment programs and exemplar projects for the sustainable existence of the region

Focus Areas

RCE Ogun focuses on developing environmental and social solutions for the sustainable development challenges plaguing our continent. We use the Sustainable Development Goals (SDGs) as our compass for solving some of Africa's pressing challenges. Our specific areas of focus are:

1. Climate Change Action (SDG 13)
2. STEM Education (SDG 4)
3. Digital Skills Training (SDG 8)
4. Advocacy Against Drug Abuse (SDG 3)
5. Financial Literacy (SDG 1)

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RCE OGUN CLIMATE CHANGE CHALLENGE WINNING ESSAY

RCE Ogun Climate Change Challenge Winning Essay

In a twinkle, in flash, in what will seem like less than a second, we will no longer live in the world we used to live in. The fresh greenery, huge boles of horse chestnuts, thick oaken stems, majestically lit-up infrastructures of great altitudes, jade and olive vacation hummocks, fascinatingly snowy igloos – all will be gone – washed away before our very eyes.

One litter thrown with much less care, one little pool of water left in utter disregard, one ounce of gas let into the air we breathe take us one step further from our perceived utopia. One felled tree left without a successor, one poached species, and one hunted breed keeps us a step away from the world we desire. Any change or alteration in the average atmospheric condition of a place over a period of time is climate change. We experience the heavy downpours and light showers, scorching heat and times we just have the mild feel of the blazing fireball on our skin – nature's ephemeral touch.

However, what happens when our planets burns up in massive billows of smoke? Enormous orange, brazen, hot balls spurt around consuming all it comes into contact with? The oceans, seas, rivers, deep and wide as they are, outrun the shore, beach

into our habitation? And what we left is all but sand? These catastrophes can be nature-caused or human activated.

Let's consider this superb cars zooming the jet black tars and flinging so much impurities into what we inhale. A number of the metal beasts do not possess catalytic converters that are able to convert harmful substances that can be released into the atmosphere. There is about twenty-one percent of oxygen in the atmospheric composition, yet these life-threatening fumes are clogging up the air – signing the world's death certificate.

How about the billions of economic trees cut down in the innocence of raw materials for production? The trees form canopy that act as protective cover and wind breaks which are destroyed during deforestation. This leaves the soil open to erosion, the washing away of the top soil, so nutrients found there are also washed away; affecting food production. Natural habitats will also be destroyed; little wonder we have frequent visits of wild foxes and deer in our dwelling. The rare plant breeds and animal species become extinct. The devastating effect of this will be desert encroachment since there will be fewer rainfall. And all we will own will be sun, sand and sea. There is more to regret in felling, sawing and chiselling those heavy logs into exquisite doors, bed frames and furniture than there is to sap joy.

The earth's temperature will increase and a dastardly effect would be the capping or melting of the North and South poles. And worse will be when we experience the greenhouse effect or global warming when the earth is so heated up. Manufacturing industries releasing compounds into the air such as nitrogen and

sulphuric oxides that are let up into the atmosphere and dissolve in the water vapour to release acid rain.

Nature also has a part in the disastrous climate alteration we experience. When the water bodies overflow their banks and seep into human dwelling flooding our inventions and artefacts. There is a lot more to look at, but the big question is: what is the way forward? A simple mapped out strategy that's easy to follow. All we have to do is to close up those little loopholes and lapses we tend to have.

The first thing to do is to pick up the tiniest litter we find around us, it saves the planet massive water flooding our houses. We can even take a bolder step by recycling the recyclable non-biodegradables, turning plastic bottles into astoundingly beautiful Christmas trees, brooms and fashionable pencil cases. We can also have our road safety officials ban cars without catalytic converters off our roads to keep us all safe.

How about the trees? For every single one we cut, plant three – to give the planet three times more a chance to live. We can instead preserve those 'weird-looking', unique species and breeds. So, in about a century or two to come, that generation will look back at our amazing work of preservation. In conclusion, there is so much we can achieve together and so much more if we each are willing. It starts with us – you and me. Let's take the pleasure to give our planet one more chance to live. Again.

***Ayomikun Divine-Grace Oladapo,
The Ambassadors College, Ota.
Winner, RCE Climate Change Challenge (2019)***



LESSON 1

Hook Article

More than 60 million Africans are affected by sea level rise

Adapted from article by Annika Joeres in the CORRECTIV

Published July 28, 2017

Keywords: *metropolis, setback line, flooding, storms, climate change, beaches, currents, waves, coasts, submerged, displacing.*

Darryl Colenbrander spends his life with the sea. In his spare time he enjoys surfing, and during the week he tries to prepare Cape Town for rising sea levels. His official job is running the coastal protection program (Coastal Management Programme). On a map, he draws a line around the **metropolis** of four million people, which he calls his “**setback line**”. Beyond it, there is already the threat of **flooding** during **storms**. In the long run, this whole zone will be under water. At the moment no new construction work is allowed beyond this line, and in the medium term the people who live beyond it will be resettled.

This is a task that requires a lot of tact, says Colenbrander. He is a trained philosopher, not an engineer or scientist, and he tries to take into account the social aspects of his planning as well. “Each coast is a complex area,” he says, “he who wants to change it needs to respect the tradition and history of its inhabitants.

When we say we want to protect you — then this means something different for every citizen.”

Overall, the data situation for the African continent is not very good. Our visualisation is based on only a few measuring points. Data is only available from ports, which are important for world trade. There are six measuring points in South African ports, which indicate that the sea has risen by more than ten centimetres in the past 30 years. They include Port Elizabeth in Simons Bay, near Cape Town, a large industrial site where Victorian houses are a reminder of the British colonial period; Port Nolloth, a hub for shipping copper ores; and East London, where historically leather was traded and where today Daimler Benz AG builds cars and trucks. Only in the Tanzanian port of Zanzibar have the sea levels dropped over a number of years, possibly influenced by numerous buildings in the vicinity of the measuring points. However, recently the sea here rose by about two centimetres.

The lack of data from Africa hampers scientific predictions of **climate change**,” says Sally Brown, environmental and marine scientist in Southampton. Brown predicts tough times for the African population: “The sea will not rise as strongly as in South Asia. But the people in Africa are much less protected than in industrialized countries.” There are very few studies and even fewer planned construction projects with which the countries could contain the rising seas. Brown does understand: “If a state is primarily concerned with building hospitals and schools, then there is no time and no money to protect against potential climate-related damages.”

Sometimes travel entrepreneurs want to protect beaches with controversial construction projects. Some luxury resorts in Zanzibar have built protective walls in front of their sandy **beaches** which now direct the **currents** and **waves** to other **coasts** around the island. Fishermen and residents protested against these arbitrary actions that make the beaches beyond the tourist temples swell or wash away. According to Sally Brown about 1.6 million people in Tanzania will be affected by flooding in the coming decade.

Between 60 and 70 million Africans live in areas that are up to ten metres above sea level — and could soon be **submerged** into the salty water. In the average scenario predicted by climate scientists the Indian Ocean will rise 43 centimetres by 2100, **displacing** 16 million people from their homes. The worst affected areas will be Mozambique, Guinea, Nigeria, Guinea-Bissau and South Africa. But so far only Cape Town is developing a protection plan for its coasts.

In 2100, countries such as Algeria, Morocco, Cameroon, Tunisia and Libya will have to spend more than one billion euros a year repairing what the rising waters destroy on the coasts, according to calculations by Sally Brown and colleagues. Not taking protective measures would cost even more and the damage caused by the floods would have to be endured.

KEY WORDS

Metropolis: City centre or city capital

Setback line: *In this case* is a boundary between a danger zone and a coastal development

Flooding: An overflow of water that submerges land that is usually dry

Storms: a violent disturbance of the atmosphere with strong winds and usually rain, thunder, lightning, or snow.

Climate change: Climate change is a change in the usual weather found in a place (NASA)

Beaches: a pebbly or sandy shore, especially by the sea between high- and low-water marks

Currents: In this case is a continuous, directed movement of seawater generated by a number of forces acting upon the water, including earth's rotation, the wind, the temperature, salinity differences and the gravitation of the moon

Waves: In this case is a disturbance of the ocean's surface, seen as an alternate rise and fall of the ocean's surface, which is caused by wind.

Coasts: is an area where land meets the sea or ocean,

Submerged: To sink below the surface of water

Displacing: Moving from original or usual position.

QUESTIONS FROM HOOK ARTICLE

Read the questions below and document your answers in your log book.

Discuss your answers with your friends

1. What is the problem?
2. When is it taking place?
3. Where is it taking place?
4. Why is the problem occurring?
5. What do you think should be the title of this article? (Discuss as a group).

WEATHER AND CLIMATE

Weather

Weather refers to the condition of the atmosphere over a **short period** of time

Weather is basically the behavior of the atmosphere, mainly with respect to how it affects life and human.

Weather consists of **short-term** (minutes to months) changes in the atmosphere.

Weather can be expressed in terms of sunshine, rain, cloud cover, winds, hail, snow, sleet, freezing rain, flooding, blizzards, ice storms, thunderstorms, steady rains from a cold front or warm front, excessive heat, heat waves and more.

Climate

Climate is the behavior of the atmosphere over a **relatively long period** of time.

Climate describes the **long-term pattern of weather** in a particular place.

Climate has been defined as the **average weather** for a particular region and time period, usually taken over 30-years.

So, it is actually an **average pattern of weather** for a particular region.

Climate is expressed in terms of an **average** of precipitation, temperature, humidity, sunshine, wind velocity, phenomena such as fog, frost, and hail storms, and other measures of the weather that occur over a long period in a particular place.

Climate Change is change in long-term averages of daily weather.

Adapted from https://www.nasa.gov/mission_pages/noaa-n/climate/climate_weather.html

Weather and Climate Exercise

Describe the following sentences in terms of weather, climate or both.

1. The year 2016 was one of the hottest on record.
2. 2012 was one of the coldest harmattan seasons in Nigeria.
3. Coastal cities are usually wet.
4. Sahara desert is hotter than the rain forest.
5. It might snow in Jos tomorrow.
6. It rained on February 4.
7. It is supposed to rain tonight.
8. Today it was hotter than usual.
9. Mambilla is a cold region.
10. Harmattan is cold.
11. The highest recorded temperature in Nigeria was 47.2 degree Celsius.
12. It rains every July.

Adopted from <https://pangea.stanford.edu/programs/outreach/climatechange/curriculum>

Home Work 1

Read the statement carefully. Classify the statement in terms of weather or climate. Explain your choice of answer in your log book.

'My grandmother told me that it had always rained every July since she was a little girl'.



LESSON 2

Hook Article A

Earth's Energy Balance

Adapted from North Carolina Climate Office
<https://climate.ncsu.edu/edu/EnergyBalance> assessed on
26/02/2019

Keywords: *Earth's energy balance, longwave radiation, infrared radiation, thermal inertia, convection, condensation, greenhouse gases, global warming, tropics, polar regions.*

Essentially 100% of the energy that fuels the earth comes from the sun. To maintain a constant global average temperature, all of the sun's radiation that enters Earth's atmosphere must eventually be sent back to space. This is achieved through **Earth's energy balance**.

100% of the energy entering earth's atmosphere comes from the sun, 50% of the incoming energy is absorbed by the earth's surface i.e. the land and oceans, 30% is directly reflected back to space by clouds, the earth's surface and different gases and particles in the atmosphere while 20% is absorbed by the atmosphere and clouds.

The 70% of the sun's energy that is absorbed by the earth's surface, clouds, and atmosphere causes warming. Any object or gas that has a temperature emits radiation outward, and this is ultimately re-radiated back into space. This occurs 24 hours a day, and the energy is emitted as longwave radiation due to the characteristic temperatures of the earth and atmosphere.

Consider a stove, for example. If you were cooking, you'd have the burner turned on so it would heat up. The burner is like the earth and the heat source, be it gas or electric, is like the sun. When you're done cooking you turn off the burner, but it stays hot for a long while even after the heat source is gone. Turning off the burner is like the sun going down. Even though there is no more energy input, there is still energy output in the form of infrared radiation. The burner stays hot because it's still emitting the energy it absorbed earlier, just like the earth. This time delay is sometimes called "**thermal inertia**."

Most of the energy emitted from the earth's surface does not go directly out to space. This emitted energy is reabsorbed by clouds and by the gases in the atmosphere. Some of it gets redistributed by **convection**. Even more energy is released into the atmosphere through **condensation**. The majority of the energy is reabsorbed by the **greenhouse gases** such as methane, nitrous oxide, ozone, carbon dioxide and water vapor. These gases constantly emit the sun's energy back into the atmosphere and keep the earth's temperature habitable. Eventually, most of the energy makes its way back out to space and Earth's energy balance is fairly well maintained. The energy that doesn't make its way out is responsible for **global warming**.

On a global scale, the atmosphere's circulation and weather is an attempt to balance differences in solar energy that the earth receives across the globe. Sunlight at the **tropics** is intense and direct and a lot of heating of land, atmosphere, and oceans occur there. Sunlight in the is weak and indirect and does not do a good job of heating up the region. Currents in wind and ocean water carry energy from the tropics toward the poles to help balance out the energy differences across the globe.

KEY WORDS 2

Earth's energy balance – Is the balance between incoming energy from the sun and outgoing energy from the earth

Thermal inertia - the degree of slowness with which the temperature of a body approaches that of its surroundings and which is dependent upon its absorptivity, its specific heat, its thermal conductivity, its dimensions, and other factors

Convection - Convection is the transfer of heat from a warmer region to a cooler one by moving warm liquid or gas from the heated area to the unheated area

Condensation - Conversion of gas or vapour to liquid

Greenhouse gases - Are gases that prevent the heat in the earth from escaping into space

Global warming - is the process that causes the Earth's temperature to rise and makes the Earth warmer

Tropics - the tropics are the region of the Earth surrounding the Equator

Polar regions - are the regions around the north and south pole

QUESTIONS FROM HOOK ARTICLE A

Write your answers in your log book and also discuss the answers with your friends

1. Where does the Earth get its energy?
2. Does all the energy that enters the Earth from the sun remain on the Earth?
3. What happens to the energy entering the Earth from the sun?
4. Do all the regions of the Earth get equal amount of sunshine?
5. What part of the Earth gets the most sunlight

Hook Article B

Greenhouse Gasses: Causes, Sources and Environmental Effects

Adapted from an article by Marc Lallanilla in Live Science

Published on January 3, 2019

Keywords: *infrared radiation, greenhouse gases, global warming, ultraviolet (UV) radiation, fluorinated gases, chlorofluorocarbons, fossil fuels*

Behind the struggle to address global warming and climate change lies the increase in greenhouse gases in our atmosphere. A greenhouse gas is any gaseous compound in the atmosphere that is capable of absorbing **infrared radiation**, thereby trapping and holding heat in the atmosphere. By increasing the heat in the atmosphere, **greenhouse gases** are responsible for the greenhouse effect, which ultimately leads to global warming.

Global warming isn't a new concept in science. The basics of the phenomenon were worked out well over a century ago by Svante Arrhenius in 1896. His paper, published in the Philosophical Magazine and Journal of Science, was the first to quantify the contribution of carbon dioxide to what scientists now call the "greenhouse effect."

The greenhouse effect occurs because the sun bombards Earth with enormous amounts of radiation, which strike Earth's atmosphere in the form of visible light, plus ultraviolet (UV), infrared (IR) and other types of radiation that are invisible to the human eye. About 30 percent of the radiation striking the Earth is reflected back out to space by clouds, ice and other reflective surfaces. The remaining 70 percent is absorbed by the oceans, the land and the atmosphere, according to NASA.

As they absorb radiation and heat up, the oceans, land and atmosphere release heat in the form of IR thermal radiation, which passes out of the atmosphere into space. The balance between incoming and outgoing radiation keeps Earth's overall average temperature at about 59 degrees Fahrenheit (15 degrees Celsius), according to NASA.

This exchange of incoming and outgoing radiation that warms Earth is referred to as the greenhouse effect because a greenhouse works in much the same way. Incoming **UV radiation** easily passes through the glass walls of a greenhouse and is absorbed by the plants and hard surfaces inside. Weaker IR radiation, however, has difficulty passing out through the glass walls and is trapped inside, warming the greenhouse.

The gases in the atmosphere that absorb radiation are known as "greenhouse gases" (sometimes abbreviated as GHG) because they are largely responsible for the greenhouse effect. The greenhouse effect, in turn, is one of the leading causes of global warming. The most significant greenhouse gases are water vapor (H₂O), carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O), according to the Environmental Protection Agency

(EPA). "While oxygen (O₂) is the second most abundant gas in our atmosphere, O₂ does not absorb thermal infrared radiation," said Michael Daley, an associate professor of environmental science at Lasell College in Massachusetts.

While some argue that global warming is a natural process and that there have always been greenhouse gases, the amount of gases in the atmosphere has skyrocketed in recent history. Before the Industrial Revolution, atmospheric CO₂ fluctuated between about 180 parts per million (ppm) during ice ages and 280 ppm during interglacial warm periods. Since the Industrial Revolution, though, the amount of CO₂ has increased 100 times faster than the increase when the last ice age ended, according to the National Oceanic and Atmospheric Administration (NOAA).

Fluorinated gases that is, gases to which the element fluorine was added — including hydrofluorocarbons, perfluorocarbons and sulfur hexafluoride, are created during industrial processes and are also considered greenhouse gases. Though they are present in very small concentrations, they trap heat very effectively, making them high "global-warming potential" (GWP) gases.

Chlorofluorocarbons (CFCs), once used as refrigerants and aerosol propellants until they were phased out by international agreement, are also greenhouse gases.

There are three factors that affect the degree to which any greenhouse gas will influence global warming, as follows:

- Its abundance in the atmosphere.
- How long it stays in the atmosphere.
- Its global-warming potential.

Carbon dioxide has a significant impact on global warming partly because of its abundance in the atmosphere. According to the EPA, in 2016, U.S. greenhouse gas emissions totaled 6,511 million metric tons (7,177 million tons) of carbon dioxide equivalents, which equaled 81 percent of all human-caused greenhouse gases — down 2.5 percent from the year before. Additionally, CO₂ stays in the atmosphere for thousands of years. However, methane is about 21 times more efficient at absorbing radiation than CO₂, giving it a higher GWP rating, even though it stays in the atmosphere only about 10 years, according to the EPA.

Some greenhouse gases, like methane, are produced through agricultural practices, including livestock manure. Others, like CO₂, largely result from natural processes like respiration and from the burning of **fossil fuels** like coal, oil and gas. The second cause of CO₂ release is deforestation, according to research published by Duke University. When trees are killed to produce goods or heat, they release the carbon that is normally stored for photosynthesis. This process releases nearly a billion tons of carbon into the atmosphere per year, according to the 2010 Global Forest Resources Assessment.

Forestry and other land-use practices can offset some of these greenhouse gas emissions, according to the EPA.

"Replanting helps to reduce the buildup of carbon dioxide in the atmosphere as growing trees sequester carbon dioxide through photosynthesis," Daley told Live Science. "However, forests cannot sequester all of the carbon dioxide we are emitting to the atmosphere through the burning of fossil fuels, and a reduction

in fossil fuel emissions is still necessary to avoid build up in the atmosphere.”

Worldwide, the output of greenhouse gases is a source of grave concern. From the time the Industrial Revolution began to the year 2009, atmospheric CO₂ levels have increased almost 38 percent and methane levels have increased a whopping 148 percent, according to NASA, and most of that increase has been in the past 50 years. Because of global warming, 2016 was the warmest year on record, and with 2018 on track to be the fourth warmest, 20 of the hottest years on record have all come after 1998, according to the World Meteorological Organisation.

"The warming we observe affects atmospheric circulation, which impacts rainfall patterns globally," said Josef Werne, an associate professor in the Department of Geology and Planetary Science at the University of Pittsburgh. "This will lead to big environmental changes, and challenges, for people all across the globe."

If current trends continue, scientists, government officials and a growing number of citizens fear that the worst effects of global warming — extreme weather, rising sea levels, plant and animal extinctions, ocean acidification, major shifts in climate and unprecedented social upheaval — will be inevitable. In answer to the problems caused by global warming by greenhouse gases, the U.S. government created a climate action plan in 2013. And in April 2016, representatives from 73 countries signed the Paris Agreement, an international pact to combat climate change by investing in a sustainable, low-carbon future, according to the United Nations Framework Convention on Climate Change

(UNFCCC).

According to the EPA, greenhouse gas emissions were 12 percent lower in 2016 than in 2005, in part due to the large decrease in fossil fuel combustion resulting from the switch to natural gas from coal. The warmer winter conditions during those years also reduced the need for many homes and businesses to turn up the heat.

Researchers around the world continue to work toward finding ways to lower greenhouse gas emissions and mitigate their effects. One potential solution scientists are examining is to suck the carbon dioxide out of the atmosphere and bury it underground indefinitely, said Dina Leech, an associate professor of biological and environmental sciences at Longwood University in Virginia.

"What we can do is minimize how much carbon we put up there, and as a result, minimize the temperature change," Leech said. "However, the window of action is quickly closing."

KEY WORDS

Infrared radiation: Infrared radiation is a type of radiant energy (energy of electromagnetic waves) with longer wavelengths than the visible light humans can see

Greenhouse gases: Are gases that prevent the heat in the earth from escaping into space

Global warming: is the process that causes the Earth's temperature to rise and makes the Earth warmer

Ultraviolet (UV) radiation: Ultraviolet (UV) light has shorter wavelengths than visible light and are invisible to the human eye

Fluorinated gases: Fluorinated gases contain fluorine which cause global warming because fluorine stays in the atmosphere for centuries

Chlorofluorocarbons: are nontoxic, nonflammable chemicals containing carbon, chlorine and fluorine because of the carbon and fluorine in chlorofluorocarbons, it causes global warming

Fossil fuels: Fossil fuel is a general term for buried combustible geologic deposits of organic materials, formed from decayed plants and animals that have been converted to crude oil, coal, natural gas, or heavy oils by exposure to heat and pressure in the earth's crust over hundreds of millions of years.

QUESTIONS FROM HOOK ARTICLE B

Document your answers in your log book. Share your answers with your friends.

1. With your understanding of a greenhouse, explain how global warming occurs.
2. Which of the Greenhouse gases has the highest global warming potential?
3. Which of the Greenhouse gases stay longest in the atmosphere?
4. What factors affect the degree to which Greenhouse gases influence global warming?
5. What are fluorinated gases?
6. Where do they come from?
7. Why do they cause global warming?
8. Where do CO₂ and Methane come from?
9. Why should we be bothered about global warming?

HOME WORK 2

Watch the following videos and document what you have learnt in your log book.

1. Earth's energy budget - YouTube [e](https://www.youtube.com/watch?v=el7ygWztQqA)
<https://www.youtube.com/watch?v=el7ygWztQqA>
2. Greenhouse Effect Video - Scott Denning | UCAR Center for Science
<https://scied.ucar.edu/greenhouse-effect-video-scott-denning>



LESSON 3

Hook Article A

Effects of Climate Change

Adapted from 'Climate change, environmental pollution and health implications: the need for stakeholders' collaboration towards a climate-smart economy in Nigeria'. A speech presented by Prof. Sani Abubakar Mashi Director General, Nigerian Meteorological Agency at the Official Launch of RCE Ogun

Presented on the February 4, 2019

Keywords: Climate change, global cooling, global warming, anthropogenic activities, carbon absorption/sequestration, arid and semiarid regions

Climate change occurs in two forms: **Global cooling** and **global warming**. Available pieces of evidence clearly show that the ongoing changing climate is that of global warming, whereby temperatures have been on the increase since the past 5 decades. Where the 5 warmest years on record since 1850, when methodical thermometer-based records began are; 2014, 2018, 2017, 2015 and 2016 in that order. Nigerian climatic trend as observed by the Nigerian Meteorological Agency (NiMet) almost follow that order. NiMet has reliably established evidence of

increasing air temperatures since about 1920s, in addition to recurring droughts since 1960s.

There are clear indications that other climate variables especially rainfall (both magnitude and distribution), atmospheric circulation patterns are changing, while extreme weather events and incidences of climate-related disasters are increasing, as the memory of 2012, 2015 & 2017/18 flood episodes is still fresh in our minds. The projections of the The Intergovernmental Panel on Climate Change (IPCC) Working Group-I predict that warming trend in this part of the world will become 1½ times more than the global trend.

Climate change is caused by either natural processes or **anthropogenic activities**. The natural processes that could cause climate change include the followings amongst others; terrestrial processes, extra-terrestrial processes, astronomical processes etc. On the other hand, the anthropogenic forces that cause climate change include: Urbanization, industrialization, burning of fossil fuel, deforestation, agriculture and pollution among others. These human factors of climate change take two forms: (1) those that emit greenhouse gases (methane, carbons, chlorofluorocarbon, nitrous oxide) like; industries and burning of fossil fuel. (2) While those that reduce atmospheric **carbon absorption** or sequestration are; deforestation, agriculture and water pollution etc.

It is pertinent to note that the start of 2019 has continued where 2018 left off – with extreme weather, which has claimed lives and destroyed livelihoods. The 2017/18 hurricane season was the costliest ever for the United States – and eradicated decades of

developments gains in small islands in the Caribbean such as Dominica. Floods displaced millions of people on the Asian subcontinent, whilst drought is exacerbating poverty and increasing migration pressures in the Horn of Africa. The World is now experiencing extreme weather conditions as fallout of the effects of the polar vortex with attendant 'once a life time lower temperatures in the US and parts of Europe. In fact, Parts of Australia are currently experiencing a record breaking soaring extreme temperatures close to 50 degrees Celsius, while other section of the country is being plagued with floods.

It is no surprise that, for the second consecutive year, the environment was by far the greatest concern raised by global leaders in the *World Economic Forum's Global Risks Report*. *These include: Extreme weather; biodiversity loss and ecosystem collapse; major natural disasters; man-made environmental disasters; and failure of climate-change mitigation and adaptation*. Extreme weather events were seen as the single most prominent risk. As such, 2018 was found to be one of the four warmest years on record, and was the warmest year without an El Niño. Long-term climate change as a result of greenhouse gas emissions commit our planet to a warmer future, with more extreme weather and water shocks. The impacts of climate variability and change are evident to all of us, as manifested, even recently in the 2018 rainy season in Nigeria. Many States were subjected to floods and severe storms with attendant loss of lives and properties.

Climate change is affecting and will continue to have a lot of effects on every sector of human endeavour like; Water resources, agriculture, industries, transportation, sport,

recreation and tourism, migration and conflict and human health among others. With regards to human health, increasing cases of skin diseases (cancer especially for the Albinos and those with very light skins, heat rashes etc) intestinal diseases, eye cataract, heat exhaustion/stroke and deaths, meningitis etc. With increasing drought intensity and desertification, famine will be wide spread especially in the **arid** and the **semi arid**

, which will cause malnutrition related ailments and deaths. The changing temperature, rainfall and humidity will lead to spread of diseases to areas that such diseases are not currently found. In all of these, developing countries like Africa will be worst hit due to low technological development and low coping capacity as a result of poor economy.

KEY WORDS

Climate change: is change in long-term averages of daily weather.

Global warming: is the process that causes the Earth's temperature to rise and makes the Earth warmer

Global cooling: the process that causes cooling of the Earth's surface and atmosphere culminating in a period of extensive glaciation.

Anthropogenic activities: Some human activities that cause damage (either directly or indirectly) to the environment on a global scale such as, overconsumption, overexploitation, pollution, and deforestation

Carbon absorption/ sequestration is the process of removing carbon from the atmosphere and depositing it in a reservoir.”

Arid region Is a region that is characterized by a severe lack of available water, to the extent of hindering or preventing the growth and development of plant and animal life.

Semi-arid region -A semi-arid region is a region that experiences low precipitation (rain, snow, drizzles, hail), but not as low as a desert climate.

QUESTIONS FROM HOOK ARTICLE A

Attempt the following questions and document your answers in your log book. Share your answers with your friends

1. From the article, which year was the warmest?
2. Which sectors of the economy are mostly affected by climate change?
3. What are the major concerns of global leaders?
4. Discuss the natural and anthropogenic causes of climate change
5. Identify and discuss the effects of climate change identified in this article.

HOOK ARTICLE B

Adapting and Mitigating Climate Change

From 'Climate change, environmental pollution and health implications: the need for stakeholders' collaboration towards a climate-smart economy in Nigeria'. A speech presented by Prof. Sani Abubakar Mashi Director General, Nigerian Meteorological Agency at the Official Launch of RCE Ogun
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Since climate change is caused by all, and its impact is affecting all, its solution therefore, must be a collective collaboration by all stakeholders. Therefore, since the weather affects all human enterprises, we need to follow closely the weather and climate information being produced by NiMet which is critical for combating Climate Change through adaptation and mitigation strategies.

It is against the foregoing challenging background, that, Nigerian Meteorological Agency (NiMet) embarks on regular weather and climate predictions to help the public mitigate the effects of extreme weather events through Early Warning Systems (EWSs). The Seasonal Rainfall Prediction (SRP) is part of the Agency's Meteorological Early Warning System, containing

rainfall and temperature outlook for the year, climate and health forecast as well as the possible socio-economic implications of the projected weather patterns. It is designed to provide relevant information for planning and execution of projects and programmes in various sectors of the economy, especially those that are sensitive to weather. Agriculture, environment, health, air transportation, infrastructure, construction, telecommunication, water resources are particularly sensitive to weather variability and change. The SRP is further updated regularly by the Agency to give more focused weather pattern during the season.

It has been reliably confirmed that, the Early Warning Services provides useful information for reducing losses, and taking advantage of favourable weather conditions to increase agricultural productivity. Several testimonies from farmers who have used the Forecasts across the states such as Katsina, Sokoto, Kebbi, Oyo, Enugu and Jigawa confirmed the reliability of this tool in boosting agricultural productivity by an average of 50% increase in annual yield. The Agency has made series of efforts to consistently improve on the lead-time, quality and accuracy of this very vital product. Over the past years, SRP has gained national and international recognition, especially in water resources and agricultural sectors due to recorded impact by practitioners, such as improvement of the sector's contribution to national GDP.

It is imperative to note that the early release of this vital information before the beginning of rainy season every year is not only to ensure effective harnessing of the climate resource, but to also guarantee minimal losses from associated hazards,

which are becoming quite devastating in this era of Climate Change. *It is on records that increase of at least 30% agricultural yields can be achieved if the relevant meteorological information is utilized. According to World Bank, for every dollar invested in early warning services on weather, about 7dollars is saved from cost of disaster management.*

By this prediction, we are already witnessing the following characteristics in the country:

- (i) Warmer and more frequent hot days over most areas.
- (ii) Warm spells as heat waves frequency increases.
- (iii) Heavy precipitation (rainfall) events increase over most areas.
- (iv) Areas affected by drought and flood increases.
- (v) Increasing climate related diseases : cholera, meningitis & measles

In the face of climate change, farming in Nigeria and in most developing nations must move from the current subsistence to mechanized (**sustainable smart agriculture**), while drought resistant crops and early maturing varieties must be developed for use. Also, agro-based industries must be established so as to add value to the raw crops which will enhance export. The current emphasis on rice production by this Federal Government Administration is a good example. Which I recommend, should be replicated in other crops.

With increasing day and night temperatures, the demand for electricity will be increased and this calls for proper plan to develop all modes of clean and **eco-friendly electricity** such as solar, wind, tidal, geothermal and hydro. The current electricity supply in Nigeria is grossly inadequate which encourages the

use of generators that causes not only increase in atmospheric carbons but also noise pollution. Adequate water must be supplied both for man and animals and this will reduce man and animals using the same source of water. With this, water borne diseases will be reduced drastically.

Afforestation is a must if we are to improve on the current loss of biodiversity and enhance rainfall. Moreover, urban forestry and greenery must be vigorously pursued and this calls for change of habit in adopting climate smart lifestyle in building and landscaping. The current practice by most house owners of using interlocking tiles or concrete in their entire compound should be stopped to give way to green landscaping by planting flowers and economic trees which can also serve as sources of fruits and vitamins intake.

Aquaculture should be developed and varieties of fishes should be produced rather than the current emphasis on cat fish.

The insurance industries need to intensify their efforts in encouraging people to insure their property so as to reduce the financial shock in case of fire, since increasing dryness is a catalyst for fire outbreak.

Skin bleach out to lighten the skin colour should be avoided in order to reduce effects of skin cancer due to excessive UV-B rays, since researches have shown that the black skin protect the body against the effects of the infrared and UV-B rays. The use of sunglasses and clothing that will cover most part of the body is highly recommended, especially those with light coloured skin and the Albinos.

In view of the aforementioned global and local challenges, the world has been speaking with one voice on these issues. Institutions like the WMO, the NiMet, and others like the RCEs have been established to ensure that weather-related information are researched, collated and managed to mainstream environmental sustainability. This is because the most visible impact of **global warming** and **climate change** is felt through extreme weather conditions. We need to prepare for extreme weather through better multi-hazard early warning systems and more coordinated responses. This will help us acquire resilience and adaptation to long-term climate change caused by greenhouse gas emissions.

However, for these efforts to succeed in our generation, Nigerians need to become more aware of their environment. Our children, right from the cradle, should be taught the basics of a climate smart lifestyle, environmental cleanliness and protection. Everybody should be encouraged to ensure that plastic bags and containers are disposed off in designated places where they could easily be picked up for recycling. Students, both at the secondary and tertiary education levels, should be empowered with more information on how to choose careers that will help the society solve emerging environmental problems arising from the impacts of climate change. For starters, weather and climate knowledge should be added in their curriculum. Farmers and rural dwellers should not be left behind. They need to become more ecologically-savvy in order to key in to new government programmes and policies on smart agriculture and environmental awareness

For Climate-Green and -Smart Economy, Nigeria must develop her infrastructure and technology, if the citizen is to have effective mitigation and adaptation to the effects of climate change. *It is only when deliberate and planned actions are taken against the effects of climate change that we will experience in all sectors of the economy the **Africa that we truly want in the face of climate change.*** I enjoin all stakeholders in every sector of the economy to work harmoniously together to reduce the multiplier effects of climate change through local adaptation and mitigation techniques. In the world of today where knowledge is power, weather and climate knowledge might just be the weapon every citizen needs to fight climate change to a standstill.

KEYWORDS

Sustainable smart agriculture - Smart agriculture is a revolution in the agriculture industry that helps to guide actions required to change agricultural systems to effectively support the development and guarantee food security during an ever-changing climate.

Eco-friendly electricity – refers to renewable and clean energy such as solar, wind, tidal, geothermal and hydro

Afforestation - is the process of planting trees, or sowing seeds, in a barren land devoid of any trees to create a forest

Aquaculture – is the farming (rearing) of fish and other aquatic organisms including plants

Global warming - : is the process that causes the Earth's temperature to rise and makes the Earth warmer

Climate change - is change in long-term averages of daily weather.

QUESTIONS FROM HOOK ARTICLE B

Attempt the following questions and document your answers in your log book. Share your answers with your friends

1. What is the best way of tackling climate change?
a) Individually b) Collaboratively
2. Explain your choice of answer
3. Which sectors of the economy are most sensitive to the effects of climate change
4. Discuss how data from the Nigerian Metrological Agency can be beneficial to each of the sectors identified in question 3.
5. Discuss the characteristics of global warming that is already been experienced in Nigeria
6. Discuss the climate change mitigation and adaptation strategies identified in this article.

HOME WORK 3.0

Watch the following videos and document what you have learnt in your log book.

- I. Climate Heroes: Stories of Change
<https://www.youtube.com/watch?v=nozdbgeZFxQ>
- ii. Kid vs Global Warming
<https://www.youngvoicesfortheplanet.com/youth-climate-videos/kids-vs-global-warming/>
- iii. We didn't see this coming
<http://bit.ly/2UXQbU6>

Climate Change Action

Climate Change triggered mostly by human activities has ushered us into a new era of extreme weather conditions, rapid melting of ice and the acidification of oceans. If human activities continue unchecked, natural disasters will become more severe. The effect of climate change is borderless, from China and the United States (the major contributors to climate change) to vulnerable Africa. Africa is more vulnerable to climate change effects because of weak institutional policies, limited funding and the focus on other pain problems like poverty, unemployment and terrorism. Africa is already experiencing climate change. Drought and famine in countries like Somalia and South Sudan have worsened because of climate change; Coastal regions in the Southern, Western and Northern parts of Africa are experiencing incessant flooding as a result of rise in sea level. These occurrences can lead to humanitarian crises which will eventually cause displacement of our people. Moreover, there is the subtle and devastating health risks associated with climate change. This includes respiratory illnesses, skin irritations, heat and meningitis.

Hence, we owe ourselves and posterity a duty to take climate action for the continued sustainable existence of our region. People everywhere are taking climate action to save the planet. Some are big corporations (like Google, Facebook and Microsoft)

who spend millions of dollars to mitigate climate change; others are ordinary individuals taking bold steps to improve the condition of the planet.

With the knowledge you have gained in the last three months identify one or two challenges or problems in your community that can cause climate and proffer solution (s) to the problem (s). We advise that you look for solutions that are cost effective i.e solutions that will require little or no financial resources to solve. Document the problem(s) and solution(s) in your log book. Share your ideas with your friends. With the help of your teacher agree as a group to solve one problem. Kindly ensure you take pictures and video recordings of your activities.



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