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Awareness and Perception of Climate Change among Technical and Vocational Education and Training (TVET) Educators in Nigeria

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ABSTRACT

This study employed a descriptive survey design to assess the awareness and perception of climate change among Technical and Vocational Education and Training (TVET) educators in Nigeria. Respondents were randomly selected from 73 public universities and 51 polytechnics owned by the federal and state governments. Participants were drawn from the SkillG training WhatsApp platform, which comprises lecturers and technologists teaching building/woodwork, electrical/electronic, and mechanical/metal technologies. One educator was randomly chosen from each institution's four-member representation on the platform, yielding a total of 124 respondents. Data were collected using a structured 92-item checklist divided into seven thematic sections covering the causes, effects, and mitigation strategies for climate change. The instrument was administered via Google Forms and distributed through WhatsApp, enabling real-time follow-up and achieving a 100% response rate. Respondents were asked to select all applicable items across each section. The data were analysed using simple descriptive statistics and presented through pie charts, frequencies, and percentage tables. Findings revealed that although general awareness of climate change exists among TVET educators, most respondents lacked a comprehensive understanding of its principal causes, far-reaching effects, and viable mitigation strategies. Contributing factors to this knowledge gap include insufficient environmental education, inadequate policy incentives, weak legislative frameworks, poor consumer habits, and limited government commitment to climate action. The study highlights the urgent need to strengthen climate literacy within the TVET sector to promote sustainable practices and support national and global climate objectives.

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Introduction

Climate change has emerged as a central global concern due to its profound environmental, economic, and social implications. It is broadly defined as a long-term alteration in weather patterns, typically occurring over several decades or longer, and is characterised by changes in temperature, precipitation, wind patterns, and other climatic variables [1,2]. These variations may occur at local, regional, or global scales, and often manifest in increased frequency and intensity of extreme weather events such as droughts, floods, heatwaves, and storms.

Historically, natural factors such as volcanic eruptions, tectonic movements, and wildfires contributed to gradual climate variations over extended periods. However, recent shifts in the global climate have occurred at a significantly faster pace, primarily due to anthropogenic greenhouse gas (GHG) emissions [3-6]. The Industrial Revolution marked a critical turning point, initiating large-scale fossil fuel combustion for industrial, transport, and agricultural activities, resulting in an unprecedented rise in carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) emissions [7,8].

The combustion of fossil fuels coal, oil, gas, and wood remains the dominant source of GHGs globally, contributing significantly to climate change [9]. Nigeria depends of generating sets for about 75 percent of power supply [10]. Other emissions are generated through industrial manufacturing processes (e.g., cement, steel, electronics, plastics), energy production, mechanised agriculture, and transport systems [11-13]. Additionally, energy-intensive agricultural machinery, commercial fishing vessels, and expanded livestock production release substantial quantities of GHGs. Methane, for example, is produced during digestion in ruminant animals such as cattle, goats, and sheep, as well as through manure management practices. The widespread application of nitrogen-based fertilisers contributes to the emission of nitrous oxide a potent greenhouse gas while fluorinated gases from industrial and consumer products such as refrigerators, aerosol sprays, and insulation materials further exacerbate atmospheric warming [14,15].

Residential and commercial buildings also contribute significantly to GHG emissions, accounting for more than half of global electricity use. Heating, cooling, lighting, and electronic appliances largely powered by non-renewable energy sources substantially increase carbon footprints. Moreover, individual lifestyle behaviours, including household energy consumption, transportation choices, dietary preferences, and waste generation, collectively influence national and global emission trends.

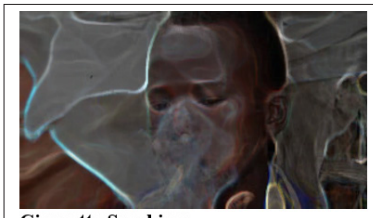
A less commonly acknowledged but significant contributor is the tobacco industry. Tobacco cultivation and consumption generate GHG emissions through land clearing, fertiliser use, processing, and distribution. In 2014 alone, the production of 6.48 million

tonnes of dry tobacco from 32.4 million tonnes of green tobacco contributed approximately 84 million tonnes of CO_2 emissions, representing 0.2% of global emissions [16]. Despite a gradual decline in global tobacco use, it remains prevalent among youth and adults, with one in five adults and nearly 30% of adolescents aged 15 reporting regular cigarette use [17,18].

Another major driver of climate change is deforestation, which disrupts the natural carbon cycle. Forests act as carbon sinks, sequestering atmospheric CO_2 through photosynthesis and storing it in biomass. However, widespread deforestation mainly for agriculture, construction, and logging releases stored carbon back into the atmosphere, thereby intensifying the greenhouse effect [19]. The Food and Agriculture Organisation (2021) estimates that more than 10% of global forest cover has been lost in the last three decades, with an additional 10% being highly fragmented and ecologically vulnerable [14]. In Nigeria, land clearing for subsistence and commercial farming is commonly done through slash-and-burn practices, which directly release CO_2 and exacerbate soil degradation, erosion, flooding, and desertification. Deforestation accounts for approximately 10% of global GHG emissions [20].

Poor waste management practices further contribute to climate instability. Open burning of solid waste, lack of proper landfill infrastructure, and rampant open defecation emit methane and other hazardous pollutants into the atmosphere. Nigeria ranks highest globally in the prevalence of open defecation, with an estimated 50 million individuals lacking access to proper sanitation facilities (EPA, 2024; Federal Government of Nigeria, 2020). These practices not only endanger public health but also accelerate climate change by releasing potent GHGs.

In summary, climate change is no longer a distant environmental issue but an urgent global challenge largely driven by unsustainable human behaviour. Addressing this crisis requires systemic interventions across sectors and scales, including education. Enhancing climate literacy, particularly among TVET educators, represents a critical pathway to building societal resilience and fostering sustainable development. Technical and Vocational Education and Training institutions, given their focus on practical and skills-based learning, are well-positioned to integrate environmental sustainability into their curricula. The effectiveness of such integration, however, depends on the climate awareness and pedagogical capacity of TVET educators. This study, therefore, explores the extent of understanding and perception of climate change among Nigerian TVET educators to identify knowledge gaps and inform strategies for climate education reform. Although this study was carried out in Nigeria, climate abuse committed in one region, such as high emissions, deforestation, or pollution, can and does cause environmental and socio-economic problems for populations far removed from the source. This demonstrates the interconnectedness of the Earth's systems and the global nature of climate justice. Therefore, neglecting any part is a harm to the entire world.



Cigarette Smoking

Deliberate Bush Burning Exercise for farming

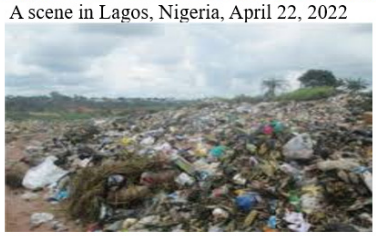
Industrial Operation

Patrol Tanker Explosion

Method of waste disposal in Nigeria 2021

A scene in Lagos, Nigeria, April 22, 2022

Gas Flaring in Niger Delta, Nigeria.



A Refuse Dump Site in Nigeria 2025

A Typical Source of Power Supply in the Nigerian Market

Indicators and Impacts of Anthropogenic Climate Change

Anthropogenic activities have significantly altered the Earth's climate system, as evidenced by a range of well-documented global indicators. These include rising sea levels, increased concentrations of greenhouse gases, elevated global mean surface temperatures, glacial retreat, more frequent and intense extreme weather events, ocean acidification, ocean warming, and the accelerated melting of sea ice [21]. A notable manifestation of these changes is the rapid retreat of mountain glaciers, a trend observed since the early twentieth century. Contemporary reports indicate that the remaining glaciers on the African continent may disappear entirely within a few decades if current warming trajectories persist (Heath, 2024).

Glacial retreat contributes substantially to global sea level rise, particularly in vulnerable regions such as sub-Saharan Africa, where coastal communities face heightened risks of inundation [22,23]. Beyond sea level rise, climate change poses a significant threat to the health and survival of humans, animals, and plant life. It increases the frequency and severity of climate-related hazards, including floods, droughts, heatwaves, tsunamis, and pest outbreaks, thereby exacerbating food insecurity and public health vulnerabilities [24].

The African continent, in particular, has experienced escalating weather and climate variability, which has disrupted ecological, economic, and social systems across multiple sectors [25,26]. Incessant flooding events across African nations are strongly linked to anthropogenic climate change, driven by rising global temperatures and intensified rainfall patterns. These changes have also contributed to the increased incidence of extreme hydrological phenomena such as tornadoes and tsunamis, further amplifying the continent’s exposure to environmental and humanitarian crises.

Flood Scenes in Nigeria in 2021

Here is a refined and academically styled version of the provided text. The revision improves clarity, coherence, tone, structure, and citation formatting, making it suitable for academic publication:

Climate Change, Human Vulnerability, and the Role of TVET Education

Climate change is a global environmental challenge that poses serious threats to ecosystems, economies, and human health. One of the more immediate consequences is desertification, which has been particularly pronounced in Nigeria. The country loses approximately 350,999 hectares of land annually to drought and desertification, primarily affecting 11 northern states such as Sokoto, Kebbi, Katsina, Jigawa, Borno, and Yobe. However, the Nigerian Meteorological Agency reports that other regions also experience periodic dry spells and droughts (Sanchi et al., 2021).

Globally, climate change continues to disrupt agricultural productivity, with long-term consequences for food security and economic stability. For instance, in 2016, China experienced economic losses exceeding 298.3 billion Yuan, affecting over 137 million people through climate-induced natural disasters (Abbass et al., 2022). In Nigeria, the 2022 flooding—recorded as the worst in recent history—destroyed over 440,000 hectares of farmland, displaced thousands of residents, and affected more than 1.4 million people, resulting in 662 deaths. The economic damages were estimated at ₦10.2Trillion (Nigerian Hydrological Services Agency, 2023). Additionally, rising sea levels pose ongoing threats to Nigeria's coastal regions through erosion, land salinisation, and persistent flooding (Sacko, 2020).

These phenomena reflect broader global transformations in the Earth's biological and ecological systems. Climate change has introduced widespread environmental hazards, including ozone layer depletion, intensifying wildfires, biodiversity loss, and the spread of vector-borne diseases (Reichstein, 2013; Sahney et al., 2010; McMichael, 2003). More frequent and intense heat waves are already impacting public health by increasing heat-related illnesses and reducing crop viability. Respiratory and cardiovascular diseases, injuries, and premature deaths related to extreme weather events are on the rise (EPA, 2024). Climate change is also associated with higher rates of waterborne diseases, mental health challenges, and vector-borne illnesses such as malaria and dengue, especially in low-income regions (WHO, 2019; WHO, 2022).

Sub-Saharan Africa is disproportionately vulnerable to these impacts. Low-income communities often reside in areas lacking adequate sanitation, healthcare infrastructure, and environmental protections. They are more likely to suffer from deteriorating agricultural productivity, rising food prices, and reduced rural incomes (World Economic Forum, 2023; Kabir et al., 2016). The degradation of natural resources exacerbates poverty cycles by forcing individuals into environmentally harmful survival strategies (Nguyen, 2024; Taconet et al., 2020). Moreover, pollution-related illnesses and climate-sensitive diseases such as childhood diarrhoea and pneumonia further entrench health disparities in these communities.

Climate change is now recognised as a key driver of displacement and poverty. Between 2010 and 2019, an average of 23.1 million people were displaced annually by weather-related events. Most of these displaced populations originated from countries that are least equipped to adapt to climate-related disruptions (United Nations, 2024). Rising global temperatures also contribute to the proliferation of pest populations, affecting crop yields and threatening food security (Abbass et al., 2022). Changes in weather patterns, glacier melting, and rising sea levels are accelerating the extinction of plant and animal species. Current estimates suggest that the world is losing species at a rate 1,000 times higher than the historical average, with millions at risk of extinction in the coming decades (United Nations, 2024; Gampe et al., 2016; Mihiretu et al., 2021; Shaffril et al., 2018).

Climate change endangers human health and livelihoods through multiple pathways, including increased exposure to epidemics, undernutrition, forced migration, and ecosystem collapse. The World Health Organisation estimates that more than 13 million deaths annually are attributable to environmental causes linked to climate change (WHO, 2019; EPA, 2016; WHO, 2022). Climate-induced stresses are disrupting traditional livelihoods such as fishing, hunting, and herding in Arctic and sub-Saharan communities, while ocean acidification continues to threaten marine biodiversity and food systems (WHO, 2022).

The growing scientific consensus underscores the urgency of climate action. Atmospheric concentrations of greenhouse gases have reached historically unprecedented levels (Usman & Makhdum, 2021). The Intergovernmental Panel on Climate Change (IPCC, 2022) stresses that the window for limiting warming to 1.5°C is rapidly closing. Without immediate global mitigation efforts, the planet faces irreversible climatic shifts. Environmental sustainability practices—defined as development activities that maintain or enhance ecological integrity—are essential for curbing these risks (World Bank, 2008). Sustainable Development Goal 7, among others, emphasises the integration of sustainable practices into national policies (United Nations, 2015).

Global initiatives have responded to this call. As of June 2024, 107 countries—accounting for 82% of global GHG emissions—have committed to net-zero targets. Additionally, over 9,000 companies, 1,000 cities, and 600 financial institutions have joined the United Nations' "Race to Zero" initiative, pledging to halve emissions by 2030 (UNEP, 2024). Educational institutions are also aligning with these targets. In 2014, UNESCO launched the Global Action Programme, and in 2015, 196 countries adopted the Paris Agreement, aiming to limit global warming and enhance resilience.

Despite these developments, the role of education—particularly Technical and Vocational Education and Training (TVET)—remains underexplored in national climate strategies. Climate change education plays a critical role in building climate literacy, influencing behaviour, and enabling communities to adopt sustainable practices. It equips individuals with the knowledge, skills, and values needed to mitigate and adapt to climate-related challenges. As part of UNESCO's Education for Sustainable Development (ESD) framework, climate change education empowers learners to make informed decisions and adopt resilient lifestyles (UNESCO, 2017).

TVET educators, in particular, are uniquely positioned to lead this transformation due to their influence on youth and community practices. However, they must first possess a sound understanding of the causes, impacts, and mitigation strategies of climate change to serve effectively as change agents. Given the increasing urgency of climate-related challenges, this study seeks to examine the awareness and perception of climate change among Nigerian TVET educators, with a focus on the following objectives:

1. To assess the level of awareness of TVET educators regarding the causes of climate change;
2. To evaluate their understanding of the environmental and socio-economic effects of climate change;
3. To identify the strategies known to educators for mitigating or slowing down the impacts of climate change.

By understanding the knowledge base of educators, this research aims to inform curriculum reform, policy intervention, and professional development efforts in the Nigerian TVET sector, contributing to national sustainability goals and the global climate action agenda.

Methodology

This study adopted a descriptive survey research design to assess the awareness and perception of climate change among Technical and Vocational Education and Training (TVET) educators in Nigeria. The target population consisted of lecturers and technologists in government-owned universities and polytechnics across the country. Participants were randomly selected from the official SkillG Training WhatsApp platform, a national digital forum comprising verified TVET educators from public tertiary institutions in Nigeria. From each of the 73 universities and 51 polytechnics (federal and state-owned), one educator was randomly chosen from a group of four institutional representatives, resulting in a total sample of 124 respondents. The sample included educators specialising in Agriculture, Building/ Woodwork Technology, Electrical/Electronic Technology, and Mechanical/Metal Technology.

Data collection was conducted using a structured 92-item checklist, divided into seven thematic sections covering the causes, effects, and mitigation strategies of climate change. The instrument was administered electronically using Google Forms and distributed through WhatsApp. This method enabled direct communication, clarification of ambiguities, and consistent follow-up, which facilitated a 100% response rate. Respondents were instructed to indicate agreement by checking (✓) as many items as applicable in each section. Data were analysed using descriptive statistics, specifically frequencies and percentages. Results were presented using tables and pie charts to highlight trends and illustrate levels of awareness and perception among respondents.

Results

Chart 1: Perceptions of Climate Change among TVET Educators

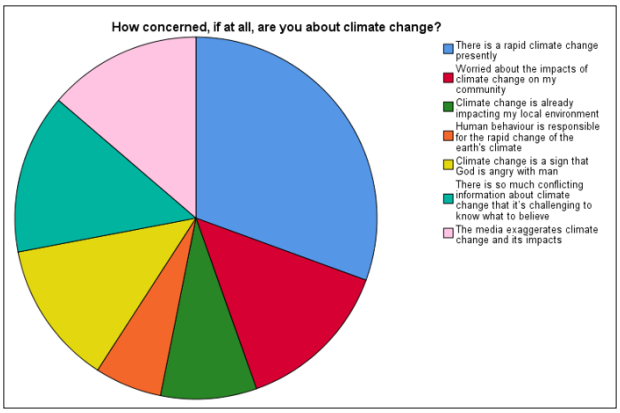


Figure 1: This chart illustrates the Perceptions of climate change among TVET Educators. It is the result of TVET Educators' responses on their concerns about climate change, as analysed by the researcher (2025)

Table 1: Presents the Distribution of Responses Concerning Tvet Educators' Awareness and Perceptions of Climate Change. A Substantial Majority of Respondents (n = 107; 86.29%) Acknowledged that the Earth's Climate is Undergoing Rapid Changes. However, a Comparatively Small Proportion (n = 21; 16.94%) Attributed these Changes to Human Behaviour, indicating a Significant Gap in Understanding the Anthropogenic Drivers of Climate Change. Only 23.19% of Participants Agreed that Climate Change is Already Affecting their Local Environment, and Less than Half (39.42%) Reported Concern about its Potential Impacts.

Table 1

	Frequency	Percent
There is a rapid climate change presently	107	86.29
Worried about the impacts of climate change on my community	49	39.42
Climate change is already impacting my local environment	30	24.19
Human behaviour is responsible for the rapid change of the earth's climate	21	16.94
Climate change is a sign that God is angry with man	45	36.29
There is so much conflicting information about climate change that it's challenging to know what to believe	50	40.32
The media exaggerates climate change and its impacts	48	38.71
Total Number of Respondents	124	

Moreover, 40.32% of respondents expressed uncertainty due to the prevalence of conflicting information about climate change, suggesting challenges in discerning credible scientific knowledge. Additionally, 38.71% perceived that the media tends to exaggerate the severity of climate change and its consequences. Notably, 36.29% of the educators interpreted climate change as a divine punishment, reflecting the influence of cultural or religious beliefs on environmental perceptions. These findings underscore the pressing need for improved climate literacy and evidence-based environmental education among TVET educators in Nigeria, as misconceptions and misinformation may impede the effective integration of sustainability principles into technical and vocational curricula.

Chart 2: Common Practices

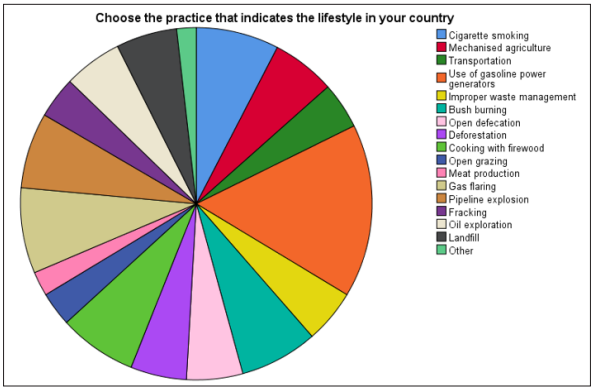


Figure 2: This Chart Illustrates Common Practices of TVET Educators Related to Climate Change. It is the Result of TVET Educators' Responses to Their Concerns About Their Common Practices, as Analysed by the Researcher (2025)

Table 2: Presents the Responses of Tvet Educators Regarding Common Practices Within their Communities that Contribute to Climate Change. A Significant Proportion of Respondents

(57.26%) Reported Widespread Use of Gasoline-Powered Generators, Highlighting the Reliance on Non-Renewable Energy Sources Due to Inadequate Electricity Supply. Cigarette Smoking was Identified by 27.42% of the Respondents as a Prevalent Behaviour, while 28.23% Acknowledged Gas Flaring as a Continuing Environmental Issue. Mechanised Agriculture was Recognised by 20.97% of Educators, whereas 15.32% Reported the Regular use of Transportation Systems for the Movement of People and Goods, Both of Which Contribute to Increased Greenhouse Gas Emissions. Improper Waste Management Practices, Including Open Dumping and Burning, Were Cited by 17.74% of Participants.

Table 2

	Percent	Percent
Cigarette smoking	34	27.42
Mechanised agriculture	26	20.97
Transportation	19	15.32
Use of gasoline-powered generators	71	57.26
Improper waste management	22	17.74
Bush burning	32	25.81
Open defecation	23	18.55
Deforestation	23	18.55
Cooking with firewood	32	25.81
Open grazing	14	11.29
Meat production	10	08.06
Gas flaring	35	28.23
Pipeline explosion	31	25.00
Fracking	17	13.71
Oil exploration	24	19.35
Landfill	25	20.16
other	8	06.45
Total Number of Respondents	124	

Bush burning and cooking with firewood—both traditional practices associated with rural livelihoods were reported by 25.81% of respondents. Open defecation was acknowledged by 18.55%, while open grazing, another environmentally impactful activity, was noted by 11.29% of educators. Meat production, which contributes significantly to methane emissions, was mentioned by 8.06%. Deforestation was cited by 18.55% of respondents, reflecting the ongoing removal of vegetation cover for agricultural and construction purposes. Oil exploration activities, including pipeline explosions (25.00%), fracking (13.71%), and general oil extraction processes (19.35%), were also identified as contributors to environmental degradation. Landfilling was recognised by 20.16% of respondents as a common waste disposal practice. Finally, a smaller percentage (6.45%) reported other harmful practices such as roasting and tyre burning, which release toxic pollutants into the atmosphere.

These findings underscore the widespread nature of environmentally harmful practices across various sectors, necessitating targeted climate education and policy interventions to promote sustainable behaviours within communities.

Chart 3: Possible Causes of Climate Change

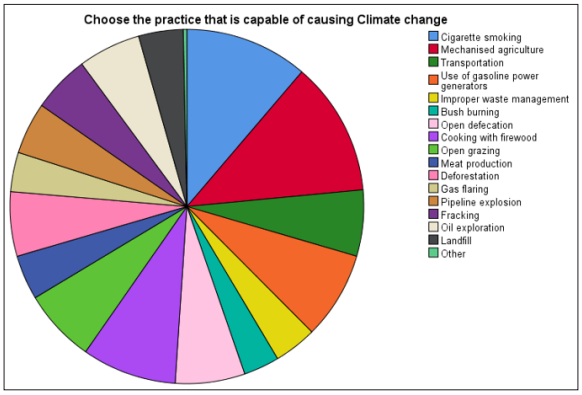


Figure 3: This Chart Illustrates the Result of Tvet Educators' Responses on the Causes of Climate Change, as Analysed by the Researcher (2025)

Table 3: Presents the Perceptions of Technical and Vocational Education and Training (tvet) Educators in Nigeria Regarding the Anthropogenic Causes of Climate Change. The Findings Reveal Varying Levels of Awareness Across Different Contributing Factors. A Majority of Respondents (60.48%) Identified Mechanised Agriculture as a Significant Contributor to Climate Change, Followed Closely by Cigarette Smoking (55.65%) and Cooking with Firewood (42.74%). The Use of Gasoline-Powered Generators was Acknowledged by 39.52% of Respondents, while 33.06% Attributed Climate Change to Open Grazing. other Factors Cited Include Open Defecation (31.06%), Deforestation (29.03%), and Transportation (29.84%). Oil Exploration and Pipeline Explosions Were Identified by 28.23% and 23.39% of Respondents, Respectively. Fracking was Recognised by 25.81%, while Landfills and Meat Production were Both Noted by 20.16% of Participants. Gas Flaring was Identified by 17.74%, and Bush Burning by 16.13%. Improper Waste Management was Cited by Only 19.35% of the Educators. A Small Fraction (1.61%) Selected other Causes, Such as Urbanisation and Infrastructural decay.

Table 3

	Frequency	Percent
Cigarette smoking	69	55.65
Mechanised agriculture	75	60.48
Transportation	37	29.84
Use of gasoline-powered generators	49	39.52
Improper waste management	24	19.35
Bush burning	20	16.13
Open defecation	39	31.45
Cooking with firewood	53	42.74
Open grazing	41	33.06
Meat production	25	20.16
Deforestation	36	29.03
Gas flaring	22	17.74
Pipeline explosion	29	23.39
Fracking	32	25.81
Oil exploration	35	28.23
Landfill	25	20.16
Other	2	.01.61
Total	124	

These results suggest a partial but uneven understanding of the diverse human activities contributing to climate change among TVET educators, with some major sources like deforestation and gas flaring receiving comparatively low recognition. This indicates a critical need for targeted climate education that addresses the full spectrum of emission sources and promotes comprehensive climate literacy in the TVET sector.

Chart 4: Perceived Effects of Climate Change Among TVET Educators

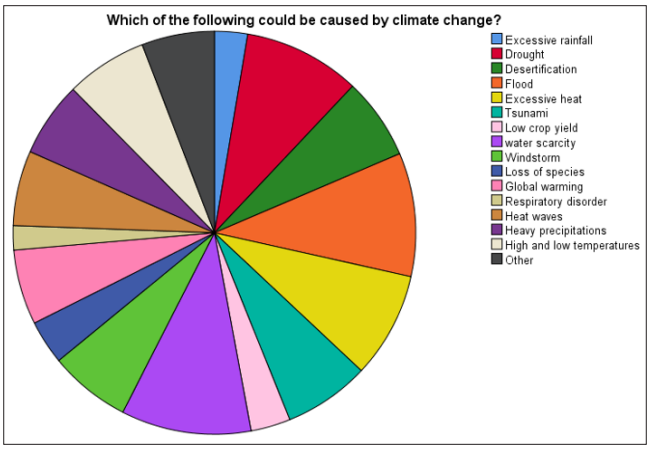


Figure 4: This Chart Illustrates the Result of Tvet Educators' Responses on the Perceived Effects of Climate Change as Analysed by the Researcher (2025)

Table 4: Presents the Perceived Effects of Climate Change as Reported by Respondents. The Most Frequently Identified Impacts Include Water Scarcity (47.58%), Flooding (45.16%), and Drought (42.74%). Other Significant Effects Cited Were Excessive Heat (38.71%), Tsunamis (31.45%), Desertification (29.84%), Windstorms (29.84%), and Fluctuations in High and Low Temperatures (29.84%). Additionally, Global Warming, Heatwaves, and Heavy Precipitation were Each Acknowledged by 27.42% of Respondents. Less Commonly Reported Effects Included Low Crop yield (14.52%), Loss of Species (16.13%), and Respiratory Disorders (8.87%). Notably, "Death" Received no Affirmative Responses as a Direct Effect. However, 26.61% of Respondents Identified other Health-Related Consequences, Such as Skin Rashes, Meningitis, and Chronic Cough, as Outcomes Associated with Climate Change. These Findings Suggest that While Tvet Educators Recognise a Broad Range of Environmental Impacts, there Remains Limited Awareness of Some Critical Health and Ecological Consequences of Climate Change, Highlighting the Need for More Comprehensive Climate Education within the Sector.

Table 4

	Frequency	Percent
Excessive rainfall	15	12.10
Drought	53	42.74
Desertification	37	29.84
Flood	56	45.16
Excessive heat	48	38.71
Tsunami	39	31.45
Low crop yield	18	14.52
water scarcity	59	47.58
Windstorm	37	29.84
Loss of species	20	16.13
Global warming	34	27.42
Respiratory disorder	11	08.87
Heat waves	34	27.42
Heavy precipitations	34	27.42
High and low temperatures	37	29.84
Other	33	26.61
Total Number of Respondents	124	

Chart 5: Sources of True Climate Change Information

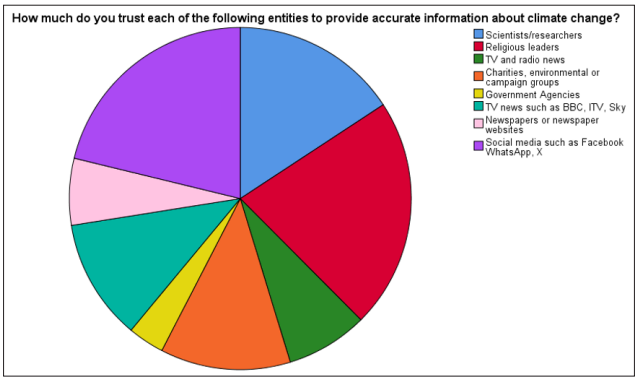


Figure 5: This Chart Illustrates the Result of Tvet Educators' Responses on The Reliable Sources of Climate Change Information, As Analysed by the Researcher (2025)

Table 5: Presents the Distribution of Respondents' Trust in Various sources of Climate Change Information. The Data Reveal Varying Degrees of Confidence Across Information Providers. Notably, 61.29% of Respondents Reported a High Level of Trust in Religious Leaders as Credible Sources of Information on Climate Change, Followed Closely by Social Media Platforms—Including Facebook, Whatsapp, and x (Formerly Twitter)—Hich Garnered 59.68% Trust. Scientific Experts and Researchers Were Considered Trustworthy by 44.35% of Participants. Meanwhile, 34.68% Expressed Trust in Information Disseminated by Charities, Environmental Organisations, and Campaign Groups, While Government Agencies were Trusted by 32.26% of Respondents. International Television News Sources, Such as Bbc, Itv, and Sky News, Were Trusted by 32.26%, whereas Local Television and Radio Broadcasts were Considered Reliable by 21.77% of Respondents. Newspapers and Newspaper Websites Received the Least Trust, with only 17.74% of Respondents Considering Newspapers Credible Sources of Climate Change Information.

Table 5

	Frequency	Percent
Scientists/researchers	55	44.35
Religious leaders	76	61.29
Local TV and radio news	27	21.77
Charities, environmental or campaign groups	43	34.68
Government Agencies	12	09.68
TV news such as BBC, ITV, Sky	40	32.26
Newspapers or newspaper websites	22	17.74

Social media such as Facebook, WhatsApp, X	74	59.68
Total Number of Respondents	124	

Chart 6: Responsibility for Tackling Climate Change

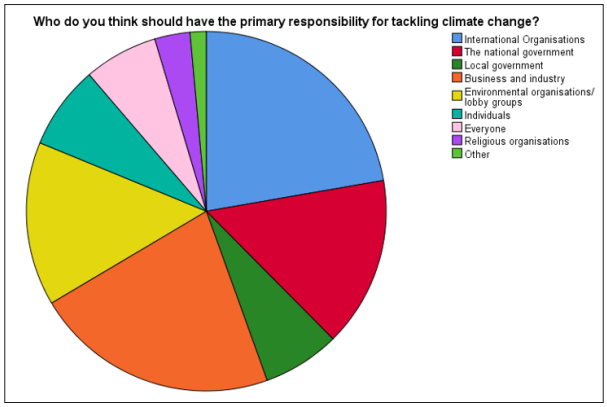


Figure 6: This Chart Illustrates the Result of Tvet Educators' Responses on Those Responsible for Tackling Climate Change, as Analysed by the Researcher (2025)

Table 6: As Presented in Table 6, the Respondents Expressed Diverse Views Regarding Who Should Bear the Primary Responsibility for Addressing Climate Change. A Majority (62.10%) Believed that International Organisations Should Take the Lead in Climate Change Mitigation Efforts. National governments were also identified by 42.74% of respondents as key actors in combating climate change. Additionally, 41.13% of participants Assigned Responsibility to Environmental Organisations, while 42.74% Considered local Government Authorities' Significant Stakeholders. Only about 20.97% of Respondents Believed Private Individuals have a Role to Play in Addressing Climate Change, whereas 19.35% Identified Businesses and Industries as Responsible Entities. A Smaller Proportion (18.55%) Viewed Climate Change Mitigation as a Collective Responsibility Shared by all Societal groups. Religious Institutions were Selected by 8.87% of Respondents, and 4.03% Attributed the Responsibility to other Actors, Such as Climate Change Experts and Scientists. These Findings Underscore the Perceived Importance of Multilevel Governance and Collaborative Action in Climate Change Mitigation, with Respondents Acknowledging Roles for Both Institutional and Individual Stakeholders.

Table 6

	Frequency	Percent
International Organisations	77	62.10
The national government	53	42.74
Local government	24	19.35
Business and industry	76	61.29
Environmental organisations/ lobby groups	51	41.13
Individuals	26	20.97
Everyone	23	18.55
Religious organisations	11	08.87
Other	5	04.03
Total Number of Respondents	124	

Chart 7: Actions Taken by TVET Educators to Mitigate Climate Change

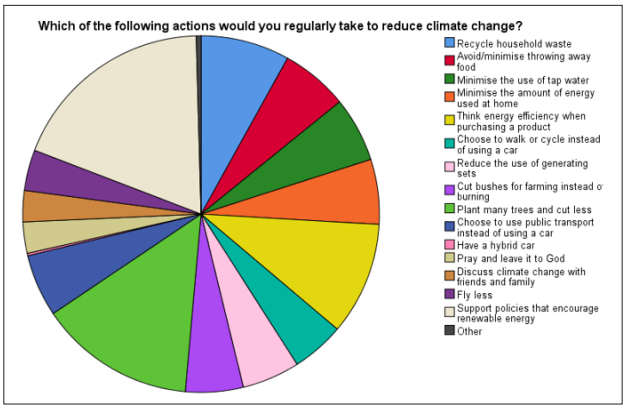


Figure 7: This Chart Illustrates the Result of Actions Taken by TVET Educators to Mitigate Climate Change, as Analysed by the Researcher (2025)

Table 7: Illustrates the Self-reported Actions of Technical and Vocational Education and Training (TVET) Educators in Nigeria Aimed at Reducing their Contributions to Climate Change. the Data Reveal Varying Levels of Engagement in Environmentally Responsible Behaviours. Specifically, 29.84% of Respondents Indicated they Regularly Recycle Household Waste, while 22.58% Reported Efforts to Avoid or Minimise Food Waste. Approximately 21.77% Stated that they Actively Reduce Water Usage, and 37.90% Consider Energy Efficiency when Purchasing Consumer Products. Additionally, 26.61% of Respondents Reported Intentionally Choosing Energy-Efficient Products, while 17.74% Preferred Walking or Cycling over Using Motor Vehicles for Local Travel. Efforts to Limit Reliance on Gasoline-Powered Generators were Reported by 19.35% of Respondents, and an Equal Proportion (19.35%) Preferred Cutting Bushes Rather than Burning them, a Practice Known to Emit Greenhouse Gases. Notably, 52.42% of Educators Claimed to Participate in Tree Planting and to Limit Tree-Felling Activities, Reflecting a Strong Awareness of the Role of Afforestation in Climate Mitigation.

Table 7

	Frequency	Percent
Recycle household waste	37	29.84
Avoid/minimise throwing away food	28	22.58
Minimise the use of tap water	27	21.77
Minimise the amount of energy used at home	27	21.77
Think energy efficiency when purchasing a product	47	37.90
Choose to walk or cycle instead of using a car	22	17.74
Reduce the use of generating sets	24	19.35
Cut bushes for farming instead of burning	24	19.35
Plant many trees and cut less	65	52.42
Choose to use public transport instead of using a car	26	20.97
Have a hybrid car	1	0.01
Pray and leave it to God	13	10.48

Have an electric car	0	0.00
Discuss climate change with friends and family	13	10.48
Fly less	17	13.71
Support policies that encourage renewable energy	86	69.35
Other	2	01.61
Total Number of Respondents	124	

Regarding transportation options, 20.97% preferred public transport over private vehicles. However, ownership of low-emission vehicles remains very low: only 0.01% of respondents owned a hybrid, and none reported owning an electric vehicle. A small proportion of respondents (10.48%) relied on prayer as a way to address climate change, while the same percentage (10.48%) discussed climate issues with friends and family. Additionally, 13.71% reported reducing air travel to lower their carbon footprint. Importantly, 69.35% supported government policies that promote renewable energy and environmental sustainability. Conversely, a small percentage (1.61%) said they take no deliberate action to combat climate change. These findings highlight both opportunities and challenges in encouraging pro-environmental behaviour among TVET educators and emphasise the need for improved climate education and policy engagement in the sector.

Major Findings

Data analysis from the 124 valid responses revealed several key trends regarding climate change awareness and perception among TVET educators in Nigeria:

General Awareness

A majority of respondents (86.29%) indicated that they were aware of climate change and its impacts. This awareness was primarily derived from media sources (57.26%), personal experience (21.77%), and professional development activities (12.10%). However, only 8.87% reported receiving formal climate change education as part of their teacher training or continuous professional development.

Understanding of Causes

Despite high levels of general awareness, only 16.94% of respondents correctly identified human activities such as fossil fuel combustion, deforestation, and industrial agriculture as the dominant drivers of contemporary climate change. The remaining respondents attributed climate change to natural variability (34.68%), spiritual or supernatural forces (11.29%), or expressed uncertainty (37.10%).

Perceived Environmental Impacts

Respondents acknowledged several environmental impacts of climate change, including rising temperatures (78.22%), erratic rainfall patterns (64.51%), increased flooding (49.19%), desertification (35.48%), and loss of biodiversity (32.25%). However, knowledge about slow-onset impacts such as sea-level rise and glacial melting was limited (19.35%).

Socioeconomic Impacts

TVET educators identified increased disease prevalence (54.03%), declining agricultural productivity (47.58%), water scarcity (33.87%), and displacement of populations (28.23%) as major consequences of climate change. Many expressed concerns about the vulnerability of low-income and rural communities.

Familiarity with Mitigation Strategies

Although 71.77% of respondents supported the integration of climate education into TVET curricula, only 22.58% could list concrete mitigation strategies such as renewable energy use, sustainable farming practices, or afforestation. This highlights the gap between awareness and actionable knowledge.

Discussion

The findings of this study reveal a significant disparity between general awareness of climate change and understanding of its anthropogenic causes among Nigerian Technical and Vocational Education and Training (TVET) educators. While a large proportion of respondents (86.29%) acknowledged the reality of rapid climate change, only 16.94% attributed it primarily to human activities. This limited recognition of anthropogenic drivers is concerning, given the overwhelming scientific consensus that human behaviour particularly the burning of fossil fuels, deforestation, and industrial agriculture is the dominant force behind global climate change [15-45]. Similar trends have been observed elsewhere. Although a portion of the European public remained sceptical about humans contributing to climatic variations, over 90% of European scientists affirmed that human actions predominantly drive climate change [46].

TVET educators play a critical role in shaping sustainable practices through skills-oriented instruction and community engagement. A lack of understanding regarding the causes of climate change among this group can undermine efforts to achieve the Sustainable Development Goals (SDGs), particularly SDG 7 (affordable and clean energy), SDG 11 (sustainable cities and communities), and SDG 13 (climate action). Educators who are not convinced of human responsibility may inadvertently reinforce climate-damaging behaviours in their instructional practices and daily lives.

Respondents reported widespread observation of practices contributing to climate change within their communities. The use of gasoline-powered generators was the most frequently identified contributor (57.26%), followed by mechanised agriculture (60.48%), cigarette smoking (55.65%), and cooking with firewood (52.74%). Conversely, awareness of other significant contributors, such as open grazing (11.29%), tyre burning (6.45%), and meat production (8.06%), was comparatively low. Notably, activities such as fossil fuel combustion for power generation and transportation, identified by global climate assessments as primary causes of greenhouse gas emissions, were ranked lower by respondents (39.52% and 29.84%, respectively), along with bush burning (16.13%). These findings suggest a disconnect between local perceptions and established scientific understanding of emission sources [47] .

In terms of the perceived effects of climate change, respondents demonstrated limited awareness. Only 12.10% agreed that climate change can cause excessive rainfall, 14.52% linked it to reduced crop yields, and a mere 8.87% associated it with respiratory illness. Surprisingly, none of the respondents recognised climate change as a cause of mortality. These views are inconsistent with extensive research indicating that climate change contributes to more frequent flooding [48]. declining crop yields, including rice, wheat, corn, and soybeans and increased respiratory illnesses and deaths due to extreme heat, air pollution, and allergenic particles [7-51]. Furthermore, climate change is accelerating species extinction at an unprecedented rate, with biodiversity loss now occurring 1,000 times faster than historical norms [52].

Another critical finding relates to trust in information sources. Respondents indicated a higher level of confidence in religious leaders and social media compared to government agencies. This aligns with trends across Africa, where institutional distrust is growing [53-55]. also noted that Nigerians tend to regard religious leaders as more credible and less corrupt than political figures. Consequently, climate change communication strategies may be more effective if channelled through faith-based institutions and trusted community figures. Education levels, media literacy, and political orientation can all influence receptiveness to scientific messaging, and misinformation remains a critical barrier to widespread climate literacy.

Moreover, the findings suggest a prevailing perception that climate action is primarily the responsibility of governments and international organisations, rather than individuals. While global institutions are indispensable in climate governance facilitating cooperation, funding, and policy frameworks individual action remains essential. Personal behaviours, such as reducing energy consumption, sustainable travel, and responsible consumption, are integral to achieving climate goals [44]. Despite the increasing advocacy for cleaner transportation, the uptake of low-carbon transport options among TVET educators remains negligible. Only 0.01% reported owning a hybrid vehicle, and none owned an electric car, although 17.74% opted to walk or cycle. These numbers highlight the gap between environmental awareness and behavioural change. Transportation emissions are a major contributor to global warming, and policy frameworks alone may be insufficient without corresponding shifts in personal practice [44]. underscores the importance of adopting sustainable mobility habits, such as walking, cycling, carpooling, and using public transport, as part of broader decarbonisation efforts.

In sum, the results underscore the urgent need to improve climate change education and literacy among TVET educators. Enhancing their understanding of anthropogenic climate drivers, environmental and health-related impacts, and mitigation strategies will not only inform their teaching practices but also equip them to act as change agents in their communities. Climate education must be inclusive, accurate, and contextually relevant, fostering both awareness and action. Integrating climate change education within the TVET framework is thus critical to advancing sustainable development in Nigeria.

Recommendations

Based on the study's findings, the following recommendations are proposed:

Integrate Climate Change Education into TVET Curricula

TVET institutions should embed climate science, environmental sustainability, and green skills into existing courses to ensure that educators and learners alike are equipped with relevant knowledge and competencies.

Enhance Professional Development for Educators

Workshops, seminars, and training programs should be organised to improve TVET educators' understanding of climate change causes, effects, and mitigation. This can be facilitated by ministries of education in partnership with environmental agencies and NGOs.

Develop Climate Literacy Standards

National education policymakers should establish climate literacy benchmarks for TVET educators and incorporate them into teacher qualification frameworks and institutional evaluation systems.

Leverage Media and Technology

Government and educational institutions should promote the use of digital media, open-access resources, and online platforms to disseminate accurate climate change information to educators across the country.

Promote Community Engagement

TVET institutions should encourage educators to lead or support local environmental initiatives, linking classroom learning with real-world sustainability practices.

Conclusion

This study has demonstrated that while general awareness of climate change is relatively high among Nigerian TVET educators, significant gaps exist in their understanding of its anthropogenic causes and appropriate mitigation strategies. These gaps undermine the capacity of TVET institutions to function as effective platforms for environmental education and sustainable development.

Addressing these deficiencies requires a multi-faceted approach that includes curriculum reform, educator training, and the establishment of climate literacy standards. Strengthening the role of TVET educators in climate action is not only essential for advancing Nigeria's development goals but also for preparing a future workforce that is resilient, informed, and capable of driving sustainable change.

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Data Availability

The raw data for this study is available at the Tertiary Education Trust Fund, Ebonyi State University, Nigeria. However, the analysed data is available at https://figshare.com/account/home.

Disclosure of Competing Interest

The author hereby declares that there is no potential conflict of interest now or at any time in the future.

References

1. (2017) The United States Environmental Protection Agency Climate Change: Basic Information. Washington DC: EPA.
2. (2020) European Commission Causes of climate change. Brussels: Directorate-General for Climate Action
3. Murshed M (2022) Pathways to clean cooking fuel transition in low and middle-income Sub-Saharan African countries: the relevance of improving energy use efficiency. Sustainable Production and Consumption 30: 396-412.
4. Heath V (2024) Africa's final glaciers will melt away by 2040. Kent: Geographical Hussain M, Butt AR, Uzma F, Ahmed R, Irshad S, Rehman A, Yousaf B (2020) A comprehensive review of climate change impacts, adaptation, and mitigation on environmental and natural calamities in Pakistan. Environ Monit Assess 192: 48.
5. Sovacool BK, Griffiths S, Kim J, Bazilian M (2021) Climate change and industrial F-gases: a critical and systematic review of developments, sociotechnical systems, and policy options

for reducing synthetic greenhouse gas emissions. Renew Sustain Energy Rev 141:110759.

6. Usman M, Balsalobre-Lorente D (2022) Environmental concern in the era of industrialisation: Can financial development, renewable energy, and natural resources alleviate some load? Ene Policy 162: 112780
7. Abbass K, Qasim MZ, Song H, Murshed M, Mahmood H, et al. (2022) A review of the global climate change impacts, adaptation, and sustainable mitigation measures. Environ Sci Pollut Res 29: 42539-42559.
8. Leppänen S, Saikkonen L, Ollikainen M (2014) Impact of Climate Change on cereal grain productioninRussia:Mimeo https://www.researchgate.net/publication/265747032_Impact_of_Climate_Change_on_cereal_grain_production_in_Russia.
9. (2024) United Nations Causes and Effects of Climate Change. New York: Climate Actions.
10. (2023) Punchnig Nigeria relies on generators for 75% of its electricity.
11. Murshed M, Nurmakhanova M, Elheddad M, Ahmed R (2020) Value addition in the services sector and its heterogeneous impacts on CO2 emissions: revisiting the EKC hypothesis for the OPEC using panel spatial estimation techniques. Environ Sci Pollut Res 27: 38951-38973.
12. Usman M, Balsalobre Lorente D, Jahangir A, Ahmad P (2022) Pollution concern during globalisation mode in financially resource-rich countries: Do financial development, natural resources, and renewable energy consumption matter? Rene. Energy 183: 90-102.
13. Usman M, Makhdum MSA (2021) What abates the ecological footprint in the BRICS-T region? Exploring the influence of renewable energy, non-renewable energy, agriculture, forest area and financial development. Renew Energy 179: 12-28.
14. (2024) European Commission Deforestation and the Environment. Retrieved from.
15. Abbass K, Qasim M Z, Song H, Murshed M, Mahmood H, et al. (2022) A review of the global climate change impacts, adaptation, and sustainable mitigation measures. Environ Sci Pollut Res 29: 42539-42559.
16. Dunning H Wilson J (2018) Cigarettes have a significant impact on the environment, not just on health. London: Imperial College Press.
17. (2022) World Health Organisation Greater Horn of Africa Food and Health Emergency. Cairo, Egypt: Media Centre.
18. (2024) World Health Organisation WHO Global Report on Trends in Prevalence of Tobacco Use 2000–2030. Geneva: TFI.
19. (2021) Climate Transform Types of Deforestation, Forms, Causes, Consequences.
20. (2020) World Meteorological Organization State of the Climate in Africa.
21. Zemp M, M Huss, E Thibert, N Eckert, R McNabb, et al. (2019) Global glacier mass changes and their contributions to sea-level rise from 1961 to 2016. Nature, 568: 382-386.
22. Knight J (2023) The last glaciers in Africa and their environmental implications. Journal of African Earth Sciences 200104863.
23. (2020) World Meteorological OrganisationState of the Climate in Africa. Geneva: WMO
24. Climate Change (2022) Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [H.-O. Pörtner, D.C. Roberts, M. Tignor, E.S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, B. Rama (eds.)]. United Kingdom: Cambridge University Press, pp 3056.
25. Sacko J L C (2020) State of the Climate in Africa. Geneva: WMO.
26. (2020) United Nations Climate Change Climate Change Is an Increasing Threat to Africa. Bonn: UN.
27. Sanchi I D, Alhassan Y J, Sabo Y A, Hamid B J (2021) Critical Review of the Causes and Effects of Dry Spell in the 2021 Rainy Season in Danko Wasagu Local Government, Kebbi State, Nigeria. Cross Current Int J Agri Vet Sci 3: 66-75.
28. (2023) Nigerian Hydrological Services Agency Annual Flood Outlook. Abuja: Federal Ministry of Water Resources.
29. Sahney S, Benton MJ, Ferry PA (2010) Links between Global Taxonomic Diversity, Ecological Diversity and the Expansion of Vertebrates on Land". Biology Letters 6: 544-547.
30. Mc Michael A J, A McMichael, D Campbell-Lendrum, C Corvalan, K Ebi, (2003) Global Climate Change and Health: An Old Story Writ Large. Geneva: World Health Organisation.
31. (2019) World Health Organisation 2018 WHO health and climate change survey report: tracking global progress. Geneva: ECH
32. (2023) World Economic Forum The climate crisis disproportionately hits the poor. How can we protect them.
33. Kabir M I, Rahman M B, Smith W, Lusha M A Z, Milton A H (2016) Climate Change and Health in Bangladesh: a baseline cross-sectional survey. Global Health Action 9: 29609.
34. Nguyen TT, Grote U, Neubacher F, Rahut D B, Do M H, et al. (2023) Security risks from climate change and environmental degradation: Implications for sustainable land use transformation in the Global South. Current Opinion in Environmental Sustainability, 63: 101322.
35. Taconet N, Méjean A, Guivarch C (2020) Influence of climate change impacts and mitigation costs on inequality between countries. Climatic Change 160: 15-34.
36. (2024) United NationsCauses and Effects of Climate Change. New York: Climate Actions
37. (2024) United Nations Environment Programme Executive summary. In Emissions Gap Report 2024: No more hot air …please! With a massive gap between rhetoric and reality, countries draft new climate commitments.
38. Gampe D, Nikulin G, Ludwig R (2016) Using an ensemble of regional climate models to assess climate change impacts on water scarcity in European river basins. Sci Total Environ 573: 1503 -1518
39. Mihiretu A, Okoyo EN, Lemma T (2021) Awareness of climate change and its associated risks jointly explain context-specific adaptation in the Arid-tropics. Northeast Ethiopia SN Social Sciences 1: 1-18.
40. Shaffril HAM, Krauss SE, Samsuddin SF (2018) A systematic review on Asian farmers' adaptation practices towards climate change. Sci Total Environ 644: 683-695.
41. (2016) Environmental Protection Agency Climate Impacts on Human Health. Washington, DC: U.S. Environmental Protection Agency.
42. (2008) The World Bank Environmental Sustainability: An Evaluation of World Bank Group Support. Washington, D.C.: Author
43. Hagelberg N (2025) The climate emergency demands action from all of us. We need to get to net-zero greenhouse gas emissions by 2050, and everyone has a role to play. Nairobi, Kenya: United Nations Environmental Programme.
44. Lockwood M, Ball WT (2020) Placing limits on long-term variations in quiet-Sun irradiance and their contribution to total solar irradiance and solar radiative forcing of climate," Proceedings of the Royal Society 476: 20200077.
45. Ribes A, Zwiers FW, Azaïs JM, Naveau P (2017) A new

statistical approach to climate change detection and attribution. Clim Dyn 48: 367-386.
46. Lockwood M, Ball WT (2020) Placing limits on long-term variations in quiet-Sun irradiance and their contribution to total solar irradiance and solar radiative forcing of climate," Proceedings of the Royal Society 476: 20200077.
47. (2024) National Oceanic and Atmospheric AdministrationU.S. Climate Extremes Index. Retrieved April 18, 2025.
48. Qasim M Z, Hammad HM, Abbas F, Saeed S, Bakhat HF, et al. (2020) The potential applications of picotechnology in biomedical and environmental sciences. Environ Sci Pollut Res 27: 133-142.
49. Manes S, Costello MJ, Beckett H, Debnath A, Devenish Nelson E, et al. (2021) Endemism increases species' climate change risk in areas of global biodiversity importance. Biol Conserv 257: 109070.
50. Andersen ZJ, Vicedo Cabrera A M, Hoffmann B, Melén E (2023) Climate change and respiratory disease: clinical guidance for healthcare professionals. Breathe (Sheff). 19: 220-222.
51. (2024) United Nations Global Set of Climate Change Statistics and Indicators Implementation Guideline. New York: Department of Economic and Social Affairs
52. Adaba K A Boio D (2024) Across Africa, public trust in key institutions and leaders is weakening. Accra: Afro Barometer
53. Rowland J, Estevens J, Krzewińska A, Warwas I, Delicado A (2022) Trust and Mistrust in Sources of Scientific Information on Climate Change and Vaccines. Science & Education 31: 1399-1424.
54. Mbaegbu R (2024). Nigerians view religious leaders as more trustworthy, less corrupt than public institutions. Abuja: Afrobarometer.
55. Chandio AA, Jiang Y, Rehman A Rauf A (2020) Short and long-run impacts of climate change on agriculture: empirical evidence from China", International Journal of Climate Change Strategies and Management, 12: 201-221.
56. (2024) Environmental Protection Agency Climate Change and Waste: Reducing Waste Can Make a Difference. Washington: Solid Waste and Emergency Response.
57. (2020) FGN Making Nigeria Open-Defecation-Free By 2025. Abuja: Federal Ministry of Water Resources.
58. Gleditsch N P (2021) This time is different! Or is it? NeoMalthusians and environmental optimists in the age of climate change. Journal of Peace Research, 58: 177-185.
59. Hausfather Z, Friedlingstein P (2024) Analysis: Global CO2 emissions will reach a new high in 2024 despite slower growth. London: CarbonBrief.
60. (2022) IPCC Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [H.-O. Pörtner, D.C. Roberts, M. Tignor, E.S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, B. Rama (eds.)]. UK and New York: Cambridge University Press 3056.
61. S Saikkonen L, Ollikainen M (2014) Impact of Climate Change on cereal grain production in Russia: Mimeo.
62. Mosavi SH, Soltani S, Khalilian S (2020) Coping with climate change in agriculture: Evidence from Hamadan-Bahar plain in Iran. Agricultural Water Management, Elsevier 241: 106332
63. National Academy of Sciences (2011) America's Climate Choices. Washington, D.C.: The National Academies Press.
64. (2017) UNESCO Education for Sustainable Development Goals: Learning Objectives. Paris: UNESCO.
65. (2009) United Nations Climate Change - The Anatomy of a Silent Crisis". Geneva: Global Humanitarian Forum.
66. Xie W, Huang J, Wang J, Cui Q, Robertson R, (2020) Climate change impacts on China's agriculture: The responses from market and trade," China Economic Review, Elsevier,62(C)
67. Ying T, Zhong S, Luo L, Bian X, Heilman W E, et al. (2015) The Potential Impact of Regional Climate Change on Fire Weather in the United States". Annals of the Association of American Geographers. 105: 1-21.

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