Review Article

Climate Change Adaptation Strategies: Implication for Behavioural Change

Abstract

Climate change is a significant environmental issue impacting people, plants, and food security in the present day. Rapid changes in the global climate have resulted in significant effects on human society and ecological systems. Climate change has far-reaching consequences for the behaviour and attitudes of an individual or group. Over time, its negative effects manifest themselves in many ways. Adaptation to climate change is vital in this respect. Adaptation may mitigate the effects of climate change, but it cannot fix the issue on its own. Changes at the level of people, homes, and communities are of immeasurably larger significance than those at the government and industrial levels, where the majority of this change is often focused. The significance of human behaviour in influencing and modifying the effects of climate change is substantial. Controlling the difficulties associated with climate change demands fundamental adjustments in behaviour, which include adjusting to the changes that have happened and will continue to occur. The shift in behaviour has to do with mitigating the consequences of climate change that cannot be prevented while also preventing future impacts from becoming more severe. The majority of climate change adaptation solutions demand that people adjust their current health, agricultural, natural resource management, infrastructure, and settlement patterns or adopt new ones. Adaptation techniques use the information to modify behaviour to handle particular climatic difficulties, which may assist people and communities in coping with current and future climate change. This study looks at climate change, its causes and effects, ways to adapt, and the effects of different behavioural strategies. So, improving and building up human capital through education, outreach, and extension services makes it easier for people at all levels to make decisions and helps the whole group be more flexible.

Comment [U1]: Along with the objective, I suggest to mention the methodology of this study

Key words: Climate Change, Adaptation Strategies, Behavioural Change.

Introduction

Climate change is any long-term, substantial change in a region's average weather conditions [1]. There is a long-term change in the averages and statistics of the weather [2]. For instance, climate change might manifest as a shift in climatic normal (anticipated average values of temperature and precipitation) from one decade to the next for a specific location and time of year [3]. The term "climate change" refers to a series of modifications in the average weather resulting from global warming induced by the release of greenhouse gases (GHGs). Climate change is a long-term change in the weather and environment that changes the way weather usually works. This change can be caused by natural, human, or a mix of both factors.

As the weather varies from year to year, so does the climate, and these changes that persist in one direction at a high pace for an unusually long length of time and may extend for many years are considered climate change. The Intergovernmental Panel on Climate Change defines climate change as a statistically significant, long-lasting alteration [4]. Climate change is characterized by changes in the frequency and intensity of irregular weather events, as well as a gradual but persistent increase in the global mean surface temperature. Climate change is related directly or indirectly to human activity; it modifies the composition of the global atmosphere in addition to the natural climate variability found over similar time intervals [5]. It hurts agricultural resources, water resources, human health, the ozone layer, plants, soil, and causes the amount of carbon dioxide in the air to double.

Climate change relates to the time periods of the changes, the degree of variability to which the changes are exposed, the length and effect of such fluctuations on humans and ecosystems, and the degree to which the changes are susceptible to variability. Climate change refers to the long-term occurrence of average seasonal variations in the weather [6]. Climate change is regarded as the fluctuation of global or regional climates throughout time [7]. It is the alteration of the status of the environment across timescales spanning from decades to millennia. Climate change is the detectable rise in the average temperature of the earth's atmosphere, seas, and landmasses [8]. Climate change is a long-term, significant change in the weather patterns of a region [9]. The earth's climate changes due to natural causes such as volcanic eruptions, ocean currents, the earth's orbital changes, and solar variations as well as due to human activities such as hunting with firearms, domesticating animals and crops, and implementing streamlined transportation and production systems [10]. The greenhouse effect is caused by the excessive release of greenhouse gases (GHGs) into the atmosphere as a result of various human activities. The concentration of greenhouse gases in the atmosphere causes ozone layer depletion, which inevitably attacks the ozone layer and creates a hole in it. All of them have serious effects, such as drought, rising temperatures, less crop production, water bodies drying out, and floods, to name a few.

Changes in one or more climatic variables, including wind, precipitation, temperature, and sunlight, constitute climate change [11]. The United Nations Framework Convention on Climate Change defined climate change as a change in climate that is attributed directly or indirectly to human activity that alters the composition of the global atmosphere, in addition to the natural climate variability observed over comparable time periods [5]. On its website, the Australian Government's defined climate change as a shift in the climate caused by documented increases in human-produced greenhouse gases [12]. However, climate change is not uniform throughout the globe, and its effects vary by place. Regions vary in terms of their inherent adaptive potential. These factors, including exposure, sensitivity, and autonomous adaptation capability, produce substantially diverse regional climate change susceptibilities.

A short methodological note should be added after the background/introduction of the study. In the methodology, literature searching method and search items, inclusion and exclusion criteria and time period should be highlighted.

Comment [U2]: A Short methodology of this research should be included.

Causes of Climate Change

A number of factors cause climate change. These factors include deforestation, ozone layer depletion, increased CO2, and greenhouse gas emissions into the atmosphere.

Deforestation: By aiding photosynthesis, which generates oxygen (O2) and burns vast quantities of the greenhouse gas CO2 believed to contribute to global warming, forests constitute a significant barrier to climate change [13]. Due to deforestation, the number of trees capable of absorbing CO2 through photosynthesis has drastically decreased. When trees are chopped down for lumber or to clear land for agriculture or construction, the carbon stored in them is released, and the number of trees available to absorb CO2 is drastically reduced [14]. In Nigeria, a lot of carbon has been taken up by forest and non-forest tree growth, the abandonment of managed lands, the harvesting of biomass, and the turning of forests and savanna into farmland.

Ozone layer depletion: The stratospheric layer of ozone is the thin shield in the sky. The ozone layer shields life on Earth from the ultraviolet radiation of the sun [7]. These compounds degrade the ozone layer by emitting substances such as chlorofluorocarbons (CFC), carbon monoxide (CO2), hydrocarbons, smoke, soot, dust, nitrous oxide, and sulfur oxide [13]. When the ozone layer gets thinner, more ultraviolet light can reach the surface of the earth. This speeds up the rate at which the global climate is changing, so the rate at which the climate is changing also speeds up.

Concentration of CO2: CO2 is released into the atmosphere by natural processes such as volcanic eruptions, animal respiration, and the combustion or decomposition of plants and other organic matter. CO2 is released into the atmosphere by human activities such as the combustion of fossil fuels, solid wastes, and wood products to heat homes, power cars, and create electricity. The industrial revolution increased the mid-1700s CO2 levels [3]. Considering its harmful effects on agricultural systems, in particular, the increase in CO2 concentrations is very worrying and perilous. In Nigeria, gas flaring and the use of liquid and gaseous fuels were major contributors to the energy sector's CO2 emissions [15].

Greenhouse gases: Greenhouse gases are the primary cause of global warming. They are very effective in trapping heat in the atmosphere, causing the greenhouse effect. The greenhouse effect is the ability of greenhouse gases such as water vapour, carbon dioxide, methane, nitrous oxide, ozone, chlorofluorocarbons, hydro-chlorofluorocarbons, hydro-fluorocarbons, and perfluorocarbons in the atmosphere to trap heat emitted from the earth's surfaces, thereby insulating and warming the planet in a layer of greenhouse gases in the atmosphere [3]. Greenhouse gases are gases that absorb infrared light and contribute to the greenhouse effect [16]. When some gases in the atmosphere capture energy from the sun and keep a higher portion of the trapped energy, it leads to a rise in the earth's temperature, resulting in the current warming and alteration of the global climate. These atmospheric gases concentrate as a consequence of innovations that burn fossil fuels and other activities like land clearance for agriculture or construction, and cause the earth's temperature to become warmer than it would be naturally [3]. Greenhouse gases are both naturally occurring and the product of human actions. This greenhouse often makes a hole in the ozone layer, which speeds up the process of climate change around the world.

Aerosols: Aerosols are airborne particles that absorb, scatter, and reflect radiation back into space. There are both natural and artificial aerosols. Examples of natural aerosols include clouds, windblown dust, and particles that may be linked to erupting volcanoes. Human activities such as the combustion of fossil fuels and the practice of slash-and-burn agriculture add extra aerosols to the atmosphere [17]. Aerosols have an impact on the radiative transport of heat energy from Earth to space. Climate scientists think that light-colored (soot) aerosols have a cooling impact, while dark-colored (aerosols) aerosols contribute to warming [15].

Agriculture: Agriculture contributes to global warming. Clearing forests for agriculture, burning agricultural waste, submerging land in rice paddies, raising large herds of cattle and other ruminants, and nitrogen fertilization all contribute to greenhouse gas emissions [18].

Effects of Climate Change

Effect on Agriculture: Climate change increases the severity of droughts, floods, and shifting growing seasons, which may reduce soil productivity, food, and water supplies [19]. This will result in difficulties and mortality in plant and animal habitats. In a similar vein, semiarid tropical farmlands in some regions of Africa may become more destitute as a result of climate change [13]. The output of C3 crops such as cassava, yam, cowpea, wheat, soybeans, rice, and potatoes, as well as C4 crops such as millet, sorghum, sugar cane, and maize, will be significantly impacted by climate change resulting from higher CO2 levels [15]. Changes in crop development and phenology that are expected to happen because of climate change could cause crop cycles to get shorter or longer, which could lower or raise agricultural yield.

Effect on the soil: As a consequence of global warming, storms are becoming stronger and more frequent, causing catastrophic erosion damage to agricultural fields [19]. As a result of climate change, certain regions experience greater and more consistent precipitation, leading to an increase in rainfall-induced erosion. In contrast, in arid and semi-arid locations, greater temperatures lead to dry conditions that exacerbate wind erosion and flooding [15]. Warmer circumstances accelerate the natural decomposition of organic matter and the acceleration of other soil processes, resulting in greater soil air temperatures. When conditions are dry, roots can't grow as well and plants are more likely to be damaged by wind, especially if gusts get stronger [3].

Effect on water availability: Due to climate change, water evaporates from soils at a quicker rate, causing soils to dry out extremely quickly between rainfall and increasing the requirement for suitable crop management [20]. This impacts water availability. Warmer temperatures make irrigation more important, so dams, reservoirs, canals, wells, pumps, and pipelines need more money to be put into them [21].

Effect of higher temperatures: Climate change-induced temperature increases may accelerate the pace at which plants emit CO2 during respiration, resulting in less-than-optimal circumstances for crop development. When temperatures exceed the ideal range for biological activities, plants often experience a sharp decline in net growth and output [3]. Another significant consequence of high temperatures is the acceleration of physiological development, which has the outcome of rapid maturation and decreased yield [12]. Multiple sectors, including health, water, biodiversity, agriculture, forestry, and fisheries, will be affected by these changes [22]. Also, hurricanes and tornadoes grow more powerful as a consequence of warming seas and air temperatures. A warmer atmosphere results in more atmospheric energy. When storms begin, they typically get energy from the oceans, and as a

consequence of the greenhouse effect, the oceans are warmer, giving hurricanes more energy. As a result, hurricane intensity increases. Also, higher temperatures cause the air to hold more water vapor, which makes it rain harder and more often.

Effect on Vegetation: Climate change may affect the kind, distribution, and covering of vegetation. Certain climatic changes may result in greater precipitation and temperature, leading to enhanced plant growth and eventual CO2 sequestration [23]. As plant groups attempt to adapt to the changing climate by migrating to cooler regions, the animals that rely on them will be compelled to relocate [24].

Effect on Pests and Diseases: Due to warmer temperatures, circumstances are favourable for the spread of insect pests and illnesses. Also, altering wind patterns caused by climate change may affect the distribution of wind-borne pests as well as the bacteria and fungi that cause crop diseases that result in low agricultural productivity. Several animals may be more susceptible to heat stress, disease transmission, and possibly resistance to disease management techniques in most African locations due to economically significant pests and illnesses [13]. In addition, a rise in the frequency of extreme events such as extended droughts or significant floods might generate circumstances favourable to disease or pest outbreaks and drastically disrupt the predator-prey connections that generally limit the growth of pests [15]. Due to warmer and more humid circumstances, the development of bacteria and moulds on many kinds of stored food will rise, leading to increased food spoiling and particular toxicological health risks [25].

Effect on Food Security: Depending on their location and reliance on the agricultural industry, some areas may gain from climate change-induced increases in agricultural production, while others may experience decreases. A small drop in African agriculture, which employs up to 70% of the continent's workers and makes up 40% of its gross national product [26], could have terrible effects on the food security and standard of living of the continent's people.

Effect on natural disasters: Climate warming will increase both the likelihood of flooding and droughts. Ninety percent of the people who die in natural disasters live in developing countries, where poverty and population growth force more and more people to live in flood plains and on unstable slopes [27]. Climate change has caused recent floods in Nigeria, Benin Republic, Pakistan, Brazil, Bangladesh, and China, as well as cold and mild winters in the world's temperate regions and droughts in parts of Africa and Asia [15]

Climate Change Adaptation Strategy

An adaptation strategy to climate change is any activity that strengthens people's resistance to climate change. A climate change adaptation strategy involves predicting the negative consequences of climate change and taking the necessary steps to avoid or mitigate the effects [12]. This implies that adaptation to climate change entails predicting and responding to new circumstances, i.e., what changes are on the horizon and what adjustments are necessary. It is a framework for managing existing and future climate risks [4]. It also involves the possibility of lowering existing and future economic, environmental, and social climate-related costs. Cooper, Stern, Noguer, and Gathenya say that early and well-planned strategies for adapting to climate change save money and lives and are needed at all levels of work [28].

Climate change adaptation is the process of mutation or genetic change that enables an organism, such as a plant or animal, to live in its environment in response to the negative consequences of climate change. A climate adaptation strategy entails predicting the changes

brought on by climate change and then taking necessary action to avoid or lessen the resulting damage or take advantage of potential opportunities. Adaptation techniques to climate change may be structural or behavioral, depending on whether they influence the physical or behavioral aspects of an organism. Climate change adaptation strategy involves either mitigation attempts to reduce the enormous quantity of greenhouse gases in the atmosphere or adaptation efforts to prepare systems and civilizations to survive the effects of climate change [39].

Global adaptation methods to climate change depend on governance, infrastructure, money, and institutions. Climate change solutions at the global level include a vast array of responses, including financial adaptations, technology-based strategies, land-based strategies, labor adaptations, and cultural strategies [12]. Locally, they incorporate local knowledge and talents. Local adaptation tactics to climate change include growing superior agricultural types, shifting planting dates, fishing at night, and using energy in bulk [30]. Climate change adaptation solutions on a global or local scale have come about in part because it has become clear that reducing carbon emissions hasn't helped [26]. Adaptation can be identified along three dimensions [31]:

-The subject of adaptation, that is, who or what adapts, is observed in changes in ecological, social, and/or economic systems, and these changes can be the result of natural responses, which typically involve organisms or species, or of socio-economic or institutional responses, in which case they are carried out by an individual or collective of private or public agents.

-The target of adaptation (what they adapt to): changes in average circumstances or changes in the variability of severe occurrences might trigger adaptive responses in the event of climate change. In the first case, changes happen slowly and are usually within the system's ability to handle them. In the second case, changes happen quickly and are outside of this range [32].

-How they change (how they adapt): This includes what resources they use, when and how they use them, and what happens as a result.

Adapting to climate change entails taking the proper steps to mitigate the negative consequences of climate change or capitalize on the favourable ones by implementing the necessary modifications and changes. Adaptation is the modification of natural or human systems in response to present or anticipated climatic stimuli or consequences, which mitigates damage or exploits advantageous possibilities [32]. It also refers to the actions taken by individuals, nations, and civilizations in response to the occurrence of climate change. Adaptation has three potential goals: reducing exposure to the danger of harm; developing the ability to deal with inevitable damage; and capitalizing on new possibilities. Adaptation to climate change means enhancing our capacity to withstand or avoid negative consequences, or to take advantage of more favorable circumstances, thus lowering risk and susceptibility.

Implication for Behavioural Change

Climate change has far-reaching consequences for the behavior and attitudes of an individual or group. Over time, the negative effects of climate change manifest themselves in a variety of ways. The significance of human behavior in influencing and modifying the effects of climate change is substantial [33]. Controlling the difficulties associated with climate change demands major adjustments in energy production, transportation, industry,

government regulations, and global development initiatives. The shift in behaviour has to do with mitigating the consequences of climate change that cannot be prevented while also preventing future impacts from becoming more severe. Changes in behaviour may need time. Numerous adaptive activities (changes in behavior) may be undertaken to mitigate or counteract the negative consequences of climate change. They consist of:

Seeking information: erroneous mental models of climate change are held by individuals. It is essential and necessary to give knowledge and information that educates people about climate change misunderstandings. To make educated choices, people must have a fundamental understanding of the causes, the severity of the consequences, the cost, and the effectiveness of various climate change adaptation strategies. To adapt to climate change by changing how you act, you need to know about it and how it works [34].

Shifting cultivation, investing in drought- and heat-tolerant crop varieties, early sowing, switching crop sequences, adjusting the timing of field operations, soil moisture conservation through appropriate tillage methods, crop rotation, planting cover crops, reducing fertilizer use, and improving irrigation efficiency are examples of agricultural practices. Between 1970 and 1990, the planting of high-yielding crop types as part of the Green Revolution prevented an estimated 170 million hectares of forest in Africa, Latin America, and Asia from being cleared for agriculture, saving the equivalent of two to three years of world carbon emissions [35]. Conservation of natural resources for the optimal protection of ecosystems or the preservation of natural resources by decreasing their excessive use and safeguarding them from contamination or pollution, as well as reusing or recycling them wherever feasible [36]. Utilization of renewable energy sources: Newer technologies for cleaner energy sources are starting to provide viable alternatives to past energy sources known to contribute to global warming [3]. Alternative energy sources or less harmful replacements include solar power, wind power, nuclear energy, biodiesel, ethanol, and hydrogen fuel cells, among others, and are ranked as non-emitters of greenhouse gases. These alternative fuels may significantly offset or reduce automotive CO2 emissions.

This approach involves removing carbon dioxide from the atmosphere by storing the gas or its carbon component elsewhere; it is known as carbon sequestration or carbon capture [13]. This can be accomplished by protecting and growing more trees. However, when trees are burnt to clear land, carbon dioxide is released back into the atmosphere.

Resilience and compensatory behaviours, such as altering habitat structure, mitigation, and civic engagement; constructing fences to prevent increased flooding; wearing light clothing during hot weather; using a fan to reduce heat; planting flowers and trees; using an air conditioning system to reduce heat waves; driving cars with good engines; maintaining regular sanitation to reduce diseases associated with climate change; using an umbrella to deal with intense sunlight.

Conclusion

The climate has been stressed, which has increased its susceptibility to future climate change and diminished its adaptability. Climate change has disastrous effects on agriculture, food security, vegetation, natural catastrophes, soil, and human life, among others. This has had an influence on food production, resulting in widespread poverty. Diversification of herds and incomes; use of forest products as a buffer against climate-induced crop failure; soil fertility improvement techniques; soil moisture and water conservation practices; decentralization of resource governance; and manipulation of land use leading to land-use conversion are some

of the strategies employed. A general lack of knowledge, expertise, and data on climate change issues, the absence of specific climate change institutions to take on climate change work, and the need for a better institutional framework to implement adaptation strategies have been the primary obstacles to the implementation of adaptation strategies. Adaptation may enhance the capacity to deal with climate change by incorporating climate change into long-term decision-making, reducing disincentives for modifying behavior in response to climate change, and offering incentives to adjust behavior in response to climate change. So, improving and building up human capital through education, outreach, and extension services makes it easier for people at all levels to make decisions and increases the chances of collective adaptation and behaviour change.

Comment [U3]: Similar kind of conclusions are drawn by other various studies. Therefore, it is suggested to clarify the novelty of this research.

References

[1] Omotosho DO. Farmers perception of the impact of climate change on agriculturaldevelopment in Edo state. Ph.D. Project of the Department of Agriculture Economics, Michael Okpara University of Agriculture, Umudike. 2007.

[2] Kauker F. Langerberg H. Two models fot the climate change related development of sea levels in the North Sea comparison. Journal of Climate Research. 2000: 15(1): 321-335

[3] Paehler K. Nigeria in the dilemma of climate change. Konrad Adenauer Publications, Nigeria Office. Also available at http//www.kas.de/proj/home/pub/33/2/Document_id11468/index.html. 2009.

[4] Intergovernmental Panel on Climate Change (IPCC). Climate Change 2007: Climate change impacts, adaptation and vulnerability - Summary for policymakers. Contribution of Working Group II to the Fourth Assessment Report of the IPCC. Cambridge University Press, 2007.

[5] United Nations Framework Convention on Climate Change (UNFCC). Fact sheet: Climate Change science – the status of Climate Change science today. UNFCC, 2011, http://unfccc.int/files/press/backgrounders/application/pdf/press_factsh_science.pdf, 2011.

[6] Sampson M. Physio-demographic factors as correlates of climate change awareness and attitude among secondary school students in South-East, Nigeria. Ph.D. Project of the Department of Social Science Education, University of Nigeria, Nsukka. 2018.

[7] Igwe I.O. *Impact of climate changes on environment.* London: Cambridge University Press. 2003.

[8] Nzewi U. Climate and the biosphere. STAN. Environmental Educational Series. 2009: 13(1): 37-54.

[9] Ezeudu F.O. Using concept map to teach ozone layer depletion and green house effects to ssenior secondary school chemistry students. STAN. Environmental Educational Series. 2009: 13(1): 78-87.

[10] Anyadike R.N.C. Climate change and sustainable development in Nigeria: Conceptual and empirical issues. Debating policy options for national development. Enugu forum policy paper 10: African Institute for Applied Economics (AIAE); Enugu, Nigeria. 2009: 9-12.

[11] Efut E.N. Climate change awareness and adaptation strategies of farmers, fisherman and teachers in South-South Nigeria. Ph.D. Project of the Department of Social Science Education, University of Nigeria, Nsukka. 2021.

[12] Department of Climate Change and Energy Efficiency (DCCEE). Climate Change in a nutshell. Australian Government, Canberra, http://www.climatechange.gov.au/en/climate-change.aspx. 2012.

[13] Manstrandrea M.D. & Schneider S.H. Global Warming. Microsoft Encarta Online Encyclopedia. 2009.

[14] Syrquin A. EU Commission discusses soil degradation and climate change. Jerusalem Post. http:/www.jpost.com/servlet/satellite?cid. 2008.

[15] Federal Ministry of Environment (FME). Nigeria's First National Communication under the United Nations Framework Convention on Climate Change. The Federal Ministry of Environment, Abuja. Landmark Publications, Lagos, Nigeria. 2003.

[16] Sjoberg H. The Human Impact on the Natural Environment. Oxford: Blackwell Publishers. 2002.

[17] Mendelsohn R. Dinar A. & Dalfelt A. Climate change impacts on African agriculture. Preliminary analysis prepared for the World Bank, Washington, District of Columbia. 2000: 25.

[18] McLeman R. & Smit B. Climate change, migration and security. Canadian Security Intelligence Service, commentary no. 86, Ottawa, P. 8. 2004.

[19] Soil and Water Conservation Society (SWCS). Conservation implications of climate change: soil runoff from croplands. SWCS: Ankey, Iowa, USA. Also available at http:/ www.swcs.org/docs/climate%20change-final.pdf. 2003.

[20] Southworth J. Randolph J.C. Habeck M. Doering O.C. Pfeifer R.A. GrangadharRao D. & Johnson J.J. Consequences of future climate change and changing climate variability on maize yield in Midwestern USA. Agriculture, Ecosystems and Environment. 2002: 82: 139-158.

[21] Pfeifer R.A. & Habeck M. Crop modeling results under climate change for the Upper Midwestern USA. In Doering O.C. Randolph J.C. Southworth J. & Pfeifer R.A. (eds). Effects of climate change and variability on agricultural systems. Boston: Kluwer Academic Publishers, USA. 2002.

[22] Zhao M. & Running S.W. Drought-induced reduction in global terrestrial primary production from 2000 through 2009. Available at http://www.sciencemag.org/content/329/5994/940.abstract. 2010.

[23] Lema M.A. & Majule A.E. Impacts of climate change, variability and adaptation strategies on agriculture in semi-arid areas of Tanzania: The case of Manyoni District in Singida Region, Tanzania. African Journal of Environmental Science and Technology. 2009: 3(8): 206-218.

[24] Nemani R. Keeling C.D. Hashimoto H. Jolly W.M. Piper S.C. Tucker C.J. Myneni R.B. & Running S.W. Climate driven increases in global terrestrial net primary production from 1982 to 1999. Science 300 (5625): 1560-1563. Also available at http:// www.sciencemag.org/content/300/5625/1560.abstract. 2003.

[25] Onoja U.S. Dibua U.M.E. & Enete A.A. Climate change: causes, effects and mitigation measures. Global journal of Pure and Applied Sciences. 2011: 17(4): 469-479.

[26] Khan R. & Roberts T. Adaptation and international climate policy. Wiley Interdisciplinary Reviews: Climate Change 2013: 4: 171-189.

[27] Cooper P.J.M. Stern R.D. Noguer M. & Gathenya J.M. Climate change adaptation strategies in Sub-Saharan Africa: foundations for the future. Retrieved from https://www.intechopen.com/books/climate-change-realities-impacts-over-ice-cap-

sea-level-and-risks/climate-change-adaptation-strategies-in-sub-saharan-africa-fondations-for-the-future. 2012.

[28] Suarez I. Five strategies that achieve climate mitigation and adaptation simultaneously. Retrieved from www.wri.org. 2020.

[29] Alam G. & Mushtaq S. Climate cnange perceptions of local adaption strategies of hazard-prone rural household in Bangladesh. Science Direct. 2017: 17: 52-63.

[30] Spence A. & Pidgeon H. Framing and communicating climate change: the effects of distance and outcome frame manipulations. Global Environmental Change. 2010: 20: 65-76.

[31] Kaddo J.R. Climate Change: Causes, Effects, and Solutions. A with Honors Projects. 164. http://spark.parkland.edu/ah/164. 2016.

[32] Naz R. Shah M. Jamal H. & Khan Y. Effects of Climate Change on Human Behaviour: A People Perspective. Journal of Applied Environmental and Biological Sciences. 2019: 9(5): 1-10.

[33] Volk T.L. & Cheak M.J. The effect of Environmental Education program on students, parents and society. The Journal of Environmental Education. 2003: 34(4): 12-25.

[34] Gregory P.J. Ingram J.S.I. & Brklacich M. Climate change and food security. Philosophical Transactions of the Royal Society. Biological Sciences. 2005: 360(1462): 2139-2148.

[35] Sodangi I.A. Izge A.U. & Maina Y.T. Climate change: Causes and effects on African agriculture. Journal of Environmental Issues and Agriculture in Developing Countries. 2011: 3(3): 1-15.

Comment [U4]: It is suggested to add the date of access in the parentheses.

Comment [U5]: It is suggested to add the date of access in the parentheses.