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Climate resilient strategies for enhancing farmers' eye health for sustainable agriculture in Nigeria

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Abstract

Farmers' eye health is an essential component of universal health coverage; It must be included in planning, resourcing, and delivery of health care for sustainable agriculture in Nigeria. Through systematic literature review and participant observation, this study identifies the climate resilient strategies for enhancing farmers' eye health for sustainable agriculture in Nigeria. Climate change is affecting every aspect of human health, and ophthalmology is not an exception. The stability of eye health care systems will greatly enhance sustainable agriculture in Nigeria. This study recommends green financing from multilateral organizations such as the World Bank Group (WBG) and United Nations Environment Programme (UNEP) towards mitigating the impacts of climate change on farmers' eye health in Nigeria. This study concludes by reiterating that climate change is affecting farmers' eye health in Nigeria. It offers a clarion call for more research and advocacy for enhancing farmers' eye health for sustainable agriculture in Nigeria.

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1. Introduction

Climate change refers to the long-term changes in the Earth's climate, including changes in temperature, precipitation, and atmospheric conditions, that have occurred over the past century or more, largely as a result of human activities such as the burning of fossil fuels and deforestation (WHO, 2021). The effects of climate change are far-reaching and include heat waves and severe weather, deteriorated air quality, displacement and migration of vectors resulting in increase of a range of diseases related to water and ecological factors. Increasing incidences of mental health issues are being recorded and identified as a consequence of climate change (Lu, 2016; PAHO, 2013).

Researchers have recently identified the impacts of climate change on biodiversity in Nigeria (Anabaraonye et al., 2022a). The impacts of climate change which include flooding, land pollution, erosion, etc. also affect soil fertility in Nigeria in a profound way (Anabaraonye et al., 2021). There is therefore a great need for climate change education across various communities, cities, companies and campuses in Nigeria thereby enhancing climate resilience (Anabaraonye, 2022c).

Climate resilience is the capacity for a socio-ecological system to absorb pressures and maintain function in the face of external stresses imposed upon it by climate change (Folke et al., 2010; Moench, 2014). It also includes the ability and capacity of an ecosystem to adapt, reorganize, and evolve into more desirable configurations that improve the sustainability of the system, leaving it better prepared for future climate impacts (Carpenter et al., 2001; Folke, 2006).

Climate change presents a substantial peril to local, national and global health especially as it relates to eye health. Climate change is a global challenge that requires multi-stake holder partnerships to adapt and mitigate the impacts (Anabaraonye et al., 2022b). The impact of climate change is being felt on eye health in Nigeria in a profound way (Anabaraonye et al., 2024). The influence of climate change on eye health is a developing matter of worry, supported by research indicating heightened vulnerabilities to illnesses including cataracts, conjunctivitis, and other eye problems as a result of changes in the environment (Femi, 2020).

The correlation between climate change and eye health is complex and has several aspects. Fluctuations in temperature, air quality, and UV radiation levels may worsen pre-existing eye diseases and give rise to new health problems. For instance, there is a correlation between elevated UV radiation and a greater occurrence of cataracts and other retinal problems. Moreover, alterations in air quality caused by climate change might worsen symptoms such as dry eye and conjunctivitis (Chawda & Shinde, 2022; Alebrahim et al., 2022).

Climate change has significant impacts on eye health care systems and local communities in Nigeria especially farmers in rural areas which affects their agricultural productivity (Anabaraonye et al., 2024;

Anabaraonye et al., 2020). The rise in temperature, changes in precipitation patterns, and increasing air pollution levels have resulted in a high prevalence of eye diseases such as dry eyes, cataracts, and allergic conjunctivitis. Additionally, these changes have created an environment that favours the breeding of vectors that carry diseases such as trachoma, onchocerciasis, and river blindness, which are prevalent eye diseases in Nigeria (Oladimeji & Okoye, 2019).

Climate change negatively affects Nigerian farmers' eye health through increased exposure to UV radiation, worsening air pollution, and the spread of infectious eye diseases. These factors contribute to conditions like cataracts, macular degeneration, dry eye syndrome, and allergic conjunctivitis, particularly impacting farmers who spend extended periods outdoors. Vulnerable farmers often lack access to necessary eye care services, creating a cycle of increasing visual impairment and blindness (Anabaraonye et al., 2024; Anabaraonye et al., 2020). Comprehending these connections is vital for formulating efficient climate resilient strategies.

This study vividly identifies the climate resilient strategies for enhancing farmers' eye health for sustainable agriculture in Nigeria.

2. Methodology

Data used for this study is derived from published works including academic articles, journals, conference papers, textbooks, and internet materials. This paper examined Climate resilient strategies for enhancing farmers' eye health for sustainable agriculture in Nigeria through systematic literature and participant observation. The main purpose of this research work was to survey theoretical backgrounds and previous studies on the subject matter, as well as proffer solutions to the impacts of climate change on eye health care in Nigeria.

3. Results and Discussion

Eye health is an essential component of universal health coverage; It must be included in planning, resourcing, and delivery of health care for sustainable agriculture in Nigeria (Burton et al., 2021; Anabaraonye et al., 2024). A number of well-known factors, including exposure to UV radiation, genetics and aging, can lead to cataracts, a condition affecting roughly 94 million people in which the lenses of the eyes get cloudy, causing blurry vision. But in recent years, researchers have found another causative factor for cataracts and other eye disorders: climate change (Jain, 2025; Burton et al., 2021).

Numerous health consequences have been identified, encompassing threats to eye health. The risks of blindness and emerging of ocular conditions impact the most vulnerable countries with a lack of access to healthcare and governmental funding due to global and gender disparities (Wong et al., 2024; Yu & Khan, 2021). More recently, The Lancet Commission on Global Eye Health stated that

planetary health is a key component to improving quality of eyecare and emphasized that the eyecare community strongly consider environmentally sustainable eye health services to make progress towards the SDGs (Burton et al., 2021).

3.1. Understanding sustainable agriculture

Sustainable agriculture is a way of producing food, fiber, and fuel that balances long-term environmental health, economic profitability, and social equity. It aims to meet present needs without compromising the ability of future generations to meet their own needs by minimizing environmental impact, conserving natural resources like water and soil, promoting biodiversity, and supporting the viability of farms and farming communities (Anabaraonye et al., 2025).

Enhancing sustainable agriculture in Nigeria requires a multifaceted approach, integrating climate-resilient strategies that also protect farmers' eye health by reducing exposure to environmental hazards and improving access to quality eye care. Key strategies include promoting climate-smart agricultural practices like using stress-tolerant crop varieties and water-efficient irrigation, leveraging renewable energy to power agricultural operations and healthcare services, diversifying crops to reduce vulnerability to climate shocks, and implementing comprehensive land-use planning to mitigate conflicts and encourage sustainable practices. Policy support, access to finance for smallholders, and effective communication through agricultural extension services are vital for widespread adoption of these measures and for a self-sufficient agricultural industry.

3.1.1. Key Goals and Principles

i) **Environmental Stewardship:** Protecting and restoring natural resources, such as soil, water, and ecosystems, by reducing pollution from pesticides and fertilizers, conserving water, and fostering biodiversity;
ii) **Economic Viability:** Ensuring that farms can remain profitable and provide a good quality of life for farmers and their communities;
iii) **Social Equity:** Promoting fair labor practices, enhancing the well-being of farm workers and consumers, and ensuring access to healthy food for all;
iv) **Resource Efficiency:** Using non-renewable resources as efficiently as possible while prioritizing the use of renewable energy sources.

3.1.2. Common practices and methods

i) Crop Rotation: Alternating different types of crops in the same field to improve soil health and fertility;

ii) **Polyculture and Diversity:** Growing multiple types of crops together (polyculture) to reduce reliance on chemical inputs and improve soil quality, rather than relying on a single crop (monoculture);
iii) **Agroforestry:** Integrating trees and shrubs into farming systems to provide additional benefits like soil stabilization and habitat;
iv) **Water conservation:** Implementing techniques like water-efficient irrigation to apply water directly to plant roots, reducing wastage;
v) **Reduced chemical use:** Minimizing or eliminating the use of synthetic pesticides and fertilizers.

3.2. Enhancing climate-resilient farmer's eye health care in Nigeria

To enhance farmers' eye health care in Nigeria in a climate-resilient and sustainable manner, it's crucial to integrate climate-resilient strategies into existing health systems and national development plans. This includes strengthening health infrastructure, improving early warning systems for climate-related health issues, and promoting sustainable agriculture to address food security and malnutrition, which are linked to eye health (Anabaraonye et al., 2025; Onnoghen et al., 2025).

Factors worsening farmers' vulnerability to climate impacts include:

i) **Outdoor work:** Farmers' prolonged hours spent working outdoors in various weather conditions expose them to greater environmental stressors, including UV radiation and airborne particles.
ii) **Limited healthcare access:** Rural farmers, who are already at risk of poverty, have even less access to quality healthcare services, making it harder to get timely treatment for eye conditions.
iii) **Climate-related stressors:** Climate change-induced stress, extreme weather events, and the resulting health issues (like hunger and illness) can further strain farmers' resources and access to care.

Climate resilient strategies for enhancing farmers' eye health include:

3.2.1. Strengthening health systems

i) **Climate-resilient infrastructure.** Eye care facilities should be built to withstand extreme weather events, ensuring their continued functionality during natural disasters or periods of high heat.
a) **Early warning systems:** Implementing early warning systems for climate-related health hazards, such as heatwaves or droughts,

can help health professionals prepare for potential outbreaks of climate-sensitive eye diseases.

b) **Emergency preparedness.** Developing and maintaining emergency preparedness plans for eye care services in the event of climate-related emergencies is crucial.

ii) Integrating eye care into national development plans

a) **National eye health strategic development plan.** The National Eye Health Strategic Development Plan 2024-2028 should incorporate climate resilience strategies to ensure that eye care services for farmers are sustainable and can adapt to changing environmental conditions,

b) **Sustainable development goals:** Connecting farmers' eye care services with Sustainable Development Goals (SDGs), particularly SDG 2 (Zero Hunger) and SDG 3 (Good Health and Well-being), can help promote food security and address nutrition-related eye conditions.

3.2.2. Promoting sustainable agriculture

a) **Climate-smart agriculture.** Adopting climate-smart agricultural practices can enhance food security and improve access to nutritious foods, which are essential for good eye health.

b) **Vitamin A deficiency.** Addressing Vitamin A deficiency, a common cause of blindness in developing countries, through improved nutrition and sustainable agriculture can significantly impact eye health.

3.2.3. Climate change adaptation and mitigation

a) **Strategic tree planting.** Engaging in strategic tree planting activities can help mitigate the impacts of climate change on farmers' eye health by providing shade, reducing heat exposure, and improving air quality.

b) **Sustainable land use practices.** Promoting sustainable land use practices can help protect ecosystems and reduce the risk of climate-related health impacts, including those on farmers' eye health.

3.3. The role of advocacy in enhancing farmers' eye health care in Nigeria

The information and communication technology can be used innovatively in advocacy programs towards enhancing climate resilience in farmers' eye health care in Nigeria (Oboti et al., 2024). Advocacy on the impact of climate change on eye health in Nigeria has

the potential to modify people's behaviour, elicit a more comprehensive response from national and global leaders, and stop future catastrophes (Orji et al., 2024).

Some advocacy approaches that can impact positively on farmers' eye health include:

i) **Raising awareness.** Educating the public about the link between climate change and eye health can encourage individuals to take preventive measures, such as wearing protective eyewear and seeking medical attention for eye problems.

ii) **Influencing policy.** Advocacy efforts can push policymakers to implement measures to mitigate the effects of climate change on eye health, such as increasing access to eye care services and promoting sustainable practices (WHO, 2021).

iii) **Encouraging community engagement.** Community-based initiatives can foster a sense of responsibility and ownership, leading to collective action to address climate change and its impact on eye health (United Nations Climate Change, 2019).

iv) **Supporting research and development.** Advocacy can drive investment in research and development of innovative solutions to address climate-related eye health issues, such as affordable eye care technologies and sustainable eye care services (NIH, 2020).

v) **Eco-poetry.** eco-poetry can be used innovatively in advocacy events towards enhancing climate resilience for sustainable development in Nigeria (Anabaraonye, 2024).

Overall, advocacy on the impact of climate change on farmers' eye health in Nigeria can contribute to farmers' behaviour change, elicit a more comprehensive response from national and global leaders, and stop future catastrophes. However, sustained efforts are required to ensure the impact and longevity of such advocacy efforts.

4. Recommendations

i) There is a need for more in-depth research and advocacy to highlight the impacts of climate change on farmers' eye health in Nigeria.

ii) The Nigerian government needs to implement policies that promote climate-resilient eye healthcare and improve access to health services for farmers especially those in rural areas.

iii) Farmers should be encouraged to use protective eye goggles and other measures to reduce exposure to UV radiation and air pollution.

iv) Rural farmers, who are already at risk of poverty, should be provided with access to quality healthcare services, making it easier to get timely treatment for eye conditions.

v) Green financing from multilateral organizations such as the World Bank Group, World Health Organization (WHO) and United Nations Environment Programme (UNEP) towards mitigating the impacts of climate change on farmers' eye health in Nigeria is greatly encouraged.

5. Conclusion

Climate change is having a negative impact on farmers' eye health in Nigeria, with the incidence of environmental eye disorders such as dry eye syndrome and cataracts increasing due to climate change. In response, there is a growing need for more research to understand the impacts of climate change on eye health, as well as to develop climate-informed public health interventions to mitigate these impacts for sustainable agriculture in Nigeria. Continued funding from government at all levels towards climate change adaptation and mitigation is vital for increasing the resilience of Nigeria's eye healthcare system in the face of climate change.

Conflict of interest

The authors declared no conflicts of interest.

Authors' contributions

All authors contributed to the original idea, study design.

Ethical considerations

The authors have completely considered ethical issues, including informed consent, plagiarism, data fabrication, misconduct, and/or falsification, double publication and/or redundancy, submission, etc. This article was not authored by artificial intelligence.

Data availability

The dataset generated and analyzed during the current study is available from the corresponding author on reasonable request.

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