Academic Research Journal of Science and Technology (ARJST)
International Refereed Peer Reviewed Research Journals eISSN 3048-9644
Journal Vol 2, Issue 01, July 2025 https://doi.org/10.63300/

THE ROLE OF RENEWABLE ENERGY IN ENHANCING CLIMATE RESILIENT EYE HEALTH CARE FOR SUSTAINABLE AGRICULTURE IN NIGERIA

Benjamin Anabaraonye[1*] Latif.B. Rashid[2] Prince-Timothy Wokoma[3]

1. University of Nigeria, Nsukka, Nigeria. Email: benjaminshines@gmail.com*
2. University of Mines and Technology, Tarkwa, Ghana. Email: rashidlatifbukari@gmail.com
3. University of Nigeria, Nsukka, Nigeria. Email: princetimo12345@gmail.com

ABSTRACT

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. The use of renewable energy is a climate change mitigation strategy vital for sustainable agriculture in Nigeria. Through systematic literature review and participant observation, this study identifies the role of renewable energy in enhancing climate resilient eye health care for sustainable agriculture in Nigeria. It highlights that renewable energy plays a crucial role in enhancing eye health care within Nigeria's agricultural sector, primarily by mitigating climate change impacts and improving access to healthcare services. By reducing reliance on fossil fuels, renewable energy technologies like solar and wind power can significantly decrease air pollution and greenhouse gas emissions, thus lessening the burden of climate-related eye problems. This study recommends that the Nigerian Government should enact policies and regulations towards advancing the role of renewable in enhancing climate resilient eye health care in Nigeria. It concludes by reiterating that climate change is affecting eye health care in Nigeria and there's a clarion call for more research and advocacy for enhancing climate resilient eye health care for sustainable agriculture in Nigeria.

Keywords: Climate Change, Education, Eye Health, Renewable Energy, Sustainable Agriculture**.**

1. INTRODUCTION

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 is a global challenge that requires multi-stake holder partnerships to adapt and mitigate the impacts(Anabaraonye, Anukwonke, et al, 2022).Climate change presents a substantial peril to local, national and global health especially as it relates to eye health which also negatively affects Nigeria's agricultural sector. The impact of climate change is being felt on eye health in Nigeria in a profound way(Anabaraonye, Ukpanyang & Asam-Utim, 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, Ukpanyang & Asam-Utim, 2024; Anabaraonye, Okafor & Hope,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). Comprehending these connections is vital for formulating efficient climate resilient strategies. This study identifies the role of renewable energy in enhancing climate resilient eye health care for sustainable agriculture in Nigeria.

2.1. METHODOLOGY

Data used for this study is derived from published works including academic articles, journals, conference papers, textbooks, and internet materials. This paper examined "the role of renewable energy in enhancing climate resilient eye health care 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 enhancing climate resilient eye health care for sustainable agriculture in Nigeria.

2.2. 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, Ukpanyang & Asam-Utim, 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). Climate change is increasing risk to eye health in multiple ways. First, it is making the planet hotter—Earth's average surface temperature in 2024 was the warmest on record. Body temperatures reaching 104 degrees Fahrenheit can cause heatstroke, a condition that disrupts biological processes throughout the body. In the eyes, heatstroke damages the natural defense systems that normally counteract the buildup of harmful molecules called reactive oxygen species(Jain, 2025; Burton et al,2021; Wong et al,2024).Cataracts are one of the most common causes of vision impairment worldwide. But climate change is also causing an uptick in other eye conditions. These include keratitis, an inflammation of the cornea, the eye's clear, outermost layer; pterygium, an overgrowth of fleshy pink tissue over the white part of the eye (called the sclera); and conjunctivitis, an eye infection or irritation also called pinkeye(Wong et al,2024). 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; Eye News,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). In 2019, WHO published the *World report on vision*, which was endorsed by the 73rd World Health Assembly in 2020. The report and resolution call for the advancing of eye health as an integral part of universal health coverage, by

implementation of integrated people-centered eye care, following the approach outlined in a broader health services framework(IAPB,2024).

2.3. THE IMPACT OF CLIMATE CHANGE ON EYE HEALTH CARE SYSTEMS IN NIGERIA

Climate change is recognized as a public health threat in Nigeria, with significant impacts on the health of vulnerable populations. With the growing body of evidence suggesting a link between climate change and eye health, attention to the potential impact of climate change on eye health is gaining momentum(Anabaraonye, Ukpanyang & Asam-Utim, 2024). The impacts of climate change continue to resonate across the globe. There are increasingly bitter complaints at different regions of the globe of the devastating effects of climate change. Cases include wild fires, earthquakes, floods, hurricanes, droughts, erosion and heavy rainfall patterns to mention but a few. In Nigeria, flooding is one of the major impacts of climate change which in 2025 alone has led to the death of hundreds, loss of properties worth billions of naira and triggered eco-anxiety. However, the use of renewable energy is one of the valuable tools for enhancing the innovative use of information and communication technology in mitigation of flooding in Nigeria (Oboti, Orji & Anabaraonye, 2024).Climate change is linked to a rise in eye diseases such as cataracts, glaucoma, and conjunctivitis due to increased exposure to UV radiation, heat, and dust (Akande, 2020). Researchers suggest that climate change impacts on eye health may worsen given the increasing frequency of heat waves, dust storms, and other extreme weather events in Nigeria(Anabaraonye, Ukpanyang & Asam-Utim, 2024).Another study by Ovenseri-Ogbomo et al. (2020) analyzed the association between climate factors and dry eye disease in Nigeria. They found a significant increase in the incidence of dry eye disease during the dry season (November – February), which is typically characterized by low humidity and high temperatures. Furthermore, climate factors such as temperature and humidity were significantly associated with increased incidence of dry eye disease. They suggest that climate-informed public health interventions, such as increasing access to eye health services during the dry season, could help to mitigate the impact of climate change on eye health in Nigeria(Anabaraonye, Ukpanyang & Asam-Utim, 2024).In addition to increasing the frequency of natural disasters leading to ocular trauma, malnutrition, and prolonged homelessness from increased environmental refugees, climate change has had other important ocular health impacts in some parts of the world. In Nigeria, hot ambient conditions have been identified as clumsily tied to an increase in the prevalence of many ocular diseases including blepharitis, endophthalmitis, cataract, dry eye syndrome, infectious keratitis, ocular hypertension, conjunctivitis, pinguecula, pterygium, photokeratitis, solar retinopathy, ultraviolet radiation retinopathy, and retinal ischemia(Ovenseri-Ogbomo et al, 2020). Local communities have also been significantly impacted by climate change, resulting in poverty, displacement, and food insecurity. These impacts have made it challenging for local communities to access eye health care services, as they are often far from health care facilities, and the costs of transport and treatment are too high for those who are poor and vulnerable(Oladimeji & Okoye, 2019). When farmers are affected with ocular diseases instigated by climate change, it makes them unable to farm effectively and productively thereby negatively affecting sustainable agriculture. Many times, these farmers in rural areas find it difficult to access eye health care services due to financial limitations, lack of qualified professionals, etc. Thus, farmers in rural areas in Nigeria need to be well educated on climate resilient strategies in enhancing eye health care for sustainable agriculture (Anabaraonye, Okafor & Hope,2020). Climate change has significant impacts on eye health care systems. Climate-related disasters and migrations lead to an influx of patients, straining already limited eye health care resources (WHO, 2021). Climate-related events, such as storms and flooding, lead to an increased risk of eye injuries (CDC, 2020) Disruption of eye care services: Climate-related events damage or destroy eye care facilities, disrupting services and leaving communities without access to essential eye health care (UNFCCC, 2019). Climate change exacerbates poverty, reducing

individuals' ability to afford eye care services, leading to delayed or foregone treatment. There is therefore need for climate resilient strategies to enhance eye health care for sustainable agriculture in Nigeria.

2.4. RENEWABLE ENERGY AND EYE HEALTH CARE FOR SUSTAINABLE AGRICULTURE IN NIGERIA

The innovative use of renewable energy will play a great role in enhancing climate resilience and sustainable development in Nigeria(Anabaraonye,2018). Researchers have identified the role of renewable energy in enhancing climate smart agriculture in Nigeria(Olisah et al,2025). Renewable energy technology can also play a great role in enhancing green building projects in Nigeria(Anabaraonye, Nzewi & Olisah,2025). Green building projects and Climate Smart Agricultural practices are vital forces needed for sustainable agriculture in Nigeria. Renewable energy plays a crucial role in enhancing eye health care within Nigeria's agricultural sector, primarily by mitigating climate change impacts and improving access to healthcare services. By reducing reliance on fossil fuels, renewable energy technologies like solar and wind power can significantly decrease air pollution and greenhouse gas emissions, thus lessening the burden of climate-related eye problems. Furthermore, renewable energy can power vital healthcare infrastructure, including lighting for clinics and powering medical equipment, improving access to quality eye care in rural agricultural communities.

Here's a more detailed look at the benefits:

1. Climate Change Mitigation and Eye Health:
   a) **Reduced Air Pollution:** Reliance on fossil fuels in agriculture (e.g., for irrigation, transportation, and processing) contributes to air pollution, which can exacerbate eye conditions like conjunctivitis, cataracts, and other infections. Renewable energy sources like solar and wind power produce little to no emissions, helping to improve air quality and reduce the risk of these issues.
   b) **Adaptation to Climate Change Impacts:** Climate change is already impacting agriculture through increased temperatures, droughts, and floods, which can affect eye health. Renewable energy can power irrigation systems, enabling farmers to adapt to changing weather patterns and reduce the risk of eye problems associated with water scarcity or poor hygiene.

2. Access to Healthcare in Agricultural Communities:
   a) **Improved Infrastructure:** Renewable energy can power rural clinics and healthcare centers, providing essential lighting and electricity for medical equipment. This is particularly important in remote agricultural areas where access to healthcare is often limited.
   b) **Refrigeration for Vaccines and Medicines:** Renewable energy can be used to power refrigeration systems, ensuring that vaccines and medicines, including those related to eye health, are stored and transported safely.
   c) **Telemedicine:** Renewable energy can support telemedicine initiatives, allowing eye specialists to remotely diagnose and treat patients in rural areas, improving access to specialized eye care.

3. Sustainable Agriculture and Economic Development:
   a) **Increased Productivity:** Renewable energy can power irrigation systems, reducing reliance on manual labor and improving crop yields. This can lead to increased income for farmers, allowing them to invest in better healthcare and improve their overall well-being.

b) **Reduced Energy Costs:** Renewable energy sources, particularly solar power, can be more cost-effective in the long run than fossil fuels, especially in remote areas. This can free up resources for farmers to invest in other areas, including eye health.
c) **Diversification of Energy Sources:** Relying on a mix of renewable energy sources can improve energy security and reduce vulnerability to fluctuating global energy prices. This stability can contribute to a more predictable and sustainable agricultural sector.

4. Policy and Investment:
a) **Government Support:** The Nigerian government has shown commitment to renewable energy development through initiatives like the Renewable Energy Master Plan. Continued investment and policy support are crucial to scaling up renewable energy adoption in the agricultural sector.
b) **Private Sector Involvement:** Attracting private sector investment in renewable energy projects can accelerate the transition to sustainable energy in agriculture. This includes both domestic and international investors.
c) **Capacity Building:** Training and education programs are needed to build the capacity of local communities and technicians to operate and maintain renewable energy technologies.

3.1. ENHANCING CLIMATE-RESILIENT EYE HEALTH CARE IN NIGERIA

To enhance 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.

1. **Strengthening Health Systems:**
a) **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.
b) **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.
c) **Emergency Preparedness:** Developing and maintaining emergency preparedness plans for eye care services in the event of climate-related emergencies is crucial.

2. 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 are sustainable and can adapt to changing environmental conditions,
b) **Sustainable Development Goals:** Connecting 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. 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.

4. Climate Change Adaptation and Mitigation:

a) **Strategic Tree Planting:** Engaging in strategic tree planting activities can help mitigate the impacts of climate change on 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 eye health.

4. CONCLUSION

Climate change is having a negative impact on 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 deeper research to understand the impacts of climate change on eye health in Nigeria. It is also vital to develop climate-informed public health interventions especially the use of renewable energy technology to mitigate these impacts for sustainable agriculture in Nigeria. Renewable energy which is a climate change mitigation strategy plays a crucial role in enhancing climate resilient eye health care for sustainable agriculture in Nigeria. By embracing renewable energy, Nigeria can create a more sustainable and resilient agricultural sector, improve eye health outcomes, and enhance the overall well-being of its citizens.

REFERENCES

Alebrahim,M,Bakkar.M, Darayseh, A., Msameh, A., Jarrar, D., Aljabari, S. and Khater, W(2022). Awareness and knowledge of the effect of ultraviolet (UV) radiation on the eyes and the relevant protective practices: A cross-sectional study from Jordan. *Healthcare*, 10(12), p.2414

Anabaraonye. B(2018). The innovative use of renewable energy for sustainable development in Nigeria.ICCSEE-UNN International Journal of Climate Change Studies, Energy and Environment, University of Nigeria, Nsukka. Vol. 1:122-130.

Anabaraonye. B, Okafor, J.C. & Hope, J. (2020). Educating farmers in rural areas on climate change adaptation for sustainability in Nigeria. In: Leal Filho W. (Eds.), *Handbook of climate change resilience*. Springer Nature Switzerland Ag. Https://Doi.Org/10.1007/978-3-319-71025-9_184-1

Anabaraonye.B,Anukwonke.C.C, Dibia.S.I.C, Onwuzurike.U, Olisah.N.C & Ezeukwu.J.C(2022) Leveraging multi-stake holder partnerships to combat climate change in Africa. International Journal of Research in Civil Engineering and Technology 2022; 3(2): 21-27

Anabaraonye.B, Ukpanyang.K.A & Asam-Utim.K.O(2024) Impacts of climate change on eye health in Nigeria. International Journal of Climate Change and Environmental Sustainability. Vol. 1(1):1-12

Anabaraonye.B, Nzewi.N.U & Olisah.N.C.(2025) The role of renewable energy technology in enhancing green building projects in Nigeria. International Journal of Research in Engineering, Vol. 6(2):55-59

Burton.M.J, Ramke.J, Marques.A.P et al(2021). The Lancet Global Health Commission on Global Eye Health: Vision beyond 2020. The Lancet Global Health 2021;9(4):e489-e551.

Carpenter, S., Walker, B., Anderies, J. M., & Abel, N. (2001). From Metaphor to Measurement: Resilience of What to What? Ecosystems, *4*(8), 765–781. https://doi.org/10.1007/s10021-001-0045-9

Centers for Disease Control and Prevention (CDC). (2020). Emergency preparedness and response.

Chawda,D. & Shinde, P.(2022). Effects of solar radiation on the eyes. *Cureus*, 14(10), p.e30857. Available at: https://doi.org/10.7759/cureus.30857

Eye News(2021) Climate action in eye care. https://www.eyenews.uk.com/media/25448/eyeas21-yu-2.pdf

Femi.M.(2020) *Investigating effects of climate change on health risks in Nigeria*. IntechOpen. Available at: https://doi.org/10.5772/intechopen.86912

Folke, C. (2006). Resilience: The emergence of a perspective for social–ecological systems analyses. Global Environmental Change, 16(3), 253–267. https://doi.org/10.1016/j.gloenvcha.2006.04.002

Folke, C., Carpenter, S. R., Walker, B., Scheffer, M., Chapin, T., & Rockström, J. (2010). Resilience Thinking: Integrating Resilience, Adaptability and Transformability. *Ecology and Society, 15*(4), https://doi.org/10.24926/ijps.v7i2.3386 12

IAPB(2024) Building Climate-Resilient Eye Care: A Landmark Resolution at the World Health Assembly. https://www.iapb.org/blog/building-climate-resilient-eye-care-a-landmark-resolution-at-the-world-health-assembly/

Jain.S.(2025) Climate Change Is threatening eye health in disturbing ways. https://www.smithsonianmag.com/science-nature/climate-change-is-threatening-eye-health-in-disturbing-ways-180986573/

Moench, M. (2014). Experiences applying the climate resilience framework: linking theory with practice. *Development in Practice*, *24*(4), 447–464.

Oboti.P.N, Orji.E.I & Anabaraonye.B(2024). Innovative use of information and communication technology in mitigation of flooding in Nigeria. International Journal of Climate Change and Environmental Sustainability.Vol. 1(1): 34-42

Oladimeji. A. & Okoye.O. (2019). The impact of climate change on eye health care systems and local communities in Nigeria. African Journal of Environmental Science and Technology, 13(4), 135-143.

Olisah.N.C, Anabaraonye.B & Odoh.C.C(2025) The role of renewable energy in enhancing climate smart agriculture in Nigeria. Journal of Environmental Science and Agricultural Research. Vol. 3(1):1-5

Ovenseri-Ogbomo, G. O., Omoti, A. E., Okeigbemen, V. W., & Asuquo, I. M. (2020). Association between climate factors and dry eye disease: Evidence from a tertiary eye hospital in southwest Nigeria. Nigerian Journal of Clinical Practice, 23(11), 1557-1562.

United Nations Framework Convention on Climate Change (UNFCCC) (2019) Community-Based Initiatives.

Wong.L.Y, Wong.S.W, Ting.D.S.J, Muralidhar et al(2024) Impacts of climate change on ocular health: A scoping review. The Journal of Climate Change and Health (Elsevier). Vol. 15, January-February 2024, 100296. https://doi.org/10.1016/j.joclim.2023.100296

World Health Organization(WHO)(2021). Climate change and health. Retrieved from https://www.who.int/news-room/q-a-detail/climate-change-and-health