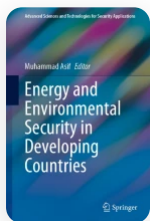


[Home](#) > [Energy and Environmental Security in Developing Countries](#) > Chapter


Climate Change Adaptation and Mitigation in Sub-Saharan African Countries

| Chapter | First Online: 03 March 2021

| pp 393–409 | [Cite this chapter](#)



Energy and Environmental Security in Developing Countries

[Kayode I. Adenuga](#) , [Abubakar Sadiq Mahmoud](#), [Yakubu Aminu Dodo](#), [Moutlen Albert](#), [Said Alkali Kori](#) & [Nusa Jibril Danlami](#)



 Part of the book series: [Advanced Sciences and Technologies for Security Applications \(\(ASTSA\)\)](#)

 1238 Accesses  16 Citations

Abstract

The impact of climate change and global warming is high on agriculture, food security, quality of life, human health, economic growth, and development in sub-Saharan African countries. Thus, there are ongoing global discussions on climate change adaptation and mitigation including the Kyoto Protocol; an international treaty which extends the 1992 United Nations Framework Convention on Climate Change (UNFCCC) that commits state

parties to reduce greenhouse gas emissions caused by global warming, the 2012 Doha Amendment to the Kyoto Protocol, United Nations Development Programme climate change portfolio, United Nations Educational Scientific and Cultural Organization climate change awareness program, United Nations Environment Programme (UNEP) and other bodies efforts to reduce climate pollutants globally, Africa in particular. However, despite these interventions, there is little scholarly information discussing the extent to which the region's vulnerability to climate change on its economies and growing populations is addressed. Thus, this review paper examines the impacts of climate change and global warming in sub-Saharan African countries and strategies adopted to mitigate the effects on its environments and economy.

 This is a preview of subscription content, [log in via an institution](#)  to check access.

Access this chapter

Log in via an institution

Subscribe and save

 Springer+

from €37.37 /Month

Starting from 10 chapters or articles per month

Access and download chapters and articles from more than 300k books and 2,500 journals

Cancel anytime

[View plans](#) 

Buy Now

 Chapter

EUR 29.95

Price includes VAT (Sudan)

Available as PDF
Read on any device
Instant download
Own it forever

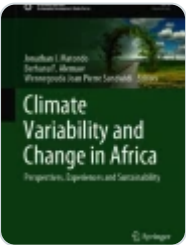
Buy Chapter

▼ eBook	EUR 117.69
▼ Softcover Book	EUR 149.99
▼ Hardcover Book	EUR 149.99

Tax calculation will be finalised at checkout
Purchases are for personal use only

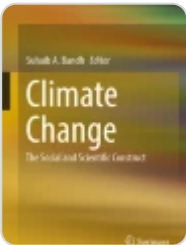
[Institutional subscriptions →](#)

Similar content being viewed by others



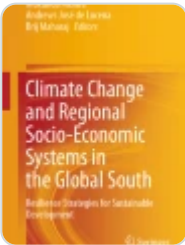
Africa in a Changing Climate: Redefining Africa’s Agrarian Development Policies

Chapter | © 2020



Perspectives of Climate Change

Chapter | © 2022



Collaborative Climate Actions: Integrity and Cooperation in the Global South

Chapter | © 2024

References

1. Hamin EM, Gurran N (2009) Urban form and climate change: balancing adaptation and mitigation in the US and Australia. *Habitat Int* 33(3):238–245

[Article](#) [Google Scholar](#)

2. Munang R et al (2013) Climate change and ecosystem-based adaptation: a new pragmatic approach to buffering climate change impacts. *Current Opin Environ Sustain* 5(1):67–71

[Article](#) [Google Scholar](#)

3. Fankhauser S, Ward J (2010) Regional implications of the AGF recommendations: Africa

[Google Scholar](#)

4. Tyokumbur ET (2014) Review of ecological perspectives on climate change in Nigeria. *Am J Environ Eng Sci* 1(1):36–49

[Google Scholar](#)

5. IPCC (2007) The physical science basis. In: Manning M, Chen Z, Marquis M, Averyt KB, Tignor M, Miller HL (eds) Contribution of working group I to the fourth assessment report of the intergovernmental panel on climate change, vol 996. Cambridge University Press, Cambridge, UK and New York, NY, USA

[Google Scholar](#)

6. Arbuckle JG Jr et al (2015) Understanding farmer perspectives on climate change adaptation and mitigation: The roles of trust in sources of climate information, climate change beliefs, and perceived risk. *Environ Behavior* 47(2):205–234

7. Coumou D, Rahmstorf S (2012) A decade of weather extremes. Nat Climate Change 2(7):491

8. Hatfield JL, Prueger JH (2015) Temperature extremes: effect on plant growth and development. Weather Climate Extre 10:4–10

9. AO OP (2008) The impact of tillage systems on soil microclimate, growth and yield of cassava (*Manihot utilisima*) in Midwestern Nigeria. Afri J Agri Res 3(3):225–233

10. Asante FA, Amuakwa-Mensah F (2015) Climate change and variability in Ghana: stocktaking. Climate 3(1):78–99

11. Mitigation CC (2011) IPCC special report on renewable energy sources and climate change mitigation

12. Sallema R, Mtui G (2008) Adaptation technologies and legal instruments to address climate change impacts to coastal and marine resources in Tanzania. Afri J Environ Sci Technol 2(9):239–248

13. Liu J (2011) The Cancun agreements. *Environ Law Rev* 13(1):43–49

[Article](#) [Google Scholar](#)

14. Awosika L et al (1992) The impact of sea level rise on the coastline of Nigeria. In: Proceedings of IPCC symposium on the rising challenges of the sea. Magaritta, Venezuela

[Google Scholar](#)

15. Idowu AA et al (2011) Impact of climate change in Nigeria. *Iran J Energy Environ* 2(2):145–152

[Google Scholar](#)

16. Akpodiogaga-a P, Odjugo O (2010) General overview of climate change impacts in Nigeria. *J Human Ecol* 29(1):47–55

[Google Scholar](#)

17. Isingoma JB (2009) Climate change and energy in Africa. *Climate Change Afri* 36

[Google Scholar](#)

18. UNEP-GRIDA (2000) <https://www.grida.no/resources/6895>. Accessed 30 April 2020

19. Tesfahun W (2018) Climate change mitigation and adaptation through biotechnology approaches: a review. *Cogent Food Agri* 4(1):1512837

[Article](#) [Google Scholar](#)

20. Odjugo AP, Isi AI (2003) The impact of climate change and anthropogenic factors on desertification in the semi-arid region of Nigeria. *Global J Environ Sci* 2(2):118–127

21. Odjugo P (2000) Global warming and human health: current and projected effects. Environ Analar 4(2):49–60

22. Hengeveld H, Whitewood B (2005) Understanding climate change-2005: a synthesis of climate change science. Meteorological Service of Canada

23. DeWeerd S (2007) Climate change, coming home. World Watch 20(3):8–13

24. Nwafor J (2006) Environmental impact assessment for sustainable development. Eldermark Publishers, Enugu

25. Odjugo PA-AO (2009) Quantifying the cost of climate change impact in Nigeria: emphasis on wind and rainstorms. J Human Ecol 28(2):93–101

26. Hanjra MA, Qureshi ME (2010) Global water crisis and future food security in an era of climate change. Food Policy 35(5):365–377

27. Ayuba H et al (2007) Climate change impact on plant species composition in six semi-arid rangelands of Northern Nigeria. Niger Geograph J 5(1):35–42

28. Stanturf J et al (2011) Ghana climate change vulnerability and adaptation assessment. United States Agency for International Development, Washington

[Google Scholar](#)

29. Conway D, Schipper ELF (2011) Adaptation to climate change in Africa: challenges and opportunities identified from Ethiopia. *Global Environ Change* 21(1):227–237

[Article](#) [Google Scholar](#)

30. Zerga B, Gebeyehu G (2016) Climate change in Ethiopia variability, impact, mitigation, and adaptation. *J Soc Sci Human Res* 2(4):66–84

[Google Scholar](#)

31. World Bank (2007) Ethiopia: Accelerating Equitable Growth, Country Economic Memorandum. World Bank, Washington, DC

[Google Scholar](#)

32. Hydropower (2017) Hydropower energy. <https://www.hydropower.org/country-profiles/nigeria>. Accessed 31 Dec 2019. Earthscan

33. Afrec (2008) Designing the African energy transition. <https://au-afrec.org/bk-energytransition-en.php>. Accessed 31 Dec 2019

34. Karekezi S et al (2009) Large hydropower, renewable energy and adaptation to climate change: climate change and energy security in east and horn of Africa. AFREPREN/FWD occasional paper (33)

35. Bekoe EO, Logah F (2016) The impact of droughts and climate change on electricity generation in Ghana. Meteorol Energy Secur Simulat Project Manage 163

[Google Scholar](#)

36. Karekezi S, Kithyoma W (2005) Sustainable energy in Africa: cogeneration and geothermal in east and horn of Africa: status and prospects, AFREPREN/FWD

[Google Scholar](#)

37. Baanabe J (2008) Large scale hydropower. Renewable energy adaptation & climate change & energy security in east & horn of Africa. A paper presented at HBF Regional Workshop on 21st November

[Google Scholar](#)

38. Schaeffer M et al (2013) Climate-change impacts, adaptation challenges and costs for Africa

[Google Scholar](#)

39. Lloyd SJ et al (2011) Climate change, crop yields, and undernutrition: development of a model to quantify the impact of climate scenarios on child undernutrition. Environ Health Perspect 119(12):1817–1823

[Article](#) [Google Scholar](#)

40. Meehl GA, Tebaldi C (2004) More intense, more frequent, and longer lasting heat waves in the 21st century. Science 305(5686):994–997

[Article](#) [Google Scholar](#)

41. D'Ippoliti D et al (2010) The impact of heat waves on mortality in 9 European cities: results from the EuroHEAT project. *Environ Health* 9(1):37

[Article](#) [Google Scholar](#)

42. Locatelli B (2011) Synergies between adaptation and mitigation in a nutshell, CIFOR

[Google Scholar](#)

43. IPCC (2013) Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 1535 pp

[Google Scholar](#)

44. UNDP (2007) Human Development Report 2007/2008: Fighting Climate Change: Human Solidarity in a Divided World. New York: United Nations Development Programme

[Google Scholar](#)

45. Manne A, Richels R (2004) US rejection of the Kyoto protocol: the impact on compliance costs and CO₂ emissions. *Energy Policy* 32(4):447–454

[Article](#) [Google Scholar](#)

46. UNFCCC BAP, Plan BA (2007) Decision 1/CP. 13. COP13, Bali, Indonesia

[Google Scholar](#)

47. Union A (2014) Draft African Union strategy on climate change. African Union, May

48. UNESCO (2019) Climate change mitigation and adaptation: simple guide to schools in Africa. United Nations Educational, Scientific and Cultural Organization, East Africa Regional Office, Nairobi, Kenya

Author information

Authors and Affiliations

Farnborough College of Technology, University Centre Farnborough, Farnborough
Hants, Hampshire, United Kingdom

Kayode I. Adenuga

Safety Technology Program, King Fahad University of Petroleum and Minerals
KFUPM, Eastern Province, Dhahran, Saudi Arabia

Abubakar Sadiq Mahmoud

Department of Architecture, Faculty of Architecture and Engineering, Istanbul Gelisim
University, Istanbul, Turkey

Yakubu Aminu Dodo

School of ICT, ICT University, Yaoundé Campus, Yaounde, Cameroon

Moutlen Albert

Building Information Modelling, Nigeria & Family House Funds, Abuja, Nigeria

Said Alkali Kori

Public Building Department, Niger State Ministry of Works and Transport, Minna,
Niger, Nigeria

Nusa Jibril Danlami

Corresponding author

Correspondence to [Kayode I. Adenuga](#).

Editor information

Editors and Affiliations

King Fahd University of Petroleum and Minerals, Dharam, UK

Muhammad Asif

Rights and permissions

[Reprints and permissions](#)

Copyright information

© 2021 Springer Nature Switzerland AG

About this chapter

Cite this chapter

Adenuga, K.I., Mahmoud, A.S., Dodo, Y.A., Albert, M., Kori, S.A., Danlami, N.J. (2021). Climate Change Adaptation and Mitigation in Sub-Saharan African Countries. In: Asif, M. (eds) Energy and Environmental Security in Developing Countries. Advanced Sciences and Technologies for Security Applications. Springer, Cham. https://doi.org/10.1007/978-3-030-63654-8_16

[.RIS](#) [.ENW](#) [.BIB](#)

DOI	Published	Publisher Name
https://doi.org/10.1007/978-3-030-63654-8_16	03 March 2021	Springer, Cham

Print ISBN	Online ISBN	eBook Packages
978-3-030-63653-1	978-3-030-63654-8	Energy
		Energy (R0)

Publish with us

[Policies and ethics](#) 