



CLIMATE CHANGE, AGRICULTURE & HIGHER EDUCATION

MULTIDISCIPLINARY
ISSUES & PERSPECTIVES

Edited by
Nicholas Ozor, Ph.D

CLIMATE CHANGE, AGRICULTURE & HIGHER EDUCATION

MULTIDISCIPLINARY
ISSUES & PERSPECTIVES

Edited by
Nicholas Ozor, Ph.D

CLIMATE CHANGE, AGRICULTURE & HIGHER EDUCATION

MULTIDISCIPLINARY
ISSUES & PERSPECTIVES

© Nicholas Ozor 2014
First published 2014

All rights reserved

ISBN: 978-978-53249-2-1

Editor
Nicholas Ozor
sunny_ozor@yahoo.com

Design & Layout
Sammy Mwirigi
samwirigi@gmail.com

Foreword

There is a general consensus amongst experts that climate change presents one of the most serious environmental threats facing mankind across the globe today. Unfortunately, developing countries especially those in Africa and specifically in sub-Saharan Africa are the most vulnerable according to the Intergovernmental Panel on Climate Change (IPCC). This high vulnerability derives from their lack of capacity to adapt to the changes associated with climate variability. Besides, the vulnerability is worsened by heavy reliance on renewable natural resources for livelihoods, high unemployment rates, health related problems, poor infrastructure, and poverty.

Consequently, climate change has predisposed human beings, animals and the ecosystem to untold hardship, danger and damage respectively. This has been experienced in the form of severe incidences of flooding, drought, heat waves, sea level rise, cyclones, hurricanes, and changing rainfall patterns which have meant that rural farmers who implement their regular annual farm business plans risk total crop failure due to climate change effects.

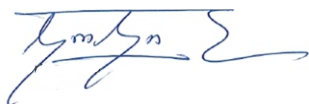
Developing strategies to mitigate and adapt to the impacts of climate change in a sustainable way will require collective effort at the local, national, and international levels. It will also require multidisciplinary and transdisciplinary approaches as climate change is a complex phenomenon. With the science of climate change now becoming increasingly clear, sustainability is turning more and more into an issue for education and capacity enhancement. This is because university education provides leadership in research, training and innovation responsible for sustainable economic development of any nation.

Effective adaptation and mitigation of complex global challenges such as climate change requires well-coordinated and collaborative efforts to galvanise ad hoc response activities at individual and institutional levels, create new curricula, new teaching methods, new pedagogies and university governance structures suitable for building necessary capacities for climate change adaptation and mitigation. At the same time, there is need for collaborative platforms for clusters of experts working on climate change adaptation in different institutions to share multidimensional, multidisciplinary, multicultural thinking and evidence-based experiences in order to anchor the African voice and fully embed the new curricula and

pedagogies on climate change adaptation and mitigation on African realities, cultures and experiences. Achieving such links requires adjustments in the way universities function. One such adjustment is the call for change in the curricula of African universities to accommodate issues of climate change so as to clearly understand the phenomenon and at the same time build the required capacity to adapt to the change.

Based on the above considerations, the book *Climate Change, Agriculture and Higher Education: Multidisciplinary issues and perspectives*; could not have come at a more opportune time than now. First, the content provides in-depth knowledge on climate change issues especially how it affects agriculture and the ecosystem. The book clearly illustrates that climate change cuts across all disciplines and fields of endeavour and hence requires a multidisciplinary approach in seeking solutions to its catastrophic consequences on humanity, animals and the ecosystem. Second, the contributors of the book chapters are renowned experts and professionals in their respective fields of endeavour with proven records in teaching and research in relevant areas of the subject matter. Besides, some of the chapters are already outcomes of multidisciplinary and transdisciplinary research activities by experts drawn from Africa, Asia and Europe. This has greatly enriched the book with multicultural perspectives and showcases opportunity for experiential learning.

I am therefore confident that this book will be very useful to academicians, practitioners and policy makers interested in climate change research, teaching, adaptation, mitigation and collaborations. With the current wave to climate-proof courses in universities, this book will be particularly useful in guiding departments and faculties in their curriculum development efforts that are required to meet the need of academia and the industry as well.



Bartho Okolo
Vice Chancellor, University of Nigeria, Nsukka

Table of Contents

Foreword	iii
Preface	vii
Acknowledgment	x
List of Abbreviations and Acronyms	xi
List of Contributors	xvi
SECTION ONE: CLIMATE CHANGE & AGRICULTURE	1
1. Understanding Climate Change: Implications for Nigerian Agriculture, Policy and Extension	2
2. A Framework for Agricultural Adaptation to Climate Change in Southern Nigeria	14
3. Economic Implications of Climate Change Adaptation in Agriculture: Lessons and Challenges for Nigeria	35
4. Farm-level Strategies and Practices for Climate Change Adaptation in Nigeria	53
5. Challenges of Agricultural Adaptation to Climate Change in Nigeria	93
6. International Initiatives and Capabilities of National Institutions for Climate Change Adaptation	110
7. From Global to Local Action: Climate Change Adaptation in International Policy and in Farming Systems in China	131
SECTION TWO: CLIMATE CHANGE & HIGHER EDUCATION	143
8. The Need for Curriculum Development and Knowledge of Climate Change Issues in Universities: The Case of University of Nigeria, Nsukka	144
9. Climate Change and the Need for New Curriculum Development in Nigerian Universities	158
10. Climate Change and Sustainable Development: Challenges of Curriculum Development in Nigeria's Higher Education	170
11. Climate Change and Agriculture	179
12. Climate Change and Arts and Humanities	187
13. Climate Change and the Social Sciences	202

14. Climate Change and Veterinary Sciences	215
15. Climate Change and Biological Sciences	227
16. Climate Change and Engineering and Technology	236
17. Climate Change and Environmental Sciences	245
18. Climate Change and Law	263
19. Climate Change and Health Sciences and Technology	275
20. Climate Change and the Physical Sciences	291
Index	315

Preface

The most significant damage done to the environment that future generations will feel is caused by climate change. Climate change is a result of pollutants from activities in our global economy exceeding the ability of the earth to absorb them. In the case of climate change, the pollutant is carbon dioxide, which together with water is the main product of fossil fuel combustion from which virtually all aspects of the global economy activities are based. No doubt, the contemporary world today is paying the price of industrialisation and unsustainable human activities as a result of climate change and global warming, which has sounded a global warning as to the relationship between our actions and the environment. The catastrophic impacts of global warming, drought and desertification, soil erosion, sea level rise, among others, is better imagined.

Agriculture, considered as the mainstay of the economy of developing nations involves four broad systems of land use: crop production, animal husbandry, fishery and forestry. These economic activities have become vulnerable to the vagaries of climate change. Over 70% of the Nigerian populace are predominantly farmers and they lack the adaptive capacity to confront these challenges. These environmental challenges include population pressure and continuous exploitation of marginal lands, aggravating the process of drought and desertification in the arid and semi-arid areas such as Northern Nigeria, severe gully erosion in the Eastern States of Nigeria, coastal and marine erosion and land subsidence in the coastal and riverine states, flooding in the low-lying belt of mangrove and fresh swamps along the coast, the plains of large rivers and short-lived flash floods in the inland rivers, uncontrolled logging with inherent problems of the destruction of biodiversity, inappropriate agricultural practices, destruction of watersheds, soil-crust formation caused by loss of water, destruction of vast agricultural lands, oil pollution from oil spillage and gas-flaring related problems and industrial pollution, municipal waste generation and urban decay to name but a few.

With the science of climate change now becoming increasingly clear, sustainability is turning more and more into an issue for education. University education provides leadership in research, training and innovation responsible for sustainable development of any nation. Effective adaptation to complex global challenges such as climate change requires well-coordinated and collaborative efforts to galvanise ad hoc response activities at individual and

institutional levels across Africa, to create new curricula, new teaching methods, new pedagogies and university governance structures suitable for building necessary capacities for climate change adaptation. Beyond advocacy, there is the glaring need to incorporate climate change issues in the curriculum of our universities. Climate change affects all aspects of human life. The proposed curriculum challenges students to seek integrated approaches to the study by drawing from a cross multidisciplinary and transdisciplinary fields in universities. Integrating these core disciplines will provide students with substantive knowledge required to analyse and diagnose multidimensional problems such as malnutrition, extreme poverty, climate change, and infectious diseases control.

Two Projects: The Springboard for this Book

This book is a product of two transdisciplinary international research projects namely; “Developing a framework for agricultural adaptation to climate change in Southern Nigeria” which was funded by the British Department for International Development (DFID) and implemented by the British Council Nigeria under the Development Partnership in Higher Education (DeLPHE) Programme. The other project, tagged “Influencing curriculum development and knowledge of climate change issues at the University of Nigeria, Nsukka and environs” was funded by the global change SysTem for Analysis, Research and Training (START), based in Washington, DC, USA under the African Climate Change Fellowship Programme (ACCFP).

During the course of implementing these two research projects, numerous activities including workshops, international conferences, round tables, high level policy dialogues, focus group discussions, seminars, and other knowledge valorisation strategies were conducted in order to realise the aims of the projects. Several professional papers cutting across disciplines, countries and continents were presented to showcase adaptation and mitigation measures against climate change in agriculture. The first ever forum at the University of Nigeria, Nsukka to discuss the issue of influencing curriculum development to integrate issues of climate change was held in 2009 at the University.

Over 100,000 stakeholders drawn from the academia (researchers and students), policy makers, private sector, civil society actors, farmers and farmer organisations, and the media have participated directly in the two projects mentioned above. These projects were also implemented through various bilateral and multilateral partnerships across Africa and Europe thereby drawing strength and lessons that enriched this book.

Section One of the book, *Climate Change and Agriculture* provides a clear understanding of the inter-relationships between agriculture and climate change in terms of the causes, impacts, strategies for mitigation and adaptation, and the constraining factors to adaptation. It shows

on a global level how climate change issues are being addressed and the lessons for Nigeria, Africa and other developing countries.

Section Two of the book, *Climate Change and Higher Education* argues for the need for reforms in the educational system of universities paying particular attention to curriculum development. It shows the relationship between climate change and relevant disciplines including agriculture, arts and humanities, biological sciences, education, engineering and technology, environmental sciences, health sciences and technology, law, physical sciences, social sciences, and veterinary sciences, citing specific examples in each case. This section also argues for the need to develop a new curriculum to include issues of climate change in the respective university faculties. It also identifies examples of courses that could be introduced in the respective university faculties that will cover issues of climate change. It also shows examples of existing courses in the respective faculties that could be revised to accommodate issues of climate change. Finally, the section examines the process of curriculum development in universities and makes recommendations on how curriculum development reforms could be facilitated.

Benefits of this book

It is with delight that I urge you to enjoy the informative presentations, exciting analyses, and illuminating postulations from the selected experts that contributed book chapters. There is no doubt that they are all critical for an enriched understanding of climate change issues and its implication on agriculture and education. Therefore, the book serves as a reference tool for research, teaching, learning, policy advocacy, capacity building, knowledge brokerage, and knowledge valorisation. It is an important source of reference material for policy makers and technocrats, professionals, researchers, scholars, teachers, students and practitioners.

Dr Nicholas Ozor
African Climate Change Fellow, Teacher and Researcher
15 February 2014