

International Conference on

CLIMATE CHANGE 
& NATIONAL DEVELOPMENT

Harnessing Research for Sustainability

June 24-25, 2015

Center for African Wetlands
University of Ghana, Legon

Sponsors:



CENTER FOR AFRICAN WETLANDS

from www.ccndconference.com

ccnd@ug.edu.gh

**Funding for the B4C Project and the 2015
CCND Conference has been provided
by the Open Society Foundations**



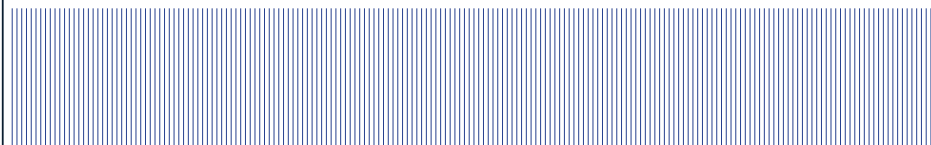
**International conference on Climate
Change and National Development:
Harnessing Research for Sustainability**

Auditorium of the Centre for African Wetlands

University of Ghana, Legon

June 24-25, 2015

**CONFERENCE PROGRAMME
AND ABSTRACTS**



CLIMATE CHANGE AND NATIONAL DEVELOPMENT (CCND)-2015

HARNESSING RESEARCH FOR SUSTAINABILITY

www.ccndconference.com

The 2015 International Conference on Climate Change and National Development (CCND) is organised under the University of Ghana's "Building Capacity to meet the Climate Change Challenge (B4C)-Ghana" project. The project is implemented by a consortium of three organisations, the University of Ghana, the Centre for African Wetlands and the Ghana Wildlife Society and is supported by the Open Society Foundation.

This year's conference is the first of what is to become an annual event, each year focusing on a specific global environmental issue of high relevance to African nations. The sub-theme of the 2015 conference, "Harnessing Research for Sustainability" was selected to showcase results of the research studies carried out under the B4C project over the past four years, but also to bring together researchers, policy makers and other stakeholders to deliberate on climate change issues across Africa and explore options for national development in the face of a changing climate.

We are pleased to welcome researchers from eight countries (Hong Kong, Germany, Ghana, Kenya, Nigeria, Tanzania, United Kingdom and the United States) who will be presenting papers on a range of climate change issues including food security, water resources, ecosystems and biodiversity, gender and health. The final session of the conference will be devoted to communication, with a special media event to highlight the importance of spreading the climate change message and the key role of the media in this endeavour.

BRIEF ON INSTITUTIONS

University of Ghana

The University of Ghana (UG), the premier university in the country, was established by Ordinance on August 11, 1948 as the University College of the Gold Coast and gained independent status to become the University of Ghana on October 1, 1961. The University offers degrees at Diploma, Bachelors, Masters and PhD levels in a range of disciplines covering Basic and Applied Sciences, Agricultural Sciences, Health Sciences, Education and Humanities. The University's vision defined in its 2014 -2024 Strategic Plan is to become a "World Class research-intensive University" over the next decade. Its mission is to "create an enabling environment that makes University of Ghana increasingly relevant to national and global development through cutting edge research as well as high quality teaching and learning". A key priority of the UG's Strategic Plan is research, where the University seeks to create a vibrant intellectual climate that stimulates relevant cutting edge research and community engagement.

Centre for African Wetlands

The Centre for African Wetlands (CAW) was established in 2000 as a sub-regional initiative with funding from the Royal Netherlands government. It is hosted by the University of Ghana and covers 12 West African countries. The ultimate goal of CAW is to contribute

to the preservation of the global, sub-regional, national and local values of West African wetlands to improve the quality of life for people living within and around wetlands, and maintain wetland biodiversity and the general ecological integrity of wetlands. The mandate of CAW is to promote sustainable wetland management through research (ecological, socio-economic), capacity building, information dissemination, networking, advocacy and policy support. Currently the Centre's programme focuses on training and capacity development, as well as research on a range of wetland related issues including assessment and monitoring of ecological character and values of wetlands, wetland inventory, climate change impacts, pollution and degradation.

***Open Society
Foundations (Donor)***

The Open Society Foundations work to build vibrant and tolerant societies whose governments are accountable and open to the participation of all people. The organisation:

- seeks to strengthen the rule of law; respect for human rights, minorities, a diversity of opinionism and democratically elected governments.
- helps in shaping policies that assure greater fairness in political, legal, and economic systems and safeguard fundamental rights
- implements initiatives to advance justice, education, public health, and independent media.
- builds alliances across borders and continents on issues such as corruption and freedom of information.

Organising Committee

Prof. Yaa Ntiamao-Baidu (Chair)

Dr. Albert Ahenkan

Dr. Irene Egyir

Prof. Audrey Gadzekpo

Prof. Chris Gordon

Dr. Nana Ama Browne Klutse

Dr. Rosina Kyerematen

Dr. Erasmus Owusu

Dr. Kwadwo Owusu

CONTENTS

Day 1 – Wednesday, June 24, 2015	01
Day 2 – Thursday, June 25, 2015	04
Building Capacity To Meet The Climate Change Challenge: Some Lessons From Ghana	06
The Role Of Institutional Support In Climate Change Adaptation Amongst Smallholder Farmers In Selected Communities In The Sissala Districts Of Ghana	09
Climate Variability and Food Security in Tanzania: The Case of Western Bagamoyo	10
Nutritional Quality, Physicochemical Properties and Sensory Evaluation of Four Soybean Varieties Grown in Western Kenya	11
The Socioeconomic Impact of Climate Change Adaptation on Smallholder Farmers in Lawra District, Upper West Region, Ghana	13
Origin And Phylogenetic Status Of The Local Ashanti Dwarf Pig (ADP) Of Ghana Based On Evidence From mtDNA, MC1R Gene And Snp Genotyping Analyses	14
Reducing Climate Change Effect on Maize and Sorghum Yield Using Traditional Practices: Experiences from Northern Ghana	16
Implications of climate change for food security among maize producing households around forest protected areas of Ghana	17
Climate Change, Food Security and Competition for Land and Water Resources in the White Volta Basin in Northern Ghana	18
Drivers of Crop Choice as an Adaptation Technique to Climate Change in North Eastern Ghana	19
Climate Change Impacts on Smallholder Agriculture and Adaptation Strategies in the Sisili-Kulpawn Basin of the Northern Region of Ghana	20

Climate Change Signals in Kenyan Rift Valley Lakes	23
Trends in daily extreme precipitation and temperature indices over Ghana from 1980 to 2011	24
Changes in rainfall characteristics in Wenchi and Saltpond farming areas of Ghana	25
Climate Change Adaptation and Water Resources: Redefining Climate Change Impacts and Vulnerability by the Creation of Resilient, Green Solutions	26
Effects of Climate Variability on Household Water Availability and the Public Health Implications in four Rural Communities in Ghana	27
Rainwater Harvesting for Domestic Use as an Adaptation to Climate Change: The case of Kpando, Ghana	28
Payment for Environmental Services (PES) in the Feng Shui Forest in Hong Kong: Relevance in the Climate Change Discourse	30
Conserved forests and sustainable livelihoods in the face of climate change: experiences of fringe communities along the Atewa Range Rorest Reserve	31
Implementing Ecosystem Based Approaches (EBA) for Enhanced Agricultural Productivity and Food Security in Eastern Region of Ghana	33
The Socio-economic vulnerability of coastal communities in Ghana to the impact of climate change: A case study of the Anloga community	34
Preliminary studies on impacts of ocean acidification on diversity of fish species landed by artisanal and semi-industrial fisheries in Ghana	36
Suitable financing models for rural solar electrification projects in Ghana	38
Clean Energy Transition in a Developing Society: Reflections on the Socio-Economic Determinants of SHS Adoption among Urban Households in Nigeria	40
Climate change and changing productive economic activities in Ghana: A gendered perspective	41

Relationship between climatic variables and diarrhoea cases in two agro-ecological zones of Ghana	42
Climate Change Induced Occupational Stress and Reported Morbidity among Cocoa Farmers in South Western Nigeria	43
Disaster risk reduction and climate change adaptation: Inter- and intra-agency knowledge flows in Accra, Ghana Using urban flooding as an example	44
The Role of Social Protection Interventions in Enhancing Climate Change Adaptation and Mitigation: The case of LIPW component of Ghana Social Opportunities Projects (GSOP)	45
Media and Climate Change in Ghana: A Survey of Media Practitioners Response to Climate Change	47
Climate Change Research Publication Output in Africa: Bibliometrics Analysis	49
Scientists and Creative Artists Collaborating to Create Climate Change Awareness: The Case of “The Day After Tomorrow”	50
Visibility and Accessibility of Climate Change Scholarly Literature on Ghana	51
Climate Science Communication: Lessons from Sub-Saharan Africa	52

Conference

Programme



Day 1 – Wednesday, June 24, 2015

TIME	SESSION
09:00 - 09:45	OPENING SESSION
SESSION 1	FOOD SECURITY: Convener - Dr. Irene Egyir
09:45 - 10:00	Irene S. Egyir - Implications of climate change for food security among maize producing households around forest protected areas of Ghana
10:00 - 10:15	Kranjac-Berisavljevic, G. - Reducing climate change effect on maize and sorghum yield using traditional practices: Experiences from Northern Ghana.
10:15 - 10:30	Ruth Quaye - The role of institutional support in climate change adaptation amongst small holder farmers in selected communities in the Sissala districts of Ghana.
10:30 - 10:45	Paschal Mugabe - Climate variability and food security in Tanzania: A case study of Western Bagamoyo.
10:45 - 11:00	Frederick Agengo - Nutritional quality, psychochemical properties and sensory evaluation of four soya bean varieties grown in Western Kenya.
11:00 - 11:30	<i>Cocoa Break</i>
11:30 - 11:45	Nana Yamoah Asafu-Adjaye - The socio-economic impact of climate change on small holder farmers in Lawra district, Upper West Region, Ghana.
11:45 - 12:00	Toulupe Oyekale - Farm households' perception on climate change and willingness to subscribe for advisory weather forecasts in South West Nigeria.

12:00 - 12:15 **Asaah Sumaila Mohammed** - Climate change, food security and competition for land and water resources in the White Volta basin in Northern Ghana.

12:15 - 12:30 **Dadson Awunyo-Vitor** - Drivers of crop choice as an adaptation technique to climate change in North Eastern Ghana.

12:30 - 12:45 **Mercy Obenewaah Owusu** - Climate change impact on smallholder agriculture and adaptation strategies in the Sisili-Kulpawn basin of the Northern Region of Ghana.

13:00 - 14:00 *Lunch Break*



SESSION 2**WATER RESOURCES:** *Convener - Prof. Chris Gordon*

- 14:15 - 14:30 **Eunice Keoch** - Climate change signals in Kenyan Rift Valley Lakes.
- 14:30 - 14:45 **Francis Nkrumah** - Trends in daily extreme precipitation and temperature indices over Ghana from 1980 - 2011
- 14:45 - 15:00 **Kwesi Quagraine** - Changes in rainfall characteristics in Wenchian Saltpond farming areas of Ghana.
- 15:00 - 15:15 **Joachim Ayiwe Abunga** - Climate change adaptation and water resources: redefining Climate change impacts and vulnerability by the creation of resilient green solutions
- 15:15 - 15:30 **Karyn Asmah** - Effects of variability on household water availability and the public health implications in four rural communities in Ghana.
- 15:30 - 15:45 **B. A. Odonkor** - Rainwater Harvesting for Domestic Use as an Adaptation to Climate Change: The case of Kpando, Ghana
-
- 15:45 - 16:00 *Comfort Break*
-
- 16:00 - 16:15 **Fanny Frick** - Disaster risk reduction and climate change adaptation: Inter-And Intra-agency knowledge flows in Accra, Ghana.
- 16:15 - 16:30 **Simon Bawakyillenuo** - The role of social protection interventions in enhancing climate change adaptation and mitigation: The case of LIPW component of Ghana social opportunities projects (GSOP).

Day 2 – Thursday, June 25, 2015

TIME	SESSION
09:00 - 09:45	OPENING SESSION
SESSION 3	
ECOSYSTEMS AND BIODIVERSITY:	
<i>Conveners - Drs. Erasmus Owusu and Rosina Kyeremanten</i>	
09:00 - 09:15	Lawal M. Marafa - Payment for environmental services (PES) in the Feng Shui forest in Hong Kong: Relevance in climate change discourse.
09:15 - 09:30	Timothy Apeanti - Conserved forests and sustainable livelihoods in the face of climate change: Experiences of fringe communities along the Atewa range forest reserve
09:30 - 09:45	John Kwame Boateng - Implementing ecosystem based approaches (EBA) for enhanced agricultural productivity and food security in Eastern region of Ghana
09:45 - 10:00	Kasim Gawusu - The socio-economic vulnerability of coastal communities in Ghana to the impact of climate change: A case study of the Anloga community.
10:00 - 10:30	F.K.E. Nunoo - Preliminary studies on impacts of ocean acidification on diversity of fish species landed by artisanal and semi-industrial fisheries in Ghana.
10:30 - 11:00	<i>Cocoa Break</i>

SESSION 4

HEALTH, GENDER & ENERGY: *Conveners Drs. Kwadwo Owusu, Nana Ama Browne Klutse and Albert Ahenkan*

- 11:00 - 11:15 **Ama Browne Klutse** - Relationship between climatic variables and diarrhoea cases in two agro-ecological zones in Ghana
- 11:15 - 11:30 **Antonia B. Appiah** - Awareness of health impacts of climate change: Exploratory study.
- 11:30 - 11:45 **Abayomi Samuel Oyekale** - Climate change induced occupational stress and reported morbidity among cocoa farmers in South Western Nigeria.
- 11:45 - 12:00 **Hellen Seshie-Nasser** - Climate change and changing productive economic activities in Ghana: A gendered perspective.
- 12:00 - 12:15 **Ophelia Kaba** - Financing models for rural solar electrification projects in Ghana.
- 12:15 - 12:30 **Edlyne E. Anugwom** - Clean energy transition in a developing society: Reflections on the socio-economic determinants of SHS adoption among urban households in Nigeria.
-
- 13:00 - 14:00 *Lunch Break*

SESSION 5

MEDIA AND COMMUNICATION:
Convener - Prof. Audrey Gadzekpo

- 14:15 - 14:30 **Audrey Gadzekpo** - Media and climate change in Ghana: A survey of media practitioners response to climate change
- 14:30 - 14:45 **Eric Yeboah Appeadu** - Climate change research publication output in Africa: Bibliometrics analysis
- 14:45 - 15:00 **Africanus Aveh** - Tackling 'The Day After Tomorrow' is a collaborative effort of scientists and creative artists
- 15:00 - 15:15 **Catherine Asamoah** - Visibility and accessibility of climate change scholarly literature on Ghana.
- 15:15 - 15:30 **Doris Nguyen** - Climate science communication: Lessons from Sub-Saharan Africa.
-
- 15:30 - 16:30 **MEDIA EVENT**
-
- 16:30 - 17:00 **CLOSING**

Building Capacity To Meet The Climate Change Challenge: Some Lessons From Ghana

Yaa Ntiamao-Baidu¹ and Christopher Gordon²

¹Centre for African Wetlands, University of Ghana

²Institute for Environment and Sanitation Studies, College of Basic and Applied Sciences, University of Ghana

Abstract

Like many other African countries, Ghana faces several social, economic and environmental challenges that will be exacerbated by the impacts of climate change. At both the individual and the national level, climate change is of serious concern to Ghana because of the nation's overdependence on climate-sensitive sectors, such as hydro-power generation, agriculture, fisheries and wildlife resources. Projections indicate that temperatures will continue to rise and rainfall will become more unpredictable. Ghana has limited ability to generate and harness relevant research to tackle climate change or to diffuse knowledge and technology developed elsewhere for the benefit of communities for climate change adaptation. The B4C project exemplifies efforts in Ghana to develop expertise to tackle the challenge that the nation faces from the negative impacts that climate change could have on its development trajectory. The goal of project was to develop the University of Ghana as a centre of excellence in global environmental change research and training, enhancing existing capabilities to contribute effectively to sustainable development. The B4C Project was funded by the Open Society Foundations and implemented by a consortium led by the University of Ghana and included the Ghana Wildlife Society and the Centre for African Wetlands. It focused on three areas: strengthening teaching and training in climate change adaptation; enhancing research capacity for climate change adaptation; and equipping policy makers with relevant climate change knowledge through outreach and advocacy. The key outcomes of the B4C project have been

- i. the development and implementation of the UG post-graduate programme on Climate Change and Sustainable Development (CCSD)
- ii. the emergence of a critical mass of researchers working on climate change issues at UG;
- iii. the development of a Climate Change and Sustainable Development Resource Centre expected to be completed by December 2015 and iv) the establishment of the Ghana Climate Change Adaptation Network (Ghana-CAN). At the national level, a number of other initiatives have led to development of climate change policies and implementation of interventions at various levels that have contributed significantly to the national climate change agenda. This paper presents a review of experiences; lessons learned and discusses key capacity concerns that may guide future climate change research agendas and adaptation interventions.

Keywords: *capacity building, climate change, adaptation, graduate training, Ghana, OSF*

Food Security

The Role Of Institutional Support In Climate Change Adaptation Amongst Smallholder Farmers In Selected Communities In The Sissala Districts Of Ghana

Ruth Quaye

Climate Change and Sustainable Development, University of Ghana, Legon

Abstract

The main objective of this study was to measure the effectiveness of formal institutional support on the ability of smallholder farmers to adapt to climate change, using the Sissala Districts of Ghana as cases. Challenges facing institutions providing support to farmers were identified and assessed while investigating the factors that hindered smallholder farmers from accessing institutional support. In line with these objectives, the study combined both qualitative and quantitative methods of data collection. A household survey was conducted using 160 heads of households who were randomly selected. Face to face interviews were organized with 12 heads of institutions involved in agricultural development in the districts. Selection of institutions was initially purposive but the snowball technique was adopted as the study progressed. Quantitative data from the field was subjected to statistical analysis such as chi-squares tests, frequencies and percentages. Research findings indicate that there is a significant difference in the influence of institutions on smallholder adaptation. The age and gender of respondent had no correlation with access to institutional support. However, the nature and kind of adaptation project introduced by institutions determined which sex benefited more from institutional support. It is recommended that, institutions must develop innovative ways of spreading out their reach in order to aid farmer adaptation throughout the districts. Also farmers are encouraged to take opportunity of the FCUBE programme and educate their children to make them likely to be considered for employment in their local institutions. This will enhance communication flow between farmers and officials of institutions which in turn will help local people understand the need for adopting best practices.

Climate Variability and Food Security in Tanzania: The Case of Western Bagamoyo

Paschal Mugabe

University of Ghana

Abstract

Among other factors, climate variability is the most influencing factor that affects food security for sustainable development. Also, food production is necessary but not sufficient to ensure food security in the context of climate variability. The general objective of this study was to examine the extent to which climate variability affects food security in Tanzania. Climatic data i.e. rainfall and temperature were collected from Meteorological station and subjected to trend analysis. Agriculture and livestock production data were collected from village and district agricultural and extension offices and subjected to regression analysis. A survey was conducted in seven villages in Western Bagamoyo using structured and non-structured households questionnaires, rural appraisal methods, focus group meetings, and key informant interviews. A total of 300 people (125 male and 175 female) were individually interviewed face to face (household survey), 28 focus group discussions (8-10 a group), 14 Participatory Rural Appraisal and 54 key informants were interviewed. Data obtained were subjected to statistical and qualitative analysis. It was revealed that agriculture as their main source of income contributes 69.7% of income to household's food security. Also meteorological data and community information showed that rainfall patterns were changing with the change of seasons that affected agriculture, water availability hence famine. Temperature change had significant effects on water borne diseases, pests and post-harvest effects. It is worth noting that local communities recognize the relationship between climate change and agriculture for their sustainable development.

Nutritional Quality, Physicochemical Properties and Sensory Evaluation of Four Soybean Varieties Grown in Western Kenya

Agengo Fredrick, Wamunga Florence and Serrem Charlotte

Abstract

Protein nutrition is important for human health because its deficiency leads to major public health problems such as Protein Energy Malnutrition. Soybean an excellent and cheap source of high quality protein has been introduced into developing countries for improved health and food security, but end use qualities may reduce its utilization. The main objective of this study was to evaluate the nutritional quality, physicochemical properties and sensory characteristics of four soybean varieties grown in Western Kenya. The physical characteristics of colour, grain size, hydration and swelling capacities and the cooking times were determined. The proximate analyses including moisture, crude protein, crude oil and ash were conducted using AOAC International approved methods. Protein nutritional quality was determined using male weanling albino rats for the indices of net protein retention, food efficiency, apparent and true protein digestibilities and faecal weight. The soybeans' amino acid efficiency was evaluated using Protein digestibility corrected amino acid score. Sensory evaluation was conducted using a descriptive panel to characterize the four soybean varieties and a consumer panel for acceptability using a 9 point hedonic scale. The four soybean varieties had physical characteristics that ranged from pale yellow to yellow colours. Variety SB 132 had the highest length and width of 8.35 mm and 6.69 mm respectively, shortest cooking time of 128.33 minutes and best hydration and swelling capacities of 0.26 g/seed and 0.46 ml/seed, respectively. Variety SB 132 was also highest in proximate composition for the raw, roasted and boiled samples in crude protein at 40.18 g/100 g, 38.60 g/100 g and 36.71 g/100 g, fat at 23.00 g/100 g, 23.17 g/100 g and 21.83 g/100 g and energy at 1704.00 kJ, 1830.22 kJ and 1710.28 kJ, respectively. The raw soybean had the ash content between 7.83 g/100 g in SB 25 and SB 132 to 8.17 g/100 g in SB 30. The thermal processes of roasting and boiling reduced the ash content in comparison to the raw samples. Soybean diet SB 132 had the highest protein nutritional quality with the

best protein retention of 6.29 g, Apparent Protein digestibility of 89.13%, True Protein Digestibility of 96.48%, weight gain of 5.50 g and a Net Protein Retention Ratio of 4.70. All the four soybean varieties had high amino acid profiles with a Protein digestibility Corrected Amino Acid Score of 1.0. Principal Component Analysis (PCA) revealed that of the 90% variation showed by the 26 attributes, 70% were due to the varieties and 16% due to physical characteristics. Soybean variety SB 132 was associated with positive characteristics of sweet and oily flavour, roasted soybean and sweet aromas and splitting surface by the descriptive sensory panel and the highest consumer liking rating on total quality of 7.42 in appearance, aroma, flavour and texture attributes. Soybean variety SB 132 is the most superior in digestibility, physicochemical properties, sensory characteristics and consumer acceptability and the study recommends its promotion as a food crop in Western Kenya and other developing countries for the management of Protein Energy Malnutrition and for food security.

The Socioeconomic Impact of Climate Change Adaptation on Smallholder Farmers in Lawra District, Upper West Region, Ghana

Nana Yamoah Asafu-Adjaye and Joseph Amikuzuno

Department of Climate Change and Food Security,
University for Development Studies, Tamale

Abstract

Climate change is severe in sub-Saharan Africa (SSA) where agriculture is an important source of livelihood for a majority of rural populations. This implies that, as smallholder farmers strive to overcome poverty, climate change threatens to deepen their vulnerability and undermine their prospects for development. In this study, the empirical evidence of the economic impacts of climate change in semi-arid Ghana, specifically in the Lawra District of the Upper West Region is presented. We use the trade-off analysis minimum data model (TOA-MD) to estimate the economic impacts of climate change on smallholder farmers. The focus is on three staple crops namely maize, groundnut and cowpea. The aim was to determine the impacts of climate change on poverty rates among smallholder farmers by examining the proportions of farms that would gain or lose from climate change with and without adaptation and analyse the associated income effects for adopters and non-adopters of possible adaptation strategies under climate change using five key climate model scenarios HADCM, CGCM, CSIRO, NCAR and MIROC. The findings reveal negative impacts of climate change on farmer's net revenue, per capita income and poverty rates without adaptation and with adaptation for mid-century. However, adaptation (irrigation) results shows that farms will have an increase in net revenue gains by as much as 10% to 17%, per capita income increases between 1% and 7% within upland farms but shows a decrease between 2% and 9% for lowland farms. Accordingly, poverty rates are shown to decline from 16% to 8% in the Lawra district across all farms household.

Keywords: *climate change, impacts, Ghana, mid-century, adaptation*

Origin And Phylogenetic Status Of The Local Ashanti Dwarf Pig (Adp) Of Ghana Based On Evidence From Mtdna, Mc1r Gene And Snp Genotyping Analyses

Osei-Amponsah, R.¹, Sargent, C.², Adjei O.D.¹, Skinner, B.², Bauer J.², Larson, G.³ and Affara, N.²

¹Department of Animal Science, University of Ghana, Legon, Accra, Ghana.

²Mammalian Molecular Genetics Research Group, Pathology Department, University of Cambridge, Tennis Court Rd., Cambridge, UK.

³Department of Archaeology, Durham University, South Road, Durham, UK.

Abstract

Livestock production both contributes to and is affected by climate change. Mitigation strategies in combination with ever increasing demand for food, may also have an impact on breed and species utilization. Availability of diverse animal genetic resources particularly local breeds will allow for more opportunities to match breeds to a changing climate or to replace populations hit by severe climatic events such as droughts, floods and disease outbreaks. Characterisation of animal genetic resources provides relevant data for their conservation and sustainable use for food security and development. A study was carried out to determine the origin and phylogenetic status of the local Ashanti Dwarf Pig (ADP) of Ghana and their crosses with modern commercial breeds based on their MtDNA, MC1R gene and Y-chromosome sequence polymorphisms. ADP displays multiple haplotypes based on mtDNA sequence analysis but are closer genetically to European than Asian pigs. ADP also displays considerable variation in the MC1R gene with black coat colour being the most predominant within the breed. Predominant MC1R alleles found in local pigs of Ghana were the black spotting (EP, 29%), Asian dominant black (ED1, 25%) and European dominant black (ED2, 21%). Within the subset of animals classified as 'ADP', the dominant black allele is of Asian origin, although the majority (58%) of MC1R alleles are of European origin. Consequently, coat colour alone cannot be used to adequately characterise Ghanaian local pigs, and

suggesting that presumed ADPs may have a different ancestry. SNP genotyping data indicates that the ADP is genetically close to many European and Chinese pig breeds, but certainly distinct from other West African and Ghanaian breeds. Significant SNPs for lipid metabolism, skeletal development and thyroid function provide signatures for organoleptic qualities, lean carcass and body size and the potential for their preferential selection in the ADP. It is recommended that a more sustainable breeding programme should be established for the ADP to address any risk of extinction.

Keywords: *animal genetic resources, haplotypes, selection signatures, breeding programme*

Reducing Climate Change Effect on Maize and Sorghum Yield Using Traditional Practices: Experiences from Northern Ghana

Gandaa, B. Z., and Kranjac-Berisavljevic, G.

University for Development Studies, Tamale

Abstract

Due to changes in rainfall pattern, cultivated area under traditional crops, such as sorghum and millet, is reducing in many parts of Northern Ghana. These crops are being replaced by maize. Usually, maize is grown as a mono-crop and consumed fresh, roasted, boiled or processed into numerous local dishes. Maize is furthermore currently considered as crop which bridges “hunger gap” in Northern Ghana. However, sorghum is still grown on a reduced scale, since it plays a very important role during social functions such as festivals, funerals etc. This study was conducted in nine districts and twenty-seven communities in the three Northern regions from 2013-14, among farmers cultivating maize and sorghum. The aim of the study was to identify the level to which farmers use information provided by Ministry of Food and Agriculture (MoFA) and Meteorological Services Department, as compared to their own traditional weather forecasting methods. Selection of communities was based on agro-ecological zones, as well as liability of the community to flood and/or drought. Questionnaire administration and participatory impact assessment (PIA) were tools used for the fieldwork. Survey revealed that farmers rely heavily (close to 90% of the respondents) on traditional early warning weather signs in predicting time for land preparation and planting. Only a minority of respondents use information provided by MoFA and/or Meteorological Service Department. Furthermore, most farmers attribute the poor yields to erratic rainfall distribution and poor soil fertility. From the study, traditional land preparation, soil conservation and planting methods are still widely practiced in the communities used for the study, despite the changes in the crop repertoire.

Implications of climate change for food security among maize producing households around forest protected areas of Ghana

Irene S. Egyir¹, Godfred Antwi, Kwadwo Ofori, Kwadwo Owusu and Yaa Ntiamoah- Baidu

University of Ghana, Legon.

Abstract

The study was conducted in the transition zone of Ghana. The objective of the study was to examine the effect of climate change on food security among maize producing households around the Kogyae Strict Nature Reserve. The time series results shows that the average rainfall and temperature statistics were 1288.311mm and 28.7°C in the zone within the last thirty years. The average maize output within the last decade was 29,183 Mt while hectarage and yield were 22,531 Ha and 1.34Mt/ha respectively. The climate change variables show significant correlation with maize production within the period under review. Result from surveys showed that one quarter of maize farm households experienced food insecurity in the month of June and July due to extended drought periods that have characterised the farming system in the last decade, resulting in 14% reduction in yields. However, households are diversifying; they have given increased attention to roots, tuber, vegetables and tree crops as well as livestock enterprises. Others have invested in good post-harvest facilities and agro-processing of cassava and rice. A significant number of household members migrate seasonally or permanently to the capital towns to find wage employment such as driving and hawking imported food and non-food products, and thereby are able to send remittances back home. It is recommended that, in order to minimize the adverse effects of climate change on maize producing households who cannot use ecosystems services of protected forests, programmes that trains household members in additional livelihoods as well as effective post-harvest management should be supported.

Keywords: *climate change, drought, maize, food insecurity, additional livelihood*

Climate Change, Food Security and Competition for Land and Water Resources in the White Volta Basin in Northern Ghana

Asaab Sumaila Mohammed¹ Aaron Aduna² Ernest Bagson³

^{1,3}Department of Community Development, University for Development Studies

²White Volta Basin, Water Resources Commission of Ghana

Abstract

Land and Water resources are essential to almost all human activities including agriculture, domestic and industry among others. This statement reinforces the crucial role water plays in the livelihoods of individuals, families, communities, regions and nations. However, due to intense climate variability in Northern Ghana which has affected fresh water supply, many water and land users have resorted to the use of the White Volta River for livelihood adaptation strategy. This paper analyses the dynamics of competition for the River resources from political ecology perspective. Both qualitative and quantitative data were collected through in-depth interviews and focus group discussions with crop farmers, livestock farmers, fisher folks, government officials and civil society organisations. Results show competition between uses (Crop and livestock, domestic and agriculture). There is also growing inter group competition for river resources among crop farmers due to decreasing yield of crops inland. Inter group competition for water and grazing land was also found among the livestock farmers which due to perennial drying of small dams and streams, which hitherto supplemented the river water. There is also growing conflicts among individuals, families, clans and communities arising from competition for the River resources. The current level of competition for land and water resources has resulted in application of inappropriate methods which are detrimental to the sustenance of the river resources, hence further threat to livelihoods and food security in the White Volta basin in Northern Ghana. To ensure food security in Northern Ghana, competition for the White Volta resources must be regulated to ensure fairness, equity and sustainability of the use of the River resources.

Keywords: *climate change, food security, competition, land and water resources, White Volta, Northern Ghana.*

Drivers of Crop Choice as an Adaptation Technique to Climate Change in North Eastern Ghana

Dadson Awunyo-Vitor¹, Alidu, Abdul Rahaman¹ and Godfred Seidu Jasaw²

¹Department of Agricultural Economics, Agribusiness and Extension, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana

²Institutes for the Advanced Study of Sustainability United Nations University

Abstract

The impact of climate change in Ghana on agricultural productivity and food security cannot be over emphasised. These changes in climate affect cropping systems, distribution, domestic food mix, and livelihood diversification and migration patterns as well as food security. The perceptions of farmers about climate change and their response to the climate change with regards to crop choices have significant roles to play in addressing low productivity consequently food insecurity in the region. This study seeks to examine the farmer's choice of crop variety as a climate change adaptation method and the perception of farmers towards the changing climate in the Upper East Region. A multi-stage sampling technique was used to sample 300 famers from two districts in the Upper East region of Ghana. Descriptive statistics, Heckman probit model were used to analyse the data. The findings show that there has been a change in climatic conditions over the years and that, other factors also influence crop variety choice of the farmers. These factors include socio –economic, environmental, and institutional as well as crop variety attributes such as drought tolerance, early maturing, input requirement and market demand. We propose yield productivity education, information accessibility and improvements in market linkages as part of a comprehensive policy aimed at improving farmers' adaptation practices for food security in the face of climate change.

Keywords: *climate change, food security, crop choices, Heckman probit, Upper East, Ghana*

Climate Change Impacts on Smallholder Agriculture and Adaptation Strategies in the Sisili-Kulpawn Basin of the Northern Region of Ghana

Mercy Obenewaah Owusu

Department of Agricultural and Resource Economics,
University for Development Studies, Tamale – Ghana

Abstract

Climate change is exacerbating existing vulnerabilities of the poorest people who depend on semi-subsistence agriculture for their survival. There have been concerns about how resilience of agricultural and food distribution systems will be stressed by unfavourable fluctuations in temperatures and rainfall, especially if such changes are rapid and unplanned. Hence, the greatest challenge of mankind is how to feed an estimated population of 9 billion in 2050 by producing 70% more food under climate change. This study analysed the impacts of climate change on smallholder agriculture and adaptation strategies in the Sisili-Kulpawn Basin (SKB) of the Northern Region (NR) of Ghana. It estimated the significant effects of the production inputs used on output levels under the current production system (with no climate change scenario) using Cobb-Douglas production approach and also analysed the economic outcomes of climate change on farmers' livelihood (thus, income, poverty rates and food security) in the SKB using TOA-MD approach. The study was conducted on a total of 200 farm households sampled from the catchment area of the SKB during the 2013/2014 production seasons. The study combined simulated and expected crop and livestock yields under three different climate scenarios and projections made for the year 2030. The findings of the study revealed that, farmers lack the optimal input level needed for an acre of land. They also over used the production inputs and needed to scale-down their usage per an acre of land in order to reap the maximum gains from the inputs. Livelihood outcome variables like income and poverty levels were sensitive to the different climate scenarios. Climate change will reduce yields, income, mean net revenue and resilience of farmers in the study area but good adaptation strategies (good agronomic practices and irrigation strategies) will be required to offset such effects.

The use of adaptation to climate change as an entry point is therefore crucial for the improvement of farmers' resilience and disaster preparedness and also for the sustainability of the agriculture sector in the SKB, Northern Ghana and the country as a whole.

Climate Change and Water Resources

Climate Change Signals in Kenyan Rift Valley Lakes

Koech,¹ E, and Ogallo,² L.

¹University of Nairobi, Nairobi, Kenya,

²IGAD Climate Prediction and Application Centre (ICPAC), Nairobi, Kenya

Abstract

Climate over Kenya is largely arid or semi-arid making drought the most common hazard. Floods and many other local hazards occur with most of them being location specific. Climate change has led to increased frequency of droughts and other climate extremes with devastating impacts on livelihoods in Kenya. Thus, the country cannot have sustainable livelihoods and development without an effective disaster risk reduction and climate change adaptation policies. Such policies require good knowledge of the past, present and future climate at specific locations that are often missing in many developing countries. This paper examines climate extremes and the far-reaching impacts on various life-supporting and economic sectors including water and other environmental resources. The paper presents the space-time patterns of climate extremes in the Rift Valley parts of Kenya and provides clear evidence of changing climate. This is evident in the changes in water level in the Kenyan Rift Valley lakes, including Lakes Naivasha, Magadi, Elementaita, Nakuru, Baringo and Bogoria. Rainfall data from nearby stations were used to present past and present patterns of climate trends and the associated extremes. The results show fluctuating lake levels for specific periods corresponding to changes in precipitation trends. From September 2013 to date, there has been a significant lake level rise that has expanded the lake surface area by several square kilometres, submerging nearby hotels and schools. This study also provides simulations of future climate change scenarios in the Rift Valley in 2030, 2050, 2070 and 2100 that are critical for all future planning over the region.

Keywords: *semi-arid; arid; Kenya; lakes; climate projections; livelihoods*

Trends in daily extreme precipitation and temperature indices over Ghana from 1980 to 2011

Nkrumah, F.

Department of Physics, University of Cape Coast

Abstract

Daily data on the spatial and temporal patterns of the variabilities in indices of precipitation extremes that are in association with climate change at twenty synoptic stations in Ghana over the period 1980–2011 were analysed. Daily temperature (maximum and minimum) and precipitation data over the period of 1980 to 2011 were used. Data were quality controlled, and processed into indices of climate extremes, and the indices were calculated using RClimDex. From 1980 to 2011, hot days and nights have increased, with a consequent decrease in cold days and nights. Except for the simple daily intensity index (SDII), other precipitation indices lack statistically significant trends across the whole region. The precipitation indices show a general increasing trend in annual rainfall (PRCPTOT), heavy precipitation days (R10mm) and very heavy precipitation days (R20mm) as well as in the simple daily intensity observed. However, the results of other precipitation indices indicate an unstable trend in the intensity of rainfall. In spite of the results of the precipitation indices, it is noticed that more intense rainfall is observed over short periods although the temperature trends increase sharply and dramatically. Therewith, the climate of the region is becoming warmer.

Keywords: *temperature; climate models; rainfall; synoptic stations; Ghana*

Changes in rainfall characteristics in Wenchi and Saltpond farming areas of Ghana

Quagraine¹, K. A., Browne Klutse², N. A., Adukpo¹, D. C., Nkrumah¹, F., Owusu³, K., Owusu³, A., Gutowski Jr. W.⁴

¹Department of Physics, University of Cape Coast, Cape Coast, Ghana

²Ghana Space Science and Technology Institute, GAEC

³University of Ghana

⁴Department of Geological and Atmospheric Sciences, Iowa State University

Abstract

Rainfall is an essential requirement to promote livelihoods in any part of the world. Rain has a major influence on industrial and agricultural production in all agro-ecological zones globally. Ghana mainly practices rain-fed agriculture and as such is vulnerable to the impacts of climate variability and change especially in the area of precipitation. In this study, changes in the mean, extreme and onset dates of rainfall for Wenchi and Saltpond in Ghana were analysed over two climatological periods. Rainfall records spanning 1968 to 2011 were acquired from the Ghana Meteorological Agency for Wenchi in the Transition Zone and Saltpond in the Coastal Savannah Zone. Analysis of rainfall for each station focused on two climatic periods 1968-1989 (CP1) and 1990-2011 (CP2). In both zones, the amount of rainfall in CP2 was lower than in CP1. However, in CP2 there was a trend of increasing rainfall while in CP1 there was a decreasing trend in rainfall. The onset of rains in Saltpond was found to mostly occur in May for CP1 but oscillated between April and May in CP2. For Wenchi, the onset mostly occurred in March in CP1 whereas it was mainly April for CP2.

Keywords: *agro-ecological zones; onset of rains; trends in rainfall; climatic variability*

Climate Change Adaptation and Water Resources: Redefining Climate Change Impacts and Vulnerability by the Creation of Resilient, Green Solutions

Amikuzuno, J., Gyimah, M.B. Ayiwe, J.A.

Water Resources Commission, White Volta Basin
Secretariat, Box 489, Bolgatanga, Ghana.

Abstract

Historical data for Ghana from the year 1961 to 2010 shows a progressive rise in temperature and decrease in mean annual rainfall in all agro-ecological zones. All climate scenarios show increased risk of more intense rainfall events, prolonged dry spells and more frequent drought in the semi-arid savannah agro-ecology of northern Ghana. In semi-arid agro-ecologies, water is the resource expected to suffer the most negative impact of climate change. Empirical analysis reveal that four representative river catchments across Ghana will exhibit reductions in river flows between 5-20% and 30-40% by 2020 and 2050 respectively due to global warming. The estimated consequences of water insecurity for human security are expected to be severe. This paper presents the findings of impacts and vulnerability assessment of climate change in the Upper East Region (UER) of Ghana with focus on the White Volta River Basin. Based on the questions: what are the impacts of climate change, and what climate-smart, low/no regrets investments are required to helping rural communities create adaptation strategies and build resilience against climate change? Answering these questions yields important insights into the current trends of impacts of climate change; information on the perception, causes, impacts and adaptation responses to climate change; suite of pathways to creating “Innovative Green Solutions” and climate-smart interventions; procedures for integrating resilient, cost-efficient adaptation strategies into public sector planning; and an ensemble of innovative no/low regrets climate-smart investments for building resilience in water, food and energy resources of affected communities.

Keywords: *green investment; water; vulnerability; climate change; Ghana*

Effects of Climate Variability on Household Water Availability and the Public Health Implications in four Rural Communities in Ghana

Asmah, K.

Climate Change and Sustainable Development Programme, University of Ghana

Abstract

This study investigated the effects of climate variability on water availability and its implications for public health. The methods used in this study included household surveys (n=301), direct observation and focus group discussions of women in households within the rural communities of Tsetsekpo, Klukope, Sayikope and Totope in the Central Tongu and Ada East districts of Ghana. Cross tabulations, Chi-square statistic and a logit regression model were used to identify determinants of water availability and water borne diseases. Results from the study indicate that there was an association between socio-economic factors of the household head such as education ($\chi^2 = 10.4$, $df = 8$, $p=0.002$), occupation of household head ($\chi^2 = 21.1$, $df = 10$, $p=0.02$) and the choice of a water source used by the household. Likewise socio-economic status of household and the cost of a water source were influencing factors of household water and sanitation choices. It is recommended that economically feasible options of potable water and sanitation must be provided in rural areas in addition to policies geared towards poverty alleviation and the improvement of the standards of living for small-scale female farmers and fish processors to enable effective adaptation to the effects of climate variability.

Keywords: *climate variability, socio-economic status, water availability, rural communities*

Rainwater Harvesting for Domestic Use as an Adaptation to Climate Change: The case of Kpando, Ghana

Odonkor, B. A. and Gordon, C.

Environmental Science Programme, Institute for Environment and Sanitation Studies, University of Ghana

Abstract

Ghana is particularly vulnerable to climate change due to lack of capacity to undertake the needed adaptive measures, especially those to address water supply problems as a result of reduced levels of precipitation. These problems include poor water supply, climate change associated health issues, and low operating water level of the Volta Lake which can prevent the Akosombo hydropower-generating plant from operating at optimum levels. Among the many adaptation measures suggested to reduce impact of reduced precipitation on water resources, is Rain Water Harvesting (RWH). This adaptation measure serves as an alternative water source especially as a buffer in the dry season. Its effectiveness lies in the fact that the rainfall pattern in Ghana has not changed much; with the peak season still between May and September. The results from this study of catchments in and around Kpando, showed that water quality from harvested rainwater was poor but was better than stream water and even better in some case than boreholes. The physico-chemical characteristics of the rainwater harvested varied with catchment and roof type. Harvested rainwater fell within the WHO guideline values for most elements but had appreciable levels of bacterial contamination (total Coliform of up to 2000/100ml). Thatched roofs had iron, colour and turbidity values that exceeded WHO limits. The study noted that water storage capacities were inadequate to maximize the value of rainfall as well as the fact that storage in poly tanks maintained water quality better than ferro-cement tanks. It is recommended that appropriate rainwater harvesting systems should be a requirement for the approval of building plans.

Keywords: *rainwater harvesting; microbial load; physico-chemical characteristics; climate*

Ecosystems and Biodiversity

Payment for Environmental Services (PES) in the Feng Shui Forest in Hong Kong: Relevance in the Climate Change Discourse

Lawal M. Marafa

Centre for Environmental Policy and Resource Management, Department of Geography and Resource Management, The Chinese University of Hong Kong

Abstract

Feng Shui forests are part of peri-urban ecosystem of Hong Kong, which engender substantial environmental services. These environmental services are conditions and processes through which the forests support ecological processes and improve environmental quality. However, very few studies have explored the full set of environmental services provided by Feng Shui Forest in Hong Kong. This paper investigates three main issues associated with environmental services in Tai Om Village in New Territory of Hong Kong. These are: i) examine major environmental services; ii) analyse major problems associated with delivering environmental services; and iii) discuss prospects of Payment for Environmental Services (PES) as a suitable policy instrument for delivering ecosystem services. Four major environmental services are examined in this paper borrowing from the Millennium Ecosystem Assessment, 2005. These include provisioning, regulating and supporting cultural, aesthetic and recreational services. A framework encompassing indicators from biophysical, vegetation, soil and other attributes of Feng Shui forest was developed to analyse the ecosystem services. This framework will help to understand the impact of ecosystem services on climate change. It will also help elucidate the effect the change will have on functional diversity and the consequences.

Keywords: *Environmental Services, Feng Shui Forest, PES, peri-urban forest*

Conserved forests and sustainable livelihoods in the face of climate change: experiences of fringe communities along the Atewa Range Rorest Reserve

Timothy Apeanti¹, Rosina Kyerematen^{2,3} and Erasmus Owusu²

¹ Climate Change and Sustainable Development Programme, University of Ghana, Legon

² Department of Animal Biology and Conservation Science, University of Ghana, Legon

³ African Regional Postgraduate Programme in Insect Science, University of Ghana, Legon

Abstract

The climate change challenge in this century threatens life itself on the planet including natural organic systems and human societies. The very existence and well-being of human population especially the rural poor are solely dependent on proper functioning natural systems and the services they provide and more importantly the livelihoods they derive from it. This study was primarily to assess the effects of climate change on ecosystem services provided by the Atewa Range Forest Reserve (ARFR) and how it affects livelihood outcomes in fringe communities along the Reserve. In all 184 respondents were randomly surveyed from three communities along the range. An additional 44 other respondents were purposively selected for in-depth interviews in focus group discussions. Data obtained was analysed using three statistical tests: the Pearson Chi-square, McNemar-Bowker Chi-square and Binary Logistics Regression. Respondents' perception on variable rainfall and a rising temperature in the area was corroborated by the scientific data obtained from the Ghana Meteorological Agency. Results suggests that as the amount of rainfall decreases, forest productivity also decreases leading to respondents' widely held observation that both ecosystem services and livelihood outcomes have reduced compared to the past. Remote Sensing data for 1991, 2002 and 2013, showed rapid depletion of the forest especially over the past decade, largely due to increasing population leading to over exploitation. For the forest to continue performing its

role in supporting communities around the Reserve, there is a need for collaboration between the Forestry Commission and the indigenes to ensure effective protection that would enhance the continuous provision of ecosystem services.

Keywords: *conserved forests, climate change*

Implementing Ecosystem Based Approaches (EBA) for Enhanced Agricultural Productivity and Food Security in Eastern Region of Ghana

John Kwame Boateng¹, Joyce Boateng²

¹Institute of Continuing and Distance Education, University of Ghana

²Seven Hearts Ghana

Abstract

Seven Hearts Ghana is an NGO, which runs projects in some communities within the semi-deciduous rainforest agro-ecological zones in Ghana. The forested areas in Eastern Region hold a vast potential to enhance agricultural productivity and food security. It has been estimated that with the appropriate development, the forested regions alone in Africa could provide food (including roots and tubers) for the whole of Africa's future population four times the current number. However, with the prevailing widespread subsistence cultivation, acidic, degraded and heavily leached soils and the lack of guaranteed markets for farm produce, agricultural productivity and food security is seriously hampered. Communities surveyed in Ghana's Eastern Region would like to see new policy directive work to ensure that there are: Investments into rural development, including; soil improvements, improving marketing facilities and linkages, and building of good road networks which should all serve as important preconditions for development and sustainability of EBA approaches.

Keywords: *leaching, food security*

The Socio-economic vulnerability of coastal communities in Ghana to the impact of climate change: A case study of the Anloga community

Kassim Gawusu¹, Rosina Kyerematen^{2,3} and Yaa Ntiamoa-Baidu^{2,4}

¹Climate Change and Sustainable Development Programme, University of Ghana, Legon

²Department of Animal Biology and Conservation Science, University of Ghana, Legon

³African Regional Postgraduate Programme in Insect Science, University of Ghana, Legon

⁴Centre for African Wetlands, University of Ghana, Legon

Abstract

Climatic changes and associated global warming and sea level rise has put many coastal communities all over the world especially those in developing countries at risk. The vulnerability of these communities to the impacts of climate change depend on many factors including environmental and socio-economic factors as well as their adaptive capacities. This study sought to assess the socio-economic vulnerability of coastal communities in Ghana to the impacts of climate change using the Anloga community as a case study. The study adopted a case study design and multi-stage sampling involving purposive and simple random techniques. An integrated vulnerability assessment approach was used and vulnerability indicators of exposure, sensitivity and adaptive capacity were analysed using data collected from both primary and secondary sources. Results from this study indicated that, the Anloga community is highly at risk of climate change impacts due to its geographical location. This is compounded by the lack of economic opportunities, high dependency on farming and fishing as a source of livelihood and the fact that many households had no diversified source of income. We found no adaptation plans in place in the community to protect their economic sectors from current and projected impacts of climate change, hence increasing their vulnerability. We

conclude that climatic variability, in particular the unpredictable seasonal patterns of rainfall as well as anthropogenic pressures on the coastal ecosystem threaten the community's livelihoods and will affect their food security.

Keywords: *climatic variability, climate change, food security, costal community*

Preliminary studies on impacts of ocean acidification on diversity of fish species landed by artisanal and semi-industrial fisheries in Ghana

F. K. E. Nunoo, Edna E. K. Quansah and P. K. Ofori-Danson

Department of Marine & Fisheries Sciences, University of Ghana

Abstract

Increased absorbance of carbon dioxide from the atmosphere has led to changing of the chemistry of oceans. In addition to already existing stressors, the resultant ocean acidification poses multiple threats to marine biodiversity affecting fish food security for countries with heavy dependence on fish as source of animal protein and food. The study set out to determine possible impacts of this phenomenon on the abundance and diversity of fin and shellfish species as well as ichthyoplankton in the artisanal and semi-industrial fisheries of Ghana. Fish and water samples were collected from the two fisheries for the lean and peak fishing seasons of year 2013. Fish species were identified, counted and diversity indices calculated for each fishery and season, while water samples were analysed for physico-chemical parameters. Four parameters (pH, carbonate ion concentration, total alkalinity, Revelle factor) out of six principal components were identified to contribute significantly (RELATE, $r = 0.955$, $P < 0.05$) to biological variations observed in the two fisheries. A decreasing trend in ocean acidification indicators was observed for both fisheries and variations observed in species abundance between seasons and fisheries, which indicate the possible occurrence of ocean acidification in Ghanaian waters and likelihood of impacts on fish diversity and therefore food security.

Keywords: *ocean acidification, biodiversity, food security*

Health, Gender & Energy:

Suitable financing models for rural solar electrification projects in Ghana

*Ophelia Kaba Ayamba¹, Michael Adusei²,
Albert Adjaottor³ and Samuel Ayamba⁴*

¹Institute for Environment and Sanitation Studies, University of Ghana

²School of Business, Kwame Nkrumah University of Science and Technology

³Department of Material Science, Kwame Nkrumah
University of Science and Technology

⁴P. O. Box KH 96, Kintampo B/A.

Abstract

Globally, renewal energy resources have been promoted as a means to meet energy demands of households and minimize the effects of climate change. The use of solar electricity for household lighting has been encouraged. A number of solar projects have been implemented in Ghana mainly through government and bilateral organizations. A major challenge to ensuring the sustainability of solar energy projects for rural populations is the financing of these projects especially by rural people. In most developing economies where poverty rates are high, the high cost of solar energy systems makes it a less viable option for rural populations. We therefore set out to assess the suitable financing models appropriate and acceptable to a rural district in the Upper East Region with high poverty rates in Ghana. An exploratory study was conducted in eight randomly selected communities of the Bongo District. The district was chosen for the research because it had benefited from previous solar projects funded by the Government of Ghana in partnership with the World Bank. Data analysis from 141 households showed that 12% of households possessed solar home systems. Poverty and non-availability of solar home systems were the main reasons for the low patronage of the system in the study area. Nearly 71% of households preferred self or household ownership of solar home systems as opposed to community solar systems. The proportion of households willing to

accept the cash purchase, bank pre-financing, leasing and concession models were 31.9%, 71.6%, 66.7% and 72.3% respectively. The consumer finance models (cash purchase and bank pre-financing) were found to be acceptable to the educated, government employees and middle to high income earning respondents. The fee-for-service (leasing or concession) models were more acceptable to the less educated, poor and self or unemployed respondents. In conclusion, poverty and scarcity of solar home system are undermining solar projects in the district. In addition, the concession, bank pre-financing and leasing models are the most acceptable options for financing solar projects in the district. Also the production and distribution chain of solar home system should be supported by government, stake holders in the solar industry in order to make these systems readily available to consumers.

Clean Energy Transition in a Developing Society: Reflections on the Socio-Economic Determinants of SHS Adoption among Urban Households in Nigeria

Edlyne E. Anugwom^{1,2}

¹Department of Sociology/Anthropology, University of Nigeria,

²ACCAI-UNN

Abstract

The paper seeks to identify the socio-economic factors that constrain the adoption of clean energy sources by urban households in Southeastern Nigeria using the Solar House System (SHS) as a case study. The SHS offers the real prospect of easy clean energy transition in urban households and there is no doubt that increasing access to lighting is expected to contribute to the achievement of the UN's Millennium Development Goals (MDGs). Fuel choices amongst households in developing economies like Nigeria are critical in the adoption of clean energy sources and the development of a less-carbon intensive energy system. In order to increase use of clean energy sources, there is need to understand the factors that influence household decision on which fuels to consume. Thus, making households switch to SHS require deliberate concerted efforts and context-specific policies. However, the SHS in spite of its environmental merits are by no means cheap and readily available for urban households in Nigeria. Therefore, household choices in energy consumption are not only determined by relevance and perceived environmental good but more critically by access and availability. Hence, the paper explores factors that influence the adoption of SHS by urban households in Nigeria and based on these proffer strategies for scaling-up its adoption as a critical component of Nigeria's transition to clean energy. It aims to add new evidence to the discourse on the influences that affect the adoption of SHS in developing countries. It therefore seeks to improve the understanding of the political economy of energy transitions. The paper goes on to contend that adoption of SHS is affected by household socio-economic situations and the challenge may be in ensuring that as much as possible national climate change adaptation strategies are informed by the need to tackle social disparity and more crucially address the concerns and problems of poor households in the process of adoption and transition.

Climate change and changing productive economic activities in Ghana: A gendered perspective

Emmanuel Asiedu Codjoe and Hellen A. Seshie-Nasser

University of Ghana

Abstract

There is general acceptance that the increased prevalence of weather-related incidents, which are linked to climate change, will adversely impact on several economic activities, especially those related to agriculture. One of the several important aspects of climate change that has been identified is that related to gender, and especially women. In this paper we examine the impact of climate change on the decision by both men and women to change productive economic activities in Ghana. In particular this paper explores gendered effects of climate change on economic activities in respect of movement away from sectors (such as agriculture) that may have been severely affected by climate change to other sectors of the economy, particular services. The main thrust of our paper is that with the prevalence of climatic changes, households that depend heavily on agricultural activities for their livelihoods will be adversely affected. In order to overcome shocks to household incomes, households have engaged in livelihood-adjusting activities to augment the decline in household incomes. The new productive economic activities, however, may not necessarily lead to higher incomes. Using evidence from several rounds of the Ghana Living Standards Surveys as well as climatic data on Ghana, we show that the marked decline in household members, especially women, engaged in agricultural activities can be attributed to changing climatic conditions. The prevalence of climate change in the last decade has contributed to a decline in farm productivity and consequently household incomes. Thus, household members, especially women are compelled to diversify into other sectors, notably the services sector for alternative livelihood activities. In other words, this paper argues that the drift by women towards economic activities in the services sector can partly be attributed to the effect of climate change on agricultural productivity and household incomes. We however recognise that other factors are at play in this mix and whilst these cannot be ignored, emphasis on the changing nature of the climate is paramount because of the agrarian nature of the Ghanaian economy.

Relationship between climatic variables and diarrhoea cases in two agro-ecological zones of Ghana

*Nana Ama Browne Klutse¹, Kwadwo Owusu²,
Fred Aboagye-Antwi³, and Yaa Ntiamoah-Baidu^{3, 4}*

¹Ghana Space Science and Technology Institute, Ghana
Atomic Energy Commission, Ghana

²Department of Geography and Resource Development,
University of Ghana, Legon, Ghana

³Department of Animal Biology and Conservation
Science, University of Ghana, Legon, Ghana

⁴Centre for African Wetlands, University of Ghana, Legon, Ghana

Abstract

Diarrhoeal disease is a serious health challenge in many parts of Africa. In Ghana, it accounts for over 10000 deaths annually. The relationship between diarrhoea cases and climate has been established in many studies but not much has been done on the subject in Ghana. This study investigated the relationship between reported cases of diarrhoea at Ejura and Winneba and the observed climate variables in Ghana. Records of monthly diarrhoea cases over the period 2001-2008 were obtained from the Winneba district hospital and St. Luke's hospital at Ejura. Data for the climate variables were obtained from the Ghana Meteorological Agency. A comparative assessment of the effect of rainfall and temperature on diarrhoeal disease incidence was carried out. An average annual total of 604 and 2549 diarrhoea cases were recorded at Ejura and Winneba respectively during the 8 years studied. At Ejura, the number of diarrhoea cases was high a month after the peak of each of the two rainfall seasons and also during the driest months of the year (December to February). At Winneba, the highest average diarrhoea cases were recorded one month after cessation of the major rainfall season. An increase in maximum temperature suggested a decrease in diarrhoea prevalence in one and in two months lag at Ejura and three months lag at Winneba. The results demonstrate that temperature and rainfall influence the incidence of diarrhoea cases, but the relationship varies with locality.

Climate Change Induced Occupational Stress and Reported Morbidity among Cocoa Farmers in South Western Nigeria

Abayomi Samuel Oyekale

Department of Agricultural Economics and Extension,
North-West University Mafikeng Campus,

Abstract

Climate change is one of the major development hurdles in many developing countries. The health outcome of farm households are related to climate change, which is related to several external and internal health related issues such as management of occupational stressors. This paper seeks to inter alia determine the climate related occupational stress and factors influencing reported sick times among cocoa farmers. Data were collected from selected cocoa farmers in South Western Nigeria. Descriptive statistics and Negative Binomial regression were used for data analyses. The results showed that cocoa farmers were ageing, while majority had cultivating cocoa for most of their years of farming. Cocoa was the primary crop for majority of the farmers, while 92% of the farmers in Osun state owned the cultivated cocoa farms. The forms of reported climate change induced occupational stresses were increase in pest infestation (74.5% in Ekiti state), difficulties in weed control (82.1% in Ekiti state), missing regular time scheduled for spraying cocoa pods (45.7% in Ondo state), inability to spray cocoa effectively (58.5% in Ondo state), reduction in cocoa yield (71.7% in Ekiti state). The Negative Binomial regression results showed that age of farmers (0.0103), education (-0.0226), years of cocoa farming (-0.0112), malaria infection (0.4901), missed spraying (0.5061), re-spray cocoa (0.2630), reduction in cocoa yield (0.20154), contact with extension (0.2411) and residence in Ondo state (-0.2311) were statistically significant ($p < 0.05$). Climate change influences farm operations of cocoa farmers with resultant occupational stresses. Efforts to assist cocoa farmers should include provision of weather forecasts and some form of insurance, among others.

Disaster risk reduction and climate change adaptation: Inter- and intra-agency knowledge flows in Accra, Ghana Using urban flooding as an example

Fanny Frick^{1,2}, Dori Nguyen³, Winfred Nelson⁴

¹Humboldt-Universität zu Berlin, Germany

²King's College London, UK

³University of Ghana, Legon

⁴National Development Planning Commission, Ghana

Abstract

Climate change adaptation (CCA) is increasingly pushed by international and national organisations and governments to be mainstreamed into policies and planning. Implementation at regional and local levels however remains scattered. One of the factors that are considered to hinder adaptation in local decision-making practice is the top-down approach that does not adequately take into account local concerns, vulnerabilities, terminologies, and knowledge. Integrating disaster risk reduction (DRR) (which tends to be more locally driven), CCA and urban planning is both a necessity and a challenge in overcoming the gap between national and local adaptation planning. The scope of this research is to identify current gaps and linkages across agencies in knowledge exchange on adaptation to climate change among professionals in urban planning and DRR in Accra, Ghana. Flooding is taken as an example of common risk reduction efforts in Accra. What are the linkages through which knowledge on adaptation to climate change is shared and produced across and within agencies? This question is addressed based on a document analysis of policies, grey literature and expert interviews. Experts at national and local decision-making levels were interviewed. Vertical and horizontal flows of knowledge on adaptation to climate change are identified and assessed for actors involved and significance towards DRR and CCA practices. Intended versus practiced knowledge flows are compared. The results are of particular relevance for decision-makers in Accra and Ghana who are engaged in building resilience to climate risks, as well as to other developing countries facing similar challenges. They moreover add to existing knowledge on the role of institutional learning in building adaptive capacity more generally.

The Role of Social Protection Interventions in Enhancing Climate Change Adaptation and Mitigation: The case of LIPW component of Ghana Social Opportunities Projects (GSOP)

Simon Bawakyillenuo, Isaac Osei-Akoto, George Owusu, Emmanuel Larbi Offei, Innocent S.K Agbelie,

ISSER, University of Ghana

Abstract

The devastating effects of climate change and variability globally are incontestable, hence, the urgency for upscaling adaptation and mitigation strategies. Central to initiating and implementing robust adaptation and mitigation measures is innovative financing. While there are various climate change support projects in Ghana, much is still needed to fund adaptation and mitigation measures. Similarly, social protection intervention programmes abound in the country, many of which are aimed at reducing poverty and spatial development inequalities in targeted areas. Arguably, opportunities are embedded in many of these social protection programmes to bolster climate change adaptation and mitigation issues in the country. Using the Labour Intensive Public Works (LIPW) of the Ghana Social Opportunities Project (GSOP) as a case study, the paper examines how social protection interventions in Ghana could support both climate change adaptation and mitigation measures. Analysing the panel data from two rounds of survey on the LIPW, the results show that, paid employment among beneficiary communities increased by 9.4% relative to the non-beneficiary households. Furthermore, it was found that extreme poverty and average poverty reduced by 7% and 21% respectively in the LIPW beneficiary communities. Thus, the adaptive capacity to climate change of LIPW beneficiaries became stronger than non-beneficiaries. The analyses also reveal that the trees plantation activities of LIPW will strengthen the mitigation of climate change in the long-term through an increase in the country's carbon sinks. This interplay between social protection interventions and climate change objectives drums home the need to mainstream climate change objectives into all social protection interventions in Ghana.

Media & Communication

Media and Climate Change in Ghana: A Survey of Media Practitioners Response to Climate Change

Audrey Gadzekpo, Gilbert Tietaah, Martin Segtub

Department of Communication Studies, University of Ghana

Abstract

Most of the studies that relate to climate change communication and information flow and which address the role of the media, have tended to focus on the institutional level and neglected to document the presence and spread of attitudes among media practitioners. Yet it is media practitioners that individually play particular and important surveillance roles in keeping an eye on the public sphere and alerting the public on issues of public interest or concern. They are the metaphorical bridge between policy actors, duty bearers and the public. This study sought to ascertain climate change as a subject of media interest and action, and to understand media attitudes to, and gatekeeping practices on the issue of climate change. Through a survey administered to media practitioners working in four ecological zones, it interrogated more closely the broad nature of climate change communication among media practitioners including their gatekeeping practices and editorial considerations. The study focused on four different communities in Ghana – Tamale (savannah region), Accra (urban), Sunyani (forest zone) and Keta (coastal) – which are considered high climate impact risk areas. Mainly because they represent also different ecological zones and ethnographies the expectation was that the proximity and audience identity values would constitute sufficient grounds to expect particular journalistic attention and treatment. In general the findings show high awareness and a positive disposition of media practitioners and their institutions towards addressing the incidence and consequences of climate change. There is a tendency, also, for respondents to express greater empathy and identity with specific human-induced causal factors within the ecological zone in which they operate than with factors relatively removed from their direct acquaintance. However some respondents failed to clearly express an understanding of the most common climate change issues, concepts and buzzwords. This evident lack of familiarity with the common climate change terms, policies and conferences among media practitioners suggests a need for the scientific community and climate change

advocacy agencies to break down the register and jargons of climate change into more accessible and understandable language; especially for media practitioners, and in turn, for members of the public.

Keywords: *media, climate change, gatekeeping*

Climate Change Research Publication Output in Africa: Bibliometrics Analysis

Eric Yeboah Apeadu and Chris Gordon,

University of Ghana

Abstract

Climate change as a subject has received international attention and has become one of the major research areas in the world because of its impact on human and natural systems. Researchers normally communicate using a number of media and scientific publications. Previous studies have shown that African research output on climate change issues has been low, with limited collaboration among climate change researchers on the continent. According to the Intergovernmental Panel on Climate Change (IPCC), there has been a paradigm shift in research areas on climate change and African researchers need to respond to these changes. Based on the Scopus Citation Database, climate change literature was retrieved for the years 2000-2004 and 2010-2014 using climate change terms listed in Library of Congress subject headings. The search was limited to African countries. This study compares the research output of Africa on Climate change during 2000-2004 and 2010-2014 using bibliometric techniques. The measuring parameters used are number of publications (scientific output), collaboration among authors, research hotspots in climate change, and media of communication.

Scientists and Creative Artists Collaborating to Create Climate Change Awareness: The Case of “The Day After Tomorrow”

M. Africanus Aveh,

Department of Theatre Arts, University of Ghana

Abstract

The Day After Tomorrow (2004) is a science fiction film directed Roland Emmerich seeking to create awareness of the future of Planet Earth if Climate Change issues are not tackled seriously by governments across the globe. In this highly-acclaimed film, a climatologist struggles to save the world from destruction resulting from global warming causing bizarre weather conditions across the globe. The film's family-centred drama, enriched by spectacular visual effects, vividly communicated the need to take environmental issues seriously by all, including politicians. This paper argues that though labelled as science fiction the Day After Tomorrow is based on scientific research data which was used to develop the creative script. Through this film the message of the dangers of climate change is communicated more vividly to viewers worldwide than academic papers published in journals, which have limited access to only scholars. The paper discusses the theories and tools in theatre and film underpinning effective dissemination of information to a mass audience and encourages collaboration between scientists and artists in the sharing of research findings.

Visibility and Accessibility of Climate Change Scholarly Literature on Ghana

Eric Yeboah-Apeadu and Catherine Asamoah

Department of Information Studies, University of Ghana

Abstract

Climate change has become a global issue and the whole world is looking for solution for this environmental canker. Government and academic institutions as well as international organizations are collaborating in investigating and researching on the causes, attribution, vulnerability, adaptation and mitigation of climate variability and changes. Research shows that literature from such research is normally communicated through scholarly publications and platforms such as books, journals, and conferences. However accessibility and redistribution of these materials are restricted by charges and copyright issues imposed by publishers. This paper examines how research on climate change can be disseminated, made visible and accessible to the public through open access repositories. The study provides a content analysis of literature on climate change published in institutional repositories of universities in Ghana listed on Directory of Open Access Repositories (DOAR) and journals indexed by Scopus abstract and citation database. The terms “Climate Change”, “Climate Variability” and “Ghana” were searched to retrieve climate change articles published in Ghana. A proposed model has been developed to effectively disseminate climate change literature and make the views readily accessible to the public to better understand the environment and preserve it.

Climate Science Communication: Lessons from Sub-Saharan Africa

Dori Nguyen

University of Ghana, Legon

Abstract

An understanding of the existing landscape around science communication amongst and between researchers, decision-makers and practitioners is vital for evidence based policy-making. This is particularly true for climate change, as general understanding by many non-climate scientists of the underlying science and climate models is often hazy or misconstrued. Based on surveys of participants carried out at international climate-related conferences, this study seeks to understand how information users acquire, filter and utilize climate information. The target profile for the survey was high-level researchers, decision-makers, practitioners and civil society representatives working in climate-related fields. The objective is to ascertain how communications and dissemination methods can be tailored to ensure effective implementation and application of scientific findings. Data collected included participants' access to, usage and types of climate information, as well as relationships with target audiences. The preliminary results indicate that due to the distinct context of information usage and dissemination in sub-Saharan Africa, situation specific custom-made communication approaches are needed to address (i) assessing and curating content production that meets the capacity of researchers and (ii) the needs and access of their target audiences. Specific recommendations are outlined to address select obstacles and potential in bridging the information and communications gap between research and use within sub-Saharan African. The paper concludes by highlighting capacity building, implementation methods and promising areas of research in the realm of climate science communication.

