



ENVIRONMENT AND CLIMATE

BUILDING STRONGER UNIVERSITIES
IN DEVELOPING COUNTRIES

ACTIVITY COMPLETION REPORT¹

ACTIVITY FACTS		
Activity number (from LFA)	1.2	
Activity name (from LFA)	Assignment 1 – PhD courses	
South partner institution	KNUST	
Main responsible(s) for activity (both North and South, where relevant) ²	Jørgen E. Olesen, Aarhus University Mathias N. Andersen, Aarhus University Leonard K. Amekudzi, KNUST Charles Quansah, KNUST	
Start/end (dates) of implementation	10 March 2013 / 24 March 2013	
BUDGET DETAILS		
Original Budget (DKK)	90,270	
Actual expenses (DKK) ³	84,537	
ACTIVITY DESCRIPTION		
Brief description of planned activity ⁴	Purpose	PhD course on Climate Change Processes, Mitigation and Adaptation
	Content	A combination of lectures, exercises and an essay writing based on supplied literature
	Contribution to research capacity building	Enabling students and staff at KNUST to understand climate change processes and their interactions with the biotic environment and society, and to measure and quantify emissions as well as mitigation and adaptation options.
	Indicators	Students were to deliver a two-page essay based on 15 supplied articles in order to receive the certificate of participation.
	Other relevant details/comments	
Number of participants	Target	20
	Result	35
Describe/explain deviations from planned activity (timing, number of participants, content of activity, etc.)	Before the course less than 20 persons had registered, but several additional students turn up during the first and the second day, after which it was decided to accept those students and made clear to the students that their full and complete presence was needed. The exercises turned out to take longer than originally expected, in particular because it was necessary to teach the students several options and functions in Excel. However, all planned lectures were given, as well as most of the exercises.	
Main lessons learned (list 3-5 issues)	It is very important to have a high proportion of practical exercises, and sufficient time should be allocated to this. Exercises and excursions should dominate in the afternoon, when students have ability to grasp lectures. The room should be open (available) also in evenings for students to work in groups and do their homework.	
Suggestions for follow up activities	1. New PhD courses on more specific subjects within climate change 2. New PhD course on sustainable technologies	

Activity Completion Report submitted by:

NAME	CONTACT DETAILS ⁵	SIGNATURE
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¹ Must be filled and submitted to Platform Secretariat (cc to local South [BSU administrator]) no later than 2 weeks upon completion of activity.

² All must sign Activity Completion Reform before submission.

³ If actual expenses (per budget line) deviate from original budget, this must be thoroughly explained and approval from Platform Secretariat attached to the Activity Completion Report.

⁴ Use LFA and/or Monitoring Matrix as point of departure, where relevant

⁵ Minimum e-mail address and phone number for all signatories.



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Attachments (compulsory):

- 1) Program/Course outline
- 2) List of participants/attendance register



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Budgets (back-ground information for assignment holders)

If actual expenses (per budget line) deviate from original budget, this must be thoroughly explained and approval from Platform Secretariat attached to the Activity Completion Report.

Ghana PhD Course	Ghana		Denmark	
	Budget (DKK)	Actual (DKK)	Budget (DKK)	Actual (DKK)
Salaries (Denmark) and emoluments (Ghana)	10,000		58,000	69,400
Taxameter/educational grants				
Expenses for trips abroad and fieldwork (details below)			22,270	15,137
Project and research equipment				
Project and research materials	10,000		10,000	0
Publication, dissemination and communication				
TOTAL	20,000		90,270	84,537

Ghana - Expenses for trips abroad (details)	Denmark	
Unit	Budget (DKK)	Budget for 2 weeks
International travel	9,000	9,000
Local travel, visa, vaccination, preventive medicine	2,000	2,000
Accommodation (nightly rate)	350	4,900
Per diem (daily rate)	455	6,370
TOTAL		22,270

Tanzania PhD Course	Tanzania		Denmark	
	Budget (DKK)	Actual (DKK)	Budget (DKK)	Actual (DKK)
Salaries (Denmark) and emoluments (Tanzania)	10,000		58,000	
Taxameter/educational grants				
Expenses for trips abroad and fieldwork (details below)			26,370	
Project and research equipment				
Project and research materials	10,000		10,000	
Publication, dissemination and communication				
TOTAL	20,000		94,370	

Tanzania - Expenses for trips abroad (details)	Denmark	
Unit	Budget (DKK)	Budget for 2 weeks
International travel	11,000	11,000
Local travel, visa, vaccination, preventive medicine	2,000	2,000
Accommodation (nightly rate)	500	7,000
Per diem (daily rate)	455	6,370
TOTAL		26,370

Ph.D. course in Climate Change Processes, Mitigation and Adaptation

KNUST during the period: 11 to 15 March 2013

Course objective: To equip students with the requisite knowledge on the fundamental processes underlying the principles of climate change, mitigation and adaptation and its potential impacts on the environment as well as implications for development. Students will be further equipped with the analytical tools and methods for designing, implementing and integrating innovative climate change risk management practices and impact assessment and adaptation strategies and technologies at variable spatial and temporal scales.

Course content: The course will provide lectures and exercises on 1) Causes and drivers of climate change, including the effects of greenhouse gases; 2) Global and regional climate systems and climate change projections; 3) Anthropogenic and natural sources and sinks of greenhouse gases and how they can be managed; 4) Mitigation of greenhouse gases through management, technologies and policies; 5) Impacts of climate change on land and water resources as well as natural and managed ecosystems; 6) Adaptation to climate change and various temporal and spatial scales and how this links to policies.

Description of the course:

The course aims at giving the Ph.D. student a thorough background to climate change adaptation and mitigation issues, including knowledge on the fundamental processes underlying climate change, and its potential impacts on the environment, agriculture and communities as well as implications for development. The course will include a combination of lectures, group work on chosen topics, and hands-on use and evaluation of measuring equipment and models. The practical and theoretical exercises will be conducted in groups. The students will be asked to write a short essay based on literature supplied at the start of the course. The essays will be evaluated by the course lecturers.

Learning goals:

After the course you will be able to:

- Explain and quantitatively describe the main drivers and mechanisms of climate change
- Explain the projections of climate change on a global scale and regionally with focus on West Africa
- Explain downscaling of climate change projections
- Explain how climate change affects water resources, ecosystems and agriculture
- Reflect on the use of existing models for prediction of effects on climate change
- Explain sources of greenhouse gases from society, industry, agriculture and ecosystems
- Describe effects of possible mitigation measures in energy systems, industry and agriculture and forestry
- Describe and reflect on the policy framework for reducing greenhouse gas emissions and adaptation to climate change.

Teachers and their affiliation:

Dr. Leonard K. Amekudzi, KNUST

Prof. Charles Quansah, KNUST

Prof. Jørgen E. Olesen, Aarhus University

Dr. Mathias Neumann Andersen, Aarhus University

Volume: 90 hours including preparation, reading and reporting

Target group: Ph.D. students within physics, meteorology, agronomy, forestry, renewable and natural resources, engineering or biology

Location: International Centre for Innovative Learning (ICIL), KNUST, Kumasi, Ghana

Accommodation: SMS Guest House (if needed)

Course fee: None

Number of participants: Maximum 20

Registration: The registration form should be sent to Vanessa Appiah (e-mail: vappiah@yahoo.com) no later than 25 February 2013. Students will be notified of acceptance shortly afterwards.

Course organizers:

Dr. Leonard Amekudzi, +233 (0)201842237, Leonard.Amekudzi@gmail.com

Prof. Jørgen E. Olesen, +45 40821659, JorgenE.Olesen@agrsci.dk

Reading material:

The following 13 articles will be provided to the students by e-mail or print and must be read before the start of the course. They will provide the basis for the report assignment that must be conducted during the course.

McCarthy, J.J., 2009. Reflections on: Our planet and its life, origins, and futures. *Science* 326, 1646-1655.

Peters, G.P., Marland, G., Quere, C.L., Boden, T., Canadell, J.G., Raupach, M.R., 2012. Rapid growth in CO₂ emissions after the 2008–2009 global financial crisis. *Nature Climate Change* 2, 2-4.

Houghton, R.A. (2003). Why are estimates of the terrestrial carbon balance so different? *Global Change Biology* 9, 500-509.

Powelson, D.S., Whitmore, A.P., Goulding, K.W.T., 2011. Soil carbon sequestration to mitigate climate change: a critical re-examination to identify the true and the false. *European Journal of Soil Science* 62, 42–55.

Dai, A., 2011. Drought under global warming. *WIREs Climate Change* 2, 45-65.

Smith, P., Martino, D., Cai, Z., Gwary, D., Janzen, H., Kumar, P., McCarl, B., Ogle, S., O'Mara, F., Rice, C., Scholes, B., Sirotenko, O., Howden, M., McAllister, T., Pan, G., Romanenkov, V., Schneider, U., Towprayoon, S., Wattenbach, M., Smith, J., 2008. Greenhouse gas mitigation in agriculture. *Philosophical Transactions of the Royal Society B* 363, 789-813.

Lobell, D.B., Schlenker, W., Costa-Roberts, J., 2011. Climate trends and global crop production since 1980. *Science* 333, 616-620.

Howden, S.M., Soussana, J.F., Tubiello, F.N., Chhetri, N., Dunlop, M., Meinke, H., 2007. Adapting agriculture to climate change. *PNAS* 104, 19691-19696.

Long, S.P., Ainsworth, E.A., Rogers, A., Ort, D.R., 2004. Rising atmospheric carbon dioxide: Plants FACE the future. *Annu. Rev. Plant Biol.* 55, 591-628.



- Xu, L.K., Hsiao, T.C., 2004. Predicted versus measured photosynthetic water-use efficiency of crop stands under dynamically changing field environments. *Journal of Experimental Botany* 55, 2395-2411.
- Schlenker, W., Lobell, D.B., 2010. Robust negative impacts of climate change on African agriculture. *Environmental Research Letters* 5 014010.
- Sarr, B., 2012. Present and future climate change in the semi-arid region of West Africa: a crucial input for practical adaptation in agriculture. *Atmospheric Science Letters* 13, 108-112.
- Rabe, B.G., 2007. Beyond Kyoto: Climate change policy in multilevel governance systems. *Governance: An International Journal of Policy, Administration and Institutions* 20, 423-444.

Practical information:

We recommend that you bring a laptop, if possible. Spreadsheets will be used for exercises. Students will also be required to produce a short report during the course, which will also require a computer.

Program

Monday, 11-March

9.00-10.00 Welcome and introduction to course (Dr. Leonard Amekudzi and Jørgen E. Olesen)
Introduction to the short essay based on lectures and literature supplied.

10.00-12.00 Drivers, mechanisms and projections of climate change (Lecture by Leonard Amekudzi)

Objective: To introduce scenarios of greenhouse gas emissions
To give an understanding of the functioning of climate models and impact on the water cycle
To give an understanding of the regional differences in climate change projections and their uncertainty

Content: Modelling of the climate system and possible feed-backs; Emission scenarios; Projections of climate change including extreme events.
Exercise on warming effects of individual greenhouse gases and feedback effects

12.00-13.00 Lunch break

13.00-15.00 Regional projections of CC for West Africa and observed changes (Leonard Amekudzi)

Objective: To give an understanding of regional CC projections and their impact on the water cycle etc.
To give an understanding of the uncertainty of regional CC projections

Content: The regional climate system and the expected influence of climate change on the convergence zone, occurrence of extreme events, etc.
Exercise on climate change trends and variability based on data from a climate station in Ghana (report next morning)

15.00-15.30 Tea/Coffee break

15.30-16:30 Downscaling of climate projections (Lecture and theoretical exercise by Jørgen E. Olesen)

Objective: To give an understanding of how regional CC projections on the different climate elements can be derived

Content: Presentation of downscaling methodologies (strengths and weaknesses)
Exercise on importance of downscaling (comparison of downscaled versus GCM)

Tuesday, 12-March

- 9.00-10.00 Feedback from yesterday's exercise (Leonard Amekudzi)
Presentation from groups
- 10.00-12.00 Sources of greenhouse gases (Lecture by Leonard Amekudzi)
Trends in greenhouse gases (Lecture by Jørgen E. Olesen)
- Objective To understand the processes giving rise to greenhouse gas emissions
To understand the principles behind the IPCC GHG accounting methodology
- Content GHG emissions from fossil fuel use, land use change, and biogenic emissions from agriculture and waste management
Introduction to the biogeochemical processes (carbon and nitrogen cycle) affecting agricultural GHG emissions
Sources of GHG emissions in Ghana
Exercise on measurements of nitrous oxide fluxes from soils (report back next day)
- 12.00-13.00 Lunch break
- 13.00-15.00 Mitigation of greenhouse gas emissions (Lecture by Jørgen E. Olesen)
- Objective To understand how greenhouse gas emissions may be reduced through changes in efficiency, new technologies or changed management.
- Content Effect of improved efficiency in energy systems and food production systems
Technologies aimed at reducing biogenic GHG emissions or substituting fossil fuels
Management effects on biogenic GHG emissions and carbon sequestration
Exercise on possibilities for GHG emission reductions and carbon uptake in Ghana
- 15.00-15.30 Tea/Coffee break
- 15.30-16:30 Questions and answers on the short report assignment. Students to report on topic selected for short report.

Wednesday, 13-March

9.00-10.00 Feedback from yesterday's exercise (Jørgen E. Olesen)

Presentation from groups

10.00-12.00 Climate change versus climatic variability (Leonard Amekudzi)

Objective To understand the difference between climate change and climatic variability and how observed changes can be attributed to natural and anthropogenic causes

Content Observed changes in temperature, rainfall and circulation systems

Observed changes in natural and managed ecosystems

Exercises on observed changes in Ghana, and what can they be attributed to

12.00-13.00 Lunch break

13.00-15.00 The global and national climate change policy framework (Jørgen E. Olesen and Leonard Amekudzi)

Objective To understand the structure and content of global and national policies and how and why they work and do not work

Content IPCC, UNFCCC and Kyoto Protocol and subsequent amendments

Ghana climate change policy

Exercises on GHG accounting using the IPCC methodology and effects of including mitigation measures for Ghana agriculture

15.00-15.30 Tea/Coffee break

15.30-16:30 Exercise on climate skepticism (debate between students)

Thursday, 14-March

9.00-12.00 Plant and crop responses to climatic stress and climate change (Mathias N. Andersen)

Objective: To introduce key response mechanisms of plants to stress and their effects on agricultural productivity

Content: Overview of the response of plants and crops to environmental variability, internal regulation mechanisms, water deficit, high temperature and salinity as constraints to crops and plant acclimation to stress.

Exercise on plant response to drought, in particular vapor pressure deficit (VPD)

12.00-13.00 Lunch break

13.00-15.00 Climate change effects on agroecosystems (Jørgen E. Olesen)

Objective To give the students an understanding of how climate variability and climate change affects crop production and carbon and nutrient cycling in agroecosystems.

Content An overview of important climatic factors and how they affect plant growth and yield (directly and indirectly)

Effects of climate change and changes in atmospheric CO₂ concentration on crops

Effects of climate variation and extremes

Exercise on crop yield responses to climate change and variability

15.00-15.30 Tea/Coffee break

15.30-16.30 Climate change effects on West African monsoon (Leonard Amekudzi)

Objective To understand the mechanism controlling the West African Monsoon and how this may be affected by climate change

Content Development of Monsoon: Onset and withdrawal of the West Africa monsoon and rainfall distribution

Inter annual variability of monsoon

Main synoptic pressure systems for West Africa weather

Different seasons (Dry and wet seasons)

Wind circulation over West Africa

Friday, 15-March

9.00-9.30 Hand-in of short reports by students

9.30-12.00 Adaptation to climate change (Jørgen E. Olesen)

Objective To understand the concepts of adaptation, adaptive capacity and adaptation costs
To provide an overview of adaptation options in agriculture
To understand how adaptation to climate change may be achieved in practice.

Content Assessment of current adaptation practices, Assessment of adaptation capacity, options and constraints,
Adaptation within land and water resources
Adaptation options in agriculture (short and long term)
Restrictions on adaptation to climate change in agriculture and forestry

12.00-13.00 Lunch break

13.00-15.00 Adaptation to climate change in West Africa (Charles Quansah)

Objective To understand merits and restrictions in current adaptation policies in the region

Content Presentation on current policy framework

Exercise on limitations of current policies and suggestions for improvement, including research gaps

15.00-15.30 Tea/Coffee break

15.30-16:30 Questions and answers to course content

Evaluation of the course

Hand out of certificates

Participants in PhD course and title of essay submitted

Name	E-mail	Title
ABIGAIL SEYRAM SALAH	nixnais@yahoo.com	CLIMATE CHANGE: THE IMPACT ON BIODIVERSITY
Adwoa Dansoaa Acheampong	Acheampongadwoa@yahoo.com	Influence of climate change on the ecosystem
Akwasi Afrifa Acheampong	akwasi_afrifa@hotmail.com	Adapting engineering designs to climate change
ALFRED HAYFORD	alfredhayford@yahoo.com	THE REAL EFFECT OF CLIMATE CHANGE ON GHANA'S GROSS DOMESTIC PRODUCT (GDP)
ALHASSAN SULEMANA	sulemana90gh@yahoo.com	Effects and Adaptations of Climate Change on Agricultural Production in Northern Region of Ghana
ASAMOAH GYAN	agyan37@gmail.com	SOIL CARBON SEQUESTRATION TO MITIGATE CLIMATE CHANGE
BARNIE YEBOAH SAMUEL	samuelyeboahbarnie @yahoo.com	EFFECTS OF CLIMATE CHANGE ON FOREST TREE SPECIES DIVERSITY
Bridgette Berlinda Naa Dei Amasa	naadeiamasa@ymail.com	EFFECTS OF CLIMATE CHANGE ON POVERTY IN AFRICA
Christian Bosompem	bosochristo@gmail.com	Problems arising from climate change on humans
Christiana Mortey	christianamortey@yahoo.com	THE CAUSES OF CLIMATE VARIABILITY AND CLIMATE CHANGE
Daniel Oppong	oppongdaniel60@yahoo.com	The impact of agriculture on climate change
DAVID OSEI OWUSU	davidosei1456@yahoo.com	IMPACT OF CLIMATE CHANGE ON FOREST AND SAVANNA BIODIVERSITY IN GHANA
Delali H. Adjei	delle2000@gmail.com	The impact of climate change on the vulnerable in th Ashanti Region
Emmanuel Quansah	equansah.cos@knust.edu.gh	Global Warming: The role of the African ecosystem
Fekadu Gashaw	fekeye@gmail.com	Renewable sources of energy for reduction of CO2 Emission
Felix Asante	couzon_species@yahoo.com	FARMERS' ADAPTATION TO CLIMATE VARIABILITY: THE CASE OF FARMING IN THE FOREST SAVANNA
FELIX GYIMAH DARFOUR	cristol202@gmail.com	IS THE HUMAN FACTOR IN CLIMATE CHANGE OVERSTATED?
Francis Afriyie	afriyie.francis@yahoo.com	Adapting agriculture to climate change
Francis Duku	eyescubes3@yahoo.com	A critical look at soil carbon sequestration as a mitigation
IGNATIUS SENYO YAO YAWLUI	Senatius@yahoo.com	CLIMATE MITIGATION: THE ROLE OF SOIL CARBON SEQUESTRATION
John Kormla Nyameasem	jnyameasem@yahoo.com	POTENTIAL STRATEGIES FOR MITIGATING ENTERIC METHANE EMISSIONS FROM RUMINANTS
Kidist Fekadu Wolde	kidist.fekadu@yahoo.com	Impact of Climate Change on Pest Out Break
Kwasi A. Obirikorang	quasiadu@gmail.com	A Review of Farmers' Perceptions and Adaptation Strategies to Climate Change in Agricultural Systems
Kwasi Tenkorang	mamba4eva@yahoo.com	EFFECTS OF CLIMATE CHANGE ON MAIZE PRODUCTIVITY IN NORTHERN GHA
LYDIA KWADU	olye200@yahoo.com	EFFECT OF CLIMATE CHANGE ON AGRICULTURE PRODUCTIONS
Laari Prosper	laariking@gmail.com	SPATIO- TEMPORAL MODELING OF CLIMATE CHANGE, LAND USE AND CROP PRODUCTION
Michael Nugba	mkafui2001@yahoo.com	The robust impacts of climate change on African Agriculture
NAT ANDERSON AMPOFO	abeikunat@yahoo.com	THE BUILT ENVIRONMENT PERSPECTIVE OF CLIMATE CHANGE
Prince Adade	princeadade2009@yahoo.com	Anthropogenic effect on climate variability and climate change

Priscilla Boatema Gyamfi	priscillaboatenggyemfi@yahoo.com	How the soil can contribute to climate change
RACHAEL ANTIEDU FORKUOH	rachelforkuoh@gmail.com	THE EFFECTS OF CLIMATE CHANGE ON AQUATIC LIFE
Theophilus Atio Abalori	abalorit@yahoo.com	IMPACT OF SOIL ORGANIC CARBON ON CLIMATE CHANGE
Tizazu Abza	zabishwork2@gmail.com	The Impact Of climate change on the agricultural productivity
Victoria Attah-Kotoku	atokot@yahoo.com	THE IMPORTANCE OF AGRICULTURE IN CLIMATE CHANGE
YAW OPOKU APPIAH	apicot2g8@gmail.com	The effect of climate change on wildlife