Global Environmental Change Research & Learning Forum

14-16 November 2012

Hosted by:
Institute for Environment and Sanitation Studies (IESS),
University of Ghana, Legon, Accra, Ghana

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Global Environmental Change Research Learning Forum

14-16 November 2012
Accra, Ghana

Global Environmental Change Research & Learning Forum Program

14-16 November 2012
Mensvic Grand Hotel
Accra, Ghana

Tuesday, 13 November 2012

5:00 p.m. – 6:00 p.m.	**Research & Learning Forum Registration**

Wednesday, 14 November 2012

DAY 1: Sharing Knowledge & Perspectives

Venue: Mensvic Grand Hotel

8:30 a.m. – 9:00 a.m.	**Research & Learning Forum Registration** *All meeting participants should reserve adequate time for arrival and check-in at the meeting venue.*
9:00 a.m. – 10:00 a.m.	**Opening Session** **Chair**: Prof. Chris Gordon, *Institute for Environmental & Sanitation Studies, University of Ghana* 9:00 a.m. – 9:10 a.m. **Welcome Message** Prof. Ernest Aryeetey, *Vice Chancellor of the University of Ghana* 9:10 a.m. – 9:30 a.m. **Keynote Address** Ms. Sherry Ayettey, *Minister of Environment Science and Technology* 9:30 a.m. – 9:40 a.m. **Message from Climate Development Knowledge Network (CDKN)** Dr. Natasha Grist, *CDKN* 9:40 a.m. – 10:00 a.m. **Overview of Grants for Global Environmental Change Research in Africa Program** Mr. Charles Skip Kauffman, *International START Secretariat, USA* **Research & Learning Forum Approach: Objectives and Expectations** Ms. Sarah Schweizer, *International START Secretariat, USA* **Group Photo**
10:00 a.m. – 10:30 a.m.	*Graphic Recording Stroll and Coffee and Tea Break*

Global Environmental Change Research Learning Forum

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	Parallel Session 1: Research Presentations	
10:30 a.m. – 11:45 a.m.	**(A)** **Environmental Services & Food Security** *See titles and abstracts in Section 1.A of "Participant Presentations".* **Plenary room**	**(B)** **Environmental Services & Food Security** *See titles and abstracts in Section 1.B of "Participant Presentations".* **Breakout room**
11:45 a.m. – 11:50 a.m.	*Transition to next parallel sessions*	
	Parallel Session 2: Research Presentations	
11:50 a.m. – 1:05 p.m.	**(A)** **Environmental Services & Food Setcurity** *See titles and abstracts in Section 2.A of "Participant Presentations".* **Plenary room**	**(B)** **Climate Information & Knowledge Systems** *See titles and abstracts in Section 2.B of "Participant Presentations".* **Breakout room**
1:05 pm. – 2:30p.m.	*Lunch*	
	Parallel Session 3: Research Presentations	
2:30 p.m. – 3:45 p.m.	**(A)** **Rural Livelihoods & Adaptation** *See titles and abstracts in Section 3.A of "Participant Presentations".* **Plenary room**	**(B)** **Climate Information & Knowledge Systems** *See titles and abstracts in Section 3.B of "Participant Presentations".* **Breakout room**
3:45 p.m. – 4:00 p.m.	*Coffee and Tea Break*	
4:00 p.m. – 6:00 p.m.	**Well Told Story: Block #1** **Facilitators:** Miles Bredin, *Well Told Story* Hannah-May Wilson, *Well Told Story* • Introduction to communications • Setting targets: Plan objectives and identify decision makers	

Thursday, 15 November 2012

DAY 2: Prioritizing Key Issues

Venue: Mensvic Grand Hotel

9:00 a.m. – 10:30 a.m.	**Panel: Enhancing GEC Science in Africa** **Chair: Jon Padgham**, *International START Secretariat, USA* **Sibiry Traore**, *International Crops Research Institute for the Semi-Arid Tropics (ICRISAT)* **Chris Lennard**, *Climate Systems Analysis Group, University of Cape Town* **Paul L.G. Vlek**, *West African Science Service Center on Climate Change and Adapted Land Use (WASCAL)* **Chris Gordon**, *Institute for Environmental & Sanitation Studies, University of Ghana*
10:30 a.m. – 11:00 a.m.	*Coffee and Tea Break*
	Parallel Session 4: Examining Critical Issues
11:00 a.m. – 12:30 p.m.	*Participants will break into small groups to discuss cross-cutting themes related to research findings from day 1 presentations on topics of environmental services & food security, rural livelihoods & adaptation, and climate information & knowledge systems.*
12:30 p.m. – 2:00 p.m.	*Lunch*
2:00 p.m. – 3:15 p.m.	**Report Back: Identifying Synthesis Messages** **Facilitators:** Jon Padgham, *International START Secretariat, USA* Clark Seipt, *International START Secretariat, USA*
3:15 p.m. – 3:30 p.m.	*Coffee and Tea Break*
3:30 p.m. – 5:15 p.m.	**Well Told Story: Block #2** **Facilitators:** Miles Bredin, *Well Told Story* Hannah-May Wilson, *Well Told Story* • Check the context • Target correctly
7:30 p.m.	**Forum Reception**, *Dinner and entertainment* *Venue: Mensvic Grand Hotel Pool Area*

Friday, 16 November 2012

DAY 3: Communication Pathways for Change

Venue: Mensvic Grand Hotel

9:00 a.m. – 10:00 a.m.	**Communication Pathways for Promoting Change** **Role of Media: Potential effectiveness, dangers of poorly informed journalists and resources to link to media** Patrick Luganda, *NECJOGHA, Uganda* **Film viewing with comments on using film as a communication tool** Tony Ribbink, *Sustainable Seas Trust, South Africa* **Q & A**
10:00 a.m. – 10:30 a.m.	*Coffee and Tea Break*
10:30 a.m. – 12:30 p.m.	**Well Told Story: Block #3** **Facilitators:** Miles Bredin, *Well Told Story* Hannah-May Wilson, *Well Told Story* • Target correctly • Choose the right channels: plan activities, inspired by communication pathways session
12:30 p.m. – 1:45 p.m.	*Lunch*
1:45 p.m. – 4:45 p.m.	**Well Told Story: Block #4** **Facilitators:** Miles Bredin, *Well Told Story* Hannah-May Wilson, *Well Told Story* • Plan activities • Monitor the results: Plan M & E • Plan presentations
4:45 p.m. – 5:30 p.m.	**Closing Session: Moving Research to Action**

Global Environmental Change Research Learning Forum
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Participant Directory

Vide ADEDAYO
University of Lagos
NIGERIA
vide3q@yahoo.com

Gordon Nwutih AJONINA
Cameroon Wildlife Conservation Society
CAMEROON
gnajonina@hotmail.com

Victor Ajibola ADEKUNLE
Federal University of Technology
NIGERIA
vajadekunle@yahoo.com

William Asare
University of Ghana
GHANA
ariess@ug.edu.gh

Samuel Adiku
University of Ghana
GHANA
s_adiku@ug.edu.gh

Emmanuel Morgan ATTUA
University of Ghana
GHANA
emattua@ug.edu.gh

PB Irenikatche AKPONIKPE
Universite de Parakou
BENIN
akponikpe@yahoo.com

Elias T. AYUK
United Nations University
GHANA
ayuk@inra.unu.edu

E. Akosah
University of Ghana
GHANA

Mohammed Nasser BACO
Universite de Parakou
BENIN
nasserbaco@yahoo.fr

Jane BEMIGISHA
International Foundation for Science
UGANDA
bemigisha@yahoo.co.uk

Miles BREDIN
Well Told Story
KENYA
milesbredin@mac.com

George Bindeh CHUYONG
University of Buea
CAMEROON
chuyong@yahoo.com

Olivier CRESPO
Climate Systems Analysis Group, University of Cape Town
SOUTH AFRICA
olivier@csag.uct.ac.za

Ernestina DOKU-MARFO
Conservation Alliance International
GHANA
edoku-marfo@conservealliance.org

Oluseyi O. FABIYI
Obafemi Awolowo University
NIGERIA
fabiyi@rectas.org

Mayowa Johnson FASONA
University of Lagos
NIGERIA
mfasona@unilag.edu.ng

Tewodros GODEBO
Duke University
USA
tg67@duke.edu

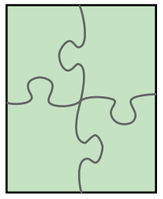
Chris GORDON
University of Ghana
GHANA
cgordon@ug.edu.gh

Natasha GRIST
CDKN
UNITED KINGDOM
n.grist@odi.org.uk

Raffael HICKISCH
University of Klagenfurt
AUSTRIA
raffaelhickisch@gmail.com

Charles KAUFFMAN
START
USA
cskauffman@start.org

Oluwatoyin Dare KOLAWOLE
Okavango Research Institute
BOTSWANA
tkolawole@ori.ub.bw



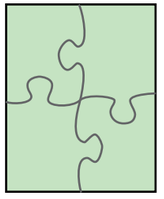
Chris LENNARD
CSAG
SOUTH AFRICA
lennard@csag.uct.ac.za

Sebastian LEWIS
Sustainable Seas Trust
SOUTH AFRICA
seb@sst.org.za

Patrick LUGANDA
Farmers Media Link Centre
UGANDA
patrick_luganda@yahoo.com

Shuaib LWASA
Makerere University
UGANDA
shuaiblwasa@gmail.com

Alla MANGA
Universite Cheikh Anta Diop
SENEGAL
allamanga@yahoo.fr



Reneth MANO
University of Zimbabwe
ZIMBABWE
rtmano@gmail.com

Shehnaaz MOOSA
CDKN
SOUTH AFRICA
shehnaaz.moosa@cdkn.org

Karina MULLEN
Natural Vision Facilitation
USA
karina.mullen@gmail.com

Moussa NA ABOU MAMOUDA
ENDA Energy-Environment-Development
SENEGAL
mamoudam@gmail.com

Hubert N'DJAFA OUAGA
International Union for Conservation of Nature (IUCN)
MALI
ouaga.hubert@gmail.com

Baba Tierto NIBER
East Africa Region Food Security, Climate Change and Economic Development Learning Center
TANZANIA
baba_tierto@wvi.org

Charles NHEMACHENA
Council for Scientific & Industrial Research
SOUTH AFRICA
cnhemachena@hsrc.ac.za

Olorunfemi OGUNDELE
Nigerian Institute of Social and Economic Research (NISER)
NIGERIA
olorunfemiogundele@yahoo.com

Philip NYEKO
Makerere University
UGANDA
nyeko@forest.mak.ac.ug

James Olaniyi OKUNLOLA
Federal University of Technology
NIGERIA
niyiyela@yahoo.com

Herbert NYOMBI
Makerere University
UGANDA
nyombiherbert2007@yahoo.com

Yaw OSEI-OWUSU
Conservation Alliance International
GHANA
yosei-owusu@conservealliance.org

Washington Odongo OCHOLA
Regional Universities Forum for Capacity Building in Agriculture
UGANDA
w.ochola@ruforum.org

Mamadou OUATTARA
West African Science Service Center for Climate Change and Adapted Land Use (WASCAL)
GHANA
mouattara@agra-alliance.org

Benjamin D. OFORI
University of Ghana
GHANA
bdofori@ug.edu.gh

Kwadwo OWUSU
University of Ghana
GHANA
kowusu@ug.edu.gh

Joseph OLOUKOI
Obafemi Awolowo University
NIGERIA
oloukoi@rectas.org

Jon PADGHAM
START
USA
jpadgham@start.org

Maren A Ochere RADENY
Climate Change, Agriculture & Food Security - East Africa Program
KENYA
m.radeny@cgiar.org

Bougouna SOGOBA
Association Malienne d'Eveil au Developpement Durable (AMEDD)
MALI
bougouna.sogoba@ameddmali.org

Anthony RIBBINK
Sustainable Seas Trust
SOUTH AFRICA
a.ribbink@sst.org.za

Emmanuel TACHIE-OBENG
Environmental Protection Agency
GHANA
etachieobeng@gmail.com

Kyle Llewellyn ROBINSON
Sustainable Seas Trust
SOUTH AFRICA
kyle@sst.org.za

D. Yirenya Tawiah
University of Ghana
GHANA

Sarah SCHWEIZER
START
USA
sschweizer@start.org

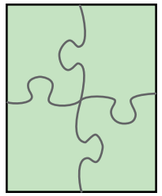
Weldemichael TESFUHUNEY
University of Free State
SOUTH AFRICA
weldit78@yahoo.com

Clark SEIPT
START
USA
cseipt@start.org

Sibiry TRAORE
International Crops Research Institute for the Semi-Arid Tropics (ICRISAT)
MALI
p.s.traore@cgiar.org

Willie SIYANBOLA

Najoua el Menif TRIGUI
University 7 novembre a Carthage
TUNISIA
elmunif2004@yahoo.fr



Elaine Tweneboah LAWSON
University of Ghana
GHANA
elaine_t@ug.edu.gh

Hannah-May WILSON
Well Told Story
KENYA
hmwilson@uwezo.net

Katinka Lund WAAGSAETHER
Indigo Development & Change
SOUTH AFRICA
katinka@indigo-dc.org

Piotr WOLSKI
Okavango Research Institute
BOTSWANA
pwolski@orc.ub.bw

Bolanle WAHAB
University of Ibadan
NIGERIA
bolanle_wahab@yahoo.com

Paul L.G. Vlek
West African Science Service
Center for Climate Change
and Adapted Land Use
p.vlek@uni-bonn.de

Ejiet John WASIGE
Makerere University
UGANDA
ejwasige@yahoo.com

Vincent Von Vordzogbe
University of Ghana
GHANA
vonvord@ug.edu.gh

Research Presentations: Titles & Abstracts

Presentation titles and abstracts are presented, herein, as submitted to the conference organizers, with the exception of one (1) abstract that was submitted in French and has been translated to English (noted). Author email addresses are available in the Participant Directory.

Wednesday, 14 November 2012

10:30 a.m. – 11:45 a.m.	Parallel Session 1: Research Presentations

Session 1.A: Environmental Services & Food Security

1.A.1. Reducing Tropical Deforestation and the Protection of Ecosystem Services to Support Food Security in Southwest Cameroon

Gordon N. Ajonina, *Cameroon Wildlife Conservation Society (CWCS)*
George B. Chuyong, *University of Buea, Cameroon*
Patience A. Usongo, *University of Buea, Cameroon*

Abstract: Tropical forests facing increasing pressures with implications for economic development and climate change. Tropical deforestation alone is responsible for 20 to 30% of carbon emissions and most species extinction. Subsistence agricultural practices are considered the main drivers of deforestation and forest degradation in our rural settings with contrasting trade-off between food security, poverty alleviation and forest conservation. We considered the trade-off between livelihood demands and payments for ecosystem services in form of REDD+ incentives for avoided deforestation. An ecological and socio-economic evaluation was carried using data from 131 subsistence agro-forest systems selected within the support zones of the Korup National Park and Douala-Edea Reserve to reconcile levels of deforestation and degradation as well as the economic value of the produce and carbon stocks therein. Using canopy openness and soil nutrient status as indices for levels of deforestation and degradation, a system dynamic model was used to assess ways of better aligning the REDD+ incentive to address livelihood needs and avoided deforestation cost with effective and equitable outcomes. The annual subsistence agro-forest system was the most detrimental and less diverse compared to the Biennial and perennial systems. Most of the trees left standing in the farms were either priced timber species or providing NTFPs. The threshold limit of 50% forest canopy opening will guarantee better economic returns and the provision of ecosystem services in the long-term. A minimum compliance value of US $10.00 per tonne of C might not be enough to entice farmers in these local setting to halt deforestation given the present environmental, economic and social conditions. There is the need to encourage perennial subsistence agroforestry systems and to design optimal incentive mix to change the behaviour of these farmers.

1.A.2. Management of Forest Ecosystem for Food Security and Rural Livelihoods in South West Nigeria

Adekunle V.A.J., *Federal University of Technology, Akure, Nigeria*
Okunlola J.O., *Federal University of Technology, Akure, Nigeria*
Oke D.O., *Federal University of Technology, Akure, Nigeria*

Abstract: Ecosystem services are essential to human survival on earth. Human activities are already impairing the flow of ecosystem services on a large scale due to population growth especially in developing countries. Utilization is done at present without any plan for the future. This study was carried out to assess the present status of the tropical natural ecosystem of southwest Nigeria, their contributions to rural livelihood, the quantity and quality of their services and the level of awareness and impacts of anthropogenic activities on climate change. The study was carried out in three of the six states that make up the southwest Nigeria. Activities carried out included: socioeconomic study of climate change and adaptation options to rural livelihood activities and food security, phyto-sociological characterization of tropical natural forest for ecosystem services, tree species diversity assessment and assessment of the impact of anthropogenic activities on forest soil properties and carbon pool. Data were collected with well structured and pre-tested questionnaire administered on randomly selected household heads, field inventory of some selected forest reserves and soil sample collection and analyses. The results of the study revealed that people in the study area were primarily dependent on the forest resources for their livelihood. Majority was aware of climate change its various effects. Intervention by government agencies on problems of climate change has been very poor. Climate change has been impacting seriously on the livelihood of the people while they also have been contributing to climate change ignorantly. Human activities have impacted the forest resources resulting in forest degradation. Forest degradation affected soil organic matter and nutrients and may through soil respiration, influence atmospheric CO_2 concentrations and global warming. Some policy and mitigation measures by all stake holders and the three tiers of government in Nigeria were recommended.

1.A.3. Changes in Tree Reproductive Phenology: Causes and Implications in and around Budongo Forest Reserve, Uganda

F. Babweteera, *Budongo Conservation Field Station, Uganda*
P. Nyeko, *Makerere University, Uganda*
A.J. Plumptre, *Wildlife Conservation Society, USA/ Uganda*
J. Agea, *Makerere University, Uganda*
H. Nyombi
N. Akumu

Abstract: Anthropogenic disturbances and climate change are thought to affect tropical rain forest functioning thus compromising the ability of these ecosystems to provide goods and services. Budongo Forest Reserve, the largest remaining tropical rain forest in East Africa, has experienced a decline in the number of fruiting trees in one part of the forest. There is no direct evidence to explain the observed reduction in the number of fruiting trees. We hypothesized that climatic change and/or changes in pollinator populations could be the cause of reduced tree fruiting.

In addition to the existing 200 plots located in the southern part of the forest, we established 400 plots in other parts of the forest to represent different forest types. The total number of trees monitored increased from 1,400 to over 6,000. In addition, the number of tree species monitored increased from 60 to 124. Tree phenology was monitored by conducting monthly visits to each tree to record whether the tree was flowering or fruiting. Primate foraging patterns were determined by observing habituated primate groups to record their dietary composition. Pollinator assemblage was assessed by using water-filled bowls (pan-traps) hung at different heights of selected tree species. Surveys were conducted among forest edge communities to assess the current spatial and temporal crop raiding patterns in relation to past crop raiding patterns.

Analysis of phenology patterns show continued reduction in the number of fruiting trees between 1993 and 2011. Analysis of individual tree species also shows reduction in fruiting for majority of tree species. Partial results indicate spatial differences in fruiting patterns. Fruiting was lowest in the least disturbed forest types. A comparison of primate foraging patterns indicates that whereas fruits constituted over 60% of primate diet in the early 1990's, there has been a significant change in their diet whereby leaves now constitute the bulk of primates' diet. In addition, the 200 forest edge residents interviewed agree that the crop raiding problem around the forest has tremendously increased over the last 15 years both in intensity and frequency. Notably, chimpanzees that occasionally raided home gardens for fruits are now frequent crop raiders of fruit and non-fruit trees. The study of pollinator assemblages has so far collected and identified 119 insect pollinators species. Insect pollinator assemblages appear to vary between forest types with the least disturbed habitats showing the lowest diversity and abundance.

The results collected so far are inconclusive and data collection is on-going. However, there are noticeable patterns emerging namely, spatial differences in tree phenology and insect pollinator assemblages across the different forest types. In addition, frugivorous primates appear to be feeding more on leaves than fruits contrary to the patterns observed in the early 1990s. This could be a direct result of fruit scarcity. Further analysis will seek to correlate the observed phenology patterns with insect pollinator assemblages and climate data. Furthermore, we will explore why pollinator diversity and abundance varies between forest types.

1.A.4. Promoting resilience to global environmental change among smallholder farmers: lessons from university-led regional initiatives in eastern, central and southern Africa

Washington O. Ochola, *Regional Universities Forum for Capacity Building in Agriculture (RUFORUM), Uganda*

Abstract: A healthy ecosystem is the basis for sustainable natural resources management and subsequently stable food security as well as resilience to climate change. Global Environmental Change (GEC) which comprises the total set of transformations of land, oceans and atmosphere, is driven by an interwoven system of socioeconomic and natural processes. African universities have for a long time faired sub-optimally in global climate change science and contributing to regional and local resilience of communities and ecosystems. The Regional universities Forum for Capacity Building in Agriculture RUFORUM, a consortium of 29 universities in Eastern, Central and Southern Africa, facilitates, inter alia, capacity building for universities to improve climate change science and partnerships. RUFORUM coordinates regional initiatives targeting access to climate change adaptation technologies, funding

and training opportunities, harnessing technologies for small holder farmers to improve resilience to climate change and managing transboundary animal diseases. Some of the initiatives include joint work with the African Collaborative Centre for Earth System Science (ACCESS) on the East African Great Lakes Observatory (EAGLO), implementing a resilience framework for climate change on Mt Elgon region of lake Victoria basin. Through collaborative efforts the initiatives also include setting of research agenda and spearheading publication and dissemination of technologies and best practices in GEC. Through many approaches engagement with policy processes has helped leverage awareness and resources. With other international agencies work is also going on future environmental change analysis using scenario modelling and integrated social, economic and environmental foresighting. Other initiatives include regional training of a critical mass of PhD students in Dryland Resources Management. The overall focus is human resource capacity and stronger climate change science based on ecosystems resilience for poverty alleviation and food security. The presentation will cover institutional and field level experiences and lessons for addressing GEC with a focus on resilience for ecosystems services integrity and food security within the RUFORUM network.

Session 1.B: Environmental Services & Food Security

1.B.1. Integrating Indigenous Knowledge and Scientific Methods for Flood Risk Analyses, Responses and Adaptation in Rural Coastal Communities in Nigeria

O.O. Fabiyi, *Obafemi Awolowo University, Nigeria*
J. Oloukoi, *Obafemi Awolowo University, Nigeria*
G.A. Akinbola, *University of Ibadan, Nigeria*
O.E. Thontteh, *Obafemi Awolowo University, Nigeria*

Abstract: The impact of Climate change on the coastal regions of the world is unprecedented especially as it relates to sea level rise which stimulates coastal flooding and the submergence of several coastal communities. The coast line is in a constant flux, thus causing apparent confusion in the use of mean sea level as a reference point for elevation. When the sea level rises due to global warming, the available land for cultivation and human habitation generally shrinks further having negative implications on food security and human survival. Nigeria has a linear stretch of more than 850 kilometer of coastline which is constantly being inundated by flooding from the Atlantic ocean (cold flood) and the distributaries of River Niger (warm flood). The coastal communities are endowed with several indigenous adaptive strategies in mitigating several challenges that are associated with coastal flooding with limited effectiveness.

The project examined and documented indigenous knowledge and practices to mitigating and adapting to coastal flooding and advanced a platform for integrating indigenous knowledge, participatory GIS and basic weather data monitoring to develop community based participatory approach in coastal flooding management. Field surveys were conducted in twenty (20) villages to identify flood related indigenous knowledge. Weather stations and flood gauges were also installed in ten(10) of the communities and GIS-based flood risk maps were introduced to the trained flood monitors who were deployed to utilize integrative approach of indigenous knowledge and science based techniques to coastal flood management.

The results showed that each of the communities have certain signs and techniques to forecast different types and magnitudes of floods. It was also observed that the rural communities are well aware of potential effects of sea level rise on their communities and willing to participate in the adaptation process. Participatory GIS approach and community based disaster management were observed as alternative paradigm for flood disaster management. The communities, however, strongly belief in engineering approach and divine solutions to solving coastal flooding challenges.

1.B.2. The Impact of Climate Change on Food Security Among Coastal Communities of Keiskamma, in the Eastern Cape, South Africa

A.J. Ribbink, *Sustainable Seas Trust*
Jan Raats, *University of Fort Hare*
Leocadia Zhou, *University of Fort Hare*
Chris de Wet, *Rhodes University*
Nolukhanyo Donyeli, *Rhodes University*
Kwezi Nkwintya, *Rhodes University*
Gavin Fraser, *Rhodes University*
Jen Snowball, *Rhodes University*
Brendon Martens, *Rhodes University*
Rob O'Donoghue, *Rhodes University*
Sebastian Lewis, *Sustainable Seas Trust*
Janine Adams, *Nelson Mandela Metropolitan University*
Nadine Strydom, *Nelson Mandela Metropolitan University*
Gillian McGregor, *Rhodes University*
Sandy de Waal, *Rhodes University*
Stephanie Stack, *Sustainable Seas Trust*
Carolyn duBois, *Sustainable Seas Trust*
Jillian Leonard, *Sustainable Seas Trust*

Abstract: Food security of impoverished coastal communities depends upon their success as fishers, on the quantity of invertebrates that they glean from intertidal and sub-tidal zones, what they obtain from the land, and from other forms of income, most of which are not sustainable. A multidisciplinary, multi-institutional study of the village of Hamburg in the Eastern Cape of South Africa evaluated the dependence of the community on natural goods and services. Initial assumptions were that in drought there would be greater dependence on the marine environment and the Keiskamma estuary and river. In wetter periods dependence on crops would dominate. Much of the work was accomplished through interviews, original scientific research and, in the case of anthropologists, living within the community to better understand lifestyles and issues.

It was found that, over several decades, the land used for cultivation had declined from 57% of the area to 3.5%, indicating little dependence on vegetables and crops. Gleaning of invertebrates from rocky shores had taken the animals to the verge of economic extinction so it is hardly worthwhile to collect. The fisheries are depleted. Water quality within the estuary is sub-standard for domestic, recreational, agricultural or maricultural use. Most families (72%) depend on social grants. Levels of education are low, skills are too limited to find alternative employment and poverty is pervading.

In the final workshop meeting, community members decided to develop a forum in order to take responsibility for their future, in the face of their deteriorating circumstances and climate change. They undertook to help develop an education and skills training centre to promote employment opportunities, to rehabilitate mussel beds, to restore water quality in the estuary and call for agricultural training to promote productivity. Mostly they wish to have opportunities for employment and to establish sustainable lifestyles.

1.B.3. Sensitivity of Coastal Lagoon Ecosystems to Climate and Related Global Changes: Developing a North African Lagoons Network

Maria Snoussi, *University Mohamed V, Morocco*
Hichem Kara, *University of Annaba, Algeria*
Gil Mahe, *IRD/HydroSciences Montpellier, France*
Najoua el Menif Trigui, *University 7 novembre a Carthage, Tunisia*

Abstract: North African coastal lagoons represent an important source of fish and shellfish, which provide a critical economic resource for the South-Mediterranean region. However many of them are experiencing acute environmental problems, which have led to a decrease in their resilience and adaptability to variability and change. Expected warming in the Mediterranean Region and changes in freshwater and sediment flows, which alter bottom sediment dynamics, salinity and oxygen levels, and nutrients, could disrupt the productivity of the trophic chain and potentially jeopardize food security and livelihoods in coastal communities that depend on these ecosystems.

The main objectives of this project are to: (1) strengthen the co-operation between scientists and managers of the region, by facilitating exchange of data and information on lagoons; (2) assess the biogeochemical budgets of the studied lagoons and their trophic status in terms of source or sink of nutrients; 3) provide a qualitative assessment of their vulnerability to climate change; (4) promote awareness of stakeholders to the goods and services provided by these ecosystems, but also to their high vulnerability to climate and non climate stressors; and (5) share best practices and disseminate them to stakeholders / managers for more effective actions to preserve and restore the lagoons.

The preliminary results on the trophic status of the six North African lagoons, using the LOICZ biogeochemical budgets showed that in terms of water Residence time, El Biban and Bizerte lagoons, with high Residence time are more sensitive to pollution than small sites with fast water renewal such as El Mellah, Ghar El Melh and Moulay Bouselham. Nador and El Mellah are net denitrifiers, while in Bizerte, Ghar el Melh and El Biban, Nitrogen fixation is the dominant process. These budgets provide perspectives for managers and other stakeholders, by signifying the scale of the ecosystem service provided by dentrification: they demonstrate its value as the mechanism by which the ecosystem could "copes" with new-nutrient loading.

1.B.4. Presentation on Environmental Services & Food Security

Mamadou I. Ouattara, *West African Science Service Center on Climate Change and Adapted Land Use (WASCAL)*

Wednesday, 14 November 2012

11:50 a.m. – 1:05 p.m.	Parallel Session 2: Research Presentations

Session 2.A: Environmental Services & Food Security

2.A.1. Sustainable Farmland Management in the Context of Climate Change in Inland Valleys of Southern Benin

P.B.I. Akponikpè, *Department of Natural Resources Management, University of Parakou, Benin Republic*
M.N. Baco, *Department of Rural Economics and Sociology, University of Parakou, Benin Republic*
E.K. Agbossou, *Department of Natural Resources Management, University of Abomey-Calavi, Benin Republic*

Abstract: Inland valleys (IV) constitute an important but underutilized land type for food production in West Africa. In southern Benin, production in these valleys is limited by lack of appropriate water management and limited access to input and output markets. This lack of appropriate water management has been exacerbated by recent climate change manifested through more frequent floods and below average rainfall years that increase the frequency of crop failure that in turn diminishes the contribution of inland valleys to food security in West Africa and Benin in particular. To expand knowledge on how to better manage IVs in Southern Benin for improved food security in the context of climate change we selected four IVs with contrasted levels of development: two (02) less or traditionally developed IVs by farmer themselves with little intervention (IVs of Dogbanlin and Gankpétin), and two (02) modernly developed inland valleys (IVs of Alahé-Centre and Houinga-Houégbé). We 1) evaluated through hydrologic meaurements (ground water level, stream flow) the suitability of current inland valleys water management schemes in the context of climate change; 2) assessed through interviews and focus group discussion farmers vulnerability to climate change and effective adaptation strategies in IVs. We found that IV managements tend to laminate (decrease and spread) both surface water level and stream discharge. The discharge lamination in the managed area increases infiltration which led to increased ground water rise in cropped areas. The modern management at Allahe performed better in this respect than the less managed IV of Dogbanlin. The main adaptation strategies implemented by farmers of the study area to cope with the various adverse effects of climate change were shifting planting dates, increased rice and vegetable cropping in IVs, the use of mineral fertilizers and planting cashew and palm trees in IVs. Income analysis showed that cropping in IVs allows farmers to have more economic gain than upland farming. The results of the project were capitalized by informing and training relevant stakeholders (students, farmers, and development actors) about the most appropriate IV management options through workshops, radio talks and posters.

2.A.2. Impact of Climate Change on Water Resources, Agriculture and Food Security in the Ethiopian Rift Valley: Risk Assessment and Adaptation Strategies for Sustainable Ecosystem Services

Tewodros Rango, *Division of Earth and Ocean Sciences, Duke University, USA*
Dagnachew Legesse, *Addis Ababa University, Department of Earth Sciences, Ethiopia*
Tenalem Ayenew, *Addis Ababa University, Department of Earth Sciences, Ethiopia*
Behailu Atlaw, *Jimma University, College of Public Health and Medical Sciences, Ethiopia*

Abstract: This work aims to investigate the linkages between climate change, water quality and availability, agriculture, and food security in the Main Ethiopian Rift (MER). The study is based on water quality assessment of 162 samples for their suitability for irrigation use as well as evaluation of about 150 farmers for their perception, adaptation and barriers to adaptation in changing climate. Based on the FAO irrigation water classification, most of the samples were found unsuitable for agricultural use due to their implications for soil permability. Preliminary modeling using a single IPCC AR5 model indicates that precipitation in the studied region may decrease even as temperature increases. These dual effects could reduce water availability and compromise water supplies for surface water dependent communities, and may increase dependence on groundwater which is already likely be detrimental to agricultural use. The most commonly observed climate related shocks are linked with lack of rainfall and variability in time. As a result, crop failure is the most common consequence of changing climate. The main adaptation mechanisms include the use of improved crops and the main barriers to implement adaptation options include the lack of: access to water, credit or saving, lack of appropriate seed, knowledge and information on weather and climate. The role of development agents has been vital to enhance the knowledge of farmers on the agriculture in the studied basin and has to continue to sustainably increase farmers' adaptability in the face of continuing climatic variability. Overall, a large fraction of the MER groundwater is of such poor quality that its expanded use would jeopardize the agricultural sector, particularly horticulture and floriculture activities. The results showed that rain-fed agriculture is increasingly vulnerable to changing climate and crop-failure is prevalent in the rift floor, where most farmers have limited access to alternative water for irrigation. The outcomes of this study should help decision-makers to design feasible strategies for adaptation measures and food security policies that help farmers better adapt with changing climate and to improve their livelihood.

2.A.3. Climate Change Adaptation for Rural Communities Dependent on Agriculture and Tourism in Marginal Farming Areas of the Hwange District, Zimbabwe

Charles Nhemachena, *Council for Scientific & Industrial Research (CSIR), South Africa*
Reneth Mano, *University of Zimbabwe, Zimbabwe*
Shakespear Mudombi, *Tshwane University of Technology, South Africa*

Abstract: The study analysed climate change adaptation for rural communities' co-dependent on agriculture and tourism industry in marginal farming areas in Hwange District. The main objective was to identify ways for strengthening local capacity for the rural communities to adapt and deal with the impacts climate change and variability. The study was based on primary data collected from a cross-sectional household survey, key informant interviews and focus group discussions with rural communities in three wards of Hwange, a semi arid district South West of Zimbabwe. The results

indicate that current climate and future climate change pose significant risks to maize-based food production in this region. Warming, and drying especially in summer, poses the highest risk. Further, the results show that most of the respondents reported that most of their adaptation efforts to address the impacts of climate change and other stressors are primarily focused on agricultural crop activities. Although livestock and tourism driven forestry- based activities are some of the key livelihoods sources, the community's adaptation confirms forces of path-dependency locking-in African agricultural families to their current crop-based livelihood strategies despite increasing vulnerability to climate change and variability. The rural communities are deploying their usual crop management strategies for coping with current seasonal climatic change including - staggered planting, multiple cropping, moisture conservation agriculture and crop-livestock interactions. All these measures are increasingly failing to cope with increasing frequency of droughts and falling mean effective rainfall. The health and vitality of both agricultural and tourism based rural livelihoods is already affected by climate change and the impact is likely to accelerate over the next decades. Given future projections of climate change for this region, semi-arid farming systems have to undergo more dramatic changes to sustain present levels of food and livelihood security than current packages of innovations already failing to cope with current seasonal climatic weather patterns. African policy makers and development planners must be made aware of the magnitude of actual and potential impacts from climate change and the steep adaptation gradient that rural agricultural communities must overcome to sustain current livelihoods in the face of climate change. Deploying appropriate climate sensitive technologies and marketing innovations to make rural agriculture work better with climate change is one possibility not yet fully exploited. Exploring rural tourism as an alternative climate resilient non agricultural source of economic livelihood could potentially absorb rural farming populations internally displaced from farming should rural agriculture fail to adapt to climate change. Assessment of uncertainties and inclusion of climate change risks should form the backbone of climate change adaptation policies in rural agricultural and rural economic development planning. Better access to climate change information and screening of appropriate technologies for climate change adaptation beyond seasonal climate adaptation and provision of technical and market incentives for farmers to invest in climate change compliant technologies should become the focus of African governments for semi arid regions most vulnerable to climate change risk. Encouraging farmers to dust up their old raincoat of yesteryear when facing a hurricane strength storm never experienced before is appropriate policy response to climate change. This study concludes that African farmers in semi arid areas of Zimbabwe are not yet fully aware nor fully prepared for the magnitude of climate change risk they are likely to face over and above the current seasonal climatic risks.

2.A.4. Assessing the adaptation mechanisms of smallholder farmers to climate change and biodiversity losses in Northern Ghana

Yaw Osei-Owusu, *Conservation Alliance International, Ghana*
Ramatu Al-Hassan, *University of Ghana*
Ernestina Doku-Marfo, *Conservation Alliance International, Ghana*

Abstract: The overall goal of the project was to assess the adaptation responses of smallholder farmers to climate change and agrobiodiversity losses. This assessment was done in the light of Ghana's Medium Term Agriculture Sector Investment Plan (METASIP) and National Biodiversity Strategy and Action Plan (NBSAP).

The research was in two components; climate change and agrobiodiversity loss. The livelihood vulnerability index and multinomial logit regression were used to measure the level of vulnerability and

determine the factors that influence farmers' choice of adaptation strategies.
Several initiatives that had been implemented in the past to address climate change and agrobiodiversity loss impacts on agriculture in northern Ghana were examined. The study revealed that the initiatives have had very little impact since majority of the farmers have abandoned most of the recommendations from these initiatives and still using the traditional strategies to cope with the impact of climate change and biodiversity loss.

The results indicate that Upper West Region is the most vulnerable. Timing of the onset of the rainy season, soil and plant health related strategies are found to be the most important climate related strategies. The major factors that influence the choice of climate related strategies are formal education, presence of a market, and accessibility to extension service. Farmer to farmer extension was seen to increase the likelihood of adoption of production and marketing practices, but reduce the tendency of adopting off-farm activities. While age positively influences adoption of soil conservation technologies, it is negatively associated with agroforestry and integrated crop management technologies.

Session 2.B: Climate Information & Knowledge Systems

2.B.1. The Role of Urban and Peri-Urban Agriculture in Enhancing Food Security and Climate Change Resilience in East and West African Cities

Shuaib Lwasa, *Makerere University, Uganda*
Bolanle Wahab, *University of Ibadan, Nigeria*
Frank Mugagga, *Makerere University, Uganda*
David Simon, *Royal Holloway University of London, UK*
Fragkias Michail, *UGEC International Project Office, Arizona State University, USA*
Corrie Griffith
David Mukukgu
Adesoji Adeyemi
John O'connors

Abstract: Considerable research on Urban and Peri-Urban Agriculture and Forestry (UPAF) in Africa has been conducted since the 1990s but not synthesized to garner knowledge on its role in building and enhancing resilience as well as adaptation to and mitigation of climate change in urban areas. This research analyzed the contributions and limitations of UPAF to livelihoods and food security, assessed eco-system services derived from and/or enhanced by UPAF in urban and peri-urban areas, synthesized UPAF's potential contributions to climate change mitigation and adaptation by identifying possible pathways for UPAF's role in building resilience in African Cities. The study was conducted with an extensive meta-analysis of both peer-reviewed and grey literature on UPAF, published in the last 15 years, in eight of the East and West African cities combined with selected field and ground verification visits in Kampala and Ibadan to draw generalizations from micro to meso scale ecosystem service provision through UPAF in African cities. Research findings indicates evidence of UPAF's role in urban livelihoods ecological resilience and potential to mitigate climate change but little evidence of policy options for scaling up and scaling out of the good practices. The research concluded that the strategies for climate change mitigation and adaptation will have to be integrated in a holistic and multi-sector approach from household to city-wide scale with a range of ecosystem services that can be potentially drawn from the urban-rural gradient.

2.B.2. The Application of Earth Observation Methods for Monitoring and Assessment of Agro-Forestry in Senegal and Ghana

Cheikh Mbow, *Cheikh Anta Diop University, Senegal*
Alla Manga, *Cheikh Anta Diop University, Senegal*
David Skole, *Michigan State University, USA*
Vincent Von Vordzogbe, *University of Ghana*
Emmanuel Morgan Attua, *University of Ghana*
Ngor Ndour, *Université de Ziguinchor, Senegal*
Raffael Hickisch, *University of Klagenfurt, Austria*
Bienvenu Sambou
Amadou Tahirou Diaw
Tidiane Sané

Abstract: We present the results of assessing effects on ecosystem service provision a large-scale reforestation project in Ferlo, Senegal entailed. A site of roughly 290 sq km has been surveyed on site, and by remote sensing carbon sequestration of these Acacia Senegal plantings has been compiled. Asides climate change mitigation in terms of carbon sequestration, various other ecosystem services have been modified or created by the plantation. Outcomes of a stakeholder survey are presented, and a possible application of choice experiments for such assessments are introduced. Building capacities in, as well as providing knowledge and a toolbox for future assessments studies of that kind is the guiding idea of this research project.

2.B.3. Presentation on Climate Information & Knowledge Systems

Pierre C. Sibiry Traore, *International Crops Research Institute for the Semi-Arid Tropics (ICRISAT)*

Abstract: Continental West Africa, the world's warmest rainfed agricultural region, offers unique climate prediction challenges and learning opportunities on adaptation. West African climates have been historically unpredictable, especially on inter-annual timescales, fueling complex stress patterns through their interactions with soils and pests. Over time, plants, farmers and ecological processes as a whole have developed singular adaptation traits and techniques to evade these constraints, consolidating the region into a primary centre of agro-biodiversity and coping capacity.

Unfortunately, the "environmental urgency" borne of the great Sahelian droughts of the 1970s and 1980s has favored a media-driven, interventionist climate where dominantly top-down applications targeted at drought risk reduction met limited success. Beyond a misleading myth of climatic homogeneity, failure to associate acute ecological sensitivities with minute changes in environmental variability patterns over time and space has led, at best, to marginal adoption of "early-maturing varieties" and at worst, to massive waste of public funding in cloud seeding experiments.

In West Africa where effects of continentality magnify the rainfall downscaling problem, scale mismatches strongly impede the translation of new climate information into actionable knowledge for small-scale farmers. We review challenges and advances in the agricultural uses of climate information based on recent ICRISAT research in the region, including early learnings from the Climate Change, Agriculture and Food Security (CCAFS) program.

2.B.4. Climate information in West Africa: Challenges of Production & Distribution

Hubert N'Djafa Ouaga, *International Union for Conservation of the Nature (IUCN)/Mali*

Abstract: In West Africa, the economy is dominated by the primary sector, including the production of agrosilvopastoral. Climate change in recent decades has had a negative impact on the development of this economic sector heavily dependent on climate, particularly in the Sahel region.

According to the 4th IPCC report, 2007, future climate predictions suggest substantial declines in rainfall in West Africa resulting in a significant decline in production. Therefore, it becomes an issues of transnational research following the development of climate information systems with questions such as: What climate information? For what type of use? Who are the users of the information? What type of partnerships are needed?

These are the centers and / or sub-regional and national institutes of research that address these topics. Overall, there appeared the need to build two major areas of work:

- Development of scientific partnerships to produce quality climate information;
- Development of national and transnational mechanisms for the implementation and use of climate products (knowledge system).

This encouraged communication and collaboration between centers and / or sub-regional and national institutes of research in the development and production of climate information and secondly it identified the need to build a climate services value chain in the sub region.

Submitted in French; translated to English.

Wednesday, 14 November 2012

2:30 p.m. – 3:45 p.m.	Parallel Session 3: Research Presentations

Session 3.A: Rural Livelihoods & Adaptation

3.A.1. Community-Based Management of Ecosystems and Natural Resources for the Improvement of Rural Livelihoods and Food Security in the Nigerian Savannah

Mayowa Johnson Fasona, *Department of Geography, University of Lagos, Nigeria*
Grace Adeniji, *Lead City University, Ibadan, Nigeria*
Felix Bayode Olorunfemi, *Nigerian Institute for Social & Economic Research, Ibadan, Nigeria*
Peter Omu Elias, *Department of Geography, University of Lagos, Nigeria*
Vide Adedayo, *Department of Geography, University of Lagos, Nigeria*

Abstract: This study examines the socio-ecological attributes required to improve natural resources management and strengthen the resilience and adaptive capacity of rural communities in the wooded savanna of Nigeria. Remote sensing, GIS and vegetal analysis methodologies were combined with participatory rural appraisal. Vegetation and land-cover conditions were extracted from satellite imageries. Site identification, geo-tagging and mapping of economic and dominant tree species was assisted by GPS. Rainfall and temperature data was analyzed for 5 stations. 191 households, 4 key informants and 5 focal groups were engaged in 11 communities across 10 LGAs in 2 States. Ministry officials and managers of protected sites were engaged. Several policy, programme and project documents were reviewed. A stakeholders' workshop was convened to present and get feedback on the preliminary results. The findings suggest that strategies to improve natural resources management, rural livelihoods and food security are well articulated in the policy and programme documents, but there were no evidence from the field to suggest their implementation. The sites are dominated by woodlands and grasses interspersed by small-holder cultivations. The protected tract of the Old Oyo National Park is the most extensive forest area. About 84% depends on fuelwood, and charcoal making remains a big trade for the male youth. About 56% agrees that trees harvested are never replanted. Over 90% believes there has been a shift in the patterns of rainfall and temperature and this is consistent with hard measured data. Farmers have started adapting by switching crops and this could be improved with local seasonal forecast. Communities are resolving resource conflicts through dialogue. Every stakeholder is willing to partner for improved natural resources management to improve rural livelihoods. Translating policy intentions into action projects is critical to improving natural resource management, rural livelihoods, and food security and to reduce rural poverty.

3.A.2. Targeting Crop Yield Increases Under Future Climate for Greater Food Security in the Upstream Catchment of Lake Victoria Basin

John Ejet Wasige, *Makerere University, Uganda*
Jane Bemigisha, *International Foundation for Science (IFS), Uganda*
Gerarld Eilu, *Makerere University, Uganda*
Timothy Lubanga, *Ministry of Disaster Preparedness, Uganda*
Adrie Mukashema, *National University of Rwanda, Rwanda*
Jean-Berchmans Mbazumatima, *Institut Geographique du Burundi (IGEBU), Burundi*
Ladislaus Kyaruzi, *Division of Environment, Vice President's Office, Tanzania*

Abstract: The potential for global climate changes to increase the risk of agriculture production in the Lake Victoria region is clear, but the actual magnitude or damage is not. It is not clear whether climate change will lead to overall positive effects or, unless adaptive measures are taken. Farmers have taken steps to adapt to climatic changes and variability. Adaptive capacity is unevenly distributed across and within society or agro-climate zones. This project aimed at assessing historical and projected climate change impacts and to identify a range of appropriate adaptation practices. Historical rainfall data was analyzed statistically to detect rainfall changes. Through a household survey, we characterize farmers' livelihood strategies with respect to managing progressive climate risks, and evaluate the impact of climate variability and climate change on crop yields. Formal priority-setting methodology was used to generate local response options to crop climate risk and a community action plan developed. Our findings suggest that climate variability and change is already occurring. Rainfall decreased in low rainfall areas by 10% while the increase in high rainfall areas was around 1% on average. Farmers perceived climate to have changed in the past 15 to 20 years. In particular, farmers observed increased incidences of drought, heavy and violent rain storms, floods, and temperature had increased. As a result, crop yields have significantly decreased which have affected the incomes of the people and their food security. The number of food deficit in year increased. Farmers are already adapting to changing climate but have limited adaptive capacity. We trained 15 undergraduates and one MSc student in climate collection and analysis/ modeling. The results present opportunities for follow up research aimed at identifying best bet farming practices to mitigate climate risk in crop production, and capacity building among farmers and agricultural officers.

3.A.3. Presentation on Rural Livelihoods & Adaptation

Bougouna Sogoba, *Association Malienne d'Eveil au Developpement Durable AMEDD*

Session 3.B: Climate Information & Knowledge Systems

3.B.1. Improving Seasonal Forecast Information for Managing On-Farm Decisions

Olivier Crespo, *Climate System Analysis Group, University of Cape Town, South Africa*
Peter Johnston, *Climate System Analysis Group, University of Cape Town, South Africa*
Mark Tadross, *Climate System Analysis Group, University of Cape Town, South Africa*
Weldemichael Tesfuhuney, *Department Soil, Crop & Climate Sciences, University of the Free State, South Africa*
Sue Walker, *Department Soil, Crop & Climate Sciences, University of the Free State, South Africa*

Abstract: Agriculture is required to feed the population and is highly sensitive to climatic parameters. Thus it is one of the most vulnerable sectors to climate change, especially over Africa where several studies have shown likely negative impacts. This study aims at testing the use of tailored downscaled climate forecasts and complementary tools for tactical decisions related to crop production.

The sites used represent semi-arid areas where maize production takes place in the Free State, South Africa. The APSIM crop model was used to simulate a range of sowing dates in a 3 months window around the usual planting date, as well as a fertilization amount ranging from 0 to 150kg/ha applied at sowing. Each combination (sowing date, fertiliser amount) was simulated under 10 seasonal forecast alternatives. The simulated yield and extractable soil water are used to guide the optimisation process. As an output example, the figure depicts the decision space explored for Bothaville under seasonal forecast computed for 1989. Within the whole space explored, the gray and red cells have been selected as optimal. In that case, the results suggest that an early November sowing and fertilization amount ranging from 50 to 150kg/ha depending on the sowing date will lead to the most efficient yield – extractable soil water combination. We compared the results achieved for the years 1990 to 1999 for 3 sites subject to seasonal forecasts with the crop yields simulated subject to the actual weather data. Though it is not a perfect match it shows a promising capacity to point in the right direction. Those first results have been taken with stakeholders in the Free State.

The limitations of this explorative study (e.g. hindcast, historical data) are to be relaxed in order to exploit the technique in the field. Ultimately the approach could be used as a new agricultural decision tool translating seasonal forecast information into agricultural impacts.

3.B.2. Presentation on Climate Information & Knowledge Systems

Kwadwo Owusu, *University of Ghana*

3.B.3. Engaging Farmers and Climatologists in Adaptation to Climate Variability and Change in the Okavango Delta of Botswana

Oluwatoyin Dare Kolawole, *Okavango Research Institute, University of Botswana, Botswana*
Piotr Wolski, *Climate Systems Analysis Group (CSAG), University of Cape Town, South Africa*
Barbara Ngwenya, *Okavango Research Institute, University of Botswana, Botswana*
Gagoitseope Mmopelwa, *Okavango Research Institute, University of Botswana, Botswana*
Olekae Thakadu, *Okavango Research Institute, University of Botswana, Botswana*

Abstract: The research specifically addresses the questions of how local farmers and weather scientists can work together in order to mitigate climate change and variability in the Okavango Delta of Botswana.

Recent trends in agriculture-related weather variables available from country's climate services, as well as in freely available satellite rainfall products were analyzed. We have also furthered the development of a seasonal hydrological forecasting system for the study area, based on seasonal weather forecast from Global Forecasting Centre for Southern Africa (GFCSA). The utility of these in the context of supporting farmer's information needs were assessed. A multi-stage sampling procedure was employed to sample a total of 592 households heads (both men and women) in eight rural communities in Ngamiland of Botswana from August 2011 to February 2012. Also, some 19 scientists were purposively selected for interviewing in the study. While interview schedules were used in eliciting quantitative information from small farmers, questionanires were used in eliciting information from the scientists. Further, key informant interviews, focus group and workshops were used to generate qualitative information from both farmers and scientists. Descriptive (frequency, percentages, mean, standard deviation, etc.) and inferential (correlation and regression) statistics were used in summarizing the data and making deductions, respectively.

Analysis of satellite rainfall products indicated that there was a consistent increase in total annual rainfall throughout the region in the last 10 years, accompanied by an increase in number of rain days, and reduction of duration of dry spells. No change in rainfall intensity was observed. Duration of the rainy season extended, with progressively earlier onset and later termination. Overall long-term trends are, however, minimal. There is a progressive increase in region's temperatures leading to increase in potential evaporation. Findings from social survey show that farmers' age ($t = 2.321$), education level ($t = 1.548$), number of years engaged in farming ($r = 0.105$), sources of weather information ($t = 2.333$), knowledge of weather forecasting ($t = 6.114$) and decision on farming practices ($t = -8.594$) either had a significant relationship or correlation with their perceptions about the nature of both local and scientific weather information. Nonetheless, there was a significant difference in farmers' perceptions and those of the scientists about the nature of both local and western knowledge. Climate variability mitigation measures utilized by farmers are mainly informed by their ability to predict the weather and make decisions on crop type selection in a given season. Both farmers and scientists agreed that there was need for the provision of advisory service and scheduled meetings through which both stakeholders could cross-fertilize ideas on weather forecasting knowledge.

Research Presentations: Titles & Abstracts
Session 3.B: Climate Information & Knowledge Systems

3.B.4. Knowledge dissemination as an Intervention towards Adaptation to Climate Change in Africa

Moussa Na Abou Mamouda, *ENDA Energy-Environment-Development, Senegal*

Abstract: Understanding climate change and addressing the consequences is critical in reducing the vulnerability of human and natural systems. This is particularly crucial for decision makers and other stakeholder groups in Africa where natural resource-based poor communities rely mostly on highly climate-sensitive livelihoods. Adaptation appears to be challenging, as it requires a good understanding of current and future impacts, the magnitude and timeframes involved so as to reduce vulnerability. Adaptation practitioners, development agencies, decision/policy makers, researchers and the vulnerable groups need quality climate information to address existing impacts of climate change and to climate-proof future development plans and programs.

Climate information and services take advantage of the recent improvements in climate prediction and climate change scenarios. Some challenges exist in terms of the availability of actionable information for decision-making in all climate-sensitive sectors. Integrating climate information with information from other sectors requires close collaboration between agencies and experts from different fields.

Information must be presented in user-friendly formats so that users can easily access it via open platforms (like AfricaAdapt), public media or tailored delivery channels. Demand driven approach is needed to address the very specific needs of users in so different socio economic sectors like health, water, DRR or agriculture. Multi-level capacity building is essential to ensuring that people fully understand the climate products and can apply climate information efficiently. An emerging lesson we've learned with AfricaAdapt was that building trust between information providers and users is critical in facilitating sharing of relevant climate information. Governments must invest in climate information and in capacity development especially through budget allocations.

Knowledge systems encompass the tools (knowledge platforms), the knowledge stars (brokers, translators, intermediaries), the knowledge producers and the end users. Some say, "Information is food". But there seem to be a proliferation of information/knowledge platforms. Is this positive or negative?

Notes

Global Environmental Change Research Learning Forum
14-16 November 2012
Accra, Ghana

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