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**CTA**

**OUAGADOUGOU, Burkina Faso**  
**26-31 October 2008**

CTA ANNUAL SEMINAR 2008

# Implications of climate change for sustainable agricultural production systems in ACP countries

Getting information and communication strategies right



## COMPILATION DOCUMENT

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# COMPILATION DOCUMENT

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# TABLE OF CONTENTS

FOREWORD	5
<hr/>	
I. INTRODUCTION	8
<hr/>	
II. MEDIA COVERAGE	10
<hr/>	
2.1. INTRODUCTION	10
2.2. TV PROGRAMME ON CLIMATE CHANGE	11
<hr/>	
III. OUTCOMES	12
<hr/>	
3.1. ELECTRONIC DISCUSSION	12
3.2. THE OUAGADOUGOU DECLARATION	14
3.3. SYNTHESIS REPORT	15
3.4. THE SEMINAR IN FIGURES	23
<hr/>	
IV. ABSTRACTS	24
<hr/>	
4.1. KEYNOTE PAPERS AND CROSS-CUTTING THEMES	24
4.2. PARALLEL SESSIONS	28
A. CROPPING SYSTEMS	28
B. AGRO-PASTORAL SYSTEMS	34
C. BIOPHYSICAL ISSUES	43
D. SOCIO-ECONOMIC ISSUES	47
4.3. INFORMATION AND COMMUNICATION STRATEGIES	52
<hr/>	
V. ANNEXES	56
<hr/>	
5.1. PROGRAMME	56
5.2. LIST OF PARTICIPANTS	66
5.3. OPENING REMARKS	82
5.4. CLOSING REMARKS	90
5.5. RADIO SCRIPT COMPETITION WINNERS	98
5.6. ADAPTATION ACTIVITIES ON CLIMATE CHANGE IN ACP	99
<hr/>	
VI. ACRONYMS AND ABBREVIATIONS	100
<hr/>	

# FOREWORD

Climate change is one of the most frightening threats to sustainable development. The situation has been aggravated over the past few years by a host of crises - the increase in oil prices, the food crisis that led to soaring cereal prices, and the real estate crisis that led to the financial crisis and to global recession.

The impact of greenhouse gases is clearly visible in the threats to food security, crop and stock production, and natural resources management. Because of poverty, the developing countries in general, and more specifically the African, Caribbean and Pacific (ACP) countries, are the most sensitive to the harmful effects of climate change.

In his book entitled *Collapse: How Societies Choose to Fail or Succeed*, Professor Jared M. Diamond of the University of California describes factors that historically have contributed to the disappearance of societies, including deforestation, soil erosion, salinisation, fertility loss, depletion of natural resources and population growth.



Now, as we go through the gravest climate change crises, we must recognise the timeliness of these themes.

Former Vice President Al Gore, in his film *An Inconvenient Truth*, gives impressive evidence of the interrelations between the problems of climate change and the exponential world population growth. With an annual population growth of 87 million inhabitants (equivalent to the present population of Germany), the world population has risen from 1 billion in 1800 to 6.5 billion today, and should reach about 9 billion by the year 2050.

All these people need to eat, yet experts feel that agriculture is responsible for about 30% of climate change.

Considering this situation, two issues are essential:

- We cannot continue with 'business as usual'. We have to change our models, values and standards if we want to protect the Earth and be able to feed our children and grandchildren;
- We need to secure substantial investments for agriculture and to slow down the effects of climate change.

## Is the world capable of facing these challenges?

According to Lord Stern, it would take only about 1% of the gross domestic product (GDP - about \$US550 billion) - to stabilise CO<sub>2</sub> emissions at a level of between 500 and 550 ppm. These figures may make us dizzy, but are no more than the amount of money recommended by the European Union countries to solve the financial crisis.

So this is a question of priorities and political determination, although we should not weigh the resolution of problems connected to the financial crisis against investments that are essential in the fight against the harmful effects of climate change.

But the fight against climate change is also an opportunity for sustainable agricultural development in the ACP countries, insofar as it enables us to improve natural resource management (management of water, soils, forests, marine resources, and new and renewable sources of energy).



This explains the continued topicality of the **Maputo Declaration**, adopted by the Heads of State of the African Union, who committed themselves in 2005 to devote 10% of the GDP to agricultural development by the year 2010. Achieving this objective before the present-day crises would have been difficult for the ACP countries, and has not been made easier by the current international economic situation.

More than 12 years ago in his film *Le Choix*, which received an award at the Panafrican Film and Television Festival of Ouagadougou (FESPACO) in 1987, Mr Idrissa Oedraogo warned us about the harmful effects of climate change. I encourage you to see the film. It tells the story of a Ouahigouya family who no longer had enough food and so decided to migrate to Bobo Dioulasso, where the rangelands were greener.

### **Considering the magnitude of climate change, does the world, like the Ouahigouya family in 1986, have a choice?**

Recommendations from experts all concur. The time to act is now. Tomorrow it will be too late. All the studies show that the present cost of adaptation and attenuation programmes is far lower than the cost of overcoming natural disaster generated by climate change in the future.

When organising this seminar on the ‘**Implications of climate change for sustainable agricultural production systems in ACP countries**’, CTA did not have a choice either. This theme was essential and inevitable, since the pillars of CTA’s mandate are to facilitate access to information and build up the capacity of ACP actors to manage information and communication in themes related to agricultural and rural development - including climate change.

Together with our partners, we decided to work on themes at the grassroots level with people who have field experience and can give practical examples of climate change adaptation strategies. We hope that they, in turn, can create awareness among political decision-makers on the challenges of climate change.

From 3-5 June 2008, the Food and Agriculture Organization of the UN (FAO) held a high-level conference in Rome, Italy on ‘World food security: the challenges of climate change and bio-energy’ ([www.fao.org/foodclimate/hlc-home/en](http://www.fao.org/foodclimate/hlc-home/en)). The conference showed the impact of climate change on agricultural development and food/nutritional security in the most vulnerable countries. It covered the themes discussed at the Ouagadougou conference. By focusing on information and communication strategies, the Ouagadougou seminar covered a very important aspect that was complementary to the FAO conference.

Providing well adapted information to the right actors is essential for formulating appropriate intervention strategies and strategies to prevent the harmful effects of climate change on the environment, agriculture and livestock production in the ACP countries. In this vein, I am pleased that the **French Agricultural Research Centre for International Development (CIRAD)** has developed a **Scientific and Technical Information System (SIST)** as a research engine designed especially for research scientists. SIST makes it easy to find not only the contents of web pages, but also grey literature on a variety of development-related subjects, including climate change.

The Ouagadougou seminar is part of a series of CTA initiatives on climate change that include the Policy Briefs (Brussels, February 2008) and a special issue of *Spore* (August 2008).

CTA hopes to contribute to overall thinking on capacity-building for ACP partners, and to the formulation of climate change information and communication strategies.

This publication provides a summary of a very busy week's agenda, especially the media coverage, lessons from e-discussions, a summary of the main recommendations and conclusions of the seminar, and abstracts of the presentations. The document is available online on the seminar's website, <http://ctaseminar2008.cta.int>.

I should like to take this opportunity to thank all our partners who helped organise the seminar: the Government of Burkina Faso, represented by the Ministry of Agriculture, Rural Hydraulics and Fisheries, the members of the steering committee, GTZ, the International Development Research Centre, and the participants who contributed so actively.

I hope you will find this document interesting to read, and would like to encourage you to share it with your colleagues and with anyone who can contribute to implementing the seminar recommendations.

Dr Hansjörg Neun  
Director, CTA

A handwritten signature in black ink, appearing to read 'Dr. Hansjörg Neun', with a stylized flourish at the end.

# INTRODUCTION

**A**griculture is the main driving force of growth in most developing countries. It accounts for some 30% of GDP, is the main source of food, and employs 70-80% of the population. Yet the harmful effects of climate change seriously threaten this sector, which is of strategic importance in the fight against poverty in the ACP countries.

It is generally recognised that the developing countries in general, and especially the ACP countries, carry little responsibility for greenhouse gas emissions. But because of their poverty, they are the most vulnerable to the harmful effects of climate change. Their vulnerability is heightened by insufficient equipment for weather forecasting and climate variation observation, and by insufficient access to the information needed to cope with these challenges.

Supplying information adapted to the various stakeholders' needs is decisive in efforts to formulate appropriate strategies for actions against, and prevention of, the harmful effects of climate change on the environment and on sustainable agricultural production systems. By facilitating dialogue among the various actors, information and communication technologies contribute to the effectiveness of intervention strategies.

With reference to this situation, CTA organised an international seminar on the **'Implications of climate change for sustainable agricultural production systems in ACP countries: getting information and communication strategies right'**, in Ouagadougou, Burkina Faso from 27-31 October 2008. The objectives of the seminar were to:

- make the political decision-makers and the rural communities aware of the impact of climate change on agricultural and rural development;
- identify information and communication needed for the implementation of programmes that contribute to the attenuation of, and adaptation to, the harmful effects of climate change on agricultural production systems;
- identify appropriate response strategies.



*Head table, Opening Ceremony*

The seminar stressed practical aspects and tangible responses that the ACP rural communities are putting forth or could put forth in the short or medium term. As preparation for the seminar, over 25 articles and 15 radio scripts on activities by ACP rural communities to adapt to climate change were produced and put on the seminar's website. Further, a special TV programme on Climate Change was made, and broadcast by over 40 television channels in ACP countries and elsewhere.

The seminar also benefited from the results of a pre-conference e-discussion with input from over 550 experts. The goal of the e-discussion was to allow the experts and persons who could not attend the seminar to share their opinions on the various themes of the seminar.





*View of the participants at the seminar*

Dr Achim Steiner, Executive Director of the United Nations Environment Programme (UNEP), set the tone in his video message to the opening session of the seminar (<http://ctaseminar2008.cta.int>).

Over 255 experts from 45 countries, mainly in the ACP regions and the European Union, heard more than 85 enlightening presentations and participated in very interesting discussions on:

- best practices in sustainable soil and forest management to curtail soil degradation and attenuate the impacts of climate change;
- problems and development of bioenergies in ACP countries;
- the effects of climate change on agro-pastoral communities and cropping systems;
- the contribution of livestock production to greenhouse gas emissions and the positive effects of improved agro-sylvo-pastoral systems management on the reduction of such emissions.

These discussions paved the way to the identification and proposal of information and communication strategies on climate change for politicians and rural communities, mainly relating to:

- the development of community radio broadcasting, cell phones and exchange visits between rural communities, focused on good initiatives;
- the dissemination of agro-meteorological information on floods, rainfall, droughts, and crop water use to help rural communities cope more easily with the impacts of climate change;
- the dissemination of knowledge on climate change to the local communities, and local adaptation strategies;
- support for regional, national and local initiatives in formulating and implementing information and communication strategies on climate change, following our seminar in the ACP regions.

The seminar facilitated information-sharing on current good practices, successful initiatives and other climate change adaptation strategies being developed in the ACP countries. The results of these meetings are presented in the Ouagadougou Declaration and the summary report.

# MEDIA COVERAGE

## GETTING OUR COMMUNICATION STRATEGIES RIGHT - MEDIA ASPECTS

Given the emphasis on information and communication technology/management (ICT/ICM) strategies to combat the negative effects of climate change, it is only fitting that this seminar, subtitled 'Getting information and communication strategies right', itself relied on a gamut of ICT/ICM strategies to communicate.

CTA is perhaps best known for its publications, and a display featuring the Centre's publications is always prominent. This year the seminar also featured a handover of publications to deserving Burkinabe organisations.

Radio, TV, press and internet were all utilised in the communication and media strategy for the seminar.

The bilingual website featured the scripts of the climate change scriptwriting contest launched in October 2007 in collaboration with Farm Radio, as well as links to the audio radio broadcasts of the two best scripts produced by Farm Radio in collaboration with FAO for World Food Day. The winners of the competition were widely publicised and their scripts were hosted on the website developed for the seminar at <http://ctaseminar2008.cta.int>.

Four journalists, two Francophone and two Anglophone, were invited to attend the seminar and be part of the news team that produced an eight-page daily journal, *Climate in Peril*, every day in French and English, to recount each day's events. The reports are also available on the seminar website.

A special live television programme also featured in the media plan. Produced in collaboration with the French company People TV, the programme featured CTA's Director, Dr Hansjörg Neun, and included experts at the seminar. The programme showcased a series of mini-documentaries of climate change adaptation strategies across the six ACP regions.

The bilingual website for the seminar hosted a number of important resources as well as a wealth of climate change information. During the seminar, it also hosted a seminar blog, a video blog open to participants, with daily reports in both French and English.

The e-discussion capitalised on internet technology to give a voice to over 500 participants, many of whom would not have been able to take part in the seminar itself.

The seminar website also included a blog and a photo blog for all participants to share their views of the workshop. A more low-tech feedback mechanism was also made available to all participants in the form of a democracy wall, where participants could write comments about the overall experience.

Following on the recommendations of CTA's Information Outreach and Impact Review (INFOIR) Study earlier in 2008, which identified the need to intensify the distribution of certain 'must-read' CTA publications, CTA has begun a more targeted distribution of its publications to ACP organisations. During the seminar, the Centre took the opportunity of being on the ground to hand over the first tranche of publications to Burkina-based organisations: Institut de l'Environnement et de Recherches Agricoles (INERA), Institut Africain pour le Développement Economique et Social (INADES-Formation), Resacifroa, and the Fédération Nationale des Organizations Paysannes (FENOP).

As usual, CTA displayed the range of publications produced by the Centre and shared all the displayed publications with participants at the end of the seminar.

A special issue of *Spore*, on Climate Change, was produced in August 2008. The print version was widely distributed far and wide, as well as to all participants at the Seminar. A special website for the electronic was also developed and hosted on the Spore portal within the CTA website (<http://spore.cta.int/climatechange/en>).





## TV PROGRAMME ON CLIMATE CHANGE

### Introduction

The special TV programme was made as an input to the seminar on the 'Implications of climate change for sustainable agricultural production systems in ACP countries'. This one-hour broadcast was made together with the People TV production company. It is composed of five thematic reports and one on-set filming session in Ouagadougou, and was shown on more than 40 channels, mainly in Africa and but also in Europe and the USA. The video of this programme was projected through various media and was distributed to partners.

### Objective

The aim of this TV programme was to present climate change-related issues in ACP countries and to show how rural communities adapt to climate change in the various ACP agro-ecological zones.

The target group was mainly political decision-makers and rural communities (farmers), but the programme is also appropriate for a larger public.

### Production of the special broadcast

The programme covers five broad themes: forests, ecosystems, land and water management, agro-forestry and pastoralism. Five documentary films of about 5 minutes each were filmed in Cameroon, Kenya, Mali, Niger and Uganda. An edited version of about 3 minutes long, showing the main impacts of climate change in the Caribbean and Pacific islands, was made using images obtained from the World Meteorological Organization.

The reports focused on the following five projects.

- A community forest project in Cameroon. The report shows rural communities' initiatives with sustainable forestry management and their contribution to the preservation of forests in the Congo Basin, one of the three lungs of the planet.
- An ecosystem rehabilitation project on the Niger River in Mali that has been coordinated by the International Union for Conservation of Nature (IUCN) for the past 20 years.
- A soil restoration project established by the Niger government together with German Development Cooperation in Ouallam region, north of Niamey. Niger is a very good example of the fight against desertification and many initiatives are taken, especially in the southern part of the country. The report presents techniques of soil management and water conservation.
- A agro-forestry project in Uganda, implemented by African Highlands Initiative, a partner of the World Agroforestry Centre (International Centre for Research in Agro-forestry, ICRAF).
- An information and communication project with the Maasai pastoral communities in Kenya using mobile telephones. This is an International Livestock Research Institute (ILRI) project that shows the Maasai using portable phones to decide on the paths their cattle should trek during transhumance, based on available grazing, the price of cattle and weather forecasts.

These programmes were made in French and English and were presented in Ouagadougou during the on-set filming. Experts were invited to give additional information on the situation.

### Distribution

The programme has been broadcast in two parts, 30 minutes each, by more than 40 television stations that are partners of the People TV audiovisual production company. CTA distributed DVDs of the programme to the seminar participants and more widely to CTA partners.

# OUTCOMES

## ELECTRONIC DISCUSSION

### Introduction

As a strategic move to improve communication and awareness of the impacts of climate change on rural economies in the ACP regions, CTA organised a Dgroup discussion prior to the seminar, with the objective of providing the opportunity for various experts to contribute their ideas, in particular for those who could not attend the seminar, to share opinions and thoughts on the seminar themes. This Dgroup discussion was moderated by Dr Yemi Akinbamijo and Dr Nouala Simplicie from the Interafrican Bureau for Animal Resources (IBAR), who also presented the main output in a plenary session of the seminar.

The following questions were suggested.

- What are the climate change-related problems, constraints and opportunities affecting the production system on which you are working?
- What priority solutions/options could be adopted to cope with these problems at decision-making and rural community level? And what lessons/good practices can be derived from the solutions/options that have been implemented and tested?
- What resources and procedures were used to implement the priority options?
- What information/communication tools and strategies were (or should be) implemented? What lessons/good practices can be derived from the information/communication tools and strategies being used? How could they be made more effective?

### Participation

The discussion on the Dgroups website ([www.dgroups.org](http://www.dgroups.org)) was the first of the top five discussions for several weeks. More than 500 experts with very different profiles actively participated, and 282 of their contributions have been shared.

## Results

### Main actions and best practices identified

Participants in the e-discussion identified actions/activities to be implemented to mitigate climate change impacts on agricultural production systems in ACP countries, both at policy-maker and community levels. The following section contains collated information obtained over 6 weeks of intensive electronic exchange.

At the *policy level*, participants advised the following.

- Mainstream climate change into development policy via Poverty Reduction Strategy Papers (PRSPs), the UN Framework Convention on Climate Change (UNFCCC), National Adaptation Programmes of Action (NAPAs), and Sector Wide Approaches (SWAp)s; ratify charters and treaties on diminishing greenhouse emissions by many of the polluting countries.
- Establish a soils information system that could include information on climate, the state of soil utilisation, degradation and health. Once such a system is linked to a dynamic soil carbon model and socio-economic module, it can be used to assess the eco-technological and socio-economic potential for carbon sequestration projects in the context of the Clean Development Mechanism (CDM) of the Kyoto Protocol.
- Promote a participatory approach in the decision-making process and avoid top-down approaches.
- Create strong synergies between the various actors (set up inter-ministerial technical commissions on climate change; involve the private sector; develop synergy among rural and scientific communities; enhance the involvement of research/development and funding institutions).
- Revisit land tenure policies.

At the *community level*, participants advised the following.

- Participate in evaluating the impacts of climate change and in selecting adaptation strategies.
- Promote community forests and adoption of sustainable soil restoration and management techniques (contour farming, crop diversification, etc.).
- Encourage the uptake of processes to shift responsibility for natural resources management to the pastoral and agro-pastoral communities.
- Strengthen the capacities of the rural communities and the decentralisation process; promote exchange relations and information sharing (e.g. through exchange visits).
- Develop literacy in order to give producers access to political intelligence and information on production techniques, and encourage training in local committees on questions of climate change.



- Improve the currently very limited role of women in the dissemination of extension work activities and in decision-making.
- Sensitise rural populations to the question of sustainable use of all forestry resources, including timber.
- Establish systems and mechanisms to ensure respect of the laws and regulations and to involve customary and traditional authorities in creating awareness.

### **Information and Communication Strategies**

Despite the abundance of knowledge and information on the effects of climate change on agricultural production systems, its impacts in ACP countries continue to increase and are a serious threat to the achievement of the Millennium Development Goals. The role of information in moving forward the climate change agenda and communicating relevant information to the public is very crucial. During the e-discussion, participants were asked to share experiences, lessons learnt and best practices on information and communication developed, or to be developed, in ACP countries.

#### *Policies to be implemented*

*At the policy level*, the priority should be the need to improve access by local communities to weather- and climate-related information, and to knowledge of the best coping strategies. This should be done by the following means.

1. Develop information and communication strategies at national and regional levels that include specific goals and targets, and ensure communication is not just one way.
2. Develop climate change platforms that provide a space where scientists, researchers, decision-makers and practitioners could share their knowledge and experience on climate change adaptation and engage in a process of mutual learning. They could also provide timely and sound information to communicators.
3. Build capacity to interpret climate change information at national and community levels.
4. Facilitate development of Local Environmental Action Plans through participatory environmental planning workshops.
5. Convene national or regional workshops where meteorological services department share information on seasonal forecasts with agricultural officers.
6. Promote and support daily television and radio programmes on impacts of climate change.
7. Provide regularly updated information on climate change issues.

For these information and communication strategies to be more efficient, climate change could be included in the education curriculum from primary school onwards. The climate information disseminated should be user-friendly and disseminated in local languages commonly spoken in specific regions.

#### *Community-level strategies*

At the community level, the strategies to improve communication should centre on the following.

- Promote village schools and field days where farmers share experiences of good farming practices, and agricultural shows where best or sustainable adaptive strategies are given awards.
- Participate in the identification and the design of communication strategies through community workshops and the development of community-based frameworks for monitoring environmental change.
- Promote village environmental news teams, who would monitor and regularly report any form of environmental issues.
- Establish information centres to provide information to communities and promote the use of mobile phone to share/exchange information on weather forecasts.
- Promote local radio, 'Radio Rural' (FM stations).

## THE OUAGADOUGOU DECLARATION

The International Seminar ‘Implications of climate change for sustainable agricultural production systems in ACP countries: getting information and communication strategies right’ was organised by the Technical Centre for Agricultural and Rural Cooperation (CTA) in Ouagadougou, Burkina Faso from 26-31 October 2008. The seminar was co-sponsored by the International Development Research Centre (IDRC), German Technical Cooperation (GTZ) and Recherches interdisciplinaires et participatives sur les interactions entre les écosystèmes, le climat et les sociétés en Afrique de l’ouest (RIPIECISA). The seminar was attended by 225 participants from 45 countries representing the six ACP regions, national institutions from EU countries, and regional and international organisations.

More than 70% of the population living in the ACP countries work in the agricultural sector. The environmental and social consequences of climate change, especially for the poor, put their livelihoods at risk. Increases in temperature, declines in fresh water availability, sea-level rise, increased frequency and intensity of extreme events, and shifting of cropping zones all impact agriculture and the related food sector. The serious problems of soil degradation and desertification, especially in Africa, are likely to be exacerbated by climate change through accelerated erosion, fertility depletion, salinisation and acidification. Hence addressing the livelihood and food security issues of the rural communities in the various agro-ecological zones of the ACP countries is an immediate priority. Development of appropriate adaptation options depends on the availability of accurate information on climate change impacts, and reliable communication strategies are needed to empower poor communities.

This seminar focused on the effects of climate change on cropping systems, mixed agriculture-livestock production systems, pastoral systems and coastal communities. Several cross-cutting issues were also reviewed, including vulnerability and risk, land degradation, renewable energy/biofuels, water management, forestry, biodiversity and ecosystem services. Media events were organised focusing on information-sharing on the given themes within the six ACP regions and on creating awareness among decision-makers.

The seminar identified several key recommendations, knowledge gaps and opportunities for policy-makers, researchers and extension systems, international organisations and NGOs to implement programmes designed to enhance access to climate change information and minimise short- and long-term vulnerability of the ACP countries to climate change. Principal recommendations are as follows.

- Urgently implement climate change adaptation measures in the ACP region with a focus on climate change hot spots, early warning systems, disaster risk management, and incentives for effective stakeholder participation in adopting better agricultural and land-use practices.
- Ensure timely provision of agro-meteorological forecasts and products on temperature, rainfall, droughts and floods, crop water use, pests and diseases to assist the farming community in coping with climate change impacts.
- Develop rigorous research and policy analysis into the impacts of biofuel development on agricultural production systems and food security.
- Undertake, on a priority basis, research on appropriate livestock production systems that help reduce the contribution of livestock to global warming and, at the same time, meet the animal protein requirements of the growing populations.
- Provide timely information and support capacity-building within the ACP countries on financial mechanisms and investment flows that support climate change adaptation, mitigation and technology development, such as carbon credits/carbon sequestration for reduced emissions from forest and agricultural land, at national and local levels.
- Take steps to ensure adequate and consistent funding is made available for climate change adaptation as soon as possible. Ensure funds are responsive to local needs and priorities, and allocated on a sustainable basis.
- Establish task forces in each of the six ACP regions to follow up on the implementation of the recommendations specific to each region.

The seminar urges the development partners and the private sector to fund the implementation of programmes that reflect the recommendations outlined above, to deal with the mitigation and adaptation to climate change while advancing food security in the ACP region. The participants thank the Government of Burkina Faso for hosting the seminar and providing all the necessary facilities. For more information on the outcomes of the seminar, please visit the website: <http://ctaseminar2008.cta.int/>.

31 October 2008, Ouagadougou, Burkina Faso



## SYNTHESIS REPORT

### UNDERSTANDING AND CONFRONTING CLIMATE CHANGE: WHAT CAN BE DONE?

#### Objectives

The objective of the CTA Seminar 2008 - 'Implications of climate change for sustainable agricultural production systems in ACP countries: getting information and communication strategies right' was to raise the awareness of policy-makers and rural communities concerning the way climate change is affecting agriculture and rural development. It also aimed to identify the information needed to develop strategies to secure local livelihoods and ensure global food supplies.

#### Generating and exchanging information

Prior to the seminar, information was generated by an e-discussion - with 550 participants - that focused on four key farming systems, and a competition that encouraged 25 journalists to write about local experiences of climate change. Web-based sources of information on climate change were also identified for the seminar website.

During the seminar, more than 225 experts, including scientists, policy-makers, development workers, donors and journalists, presented evidence of climate change and discussed the technical options for adaptation and mitigation in multidisciplinary working sessions. Field trips made during the seminar showed how communities were using agro-sylvo-pastoral techniques, forestry technologies and anti-erosion strategies to deal with increasing desertification.

Specially commissioned, short TV documentary studies of climate change - Initiative Africa ([www.initiative-africa.com](http://www.initiative-africa.com)) - were shown during the seminar and later broadcast on more than 40 national television channels in ACP countries. CTA is also disseminating seminar results via its website and in specially targeted publications. A special issue of *Spore* on climate change has also been produced and disseminated widely in ACP countries.

#### Seminar results

The impact of climate change on the agricultural sectors of ACP countries was discussed in terms of its effects on the productivity of cropping and agro-pastoral systems, and its impacts on the biophysical and socio-economic structures of rural life. In this context, recommendations were made about information strategies that could effectively support policy-making and communal action. Estimates suggest climate change will cause a serious fall in agricultural productivity - some estimates suggest between 9 and 21% - leading to conflict over resources and a movement out of agro-pastoral activities. Adaptation and mitigation strategies should therefore include the following.

#### Adaptation and mitigation strategies

##### *Agro-pastoral systems*

The need to provide feed crops or find pasture and forage is a critical factor in maintaining the productivity of livestock within the food chain. Henning Steinfeld et al., in the book *Livestock's Long Shadow* (FAO, 2006), concluded that livestock's contribution to climate change has become a major policy issue. However, changes in livestock management practices can contribute to mitigating the effects of climate change, and legislative and institutional interventions can be used to avert conflicts over water and grazing land. The principal impacts of climate change on agro-pastoral systems are:

- inconsistent productivity due to variability in pastoral and water resources;
- reduction in pastoral land as a result of desertification and agricultural activities;
- spread of disease due to changes in the environment and ecosystem imbalances;
- increasing conflicts between pastoralists and farmers.

Adaptation and mitigation strategies should therefore include:

- identifying climate change hotspots and sketching new and evolving risk scenarios;
- establishing weather and climate early-warning systems at regional, national and district levels to support farm management decisions and enable disaster risk management;
- strengthening animal and plant health services and investing in the application of science and technology to ensure early control, detection and rapid response systems as the risks to human, animal and plant health increase with the growing complexity of market chains;
- encouraging new fodder resource-management systems to check the impact of climate change - exacerbated by overgrazing - on pasture and rangeland biodiversity;

- intensifying genetic improvement and cross-breeding to increase livestock resilience;
- developing livestock management systems that produce less anthropogenic greenhouse gas emissions, but are capable of responding to the rapidly growing demand for livestock products - these new systems should take into consideration the cultural, social and risk management roles livestock play in agro-pastoral systems;
- implementing moderate grazing intensities to avoid the problems associated with overgrazing and to facilitate carbon sequestration;
- monitoring livestock behaviour and movements using participatory techniques to provide data for resource mapping, establishing secure migration routes and developing emergency contingency plans;
- stimulating funding for integrated research and maintaining donor commitment to supporting projects based on IPM, catchment rehabilitation and the documentation of best practices;
- developing systems to monitor and evaluate policies and interventions to mitigate the effects of climate change, with special reference to bottom-up approaches.

#### *Fisheries and aquaculture*

There is increasing emphasis on the need to focus on the impact of climate change on fisheries ecosystems and the food and nutritional security and livelihoods of fish-dependent communities. In ACP countries, fishing communities in general are impoverished and ill-prepared to adapt to the negative impacts of climate change. These include shifts in the geographical distribution and quality of fish that, in turn, affect prices and production costs.

The principal impacts of climate change on fisheries and aquaculture are:

- disturbances in fish fertility cycles;
- increased mortality among young fish due to rising water temperatures, particularly in lagoons and rivers;
- effects of strong salinity in these surroundings exacerbated by the penetration of sea water that seriously affects fishery resources and already fragile ecologies;
- frequent fish migration into deep water.



Adaptation and mitigation strategies should therefore include:

- initiating studies into the socio-economic resilience and capacity for adaptation of fish-dependent communities, given rising seas levels, storms, changing thermal structures and changes in the hydrological cycles of lakes, rivers and lagoons;
- compiling data that support policies to ensure appropriate livelihood diversification, natural resource management and technical innovation, as well as securing the financial, legal and aquatic property rights of communities dependent on fishing and aquaculture;
- increasing the coherence of national policies for climate-proofing fishery development initiatives;
- developing policies to respond to the risk of flooding in coastal areas and facilitate coastal erosion control.

#### *Cropping systems*

High temperatures, droughts and flooding cause an absolute reduction in food and vegetative biomass. Plant species are being lost, and increasing amounts of expensive pesticide are needed to deal with the growing incidence of crop pests and diseases - costs that are passed on to the consumer as food prices continue to rise. In addition, the increased use of inorganic fertiliser to support production under these changing conditions has led to contaminated water systems, causing polluted drinking water, fish kill and negative effects on the environment.

The principal impacts of climate change on cropping systems include:

- reduced production due to changing rainfall patterns;
- emerging diseases, pests and vectors;
- spatial redistribution of pests;
- erratic rainfall patterns.



Adaptation and mitigation strategies should therefore include:

- collecting robust data on the impact of climate change on croplands and potential yields;
- introducing technical and sustainable management measures to increase water-use efficiency in rainfed and irrigated agriculture and encouraging research into water-efficient species;
- studying indications of climate change, including the opportunities as well as the risks of rising temperatures and irregular precipitation to crop productivity;
- introducing strategies to preserve seed production on-farm, including farm-level and community seed banks;
- stimulating technologies such as conservation farming, staggered cropping, water harvesting and water catchment restoration to enable farmers to maintain adequate levels of food security;
- providing guidelines for the production of biofuels from crops, including land-use legislation, the standardisation of production, emission controls and auditing tools to assess the impacts of biofuel production on food security and greenhouse gas emissions - an inter-governmental, private sector and civil society results-orientated dialogue is needed to deal with the issue of food security and bio-energy;
- rejuvenating traditional food crops adapted to local niches and documenting indigenous knowledge about their cultivation and use to offset dependence on exotic varieties - traditional crops can provide a basis for future crops if this knowledge is not lost through neglect.

#### *Biophysical impacts*

Climate change has led to changing land-use patterns as farmers seek more productive land in forest and pastoral areas. This type of movement leads to soil degradation and the reduction of natural pastures, and has negative effects on water resources. There is a need to develop land and water resources that can support the demand for improved land and water access and ensure an adequate water supply for agriculture. Feasible remedial strategies and adaptation options must be developed and implemented.

Land and water resources and biodiversity are the biophysical resources most affected by climate change. These impacts are manifested as:

- increased conflict over the use of water resources, especially in arid and semi-arid areas;
- intense rainfall, floods and soil erosion;
- the filling of watercourses and lakes as a result of the use of banks and slopes for agricultural activities;
- losses of biodiversity and plant genetic resources as agricultural activities expand uncontrolled into forest areas.

#### *A hidden relationship: forests, agro-forestry and climate change*

Unabated deforestation, propelled by increased exploitation by forest-dependent communities, marks an important transition in man-forest relationships. In addition, population pressure combined with the impacts of climate change has contributed to undermining the regenerative capacity of forest areas in many ACP countries.

Trees - as well as other vegetative matter - play an important role in carbon sequestration. Rural communities can benefit from the carbon market and derive important livelihood products from non-timber forest and on-farm tree resources through conservation and agro-forestry.

The vast majority of developing countries, however, are excluded from carbon markets, because both the Kyoto Protocol and the EU Emissions Trading Scheme do not recognise forest and land-use credits, despite the fact that most of the developing world depends on farming and forest products. ACP policy-makers and those involved in climate change negotiations need information that will enable them to extend the provisions of the CDM and simplify accreditation procedures so that smallholders can derive financial benefits from the carbon offset programmes that also contribute to the stabilisation of greenhouse gases.

In the short term, regional, inter-governmental and international organisations have an important role to play in ensuring support services are in place to help rural producers overcome the problems caused by the complexity and high transaction costs of current procedures governing carbon credits.

Interventions that stress capacity-building, and structural interventions such as setting up country desks with links to industrialised countries wishing to get credits from CDM or voluntary carbon offset projects, can make a significant contribution.

Adaptation and mitigation strategies should therefore include:

- increasing the resilience to climate change of present food production systems by developing the capacity for better land and resource management;
- integrating agricultural water management in national development plans and increasing investment in sustainable land-use practices;
- conserving biodiversity for food and agriculture in the wild and in the field to mitigate the threats of declining agro-biodiversity to global food security;
- intensifying the coordination, harmonisation and enforcement of environmental policies;

- instigating programmes to stimulate afforestation, forest and range management and the delineation of protected areas;
- increasing awareness of the importance of agro-forestry in food security diversification and the provision of a wide range of household products;
- accurately assessing hazards and critical mitigation points, and establishing monitoring and preventive measures - an integrated approach to mapping hazards enables efficient and effective management;
- developing vulnerability identification matrixes to evaluate the impact of climate change on the biophysical environment and households.

*Bio-energy: sustainable sources that do not conflict with food production*

There are serious concerns that the growing demand for biofuel will lead to food insecurity as land is converted from food crop to bio-energy crop production. Problems with potentially invasive species such as *Jatropha curcus* have also been identified. Legislation and interventions are needed that address energy needs but also ensure adequate levels of food production.

Encouraging energy-use efficiency and alternative sources of energy, including solar and wind energy and the possibility of generating energy from organic waste, algae and biomass that would otherwise go to waste, can contribute to meeting energy needs without endangering food production.

Where crops are grown for biofuel production, legislation and guidelines are needed to ensure sustainable production and to protect the land rights and market returns of smallholder farmers.

By replacing fossil fuels and encouraging vegetative cover, biofuel crops can have an impact on climate change if their development is monitored in a context that includes natural resource management, livelihood security and communication for awareness.

*Socio-economic implications*

Policy strategies and programmes are needed to address the escalating levels of food insecurity. Climate change has led to a reduction in livelihood options in many ACP countries. Demographic shifts within rural society, as a response to the impact of climate change on the productivity of local resources, have left many households without young, able-bodied labour. Low levels of education and poorly developed communication and market infrastructures further complicate the task of developing location-specific responses that effectively address the impacts of climate change.

The main socio-economic implications of climate change include:

- reduced capacity of natural resources to support productive agriculture;
- food scarcity, resulting in extreme hunger and malnutrition;
- rising food prices that make it increasingly difficult to access food;
- weakening of the power and equity position of the most vulnerable.

Adaptation and mitigation strategies should therefore include:

- developing policies to ensure domestic food production is sufficient for local needs and to address the soaring price of resources needed to produce and buy food;
- focusing attention on the particular vulnerability of African countries to the socio-economic impacts of climate change, given the increasing frequency of climate extremes, institutional and policy weakness, poor infrastructure and the slow uptake and transfer of technology;
- planning to anticipate social tensions and conflicts - the consequence of declining economic growth - climate change will affect power, governance and equity relations and disadvantage the vulnerable;
- developing models for vulnerability assessment;
- stimulating investment in agribusiness and rural development from public and private sources to ensure food security and welfare, with emphasis on the importance of applying cost-benefit analysis to structural mitigation measures;
- developing financial mechanisms - including credit and savings schemes - and climate insurance appropriate for rural communities;
- studying the livelihood advantages of soil carbon sequestration and negotiating ways to reduce the costs - in time and money - of obtaining certification and administrative approval - the lack of clarity surrounding CDM rules and procedures needs to be addressed and the negotiating capacities of those responsible for national climate policies upgraded;
- ensuring gender issues are taken into account in assessing the impact of climate change - for example, male farmers who are heads of households in mixed systems and rural women in pastoral communities are particularly vulnerable to the effects of climate change on their livelihood options;
- increasing and far-reaching regional and international cooperation to deal with the impacts of climate change on communities that have no viable, feasible or sustainable future options - many coastal communities in the Pacific Island States fall into this category;
- fulfilling commitments to the Climate Investment Fund so that funds become available to support adaptation and mitigation initiatives.



## Information needs and effective strategies

The seminar aimed to contribute to the creation of a knowledge-rich environment strong enough to support the development and implementation of effective climate change policies. The impact of climate change on the agrarian sector directly affects the work of two categories of stakeholder: rural communities and policy-makers from political as well as scientific and development sectors.

Much needs to be done to assess and communicate the effects of climate change. For some agricultural systems these changes offer new opportunities, for others - already trapped in poverty - sensitive, participatory and knowledge-rich approaches are needed to ensure livelihoods and welfare. Strategies must be developed that encourage the integration of national, regional and international efforts to stimulate adaptation and mitigation. This requires strong political will.

## INFORMATION AND COMMUNICATION STRATEGIES FOR POLICY-MAKERS

To develop policies that contribute to a sustainable mitigation of the effects of climate change, policy-makers at international, regional and local levels need well targeted information delivered through appropriate media, including the following.

- Improved internet access, improved funding for research and resource materials, and affordable and reliable communication infrastructure to ensure access to accurate, up-to-date information on climate change. Open-access and integrated web-based literature search tools such as CIRAD's Scientific and Technical Information System (SIST) need to be developed further.
- The results of informed and inclusive debates on the impacts of climate change that include the poor and marginalised. Stimulating investigative environmental journalism is an effective way of ensuring this type of information becomes available.
- Participatory methodologies including participatory rural appraisal, participatory video and oral testimonies are among the approaches that should be encouraged in order to mobilise the local and scientific knowledge of all actors involved in the value chain, including small-scale farmers, scientists, urban consumers, extension workers and farmers' organisations. These documentation procedures deliver data essential for effective policy-making.
- Markets and trading frameworks need to be accurately assessed and information disseminated so policies can be formulated that respond to market conditions.

## Cropping systems

To increase the capacity of cropping systems to adapt to climate change, policy-makers need the following.

- To encourage national agencies and development partners to give more priority to local knowledge and indigenous solutions so bridges can be built between traditional knowledge and current technologies, enabling the development of cropping patterns that ensure food security.
- Information on farmers' perceptions of climate change and their capacity to adapt and mitigate its effects. Farmers' cultural and spiritual interpretations of climate change need to be understood so that education and information on climate change can be adapted to facilitate farm-level decision-making and planning.
- Information on yield forecasts based on long-term rainfall data to enable national and regional planning to alleviate food crises.
- Facts and figures from researchers to justify investing in strategies of adaptation, such as the promotion of agro-forestry among small-scale farmers, which farmers - especially those with low incomes - may be reluctant to adopt because of the time lag between adoption and the realisation of benefits.
- To ensure extension services have information on the impacts of climate change to demonstrate how farmers can achieve an ecological balance on their farms and offset the impacts of changing climate regimes.

## Agro-pastoral systems

To strengthen the productive capacity of agro-pastoral systems threatened by climate change, policy-makers need the following.

- Information to develop technical policy and institutional options aimed at adapting livestock management to food security and climate change. The findings of veterinary research and monitoring the movement of plant and animal disease can provide essential information.
- To share information and draw lessons from existing and proposed institutional strategies on animal production so institutional partnerships and continent and region-wide initiatives can be undertaken. Information on promising policy options, projects and experiences derived from international cooperation are important inputs.

### *Fisheries and aquaculture*

Policy-makers dealing with the climate change-related problems of fish-dependent communities need the following:

- Data sets, interactive models and communication links with communities to enable the development of adaptation and mitigation strategies;
- Information on the response of marine and inland ecosystems and fish populations, including changes in productivity and migratory patterns, so interventions can be developed.

### *Biophysical impacts*

In order to address the biophysical consequences of climate change, policy-makers need the following:

- Data derived from biodiversity mapping to develop risk analysis scenarios;
- Information on the implications of climate change treaties and protocols to enable them to take part effectively in regional and international climate change negotiations;
- Information to enable them adequately to review policies and strategies developed to mitigate the impacts of climate change, such as desertification, salinisation and inappropriate adaptations including overgrazing and slope cultivation;
- Information on climate and weather-related events from key websites, from networking with key agencies and from governments. Collaboration with communities, researchers and decision-makers is also needed. To be effective, information exchange requires the establishment of verification procedures, documentation and record-keeping formats;
- To ensure development partners have the information they need to enable them to integrate climate change into relevant planning processes and development initiatives. Websites, RSS feeds, specific databases, online documents, information systems and open archives are important sources for this type of information;
- To organise national and regional workshops to enable meteorological service departments to share information and update agricultural officers on seasonal forecasts.

### *Socio-economic implications*

Policy-makers concerned with alleviating the impacts of climate on rural communities need the following:

- Information on how households and systems respond socially and economically to climate change, and what livelihood options are available to them;
- Information to develop and adapt PRSPs and NAPAs;

- Information on the state of preparedness of local institutions and agricultural systems so scientific interventions can be effectively targeted;
- Information from in-depth studies to provide a basis for biofuel policies that are sustainable and maintain global food security. Specific information is needed to enable monitoring at national and local levels to ensure benefits are well distributed.

## **INFORMATION AND COMMUNICATION STRATEGIES FOR RURAL COMMUNITIES**

Rural communities differ widely in the types of information they need to enable them to adapt to changing climatic conditions. There is also considerable difference in the capacity of communication infrastructures and media between countries and rural locations. However, radio - and listening clubs, mobile phones, and Web 2.0, for example - are becoming increasingly common channels of communication within rural societies. Focus groups and guided interviews are also important ways of generating and disseminating farm-level information. Song, dance and drama, as well as participatory video, are particularly effective ways of giving a voice to local responses to climate change.

These channels of communication are important for increasing awareness and understanding of climate change at the community level because they:

- stimulate broader discussion and social networking and complement trusted sources of information such as extension services and radio broadcasts;
- enable rural communities to access information about the processes and impacts of climate change;
- provide the information that communities need to become involved in shaping external adaptive support programmes to their needs;
- enable communities to build an agreed common body of best practice on which sound policies can be based.

### *Cropping systems*

Farmers whose crop systems have been affected by climate change need the following:

- Information about on-farm tree projects so they can participate in carbon trading;
- Information generated by meteorological services and weather scenario techniques that enable them to plan the selection of varieties, acreages to be sown and the type of inputs to be applied;
- Information to facilitate the introduction of new crops. Well analysed data are needed before experiences can be transferred successfully.



### *Agro-pastoral systems and fisheries*

Agro-pastoral communities affected by climate change need the following:

- Information to help understand how their resources can be used to move towards less extensive forms of animal production in an attempt to reduce greenhouse gas emissions. The strategic use of electronic agricultural extension delivery systems can contribute to information dissemination.

Fish-dependent communities need the following:

- High-quality, well targeted information on climate change to enhance adaptive capacity. Short message service (SMS), radio and community information kiosks have proved useful;
- Information to enable the diversification of livelihood activities and ensure adequate nutrition.

### *Biophysical systems*

In order to mitigate the impacts of climate change at the biophysical level, efforts are needed to generate and disseminate specific types of information.

- Extensionists need to monitor, collect and disseminate farm-level data because macro-level analysis of the impacts of climate change can obscure poverty and vulnerability at the local level.
- Rural communities need information on carbon market options so they can benefit from the CDM or voluntary carbon offset projects. They also need training to enable them to comply with the provisions and calculate the benefits of participating in this exchange.
- Timely and accurate information is needed to develop databases capable of supporting sustainable development. GIS data sets, raster data and remote sensing data, combined with information derived from field surveys, can play a strategic role in delivering this timely information.

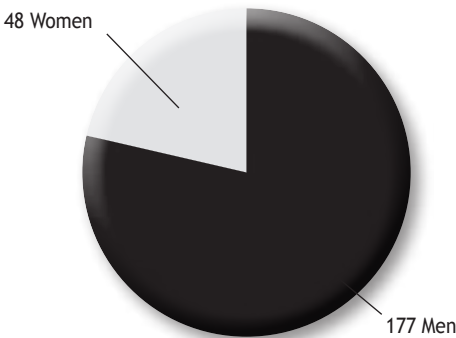
### *Socio-economic systems*

Communication strategies should focus on providing insight into the impact of climate change on socio-economic systems and developing the adaptive capacities of often extremely vulnerable communities. Therefore information is needed to achieve the following:

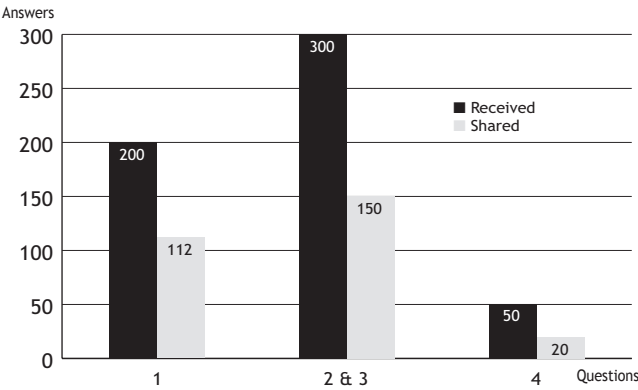
- To guide investment in low-cost alternative (renewable) energy sources. In many communities this is a first step to combating deforestation;
- To increase the awareness of young people and those in vocational education about the impacts of climate change and the need to develop and implement innovative climate change interventions;
- To target radio and extension services messages to specific groups so they can relate to the implications. The timing frequency of information delivery and content are important. Information strategies need to be designed for specific socio-economic environments and take into account the educational level of the household head;
- To enable farmers to produce successfully for local and national markets, add value to their products, access credit to enable them to diversify varieties offered, and encourage them to use and publicise indigenous farm products;
- To improve media knowledge and skills in environmental communication. Currently climate change reporting is limited and of poor quality in all major media. This is partly a reflection of a resource-poor environment where little is invested in the capacity of media professionals to report on environmental issues;
- To encourage the concept of diversity as an asset and a challenge. Biodiversity, diversity of production systems, differentiated markets and diversified diet are essential elements of food security.

# THE SEMINAR IN FIGURES

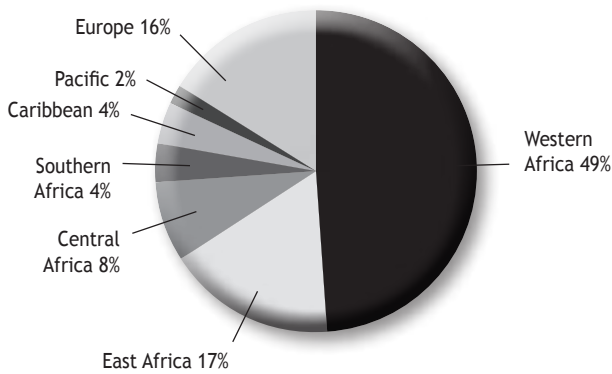
Number and gender of participants



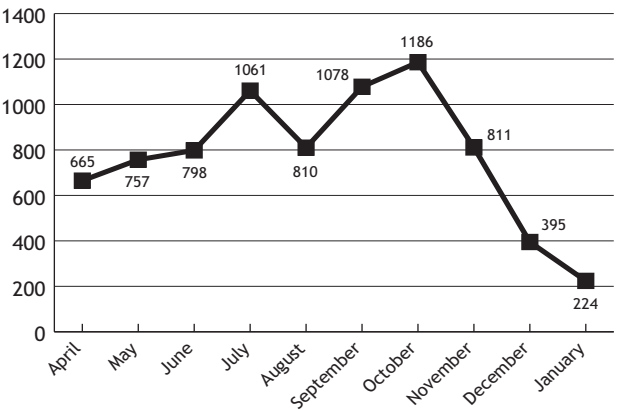
Received and shared contributions to the e-discussion



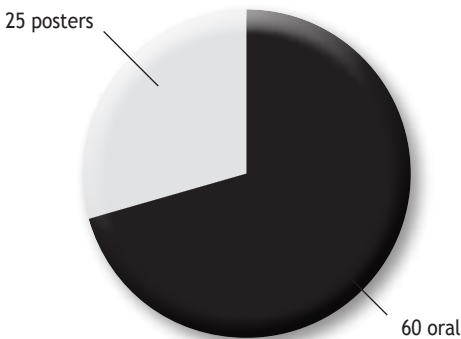
Participants by ACP region



Number of visits to the seminar website  
April 2008 to January 2009



Number of presentations and posters



Cost of one presentation: 3 000 euros

## Participants by region



## Quantity of fuel and carbon equivalent produced by the seminar

	BY ROAD	BY AIRPLANE
Total distance (km)	14.35	479.6
Fuel (L/km/passenger)	0.034	0.06
Total consumption of fuel (L)	487.9	28.776
Equivalent carbon/L (kg)	1.1-1.2	1.2
Total equivalent carbon (CO <sub>2</sub> ) (kg)	585.48	34,531.2
Total carbon transport (kg)	35,116.68	

A total of 35 t of equivalent carbon was produced by the transport of the participants of the seminar. CTA took measures to make this carbon emission to be offset through 'Gold Standard Certified Emission Reduction credit from Atmosfair ([www.atmosfair.de](http://www.atmosfair.de)). To give an idea, this amount of equivalent carbon could be offset by planting 3 ha of *Acacia nilotica* or 1 ha of *Leucena sp.* or *Casuarina sp.*

# ABSTRACTS

## KEYNOTE PAPERS AND CROSS-CUTTING THEMES

*The articles summarized in this collection, when furnished by the authors, are available on the seminar website, (<http://ctaseminar2008.cta.int>).*

### Bio-energy and development in sub-Saharan Africa: are the politics conducive?

Charles B.-L. Jumbe<sup>1</sup>, Frederick Msiska<sup>2</sup>  
and Michael Madjera<sup>3</sup>

*1 Centre for Agricultural Research and Development,  
Bunda College, Malawi;*

*2 Ministry of Agriculture and Food Security, Malawi;*

*3 Evangelical Church in Middle, Germany*

**Abstract.** This paper analyses different national, regional and international biofuels policies and strategies to assess how the policies promote or undermine development of the biofuels industry in sub-Saharan Africa (SSA). Despite having a huge comparative advantage in producing energy crops without disturbing traditional farming systems and the ecosystem, few countries in SSA have included biofuels strategies in their energy policies or national development frameworks. As developed countries commit huge financial resources for research, technology development and provision of tax incentives, there is little support for promoting biofuels by SSA governments, which makes biofuels from Africa less competitive on international markets. While the consequences of biofuels for food supply remain uncertain, nonetheless any significant shift in the agriculture landscape in the industrialised world will heavily affect African countries. As the biofuels era is here to stay, and as we now live in a global village, national governments in SSA must face reality, and adjust accordingly in order to survive in the fast-changing world. In particular, African governments must develop clear policies and strategies to harness the potential economic opportunities from biofuels development, while at the same time protecting the environment and rural communities from large-scale production of energy crops for biofuels at the expense of food crops.

**Keywords:** biofuels, energy policies, sub-Saharan Africa.

### Main messages of the FAO High-Level Conference on World Food Security and the Challenges of Climate Change and Bio-energy

Michele Bernardi

*Food and Agriculture Organization of the United Nations (FAO), Climate Change and Bio-energy Unit, Italy*

**Abstract.** Climate change and bio-energy not only affect food production. They can influence the whole food supply chain and all four dimensions of food security: availability of food from domestic production and imports; access to resources for producing or buying food; stability of food supply, both ecological and macroeconomic; and utilisation of food, including consumer preferences and safety of water and food.

In order to put agriculture, forestry, fisheries and food security on the international climate change agenda, the FAO, in cooperation with the Consultative Group on International Agricultural Research (CGIAR), the International Fund for Agricultural Development and the World Food Programme, has organised a high-level conference to bring together world leaders, policy-makers and experts from many disciplines.

The High-Level Conference on World Food Security: The Challenges of Climate Change and Bio-energy, held at FAO Headquarters in Rome, Italy on 3-5 June 2008, discussed the challenges that climate change, bio-energy and soaring food prices pose to world food security. The major outcomes of the conference are: (i) Identification of the new challenges facing world food security; (ii) a better understanding of the nexus between food security, climate change and bio-energy; (iii) discussion of required policies, strategies and programmes for ensuring world food security, in particular measures to address soaring food prices; and (iv) a declaration on 'world food security and required actions'.

*'There is an urgent need to help developing countries and countries in transition expand agriculture and food production, and to increase investment in agriculture, agribusiness and rural development, from both public and private sources', according to the declaration, which also notes that 'It is essential to address the fundamental question of how to increase the resilience of present food production systems to challenges posed by climate change.'*



## Vulnerability, climate change and livestock: challenges and opportunities for the poor

P.K. Thornton, A. Mude, R. Ouma, M. Herrero, A. Notenbaert, J.A. Van de Steeg, J. Kariuki and A. Ayantunde

*International Livestock Research Institute (ILRI), Kenya*

**Abstract.** For many people in Africa, livestock is of critical importance to livelihoods, human nutrition and household resilience. In many environments, livestock is the prime and sometimes only source of income. Livestock systems in developing countries are characterised by rapid change, driven by factors such as population growth, increases in the demand for livestock products as incomes rise, and urbanisation. Climate change is adding to the considerable development challenges of this dynamic situation. In some places, livestock keepers may be able to take advantage of the increasing demand for livestock products, but for many, adaptation will involve protecting livestock assets in the face of a changing and increasingly variable climate. Research for development organisations needs information on the vulnerability of current human populations and how this is likely to change in the future, so that appropriate technological, policy and institutional options can be made available in the places where they are needed. We outline efforts to assess vulnerability, and discuss some of the responses in terms of priority livestock development issues. Because climate change is likely to exacerbate the fragile balance of risks in pastoral systems across Africa, effective risk management options need to be developed and implemented that help vulnerable households cope with a wide range of shocks. Such work needs to be supported by the development of collaborative learning processes that can assist diverse stakeholders in making the behavioural changes that will be required if poor and vulnerable livestock keepers are to adapt to climate change.

## Reducing vulnerability of African livestock production systems: the role of pan-African policy initiatives in the impacts of climate change

O.Y. Akinbamijo<sup>1</sup>, F.S. Nouala<sup>1</sup>, M. Herrero<sup>2</sup>, C. Ong<sup>3</sup> and A. Kitalyi<sup>4</sup>

<sup>1</sup> African Union-Interafrican Bureau for Animal Resources (AU-IBAR), Kenya;

<sup>2</sup> International Livestock Research Institute (ILRI), Kenya;

<sup>3</sup> World Agroforestry Centre (ICRAF), Kenya;

<sup>4</sup> World Agroforestry Centre (ICRAF), Tanzania

**Abstract.** The African livestock production systems (ALPS) have come under severe threat from environmental and climatic factors, and the urgency of the situation has

called for immediate proactive measures to stabilise the ALPS from disintegration under the challenges of climate change. The ALPS will also have to become more efficient in resource utilisation and physiologically adapted to emerging climatological scenarios such as higher ambient temperatures and incidences of drought, floods and diseases.

Rural livelihoods and livestock-dependent communities are extremely sensitive to changes in environmental indices. Compared with the developed economies, African countries are generally considered more vulnerable to the deleterious effects of climate change. Because of the correlation between land use and environmental phenomena, there are increasing national and international concerns about observed negative consequences, such as the rapid depletion and degradation of natural resources, loss of biodiversity, and the attendant threats to human health and livelihoods. There is an urgent need for Africa to exploit new production strategies that foster greater resilience and stability of ecosystems upon which many livelihoods depend.

This requires increased understanding of the dynamics of the drivers of the climate change phenomenon, and the evolution of a complementary sustainable adaptation process to address the domino effect triggered by climate change, with far-reaching impacts on environmental sustainability and natural resource management in all livestock-related investments. Adaptive policies and regulatory frameworks will be required to govern and harmonise the adaptation processes.

## Climate variability, desertification and biodiversity in Africa: adaptation, an integrated approach

Al Hamandou Dorsouma

*Observatoire du Sahara et du Sahel (OSS), Tunisia*

**Abstract.** Desertification and climate change are vital issues in the arid regions of Africa. Everyone knows that ecosystems affect the climate and vice versa. Global change has a major impact on the climate, for example in increasing desertification and land degradation. The concept of climate change is constantly referred to, while desertification, despite numerous scientific studies on the subject, is of little interest to the political decision-makers.

Yet neither scientific connections, nor political connections resulting from synergy between the international environmental conventions, have been developed on the basis of links between desertification and climate change.





Adaptation to climate change has been a key issue in the recent work of the Intergovernmental Panel on Climate Change (IPCC) and deeply concerns the arid regions stricken by desertification and climate variability/extremes. Experiences with desertification control could serve as a well chosen starting point for studying adaptation to climate change.

This paper proposes a joint analysis of desertification and climate change, from the scientific angle through definitions and signs of these two phenomena in the arid regions of Africa, and from the institutional angle through documentation, tools and decisions on the two international conventions devoted to these subjects.

**Keywords:** desertification, climate change and variability, adaptation, vulnerability, arid regions of Africa, development.

## Politics and economic of forest carbon

Eric Bettelheim

*Sustainable Forestry Management Limited, London*

**Abstract.** The vast majority of developing countries have been excluded from the carbon markets because both the Kyoto Protocol and the EU Emissions Trading Scheme exclude forest and land-use credits. Most of the developing world remains largely dependent on farming and forestry, particularly its poorest people. Emissions from developing countries, aside from China and India, are almost entirely from land-use change and forestry. The only way in which almost all of the developing world can participate in mitigating climate change is through the forest and land-use sector. The benefits of such participation through carbon markets are measured in tens of billions of dollars per year, and for decades to come – enough to finance sustainable, low-carbon growth and to make the largest contribution to adaptation to climate change.

## Helping smallholder tree farmers in Africa participate in carbon trading: the case of Siakago, Kenya

J.B. Kung'u<sup>1</sup>, A. Gichu<sup>2</sup> and D. Mugendi<sup>1</sup>

<sup>1</sup> Department of Environmental Sciences,  
Kenyatta University, Kenya;

<sup>2</sup> Kenya Forest Service, Kenya

**Abstract.** Developing countries can achieve sustainable development and at the same time contribute to the global effort to stabilise greenhouse gas levels in the atmosphere through the Clean Development Mechanism (CDM) of the Kyoto Protocol. This can be achieved through reduced industrial production, energy substitution and efficient production processes, or by providing sinks of atmospheric carbon dioxide through the carbon sequestration programmes. Carbon credits accruing from such programmes can be used to offset carbon emissions in industrialised countries whose emission levels have been capped. Carbon sequestration through tree-planting programmes has been approved as an eligible activity for participation under the CDM. Many countries in Africa have met the requirements under the UN Framework Convention on Climate Change (UNFCCC) for hosting forestry projects under the CDM.

A study was carried out to assess whether smallholder tree farmers in Kenya are able to participate in carbon-offset programmes among other tree outputs. Data was collected using actual measurements, an interview schedule, discussion with relevant extension agents and an observation checklist, and then analysed using Excel and SPSS software. The study established that opportunities exist for smallholder tree farmers to incorporate carbon offset as a tree product for participation under the CDM. Currently farmers have been able to stock 2.08 t/ha of carbon with a market value of US\$492.

**Keywords:** clean development mechanism, carbon offset, sequestration

## Livestock and climate change

Pierre Gerber

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**Abstract.** Population growth, accelerated urbanisation and a higher standard of living have irreversibly boosted the demand for animal products. The report *Livestock's Long Shadow* (Steinfeld et al., 2006, FAO) focuses on the impact of livestock production on climate change. The livestock sector as a whole contributes an estimated 18% of anthropogenic greenhouse emissions, of which livestock production accounts for 65% of N<sub>2</sub>O, 37% of CH<sub>4</sub> and 5% of CO<sub>2</sub>. The problems of livestock production as a source of greenhouse gas, like the problems of water pollution and biodiversity loss, are issues that need to be considered in the long term.



A partial reduction in emission levels can be obtained in the relatively short term and at low cost to the sector. Various technical solutions exist and could be implemented: (i) improve productivity and carefully manage animal production intensification; (ii) improve productivity of sources of animal feed; and (iii) reduce and process methane (CH<sub>4</sub>) emissions from enteric fermentation and effluents from livestock production.

Considering population growth and persistent undernourishment, the problem of the effects of livestock production on climate change needs to be viewed in terms of the development level of the countries concerned. In the Organisation for Economic Co-operation and Development (OECD), the question that needs to be asked is whether lower consumption of animal products can improve the quality of the agricultural environment and of health. On the other hand, in the poor countries the protein ration needs to be improved by drawing on all technologies that can contribute to higher animal production, while limiting the impact on climate change. Attention should also be given to adapting livestock production to climate change.

## Sustainable agriculture and climate change - GTZ perspective and research approaches in Africa

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**Abstract.** Estimates show that agricultural productivity in developing countries will be decreased substantially by climate change. Therefore adaptation measures will become essential in the near future. At the same time agriculture is contributing to greenhouse gas emissions, particularly of methane and nitrous oxide, and thus contributing to climate change. Consequently the agriculture division of GTZ considers agriculture in this dual role and looks at sustainable agriculture as an answer to adapting to climate change and to mitigating greenhouse gases.

Sustainable agriculture increases the water-retention capacity of soils, for example as organic matter in soils is increased, or through diverse adapted cropping systems that help farmers to cope with climate change. In contrast to conventional agriculture with a high external input, sustainable agriculture also contributes to the mitigation of greenhouse gases through reduced use of chemicals and the promotion of soil carbon storage. In addition to these practical approaches, a precise understanding of the local and regional consequences is still lacking, but is essential to deal with climate change. To develop measures of adaptation to climate change, the Federal Ministry for Economic

Cooperation and Development assigned the Advisory Service on Agricultural Research for Development to design of the research priority area 'Adaptation of African Agriculture to Climate Change'. Nine projects were selected: five international agricultural research institutes (CIP, ICRISAT, IFPRI, ILRI, IWMI; see Acronyms), two German universities (Göttingen, Hohenheim), and one of the Leibniz centres (Leibniz-Centre for Agricultural Landscape Research, ZALF) have received research funding totalling 10 million Euros for the programme, which is scheduled to run for 3 years. There is a manifold network between the participating institutes and universities to achieve interdisciplinary and multi-institutional cooperation. Professional tasks range from climatology over classical agricultural disciplines - cropping systems, plant breeding, grazing management and agro-forestry - to water management and policy research. Regional focuses are in West Africa as well as Eastern Africa.

**Keywords:** climate change, agriculture, research, Africa, climatology, cropping system, plant breeding, grazing management, agroforestry, water management, food policy, non-governmental organization, farmer association, national agricultural research center, sustainable agriculture

## Impact of climate change on interactions between soil degradation and agricultural production systems in the CILSS zone: policies and strategies implemented by CILSS

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*Le Comité Permanent Inter Etats de lutte contre la Sécheresse dans le Sahel (CILSS), Burkina Faso*

**Abstract.** According to forecasts on the evolution of climate, the production systems in the Sahel are among the most vulnerable because of the overriding role of rainfed agriculture and the weakness in harnessing water. The various drought episodes in the Sahelian countries have produced evidence of the great vulnerability of the ecosystems and populations when faced with climate change and variability. The birth in 1973 of the Permanent Interstate Committee for Drought Control in the Sahel (CILSS) was a sign of the sub-region's awareness of the need for a collective response to cope with the harmful effects of climate change and variability. Since its creation, CILSS has been implementing strategies and policies to mitigate the effects of drought via a series of actions: running drought and food security early warning information systems; knowledge production and capacity-building for state agents; and support for local populations through micro-projects to hold back land degradation in order to reduce project vulnerability to climate change.

## Adaptation programmes to climate change (IDRC/DFID)

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**Abstract.** The Climate Change Adaptation in Africa (CCAA) research and capacity development programme was launched in 2006. It is jointly funded by Canada's International Development Research Centre (IDRC) and the UK's Department for International Development (DFID). It is hosted and managed by IDRC. Its original mandate is for a 5-year programme of activity with initial funding of \$65 million CAD. It will gradually devolve to African institutions.

CCAA's overall strategy is premised on the development of capacities (human, organisational and institutional) with regard to climate change adaptation. In CCAA's philosophy, capacity development is both a process and an outcome which target the reduction of climate vulnerabilities. Hence the programme is using participatory action research as the foundational pillar to support adaptation work and to communicate and share scientific findings with key stakeholders.

CCAA's first call for concept notes resulted in some 280 submissions. Ten of these were developed into full proposals.

2007-08 has been a very full year of activity for CCAA. A total amount of \$19,905,078 CAD served to: enrich the CCAA pipeline with 11 new research projects; launch a knowledge-sharing project; organise five workshops for strengthening the capacity of project teams; implement an African climate change fellowship; fund African participation at climate change meetings; attend the UN Conference of the Parties (COP)13; launch a demand-led adaptation process; support CCAA project teams for monitoring and evaluation of adaptive capacity relative to climate change, and co-fund with Ecohealth projects on water, health and climate change.

For 2008/09, the programme has three main objectives, which can be summarised in three key words: consolidation, engagement (community-based organisations, policy-makers) and learning.

## PARALLEL SESSIONS

### CROPPING SYSTEMS

#### The effect of climate change on agricultural systems and crop production - analysis of three countries

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**Abstract.** We present three papers, analysing sub-regional consequences of climate-related changes on agricultural systems and food production in our respective countries. Potential impacts are derived from similar research conducted with common objectives formulated with regard to the gradual changes in cropping patterns in the three countries: The Gambia in the drier part of West Africa, threatened by land degradation and desertification caused by higher temperatures and drought; Sierra Leone in the rain forests of West Africa, facing climate-related threats to the agro-ecosystem and forcing a shift in centuries-old agricultural systems; and Malawi in the Southern African region, where indirect impacts of climate change are felt in the agricultural sector, with threats caused by biofuel projects and the greenbelt type of agriculture.

In each of the studies, we considered the projected effects of climate change on the national food supply under different environmental and social factors affecting agriculture. The goal of the joint analysis is to understand the nature of the complex interactions in different social and environmental scenarios and how they affect people at risk of hunger as a consequence of climate in the coming decades. Much of the work is based on a timeline of assessment of change, linking this to climate data and the assumption of the single best estimate of population and economic future of the communities studied. The consequences in each of the research papers are estimated from both direct and indirect change scenarios observed over a period of time.

## Impact of climate variability on production systems in Niger: the Gaya and Aguié zones

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**Abstract.** 'Impact of climate variability on the production systems in Bana (Gaya) and Zabon Mouso (Aguié)' is a study carried out in two different agro-ecological zones in Niger. Two approaches have been used: biophysical and socio-economic. The biophysical approach is based on the use of the CROPWAT model to estimate water availability in soils growing millet, sorghum and cowpea (niébé) and the effects of this water availability on crop yields. Two scenarios have been scripted: a reference period, and timeline 2025. The socio-economic approach is based on an analysis of how the agricultural production systems in these two zones function, using a farm-level diagnostic. The analysis of the results obtained from the model suggests a drop in soil water availability in the Aguié zone for rainfed crops because of an increase in the soil humidity deficit by the year 2025, compared with results recorded for the so-called reference period. On the other hand, in the Gaya region, where conditions are already better than in the rest of the country, conditions are expected to improve slightly. No yield drops are expected for cereal crops, and cowpea yields are expected to drop only slightly. The socio-economic analysis shows major differences in farm types, with relatively different economic performances. In Zabon Mouso most farms bring in little income, unlike the Bana area, where most farms have a relatively good income level.

**Keywords:** climate variability, production systems, Aguié, Gara, farm typology.

## Farmers in the extreme north province of Cameroon and climate change: emigration or adaptation?

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**Abstract.** The Extreme North Province of Cameroon, located in the Sahelian zone, is confronted with considerable water shortages and constant climate instability. Between 1975 and 2007 over 200,000 farmers, mainly young ones, emigrated to the Bénoué plains where the climate is more favourable for agriculture, leaving behind farmers who are

elderly, poor and vulnerable. Muskuwaariculture (off-season sorghum, the basis of the local diet) was the main solution to cope with the major shortage of rainfed cereal crops in that province. Unfortunately, since 1998 short early rains and lower precipitation rates (sometimes under 750 mm) have been a handicap to Muskuwaariculture. In 2007 rains were early and stopped in the beginning of September, inhibiting early crop development. Insufficient flooding of the vertisols (karé in local Fulfuldé) means too little water for transplanting and proper growth thereafter.

The analysis of the actors' reactions and field observations (surveys, photos) show, on the one hand, that the farmers are developing new farming techniques, original adaptation practices based on experience acquired through regular observation of rainfall patterns; and, on the other, that they are spreading these new adaptation techniques - which have proven effective - from areas of high production to areas of marginal production. Research services (Cameroon's Institut de Recherche Agricole pour le Développement and CIRAD) and agricultural services (MINADER - Ministério da Agricultura e Desenvolvimento Rural) are developing supervision and monitoring methods for these new adaptation techniques - providing evidence of their effectiveness and sustainability.

**Keywords:** climate change, emigration, adaptation, Muskuwaariculture, Extreme North Cameroon

## Rainfall deficit and pineapple production in Allada, Benin

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**Abstract.** As a result of the Benin government's work on agricultural diversification, renewed interest has been shown in pineapple growing, especially around the town of Allada. But the drop in rainfall since the 1970s and 1980s, followed by unfavourable spatio-temporal rainfall distribution, is affecting the crop.

Data on rainfall levels, sown lands, and pineapple production for the Allada area have been used to identify wet and dry months and years, and even to compare rainfall thresholds for pineapple crops. The study shows that the slight improvement in rainfall in the 1990s and thereafter has had a positive impact on pineapple production in this area. Yet crop yield variations are evidence of the detrimental effects of rainfall variation on the producers' output and income.

To cope with these changes in cropping calendars, cropping techniques and professions, producers have adopted techniques that involve larger fields and repeated sowing. Furthermore, they are gradually shifting away from empirical agricultural schedules, and are adopting new varieties and the principles of fertiliser application.

**Keywords:** Allada, rainfall pejouration, pineapple crops, incidences.

### **Production systems for dry cereal crops in the Sahel: land degradation and poverty alleviation**

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**Abstract.** Climate change is having a number of impacts on dry crop production systems (sorghum, millet and cowpea) in the ADAF/Galle zone. These include squall lines that usually accompany violent winds and abundant, sometimes catastrophic rains, which break the trees and carry away arable lands, leaving cultivatable lands barren. There are regular decreases in the quantity of rainfall, and long intervals between rain spells during the cereal crop flowering stage. Farm yields are reduced, mainly because of drops in rainfall, and the range of local cereals varieties in the zone is also narrowed as the selected so-called 'improved' varieties become more popular.

Solutions to climate change have been implemented in partnership with the beneficiary populations, technical services and research institutes. They focus on the adoption of selected varieties adapted to the intervention zone (three varieties of sorghum, including CSM-63 E, and one variety of groundnut, ICGV 86 124); extension of improved metallic fireplaces (foyers amélioré métallique) and improved fireplaces in banco (earthen bricks); reforestation and fighting against deforestation by planting in exclosures; and installation of cereal banks in selected villages.

These solutions have been useful in increasing agricultural output through improved seed, stabilising farmers during the crucial tillage and sowing periods. The strategies implemented to promote these solutions included organisation of beneficiary populations to focus on activities; and development of partnerships with communal authorities and technical grassroots services, and with the national and international research institutes. Information and communication activities included information workshops, validation of outputs, and collaboration with local radio

stations in order to ensure broad dissemination of project results. The main difficulty encountered was the shortage of financial resources to reach all the ADAF/Gallé partner villages or even to reach as large an audience as possible through national television.

### **Evaluation of soil and climatic constraints on the development of rice cultivation on the Agonlin plateau**

**Guy Wokou, Michel Boko and Marcel da Matha Sant'Anna**

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**Abstract.** The natural foundations of agricultural production are essentially climatic and soil factors, and their interactions. The cultivation of rice is an important activity on the Agonlin Plateau, and is being disrupted by climate change and effects on soil.

Socio-anthropological investigations, and the analysis of climate and rice production data, demonstrated the potential damage to this important activity on the Plateau.

Reduced or excessive rainfall (notably of the first rainy season) accentuates a decrease in rice outputs, and has some important socio-economic repercussions. To attenuate these constraints, producers have developed strategies including the adoption of less demanding rice varieties in water (rice nérique) and improvement of the production systems.

**Keywords:** Benin, Agonlin Plateau, rice production, pedoclimatic constraints.

### **Climate change and dynamics of production systems of the lowlands in Burkina Faso**

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**Abstract.** In Burkina, the lowlands are used in a variety of ways during the wet season: as pastureland, for cereal crops (sorghum, maize, rice) and for tuber crops. During the off-season, market garden crops and fruit trees can be combined with livestock production (watering animals, grazing). The natural resources in the lowlands are also exploited in various ways. A link has been established between the deteriorating climatic conditions, especially





less rainfall, and the deteriorating production systems. Increased interest in the lowlands since the droughts of the 1970s and the 1980s, coupled with ecological change in the plateaux as a result of population pressure, have changed the hydrology of the area. Furthermore, the national agricultural development policy stresses the importance of the lowlands to ensure food security and territorial construction. This policy is supported by major diversification (specific to the agro-climatic zones) in the technical models used to develop the lowlands.

Climate change has profoundly altered the methods for developing the lowlands, resulting in diversification and adaptation of production systems, development of off-season crops, changes in farming techniques, and aggravated conflicts over land tenure.

**Keywords:** lowland, production systems, climate, Burkina Faso.

### The effect of climate change and adaptability on arable food crop farmers in south western Nigeria

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**Abstract.** Agriculture places a heavy burden on the environment in the process of providing humanity with food and fibres. It is the largest consumer of water and the main source of nitrate pollution of ground and surface waters, as well as the principal source of ammonia pollution. It is a major contributor to the phosphate pollution of waterways and to the release of the powerful greenhouse gases methane and nitrous oxide into the atmosphere. Increasingly, however, it is also recognised that agriculture has positive externalities, such as the environmental services and amenities that it provides, for example through the creation or maintenance of rural landscapes - given high priority by some developed countries. Trade-offs between food security and the environment are being practised in most developing countries. This has drastically reduced soil fertility and led to poor agricultural outputs. This study assesses the pressures on the environment emanating from agricultural activities and how these might evolve over time. Agricultural livelihood activity provides a larger proportion of the active working population with a means of earning an income. Efforts that focus on the environmental impacts that can be explicitly or implicitly determined from the crop and livestock production projections presented will be most appropriate. Food crop farmers in south-western Nigeria provide the bulk of arable crops that are consumed

locally, and also are the major supplies to other regions in the country. Simple random sampling was adopted for data collection, and two states were selected for further investigation. The study revealed that knowledge about the impact of climate change on agriculture is still a mirage for most food crop farmers

The socio-economic determinants of environmental impacts, such as land tenure or the marginalisation of small farmers, and technological and policy options for reducing or avoiding them, were investigated. The study concluded that a lot needs to be done by all stakeholders to come to terms with negative impacts of climate change, particularly on agriculture, from which the majority derive their livelihood. Recommendations include readily available or emerging technologies and land management practices that could greatly reduce agriculture's negative impacts on the environment and enhance its positive impacts.

**Keywords:** environmental impact, food safety, agricultural occupation, effective land administration policy, welfare improvement.

### Use of seasonal forecasts in predicting agricultural yields and gross domestic product over east Africa

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**Abstract.** Anticipated crop yield prior to the season is critical for food security management decision-making in any country. Predicted crop yields become meaningful when rainfall forecasts are skilfully made over the agro-ecological zones where crops' phenological stages are highly dependent on rainfall. Rainfall is one of the most important parameters for crops in the tropics, and consequently for food security. This research study was carried out on some food crops in agro-ecological zones of eastern Africa.

Data used for period 1990-2006 were monthly rainfall from Meteorological Services; crop yields from the planning unit of the Ministry of Agriculture; and GDP from central banks of east African countries. Sea surface temperature was from the Climate Prediction Center of the National Oceanic and Atmospheric Administration. The methods used in this study were statistical prediction by non-linear regression, correlation and principal component analyses.

The results showed similar trends in crop yields, seasonal rainfall and agricultural GDP over the agro-ecological zones studied, with a correlation coefficient of over 0.67. Sea surface temperature anomalies predicted over 48% of total rainfall variance during the October-December season. Climatic indices to predicted maize yields prior to the season were 0.71 at 95% confidence level. Results from this study give a clear indication that crop yields, and consequently agricultural GDP, are predictable using long-term rainfall predictors.

Skilful seasonal rainfall forecast is therefore critical for early warning mechanisms and impact assessment in agriculture. This information is useful for governments and policy-makers in making timely decisions to ensure food security.

## Estimating crop coefficient model for upland rice (NERICA) under sprinkler irrigation system

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**Abstract.** UEfficient crop coefficient (Kc) estimation is very important in adequately determining the water use of selected crops. In this study, the crop coefficient was determined for upland rice (cv. NERICA) under a sprinkler irrigation system. The estimation was derived from the relationship  $fc = f(LAI, MTA)$  under standard environmental conditions in Ibadan, Nigeria. The fraction of the wetted surface,  $fc$ , was determined for the three stages of crop development: initial, mid-season and maturity. These were incorporated into the model flowchart that produced  $K_e$ ,  $K_{cb}$  and  $K_c$ . Several assumptions were made, and Visual Basic 6.0 software was used as programming language. The derived  $K_c$  was compared with existing crop coefficients and the results were subjected to statistical analysis.

From the study, three  $fc$  models were derived for the three crop development stages:

initial:  $fc = 0.9392 - 0.0095LAI + 0.0010COSMTA$

mid-season:  $fc = 1.1917 - 0.0753LAI + 0.0164COSMTA$

maturity:  $fc = -0.1308 + 0.1193LAI - 0.024COSMTA$ .

The final equation describing this relationship that was introduced into the flowchart was:

$fc = 0.9167 - 0.026LAI + 0.219COSMTA$ .

The  $K_c$  values were obtained from the relationship  $k_c = k_{cb} + k_e$ .  $K_c$  (initial) = 0.9;  $K_c$  (mid-season) = 1.12;  $K_c$  (maturity) = 0.7. The coefficients of distribution  $R^2$  between the modelled  $K_c$ , and  $K_c$  values of FAO-24 and FAO-56, were 0.99 and 0.98, respectively. This showed good agreement with the existing coefficients. It also supported the improvised conversion factor from  $K_c$  (paddy) to  $K_c$  (upland) as used in FAO-24.

The dominant effect of fraction of wetted surface ( $fc$ ), leaf area index (LAI) and mean tilt angle (MTA) in influencing the crop coefficient of upland rice is evident from the study. Soil characteristics, degree of saturation and the fraction covered by vegetation ( $1 - fc$ ) are also considered to have indirect effect on  $K_c$  measurements.

**Keywords:** crop coefficient, Upland Rice, Sprinkler Irrigation.

## Rice production and rainfall/hydrological constraints around the town of Dangbo in Benin

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**Abstract.** The town of Dangbo is located in the lower valley of the Ouémé, where natural conditions are generally favourable for rice growing. But despite efforts by the rice growers, there are several problems, including rainfall levels and hydrology that curtail optimal use of these natural advantages. The methodological approach focuses on processing rainfall data (at the annual, seasonal and monthly scales), hydrometric data, statistics on rice production, and information obtained from people working in rice production. Results show that most rice is grown as an off-season crop, using rudimentary facilities and techniques, and that it is affected by rainfall variability and its hydrology-related corollaries.

In especially rainy years, for instance, when the rains start early, flooding limits farmers' access to the rice fields where the plants risk being washed away. On the other hand, during especially dry years the rains start late, and the water-stressed rice plants dry up prematurely.

Suggestions are made concerning water harnessing, improved cropping techniques, development of rural trails, etc.

**Keywords:** Benin, Town of Dangbo, rice production, rainfall/hydrological constraints.



## Market garden cropping on the shores of Lake Dang in north Cameroon: what are the socio-environmental stakes?

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**Abstract.** Market garden crops are fast gaining ground on the banks of Lake Dang, not far from Ngaoundéré University in the Adamaoua province of Cameroon. These crops represent high socio-economic stakes as they are needed to feed the student population plus the surrounding communities. Cropping practices, however, are affected by climate and the farmers' cropping techniques. Direct observation and interviews with producers bring out the unarguable effects of coupling climate and cropping techniques in transforming the banks of Lake Dang. The socio-environmental consequences (bank erosion, lake drying up, dearth of allothetic resources, changes in the cropping calendar, population movement) are significant. A solution must be found to protect this lake without interfering with the market garden crop production needed to feed the surrounding populations.

**Keywords:** cropping practices, market garden crops, shores of Lake Dang, socio-environmental challenges, North Cameroon.

## Practising profitable agriculture and environmental conservation in rural Uganda: the CELAC experience

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**Abstract.** The Collecting and Exchange of Local Agricultural Content (CELAC) project works with government and civil society towards enabling a platform from which local content can be effectively collected and shared, especially among grassroots women farmers, for improved food security and eventually for household development. Methods used include monthly knowledge-sharing forums, an annual knowledge fair, telephones (SMS, teleconferencing and calls with the grassroots community), web 2.0 applications (audio and textual blogs, information website, Google maps, wikis), and information from the digital satellite. The project is operating in 17 districts in the country.

The farming methods exchanged by farmers encompass the use of organic materials for seed and garden preparation, planting, weeding, pest and disease control, including harvesting and post-harvest methods. The farmers' continued preference for these methods is based on the fact that the materials are locally available and affordable, yet hardly damage the environment. Also, they realise bumper harvests, enabling them to compete favourably with those practising chemical farming whose inputs are more expensive. Yet another benefit they enjoy is that their land continues to gain fertility and they are able to reap maximally from the small land available.

## Some crop management practices in Jamaica and Dominica for combating the effects of global climate change

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**Abstract.** There is enough evidence to conclude that the climate in the Caribbean is changing in line with global trends. The effect of this is already being felt by agricultural producers in the region. The response to this change has, as yet, not been well planned and organised, but some agricultural practices have been emerging and evolving to deal with this crisis. In Jamaica and Dominica, agriculture's contribution to the national economy is quite significant, 6 and 18%, respectively, and adapting to the changing climate is critical to socio-economical survival. Here some of crop management practices that are evolving to deal with this situation in these two countries are highlighted. These practices include defining specific cropping seasons, increased irrigation and soil water management systems, mulch farming, multiple cropping to decrease economic risk, planting of contrasting crop species, protective agricultural systems, and varietal changes. The effectiveness of these practices is still being assessed.

**Keywords:** climate change, agriculture, crop management practices, Dominica, Jamaica, Caribbean





## AGRO-PASTORAL SYSTEMS

### Climate change and sustainable animal production systems

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**Abstract.** In areas of sub-Saharan Africa where crop and livestock farming are combined, the animal population figures have been going up for the past four decades. This is closely connected to agricultural development, improved animal health conditions, and the economic value of animals and animal products. The overall situation, which is largely due to population growth, has led to intensive land use and, hence, frequent soil fertility losses.

The increase in livestock can be traced to more secure pastoral and cultivated fodder resources for livestock producers and their herds in the agro-pastoral zones, but also leads to increased pressure on resources that predicate heavily on climatic conditions. Agriculture and livestock production in today's world need to be reconciled with global climate change (GCC), although it is difficult to separate GCC from anthropogenic actions.

To decrease their vulnerability to GCC, livestock production systems need to be adapted constantly. The extensive livestock production system is the most common, but results in animal production depend on the availability of natural resources. Decisions to maintain this system must consider the sustainability of fodder and water resources, the system's contribution to greenhouse gases and the storage of carbon, access to markets, and the socio-economics of all categories of livestock producers. Methods that allow livestock production systems to adapt to GCC should be explored and implemented. This includes better integration of agricultural and livestock activities, community land management, development of agro-forestry, intensification of animal production, and the development of monogastric production animals.

### Vulnerability of agro-pastoralists to climate change in the area around Parc W in Burkina Faso

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**Abstract.** Protected areas have been designed as natural resource protection tools for present and future populations. But efforts to manage these areas are countered by certain pastoral practices and trigger conflicts between area conservation workers and herders. In the Parc W in Burkina Faso, the management system was changed in 1984 to include the participation of the local communities. Have institutional changes improved the capacity of the agro-pastoralists in the surrounding villages to withstand climate change? A 2007-08 survey of 60 agro-pastoralists' households and 120 individual men and women living around Parc W provided responses to this question. Data from the survey showed cross-over effects of the existence of the park and the effects of climate change that increased the vulnerability of agro-pastoralists: a greater risk of losing livestock, with the attendant threat of poverty. The development of uncooperative strategies, such as agro-pastoralists entering the park, is a reaction to the unsatisfactory alternative proposals for ways of making a living. The alternative sources of revenue being proposed do not contribute to the resilience of their core activities. The recommendation is thus to promote a participatory approach to Parc W management, taking account of the effects of climate change and optimising cooperative strategies developed by the agro-pastoralists to increase their resilience.

**Keywords:** protected areas, local communities, revenue, resilience, climate change.

### Evolution of annual rainfall and impact on the distribution zones of the riparian tsetse fly in Senegal

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**Abstract.** African animal trypanosomiasis is a major obstacle to the development of livestock production in much of the humid and sub-humid zones of West Africa. The distribution of the glossina, its cyclical vector, depends mainly on local anthropic and climatic constraints (state of degradation of vegetation). The main vectors of trypanosomiasis in Senegal are *Glossina palpalis gambiensis* (G.p.g.), a riparian species that prefers riparian vegetation along the waterways, and *G. morsitans submorsitans* (G.m.s.), a savanna species. The density of the riparian glossina depends mainly on the presence and quality of

the forest habitat or its man-made equivalent, the fruit tree plantations. On the other hand, the density of G.m.s. depends more on the level of savanna degradation and the availability of wild hosts. Along the coast of Senegal, the isohyets get lower for about 100 km towards the south, which has meant over 100 mm less rainfall in the decades 1970-80 and 1980-90. This aroused our interest in the evolution of the distribution of these glossina in Senegal from 1972-79 and again from 2003-08 (project DIREL C3-SEN/5/029 03 01). In Senegal, the northern limit of G.p.g., the only specie covered by the study, did not change, but it disappeared from La petite côte located more to the south as the appealing forest vegetation faded out. These results provide confirmation that microclimatic factors (linked to plant formations and their level of degradation) are more important than macroclimatic factors in explaining the distribution of these vectors.

## Conflict prevention and natural resource preservation strategies in Mali

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*Programme d'Appui aux Collectivités Territoriales (PACT)-Mali, Deutsche Gesellschaft für Technische Zusammenarbeit GmbH (GTZ), Germany*

**Abstract.** In the Sahel, climate change is a reality that leads to increased movement among transhumant livestock producers, causing numerous conflicts with crop farmers, jeopardising social peace, and attracting the full attention of the young territorial communities. At present, climate change has led to less rainfall and thus far less Sahelian grazing land. The result is that the animals are moving onto zones, such as the lowlands, where transhumance is unknown. This situation, together with changes in social behaviour, aggravates the conflicts between farmers and transhumant herders.

The Malian support programme for local communities (Programme d'Appui aux Collectivités Territoriales, PACT) encourages the joint preparation of local rules on the utilisation of natural resources and agro-pastoral lands by everyone concerned with the process. These local agreements are approved by supervisory bodies and then certified by the Ministry of Justice, giving them the force of law. They have been vital in the regeneration of certain plant species threatened with extinction, and more importantly have contributed to a significant drop in the number of conflicts between stock- and crop-farmers. The resident populations are involved in implementing these agreements through their management committees.

The centuries-old transhumant trails that were being wiped out by agriculture have been consolidated by pilot communities, with support from PACT, in order to ensure the permanency of these trails and thus secure regional cattle movement.

## Climate change and eastern Africa pastoral livelihoods

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**Abstract.** Pastoral livestock systems in East African countries are changing rapidly in response to many drivers. These include rising human populations, rising global food prices, land tenure and land-use changes, and frequent climatic shocks (droughts), among others. The potential impact of local and global drivers of change on resource-poor pastoral systems is considerable. In addition, the climate is changing and bringing climate variability, which adds to the already considerable vulnerability of livelihoods faced by many pastoral communities residing here, and in most of the Sahel. Climate change will add burdens to pastoralists who are already poor and vulnerable. The implications for pastoral livelihoods are yet to be fully understood, and two different opinions seem to prevail. Some see pastoral groups as already surrendering to ongoing processes, as rangelands will tend to become drier and existing water shortages will worsen, thus affecting the overall sustainability of their livelihoods. Others see pastoralists as the most capable of adapting to climate change, as pastoral livelihoods are shaped to deal with scarce and variable natural resources and to tackle difficult and uncertain agro-ecological conditions - climate change conceivably could lead to the extension of territories where pastoralism could show comparative advantages. This contribution looks at the risks and challenges confronting pastoral communities of eastern Africa due to climate change, and highlights practices and policies that could help them to adapt.

## Impacts of climate change on agro-pastoral communities in the Tahoua and Tillabéry regions of Niger

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**Abstract.** For close to 30 years, German Technical Cooperation (GTZ) in Niger has been working on natural resources management in the Tillabéry and Tahoua regions, located between parallels 13° to the south and 18° to the north. The isohyet is between 200 and 600 mm. The area is considered highly prone to climate variability and change. A study was conducted in Niger by the GTZ 'Combating Poverty' programme to incorporate climate change in the programme's intervention strategies. Climate variability is characteristic of the Sahelian climate but changes can be noticed, the most tangible being the continual lowering of the isohyets over more than 200 km. The effects of climate variability and change in these regions are visible. Climatic extremes are clearly becoming more frequent and more intense. Resident populations have adapted to variations in their climate. Local adaptation strategies have been based on diversification of economic resources at the family level, especially by developing market gardens, commercialising natural resources, rural exodus, transhumance, and extensification of agricultural practices through rainfed cropping. But local responses to the climate variability and change phenomenon are inefficient, partly because of the problem of population growth. The challenge is thus to help these communities with an adaptation process that can predict the impacts of climate change and, at the same time, secure the future of these lands for the coming generations.

## Coping mechanisms and their efficacy in disaster-prone pastoral systems of the Greater Horn of Africa

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**Abstract.** A survey of 663 households investigating traditional coping mechanisms of pastoralists during the 1995-97 drought and 1997-98 El Niño rains was conducted in drought-prone zones of Ethiopia, Kenya, Tanzania and Uganda. The purpose of the study was to investigate what pastoralists do to protect their livestock and welfare during crisis periods of drought and floods.

The period investigated was divided into pre-drought, peak drought, minor rains, El Niño rains and La Niña dry phases. The pastoral zones were stratified into clusters indicating level of vulnerability to crises. Statistical analysis was performed on herd dynamics and movement during the climatic phases.

During drought, cattle and small ruminant mortality rates were highest in southern Ethiopia and northern Kenya, where they increased to 49 and 35%, respectively, for cattle and to 52 and 43%, respectively, for small ruminants. Cattle mortality during floods was highest in southern Ethiopia (37%) while small ruminant mortality was highest in northern Kenya (52%). Although migration was observed throughout the year, it increased during the drought. Cattle sales and slaughters were not significantly different across phases (below 10%), indicating that few pastoralists prepare for crises by increasing sales or slaughter of their animals. At all sites, relief food aid distributed was considered 'too little, too late'. Several overarching factors, including water and grazing for livestock, food and clean water supply, determined pastoralists' coping behaviours.

## Pastoral agenda and climate risk minimisation strategies in the Sahelian region of Senegal

Mame Arame Soumare

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**Abstract.** This presentation is on the livestock producers east of the lac de Guiers in the Mbane rural community. Livestock production is one of the two main economic activities. Traditional practices are used, based on various strategies to cope with the harmful effects of the uncertain Sahelian climate on the local environment.

The Action Thématique Programmée (2004-07), introduced by CIRAD, has provided the scientific framework for our research procedures, which mainly entail focus groups and guided interviews on the structure of the agricultural calendar, and a 'mobility questionnaire' directed to the herders (aynaabe), as they are generally responsible for annual herding practices. Our field studies have also enabled us to capitalise on data describing environmental dynamics around the lac de Guiers. The data analysis encouraged us to demonstrate that the pastoral agenda, used as a livestock-management tool, was composed of risk-minimisation strategies developed by local producers.

The presentation adopts two angles to the endogenous climate risk-minimisation strategies: the temporal angle, which is related to the annual planning of pastoral activities; and the spatial angle, which refers to the land areas used in the pastoral agenda. As a conclusion, we explain lessons learned from this endogenous planning model in order to consider the replication of the model and its contribution to decentralised territorial management.



**Keywords:** livestock production, climate change, hydro-agricultural installations, actors' strategies, decentralization, environment, risks, natural resources.

## Agro-pastoral activities, natural resources management and desertification control

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**Abstract.** A study on agro-pastoral activities, natural resources management, and desertification control was carried out in the Kalalé Commune in northeast Benin. The purpose was to analyse the effects of man's agro-pastoral practices on the overall deterioration of biological, social and agro-ecosystem regulation mechanisms confronted with climate change. The main methods involved desk studies, socio-economic surveys, and the recording of GPS coordinates and diachronic mapping of agro-pastoral lands. Specific methods were used to process the data. Results show that the needs of the Kalalé population have grown during the past few years to a stage that has created an imbalance between the production methods and the available natural resources. Current farming techniques will not be able to maintain an ecological equilibrium, although agro-forestry techniques, based on cashew trees, are used to protect the soils and secure land tenure.

When managing rangelands and arable lands, it is important to take account of the agro-sylvo-pastoral integration of the various production systems and to ensure sustainable natural resources management.

**Keywords:** agropastoral, management, desertification, ecological, climate change, Kalalé, Benin.

## Adapting to climate change in the Caribbean: rural communities' wish list

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**Abstract.** Climate change represents a serious developmental challenge to the small island states of the Caribbean region. Its projected impacts will be felt greatly in coastal communities, rural populations and the agricultural sector.

This paper briefly describes the projected impacts of climate change on the Caribbean regional agricultural sector. It will then assess the various national and regional initiatives (and proposed frameworks) for mitigating the effects of climate change in the Caribbean's agricultural sector. While laudable, these frameworks are too often centralised at the governmental planning level, which means they very rarely filter to local agricultural and rural communities. In other words, they rarely reach the very sectors that are most vulnerable to climate change. An examination of rural communities in the region confirms that the local knowledge and capital needed to assess its vulnerability, respond to emergency situations, mitigate risks, access links to governmental and other resources, and increase its resilience is not very readily available. A list of suggestions on increasing local participation and action, including the use of local knowledge in the existing frameworks, is presented. The paper also explores a wish list of practical requirements for rural readiness to climate change.

## Enhancing the resilience of small-scale fisheries to climate change

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**Abstract.** Fisheries and aquaculture make a significant contribution to development. Fish provides nutritious food; fishing and fish farming generate income and employment for millions of poor people; and trade in fishery products contributes to poverty reduction and national economic growth in many developing nations. Climate change, however, presents a challenge for fisheries and aquaculture. Global warming affects aquatic ecosystems and their fishery productivity. Fisheries and aquaculture are also threatened by the secondary effects of warming: changes in ocean currents, precipitation that affects lake levels and river flows, and increasing storms and extreme floods and droughts. This makes living near water and catching or farming fish more hazardous than it is already.

While greater climate variability and uncertainty complicate the task of governing fisheries and expanding aquaculture sustainably, this sector can also strengthen the ability of communities to maintain their livelihoods in the face of a changing climate. Fish can provide opportunities to adapt to climate change by, for example, integrating aquaculture and agriculture, which can help farmers cope with drought while boosting profits and household nutrition. Fisheries management must move from seeking to maximise yield to increasing adaptive capacity. Research is needed to find innovative ways to further improve the existing adaptability of fishers and aquaculturists.





## Participatory information platform on the adaptation of vulnerable communities to climate change (InfoClim)

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**Abstract.** Climate change obliges Sahelian communities to face the difficult challenge of surviving in a fast-changing, fragile environment. To cope with this challenge, local and national actors need to become aware of the phenomenon, monitor change as it occurs in the field, and prepare adaptive and predictive strategies. Recognising that the availability of good quality information is central to working out solutions to problems of natural resource management, and that knowledge-sharing is a precious tool for innovation and decision-making, the Centre de Suivi Écologique in Senegal, with the help of the Climate Change Adaptation in Africa (CCAA) programme run by the International Development Research Centre (IDRC), has started a project to create a participatory information platform on the uptake of scientific information, local adaptation strategies, and policies to reduce the vulnerability of rural populations in Senegal to the impacts of impending climate change. The InfoClim project works with several villages in four local communities in the Thiès region. The project approach advocates working with producers (farmers, horticulturists, livestock producers), rural community organisations, NGOs and local decision-makers. The InfoClim platform is also going to be open to national decision-makers, especially the Comité National sur les Changements Climatiques du Sénégal. The project was started about a year ago and intends to capitalise results from the IMAP research projects conducted between 2003 and 2006 with the École Polytechnique Fédérale de Lausanne.

## Effects of rainfall, temperature and humidity patterns on production levels in crop-livestock systems in Uganda

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**Abstract.** The effect of climate change on production in crop-livestock systems is mainly expressed through a depression of crop yields. A reduction in productivity of livestock also occurs subsequently as a result of their dependence on crops and pastures. Changes in temperature affect livestock feed intake and milk production. Studies

done in Uganda analysed patterns of rainfall, temperature and relative humidity in Mbarara, Masaka and Jinja districts over a period of 9 years. Patterns were also studied in relation to current crop and livestock production levels. General linear regression showed that rainfall was decreasing over the 9-year period; however, although the model was statistically significant ( $P < 0.01$ ), the patterns within each district were not. Rainfall was highest in Jinja (1380 mm year<sup>-1</sup>) and lowest in Mbarara (960 mm year<sup>-1</sup>). Minimum temperature in Mbarara was increasing with a coefficient of 0.051 ( $P < 0.05$ ) and maximum temperature in Jinja with a coefficient of 0.078 ( $P < 0.05$ ). Regression models for relative humidity showed increasing trends for the 9 am recordings and a decreasing trend for the 3 pm recordings. Yield response patterns for bananas, beans and elephant grass showed sensitivity to climatic pattern. This was expressed through the effects of the season of growth in the year (long or short rains) and the district where the field was located on yields. Feed availability (kg DM per tropical livestock unit per season) for dairy cattle in Jinja, where rainfall was highest, was fivefold that in Masaka. Similarly, daily milk yields (kg per tropical livestock unit) in Jinja were approximately twice those in Masaka and Mbarara.

## Gender, pastoralism and climate change in northern Kenya: vulnerability and adaptation

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**Abstract.** Pastoralism is an important means of earning a livelihood in the arid and semi-arid lands (ASALs). Pastoralists constitute 13.2% of Kenya's 30 million people, and their livestock accounts for 70% of the country's livestock. To date, there have been no studies to identify indigenous and emerging technologies, gender dimensions of vulnerability as well as socio-economic, and policy constraints of adaptation to climate change in Turkana and Mandera. A participatory approach was used in collecting data through the adoption of open-ended questionnaires, which were administered to the participants in groups. Disaggregated data were collected and analysed by age and sex. The results have clearly demonstrated that women are more vulnerable than men, as climate change affects the poor more, and women constitute 70% of the poor in developing countries. Pastoralists have a variety of indigenous and alternative strategies to improve adaptability while reducing risks caused by climate change. So far, there is no specific Kenya government policy on pastoralism to enhance socio-economic development in the region. In conclusion, pastoralism has a great potential as an alternative livelihood

for the majority of the population living in ASALs. Since the majority of the 50% of Kenyans leaving below the poverty line are found in ASALs, investing in ASALs is an important strategy for reducing poverty levels.

**Keywords:** adaptation, ASALs, biodiversity, climate change, gender, livelihood, participatory approach, pastoralism, Turkana, vulnerability, Kenya

### Effects of gradient and climate change on forage diversity in sylvo-pastoral systems in Senegal

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**Abstract.** Livestock production is the main activity in the sylvo-pastoral zone in northern Senegal, and ranks second after agriculture as a source of revenue in the Sudanian part of the Senegalese groundnut basin. But drought in the 1970s seriously changed the diversity of fodder in the ecosystem which, in former times, was suitable for livestock production. This means that the natural pastures no longer provide adequate feed for livestock, and the animals now suffer from permanent feed insecurity. The study focuses on the analysis made of a series of vegetation observations, climate data and data from surveys on the population's perception of pasture degradation. The study is rounded out by work to characterise the fodder diversity in the pastoral systems, and to optimise potential fodder species in order to improve fodder production in the sylvo-pastoral systems. In Senegal, the vagaries of climate over the past few years have strongly accentuated the climate differences between north and south, which has resulted in a relocation of certain species, and changes in their diversity and dynamics. Some forage species endemic to the north Sahelian area, including *Dioda scandens*, seem to have invaded the pastures in the Sudanian part of the Senegalese groundnut basin. Higher stocking rates in increasingly smaller areas are leading to overgrazing and gradual elimination of a large number of fodder species. This means that the dynamics of these species, often related to gradient and climate change, also seem to be governed by the increasing anthropic pressure of livestock in search of better grazing.

**Keywords:** climate gradient, diversity, fodder, sylvo-pastoral zone, Senegal.

### Climate change and the development of water resources in the Lac de Guiers area (Senegal): effects on potentials, access and uses

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**Abstract.** Over several decades, the dynamics of water resources in the lac de Guiers area (Senegal) have become increasingly pronounced because of climatic disturbances, land development, and operating methods that caused changes affecting the landscape in various ways, depending on the year, season and sub-zone. The impact was also conditioned by socio-economic stakes, the agronomic value of the land, and water access. Thus, in areas where most of the waters come from the river and/or the lake, changes in the availability and conditions of access to the water can often be traced to the multiplicity of uses of these waters, decided upon as soon as the waters improved. Livestock production is being put to a difficult test in this region. In other zones, however, the dynamics of the pastoral landscape are reflected in the construction of permanent water installations and improvements in cattle health coverage. The high stocking rate in this area causes a major imbalance between supply and demand and forces herders to go on the move early.

In conclusion, the unique dynamics of the pastoral areas in the zone near the lac de Guiers lead many observers to ponder about the future of pastoralism in these ecosystems, especially with increasingly pronounced phenomena linked to climate change.

### Identifying the implications of climate change on agriculture and livestock production for ASARECA

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**Abstract.** Agricultural Research for Development in Eastern and Central Africa (ASARECA) is a non-political association of research institutes in 10 eastern and central African countries: Burundi, Democratic Republic of Congo, Eritrea, Ethiopia, Kenya, Madagascar, Rwanda, Sudan, Tanzania and Uganda. It serves as a forum for promoting agricultural research and strengthening relations between research communities. It focuses on solving agricultural research for development issues to attain economic growth, food security and eradicate poverty through the development

of efficient, effective and sustainable agriculture. ASARECA follows a strategic research plan that helps it reach its development goals. However, this plan currently does not include the potential impacts of climate change on selected commodities or technological options that are promoted. Currently the International Livestock Research Institute is supporting ASARECA by undertaking a review of the state of knowledge of agricultural and pastoral implications about climate variability and future climate change within East and Central Africa. This study is considering the impacts of climate change on production systems, the magnitude of these implications, and the consequences for agricultural commodities and natural resources at a range of scales, from household and community levels to district, national and regional levels. The study also includes an evaluation of technology options promoted by ASARECA and their effectiveness in the future in the face of the changing climate. The information will be made available and disseminated to policy-makers and rural communities to raise awareness about the impacts of climate variability and climate change on agricultural and rural development. The research community of ASARECA will have easy access to the information, enabling them to guide optimal decision-making and target activities to protect their livelihood systems against climate change and to help alleviate poverty.

### **Livestock movement and migration during crisis situations in the Greater Horn of Africa: experiences from the 1995-97 and 1999-2000 droughts in dry areas of Kenya, Uganda, Ethiopia and Tanzania**

**J. Ndikumana**

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**Abstract.** Mobility and migration is a key strategy utilised by pastoralist communities in the Greater Horn of Africa (GHA) to cope with the devastating effects of crises, particularly drought, on their livestock. Two studies carried out by the ASARECA Animal Agriculture Research Network between 1998 and 2000 looked into traditional coping mechanisms in pastoral systems of the GHA, covering drought-prone areas in Ethiopia, Kenya, Tanzania and Uganda. Mobility was observed to be an inherent strategy that pastoralists use to optimise production off a heterogeneous landscape under a precarious climate. The search for water (for human and livestock consumption) and forage triggered mobility and migration, strategies that were most intensified by drought.

During the 1995-97 drought, distances trekked to live-stock water sources were almost tripled, from an average (across zones) of 5.9 km pre-drought to 15.8 km during the drought; pure pastoralists trekked greater distances than agro-pastoralists. Distances to grazing sites also increased, from an average (across zones) of 5.5 km pre-drought to 20.4 km during the drought, with pure pastoralists trekking greater distances than agro-pastoralists.

A major lesson learnt from the two studies is that crisis situations such as severe droughts are community-managed, and it is concluded that information should be gathered on the distribution of forage and water resources, market places, diseases and security hotspots along migration routes. This information may be used to develop appropriate interventions and contingency plans for crisis management in pastoral systems, and shape appropriate strategies and policies for optimisation of resource use and productivity of the rangelands. Formulated policy should be implemented in line with general principles of the community-based resource management model. The interventions should be entrenched in existing community institutions and ecosystem states to ensure sustainability.

### **BIOPHYSICAL ISSUES**

#### **Best practices on sustainable land management and forestry for reversing land degradation and mitigation of the impacts of climate change**

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**Abstract.** The agriculture sector is the backbone of Ethiopia's economic growth, contributing about 50% of GDP, 90% to export revenues and 80% of employment. This important sector is threatened by severe land degradation. About 85% of the land surface of the country is considered prone to moderate-to-severe land degradation. Over 1.5 billion t of topsoil is estimated to be lost each year due to soil erosion. Although land degradation is attributed to many factors, loss of vegetation cover is the main causal factor. Ethiopia's natural forests are believed to have covered about 40% of the country's land surface some 50 years ago, but have dwindled to a mere 3% currently. The estimated 77 million head of cattle and shoats which are mostly grazing in the highlands (beyond the carrying capacity) contribute to the slow recovery of rangelands. The agricultural sector and the livelihoods of smallholder farmers are further threatened by micro- and macro-climatic changes which





are observed worldwide. Changes in precipitation patterns (less, excessive, late-onset), occurrence of hailstorms and increased temperature have been observed in many parts of the country over the past many years.

The government and development partners have acknowledged the need for devising new ways of reversing land degradation as well as mitigating the effects of climatic changes. The country has been applying a diverse set of interventions to reverse land degradation. There are many good practices resulting from the interventions of the government, development partners, NGOs and individual farmers. However, these isolated and uncoordinated efforts have not made a dent on the rapidly expanding rates of land degradation. The new approach being pursued by the government is the scaling up of integrated and mutually reinforcing best practices in micro-watersheds (200-500 ha) so that tangible improvements in farmers' livelihoods are linked to sustainable land management. Efforts are under way to screen best practices on sustainable land management (technologies, approaches, species, procedures, etc.) from all over the country for wider dissemination. The German Development Cooperation (GTZ) has been involved for many years in the introduction and testing of innovative technologies, approaches and species appropriate for sustainable land management, and has already identified some for inclusion in the scaling-up efforts of the government. This paper presents some of the best practices on land rehabilitation, including forestry interventions outside the micro-watersheds, developed with the support of GTZ. Emphasis will be placed on the reclamation of gullies, agro-forestry, enclosures and community-based forest management.

### **Agro-forestry, a viable choice in climate change adaptation in West Africa**

**S. K. Adessou, L. Faye and S. Dembele**

*Investir Dans l'Humain (IDH), Togo*

**Abstract.** The African continent as a whole, and more specifically West Africa, must cope with numerous challenges in the 21st century, including its vulnerability and adaptation to climate change. Considering models that predict a reduction of up to 9% in potential farmlands in the 2080s and a drop in cereal yields of close to 10% by the year 2050, and the IPCC report indicating potential yield drops from rainfed agriculture of about 50% by the year 2020 in certain regions of Africa, agricultural activities must, without delay, adopt a genuine natural resources management approach.

A multicriteria analysis designed to evaluate the contribution of certain options to climate change adaptation

shows the value of agro-forestry practices that, as a corollary, include natural resource conservation. The methodology used starts with the preparation of a list of potential adaptation-promoting options and criteria, then constructs weighting and classification tables for these options on the basis of their advantages and drawbacks. In order to promote sustainable options for adapting agriculture to climate change, all the while protecting the environment and guaranteeing regular agricultural output levels in West Africa, it is recommended that development policies and programmes, post-2012 negotiations and climate change adaptation plans, assign a major role to agro-forestry.

### **Caribbean: integrating biofuels into existing agricultural systems**

**M. R. Wilson**

*Sugar Industry Research Institute, Jamaica*

**Abstract.** The Caribbean, as a traditional sugarcane producer, has the capacity to develop a sustainable biofuels industry, producing fuel-grade ethanol, generating electricity from bagasse and producing biogas. Increased production of biodiesel from oil nuts (such as *Jatropha*, castor seed and palm) is possible, and crops can be intercropped with sugarcane. The development of a sustainable biofuels industry will increase the competitiveness of traditional agriculture-based industries, allow countries to partially meet their energy needs and export to several markets, and play a useful role in tackling climate change.

Legislation mandating the local production and use of biofuels has been found to be the driving force for the development of the Brazilian biofuels industry, so this should be the first step implemented to provide the framework within which science, technology and innovation, coupled with effective communication strategies and a participatory approach, can be employed to rapidly advance biofuels production. Policy coherence is encouraged, nationally among the different ministries as well as between national policies and those of the EU and the USA, who will seek to buy surplus biofuels. Effective information and communication strategies engaging civil society are needed to inform and foster full support.

Caribbean territories must act now and build on the partnership agreements with Brazil and other governments, and foster relationships with companies owning proprietary information, so that the most efficient conversion technologies can be employed to allow for the building of local skills, development of research capabilities and stringent management protocols to protect and sustain the environment.

## The 'power' of an invasive species: exploring *Casuarina* farms for biomass gasification in The Bahamas

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**Abstract.** Lately there has been a rash of calls for Bahamians to turn to large-scale farming to address skyrocketing fuel and food prices. The fact is, however, that since the failure of loyalist plantations, large-scale agriculture has never worked in The Bahamas - except for a few brief exceptions such as the export trade in pineapples and sisal during the 19th century. Bahamian conditions are seemingly not conducive to commercial agriculture.

One plant does seem to thrive especially well in the harsh soil and climatic conditions of The Bahamas: *Casuarina glauca*, commonly known as the Australian suckering pine, is categorised as an invasive species. *Casuarina* has out-competed other, more indigenous plants to take its place as one of the commonly encountered plants in the Bahamian natural environment. Cultivating it on a commercial scale will therefore require very little input. Further, *Casuarina* farms may occupy large portions of government lands that are marginal for traditional agriculture or housing and will therefore not compete for space with either.

*Casuarina* has very high caloric content - 5000 kilocalories per kg dried wood - and application of relevant renewable energy technologies can transform the significant potential energy that is locked within its carbonaceous trunks into useful forms for electricity generation. This presentation explores the prerequisites for development of a sustainable agricultural sector around this activity, and examines its role in effecting poverty eradication, energy sustainability and climate change mitigation in The Bahamas - a country of over 700 isles and cays in which fuel transport is a significant economic and environmental cost.

## Climate change in semi-arid areas. Integrated management of drylands and wetlands for mutual benefit

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**Abstract.** Climate change will increase uncertainty for farmers in the Sahel. There are two main ways in which dryland farmers can attempt to deal with this uncertainty:

diversify to reduce risks, or move to local wetlands, where water and nutrients collect and production risks are lower. In Niger alone there are more than 1000 such isolated permanent and semi-permanent wetlands. These wetlands, however, also have important uses for activities other than cropping, including pastoralism, fisheries, collection of natural products and biodiversity. Here the interactions between drylands and wetlands are discussed. For instance: if there is no wetland, then often there is no water for livestock and no manure for the fields. If there is no dryland, then there will be no grazing for the livestock and no manure for increased production in the wetlands. It will be shown how climate risks in dryland agriculture can be reduced, and nutrient-use efficiency increased, through better knowledge of soil and crop growth variability. Participatory integrated natural resources management (PINReM) can contribute to wetlands health for the benefit of the people in the drylands as well as in the wetlands. A checklist for such PINReM is presented for discussion.

## Addressing land degradation in Tanzania: contemporary issues related to policies and strategies

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**Abstract.** Since the early years of Tanzania's independence, several attempts have been made to address land degradation. Policies and strategies were formulated that emphasised the importance of land conservation in achieving economic growth. However, the context in which the earlier strategies were designed and implemented led to further land degradation. The failure of these interventions was partly because policies that backed them remained sectoral, and most adopted the top-down approach with very little involvement of communities. The United Nations Conference on Environment and Development (UNCED) of 1992 in Rio de Janeiro created a new chapter in the country by insisting on the importance of sustainable development. New policies and strategies were formulated with the intention of correcting past mistakes.

This paper assesses the extent to which Tanzania's post-UNCED policies and strategies address the recent challenges of climate change on land degradation as reported by the IPCC in 2007. It summarises a review of selected policies, strategies and related literature on land degradation and climate change. The National Strategy for Growth and Reduction of Poverty, and two other sectoral



strategies, were reviewed in addition to the environmental, agricultural and water policies. The study finds that significant short- and long-term measures to combat the negative effects of land-use practices on land resources are addressed. However, constant review of the policies and strategies is required to ensure that emerging challenges are addressed as part of the overall efforts to combat the impacts of global climate change.

### **Climate change and farmers' strategies for sustainable management of farmlands: the pilot project in the plateau central (Zondoma Province, Burkina Faso)**

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**Abstract.** Global warming is a source of concern and is causing the international community to worry about the foreseeable short- medium- and long-term effects on human, animal and plant life. In its Fourth Report (2007), the IPCC indicated that climate change would have very pronounced negative repercussions on West Africa, especially the Sahel. Land degradation and water shortage are among the many, most plausible impacts mentioned, and lead to lower agricultural output. Climate variability and change can already be seen as major and potential inhibitors of sustainable development in the Sahel. Because of their production systems' strong dependence on natural resources and climate, the only alternative for the Sahelian populations, deemed especially vulnerable, is to adapt to the climate change.

In Burkina Faso, CILSS is implementing the pilot phase of the project on developing the capacity to adapt to climate change in the Sahel, funded by the Canadian International Development Agency (CIDA). This project has helped identify endogenous adaptation strategies for sustainable farmland management. The adaptation strategies, implemented together with the inhabitants of 24 villages in Zondoma Province, shows that these technology packages can be effective in increasing crop yields.

**Keywords:** Burkina Faso, Zondoma, Sahel, climate variability and change, adaptation, sustainable land management, yields.

### **Sustainable soil and water management technologies to mitigate climatic vulnerability in drought-prone areas of Malawi**

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**Abstract.** Land, water and climate management are essential ingredients for increased food security and sustainable livelihoods in sub-Saharan Africa. This is particularly significant in countries whose populations are heavily dependent on smallholder rainfed agriculture. In Malawi, for example, 90% of the population is rural-based and is engaged in subsistence farming. However, attainment of food security and sustainable livelihoods under these conditions are often compromised by poor investments in land, water and climate management techniques. While the former has man-made causes, the latter relates to natural causes as a result of recurrent droughts and floods. These climatic extremes have taken a toll on the lives, health, assets and infrastructure of poor households. Despite this, farmers have been shown to have vast and rich indigenous knowledge and skills, acquired over a long period, to diagnose and develop mitigating practices for land and water degradation. This has proved to be effective in determining which technologies to invest in to counter climatic variability, given the diversity of constraints at household level. In Malawi, as in many other parts of Southern Africa, households have been observed to employ the use of various water-harvesting structures, soil fertility-management technologies and drought-tolerant cultivars to survive the vulnerability context of their farming systems. The study concludes that researchers and policy-makers need to broaden their understanding of farmers' and communities' preferences with regard to selection of land- and water-management technologies to better manage the vulnerability brought about by climatic changes.

### **Monitoring and predicting weather, climate and related events for improved decision-making in the Caribbean**

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**Abstract.** In the Caribbean, farmers often rely on their experience with weather and climate to aid in making decisions on their farms. However, most farmers have been lamenting about changes in weather patterns, particularly rainfall, which bring their many years of experience to naught.

‘No more can we rely on traditional knowledge of weather and climate’, they say. This emphasises the importance of monitoring and scientifically predicting weather and climate. CIMH’s mandate is to develop meteorological and hydrological services, as well as providing awareness of the benefits of meteorology and hydrology for the economic wellbeing of CIMH Member States through training, research, investigations, and the provision of related specialised services and advice. CIMH has taken on the concerns of the agricultural community in the region by taking steps toward monitoring and predicting the weather and climate. With the use of drought and precipitation indices and other indicators, the region is embarking on a major campaign to provide information on the status of drought and precipitation and to provide projections of future (up to 3 months) drought and wet conditions to enhance decision-making. Weather models, such as WRF and MM5, will provide improved predictions of weather and, when coupled with hydrological models will provide predictions of flooding on much shorter time scales (up to 48 hours). Efforts are also under way to improve monitoring of meso-scale weather events in the Caribbean region.

**Keywords:** weather monitoring, climate monitoring, predicting, flood, drought, decision making, Caribbean

### Strategies for promoting smallholder farmers’ stewardship of ecosystem services in Africa: wielding the stick or dangling the carrot?

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**Abstract.** Land degradation and, in particular, declining soil fertility is one of the greatest biophysical constraints to food production in sub-Saharan Africa. Many countries that face seasonal food deficits, in the effort to reconcile present food deficits with future environmental debt, often sacrifice the latter for the former. Some land-use practices offer opportunities to achieve the two seemingly opposing objectives by assisting farmers to replenish soil fertility (improve food production) and simultaneously help farmers to adapt to climate change, in addition to generating environmental services (e.g. carbon sink) that contribute to climate change mitigation. The diffusion of such technologies among smallholder farmers is, however, generally low due to several factors, especially policy and institutional constraints. Dissemination of the technologies has primarily been based

on sensitisation, training (‘sermons’), and ‘wielding the stick’ (regulations and enforcement). Based on several studies carried out in southern Africa for over a decade, this paper highlights agro-forestry as an example of technologies for meeting household food security and contributing to climate change mitigation and adaptation. It discusses how farmer adoption of such technologies can be enhanced through conditional incentive mechanisms that reward farmers for the environmental services (‘offering carrots’) generated by specific technologies. In conclusion, policy options to explore existing opportunities for satisfying both food security and environmental services are identified.

**Keywords:** agroforestry, adoption, externality, path dependence, policy, Southern Africa.

### Abiotic factors influencing ecological diversity and productivity of baobab in the agro-forestry systems of Benin

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**Abstract.** Baobab (*Adansonia digitata*) is a multi-purpose tree widely used by local farmers in Africa. The objectives of this study are to evaluate the ecological diversity in Benin of *A. digitata* populations across the climatic gradient, to quantify the average productivity of its pulp, seeds, kernel, and to plan its restoration within the traditional agro-forestry systems where it is threatened. The study was carried out in the Sudanian (9° 45’-12° N), Sudano-Guinean (7° 30’-9° 45’ N) and Guinean (6° 25’-7° 30’ N) zones of Benin. The density, morphology and productivity of the individual baobabs varied significantly from one zone to another. The zones with high values of potential evaporation, rainfall, relative humidity, temperature, pH water and percentage of fine silt are associated with a low seed and fruit pulp production. The higher the pH<sub>KCl</sub> (the percentage of total nitrogen, organic carbon and organic matter), the higher the number of seeds produced by the individual baobab. The higher the clay and crude silt content of the soil, the better the productivity. The high values of C/N ratio and rainfall are negatively associated with biotic characteristics of the baobab. The distribution of the diameter classes shows that the species is facing a natural regeneration problem. There were very few individuals recorded with a diameter less than 100 cm. Based on the aforementioned outputs, the zones most suitable for baobab restoration are identified within each climatic zone for the benefit of the local people.



## Transforming waste to wealth: *Gmelina arborea* fruit pulp potential for ethanol production as biofuel resource

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**Abstract.** Enormous amounts of biomass are wasted annually in Africa as they are not utilised, thus their conversion to forms beneficial to man will amount to transforming waste into wealth. *Gmelina arborea* fruit pulp was investigated for ethanol yield as a potential biofuel resource. Fruits were collected from plantations of six different ages. Fermentation agents were baker's yeast (*Saccharomyces cerevisiae*) and palm wine. Distillation was carried out at 90°C. The distillate was subjected to spectrophotometry using ethanol standard solution (0.5%). Mean ethanol yield was 1.45-9.71% and 1.21-9.38% for fruit pulp fermented with baker's yeast and palm wine, respectively. Baker's yeast yielded significantly more ethanol than palm wine. A significant effect of plantation age on ethanol yield was obtained. However, there was no discernible pattern of ethanol yield with respect to plantation age, so the significant effect could not be attributed to age. It was concluded that *Gmelina* fruit pulp has good potential for ethanol production and thus as a good biofuel resource. The potential is better appreciated if the huge annual *Gmelina* fruit production and large extent of *Gmelina* plantations are considered. *Gmelina* fruits are generally left to waste as no use currently exists for them. Using ethanol from *Gmelina* fruit pulp for biofuel could provide a cheap substitute for fossil fuel, producing 'zero emissions' as it is renewable, thus leading to less environmental pollution and contributing to climate change adaptation.

**Keywords:** *Gmelina arborea*, fruit pulp, ethanol yield, biofuel, plantation, fermentation agent.

## Commercial algae farming for sustainable energy and a carbon-free environment

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**Abstract.** The purpose of this paper is to point out the usefulness of this technology and to find out how it can be developed in Africa to reduce the felling of trees for firewood fuel, and the increase in atmospheric CO<sub>2</sub> concentrations that results from it. The overall aim is to conserve the environment.

While a number of bio-feedstocks are currently being used for biodiesel and ethanol production, algae have emerged as one of the most promising sources, especially for biodiesel production and for algae paste used by other industries. This is a relatively new field of study, and algae are not nearly as well understood as other organisms that have found a role in today's biotechnology industry. The burning of fossil fuels is the major source of the current build-up of atmospheric CO<sub>2</sub>. Thus identifying alternatives to fossil fuels must be a key strategy in reducing greenhouse gas emissions. While no single fuel can substitute for fossil fuels in all energy sectors, we believe that biodiesels made from algal oils offer a fuel that can make a major contribution to the reduction of CO<sub>2</sub> generated by power plants and commercial diesel engines. Algae technology offers the opportunity to utilise land and water resources that are, today, unsuited for any other use. Land-use needs for micro-algae complement, rather than compete, with other biomass-based fuel technologies. We wish to propose the growth of algae farms in Africa, with the assistance of custom-designed algae systems, to help the Earth and to also provide employment.

## Changing adversity to assets: biofuel generation potential of developing countries from municipal organic wastes

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**Abstract.** The southern Africa region is anticipating an energy crisis in a few years. The region's electricity-generation capacity is failing to keep pace with the demands of expanding industry and domestic use. In cities of these developing countries, however, large quantities of organic wastes are generated, which are costly to dispose of and yet have potential use in generating biofuels. A purposive sampling survey was carried out to investigate the nature, quantities and composition of organic wastes generated by the city of Mutare. Data were collected using a questionnaire. Results from the survey showed that Mutare, a city with an estimated population of 300,000 people, generates an average of 189,987.4 t of dry organic waste, constituting 79% of all waste produced by the city. Waste emanating from marketing and processing of farm produce contributed an estimated 37% of the organic waste generated. The survey also showed that the majority (>63%) of organic waste ends up at the municipal landfills. Decomposition of organic waste at the landfill generates CO<sub>2</sub> and methane, which are potential biogases. These gases are lost into the atmosphere, contributing to climate change through their





effects on temperature and the ozone layer. The study therefore recommends anaerobic digestion of municipal organic waste to produce biogas. Municipalities are recommended to improve their capacity to generate energy using available low-cost methods in order to reduce their national energy demands and contribute towards reducing greenhouse gas emissions.

**Keywords:** municipal organic waste, biogas, energy.

### Managing drought for food security in eastern Nigeria

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**Abstract.** Around the world, hundreds of millions of men, women and children live in extreme poverty. Their poverty is multi-faceted: besides lacking money, they have limited access to education, suffer from poor health, have little political weight, and are vulnerable to all manner of external shocks such as droughts, etc. Throughout Nigeria, people are becoming increasingly affected by extreme climate and environmental change events. Worsening droughts, in particular, are ruining the lives and livelihood of many households, and have continued to hamper farming activities. Water mismanagement, inappropriate land use, as well as poor knowledge of anti-drought measures by farmers have led to land degradation such as soil erosion and loss of the soil's productive capacity to produce food. The limited potential for dry-season farming through soil and water conservation, the non-employment of rainwater harvesting technology, as well as conflicts over limited water resources, have not helped the situation. Consequently, local livelihoods are being jeopardised while increasing poverty for thousands of farmers. Using the World Overview of Conservation Approaches and Technologies (WOCAT) methodology, this paper discusses how poor men and women in Owerri, eastern Nigeria; whose livelihoods are based on small-scale cropping and livestock agriculture, sustainably harvest and use rainwater through agronomic, vegetative and structural measures. Demonstrating the sheer grit, courage and determination poor people bring to the endless challenge of survival, this paper concludes by underscoring the lesson that individuals, households and communities are not passive in the face of economic change, and even in the face of climate change.

### Water management and development issues in the arid lands of Cameroon

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**Abstract.** Climate variability in the Sudano-Sahelian and Sahelian parts of Cameroon causes sporadic droughts. The resulting desiccation leads to chronic water shortages for the local populations. Because of the increasing 'Sahe-lianisation', prudent water management is essential in all activities. This article is based on an inventory of traditional farming techniques to combat the effects of run-off and to protect soils by storing surface waters in a plot-level micro-system to retain and infiltrate surface waters. It is based on direct observation and field studies.

**Keywords:** development, water, environment, management, Extreme North Province of Cameroon.

### Poverty and land degradation: the effect of the rural woman's role on climatic change in Uganda

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**Abstract.** Uganda is one of the poorest countries in the world, with more than 70% of her population residing in rural settings. This population is highly dependent on agriculture for survival, with women being the more productive gender. Culture in Uganda dictates that the role of a woman is that of feeding and taking care of the family, as well as bearing children to till the fields, which are a main source of livelihood. She tills the land and sells the produce to fend for the family. Whereas she is the main income-earner, the man is the decision-maker in resource allocation, and often diverts family income to personal expenditure such as on drinking, polygamy, witchcraft and womanising, leaving very little, if any, for more productive household expenditure. This is a common trend in the rural parts of the country where we work as BROSDI.

To meet household and cultural expectations, women subconsciously engage in activities detrimental to the environment and climate. These include overcultivation, overgrazing, monoculture and digging in the swampy areas, which are destructive farming practices. In addition, because they cannot afford electricity, women resort to

firewood and sometimes charcoal fuel for cooking and lighting. House construction ingredients are mud, clay, firewood and sticks, which further degrade swamps, water levels and forests. Combined, these practices are destructive to the environment and eventually to the climate.

## **Sustainable agriculture as an adaptation strategy to climato-edaphic constraints in north Cameroon**

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**Abstract.** By determining the evaporation deficit through a frequency analysis of statistically significant threshold overruns (median, lower quintiles, upper quintiles), this paper shows that the North Cameroonian plains are in a region regularly constrained by rainfall problems, marked by droughts, but without a specific seasonal pattern. This upsets the calendar of agricultural activities in the region: re-sowing, floods, food shortages, soil degradation, etc. To cope with this situation, the local populations develop strategies, or adopt those proposed by development support services such as the ESA project (Water, Soil, Trees). These innovations (erosion control measures, agro-forestry, crops under plant cover, production of organic manure, etc.) are remarkably effective in improving productivity and the cropping system.

**Keywords:** climato-edaphic constraints, adaptation strategy, sustainable agriculture, North Cameroon.

## **Solar cookers offer alternatives for cooking in atoll countries**

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**Abstract.** The demonstration and monitoring of performance of solar cookers arose through a collaborative partnership between SOPAC and Ferris University of Japan. The demonstration of two types of solar cooker, a parabolic and a hand-made cooker, was carried out in Kiribati and Tuvalu in February and September 2008, respectively. This provided the opportunity for locals to observe first-hand how the technology works and to gauge its applicability, particularly for atoll countries where there is limited biodiversity and fuelwood for cooking. The high cost of kerosene and LPG has added a further burden to atoll country households' energy budget.

The Kiribati activity included monitoring the performance of the hand-made cooker during a day. The results show a saving of 0.3 l of kerosene (AUD0.43; the cost of 1 l of kerosene is \$1.30) - or a reduction of 9 l of kerosene per month, equivalent to about 22.401 kg CO<sub>2</sub>. During monitoring, rice, fish, breadfruit, pumpkin, shellfish and octopus were cooked at different times of day, taking into account factors such as temperature, wind and cloud cover. The presentation describes the two types of solar cooker being demonstrated and monitored in Kiribati and Tuvalu. The solar cookers can be replicated or redesigned to an appropriate model suitable for the community's needs.

**Keywords:** solar cooking, performance, atoll countries.

## **SOCIO-ECONOMIC ISSUES**

### **Vulnerability and adaptation to climate change: the case of the Ejura-Sekyedumase District of Ghana**

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and Industrial Research, Ghana*

**Abstract.** This study was conducted in the Ejura-Sekyedumase District of Ghana to gain insight into the level of awareness of climate change, how vulnerable farmers are to climate change, and how different groups respond and adapt to it. Questionnaires were administered to a total of 70 respondents chosen at random from five villages between May and June 2007. The study showed that more than 75% of respondents are aware of climate change. They also perceived that the causes of climate change were felling of trees (54.3%), natural variability (35.7%), bush burning (2.9%), and other causes (7.1%). The changes they had observed in agriculture as a consequence of the changes in climate were reduced crop yields (31.5%), more insect pests (27.1%), total crop failure (21.4%), and more diseases on crops (20%). The respondents indicated that male farmers were most vulnerable to climate change. The predominant means of adapting to climate change were to plant different crops, rotate crops, mulch, or plant short-duration crops. The dominant coping mechanisms identified by respondents were to purchase food from the market, produce charcoal, and sell their livestock.

**Keywords:** climate change, vulnerability, adaptation, coping mechanisms.



## Reducing vulnerability through natural hazard mitigation, using hazard analysis critical mitigation points (HACMP)

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**Abstract.** A mechanism is proposed for decision-makers and rural communities, utilising available information and communication tools, to protect their livelihood systems from the effects of climate change. Hazard, exposure and vulnerability represent the three sides of the climate change risk triangle. Reducing any side of the triangle lowers the amount of risk. Individuals and rural communities are limited in their ability to eliminate climate change hazards or totally avoid exposure. In order to reduce vulnerability, a policy-led mechanism is proposed that can consolidate mitigation methods. The proposed framework provides a missing link in the natural hazard mitigation milieu, by establishing a structured, auditable system to amalgamate the disparate efforts of international, regional and national agencies. The approach is based on hazard analysis and critical mitigation point (HACMP), which mirrors the hazard analysis critical control point (HACCP) principles, further institutionalising the critical point concept within the agricultural sector. It will also provide a structured mechanism to inculcate gender-sensitive, participatory methods into hazard analysis, vulnerability assessment and mitigation. The benefits to be derived, as well as the implementation challenges, are acknowledged.

## Vulnerability, poverty and adaptation to climate change in Burkina Faso

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**Abstract.** Climate change has become a clearly perceivable reality and already has serious repercussions for people and nature around the world. As a poor, land-locked country, Burkina suffers severely from the deleterious effects of climate change. Burkina is one of those least-developed countries which are very sensitive to climate change because of the very limited resources they have to cope with the challenges of development and climate shocks.

The population's vulnerability and adaptive capacities were assessed as part of the preparations for the National Adaptation Programme of Action. The results were analysed

in relation to the poverty indices that had been worked out in the PRSP for each region. After presenting the general characteristics of the country and explaining the methodology used, we analysed signs of climate change and their effects on the main sectors - agriculture, livestock production, forestry, and water resources. Projections were made for climate variables in timelines 2025 and 2050. The most pronounced climatic factor is rainfall, which is prone to major seasonal and inter-annual variations that cause ever more frequent droughts and floods.

The national economy is driven essentially by the most vulnerable sectors, which generate the livelihood of 85% of the population and account for 40% of the GDP. The rural populations are the driving force of the nation, but suffer most from poverty: 52.3% of the rural population lives below the absolute poverty threshold, as against 19.9% of the urban population. Climate change will indubitably aggravate poverty unless the appropriate adaptive measures are adopted and popularised.

## Lessons learned from vulnerability and risk reductions in selected Pacific Island countries

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**Abstract.** Pacific Island countries are highly vulnerable to natural and human-induced disasters. Key challenges include risks posed by natural hazards such as cyclones, earthquakes and volcanoes, as well as extreme vulnerability to the effects of climate change. Although the frequency and types of disaster may vary considerably across the Pacific, there are generally the same high social, economic and environmental costs that continue into the medium and long term. It is widely acknowledged that climate change impacts and other hydrological and geological hazards can greatly reduce the ability of Pacific Island countries to achieve their sustainable development goals and, in the worst case, can even reverse the benefits of existing development. Pacific Island countries are further constrained by limited availability of human, institutional and financial resources to mitigate against the risks of climate change impacts. Therefore Pacific Island countries' resilience remains fragile, particularly as these countries also face increasing population pressures, are becoming more urbanised, are losing traditional knowledge, and are struggling with the challenges of globalisation and modernisation, changing the social, economic and environmental conditions that impact on communities' resilience. Attempts to achieve sustainable development goals, including the reduction of poverty, increasing economic growth and protecting

the environment, will be undermined unless the impact of climate change - such as sea level rises, storm surges, prolonged drought periods and increase in the intensity and frequency of cyclones and typhoons - on vulnerable communities and economies is addressed.

### The 'vulnerability identity matrix' approach for evaluating households' responses to climate change impacts

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**Abstract.** External interventions on mitigating climate change impacts often homogenise and conflict the existing needs of society, a result of unclear existing models for understanding households' adaptation. As a result, households' livelihoods, mostly crop and livestock production, are compromised, exposing households to opportunistic risks such as poverty. A study of drought in South Africa's semi-arid savannas showed categories of household that responded to (i) effects of drought only, (ii) impacts only, and (iii) a combination of the two. Four categories of identified stresses were acute, recurring, chronic and intermittent stress. The ensuing vulnerability of households to drought was explained by matrices of demography, total livelihoods and other household attributes. Resource-poor, weak and least diversified households suffered food shortages, hunger and malnutrition, and depended mostly on wild resources (e.g. non-timber forest products). The study outcome was a 'vulnerability identity matrix' (VIM), which represents the boundaries and heterogeneity of adaptive capacity of households and the interventions elicited. Households with diverse livelihood options responded better to the impacts of the drought. Traditional safety nets constituted better adaptation. VIM is an outcome-based, pro-poor model for informing expectations from climate change impacts and risks. The VIM separated events occurring at the human-biophysical environment interface, differentiating between effects and impacts. It was observed that households respond differently to the impacts of climate change events. Thus VIM provides rapid evaluation of the vulnerability of society to climate change impacts and managing ensuing heterogeneity for mitigation and interventions with minimal conflicts.

### Impacts of climate change on farm income in Burkina Faso

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**Abstract.** This paper reports the results of a study to evaluate the economic impact of climate change on agricultural output in Burkina Faso. The study uses the Ricardian approach for modelling agricultural revenue in relation to climatic, edaphic, hydrological and socio-economic variables. Several econometric models, which were tested with reference to the database from the 2002-03 growing season, have been used to analyse the effects of climate on farm incomes by estimating the marginal impact of climate (temperature and rainfall) on agricultural revenue, and the elasticity of this revenue in relation to climatic variables. Simulations were made using ICPP forecasts (2001). Results show that the marginal impact of temperature on agricultural revenue is US\$19.90 per hectare, and that of rainfall is US\$2.70 per hectare. The elasticity analysis shows that agriculture is very sensitive to rainfall levels. The simulations show that, all else being equal, a 5% temperature increase would cause farmers to lose 93% of their income, and a 14% decrease in rainfall would result in their total loss of income. Since climatic conditions are already harsh, prospects of rainfall decline and/or temperature increase would be very harmful to agriculture.

Furthermore, the study shows that irrigation and extension work have a favourable impact on agricultural revenue, and could be used as viable options to help agriculture adapt to climate change in Burkina Faso.

**Keywords:** Climate change, economic impact, agricultural revenue, Burkina Faso

### Transformations in the lowlands of the Tararé watershed in the Serer Region

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**Abstract.** Spatial strategies are defined as forms of land use usually induced by constraints in an environment that supports a given population. Recent environmental transformations, mainly observed in the lowlands, reflect changes in the spatial organisation of activities. Improvements in the quality of life amount to a race between agricultural output (the main source of income) and

population growth. This dialectic is attuned to the pace of population growth, as shown through spatial pressure, with its multiple consequences for the Tararé watershed. A change in the landscape is forcing local populations to adopt parallel solutions to the traditional ancient practices used in these low-lying areas. Traditional activities, e.g. livestock production, are seeing their favourite areas subjected to vying interests with the development of another type of agriculture, intensive agriculture, being combined with the expansion of the traditionally cropped local areas. This article considers the impact of climate change, with rainfall shortages, that obliges local populations to adapt their behaviour to make better use of natural resources by controlling the low-lying areas of the catchment basin. This conquest, called transformation or spatial strategy in the Serer agricultural landscape, has led to the creation of a farming area that could improve living conditions substantially by combining endogenous and exogenous interventions in the Tararé catchment area.

### Prioritising farm-level skills that can assist grassroots communities in Africa to cope with climate change

K. D. Nkwanga

*Nature's Palace Foundation, Uganda*

**Abstract.** In Africa, the most important impact of climate change at grassroots level is expressed in terms of deficiencies in food production - escalating levels of food insecurity characterised by extreme hunger and malnutrition. The impacts of climate change include a reduction in soil productivity; unpredictable or irregular seasons characterised by extremes of both dryness and precipitation that result in destructive floods; crop failure; escalating incidence of pest attacks; and decreased livestock productivity. Because of poverty, limited resources and poor infrastructure, African countries are constrained when investing in and developing technologies to enable adaptation to global warming. Prioritising and supporting farm-level skills integrated in agricultural activities promises a sustainable answer to concerns of food security, soil rejuvenation, and increased incidence of disease and pest attacks for poor subsistence farmers in the wake of climate change in Uganda. These skills include cultivation of neglected traditional food crops highly adapted to local niches, and can provide sustainable production and food security of rural communities, particularly under poor conditions. Methods include diversified, ecological,



perennial-based agriculture, and innovative soil and water conservation techniques. Such skills, which are integrated in people's day-to-day activities, are easy to adopt, cheap and culturally acceptable, and easy to replicate.

Climate change must be viewed not only as a danger to natural systems, but more importantly, as a direct threat to human survival and wellbeing. Efforts on adaptation must include vulnerability assessments, enhanced resilience to climate impacts, and building human and institutional capacity in making countries less vulnerable to climate change.

### Climate change and variability information access and adaptation: the case of smallholder farming communities in Zimbabwe

T. Chamboko<sup>1</sup>, F. Mtambanengwe<sup>2</sup>, R. Chikowo<sup>2</sup>, P. Mapfumo<sup>2,3</sup> and M. Mekuria<sup>4</sup>

<sup>1</sup> Department of Agricultural Economics and Extension, University of Zimbabwe;

<sup>2</sup> Department of Soil Science and Agricultural Engineering, University of Zimbabwe;

<sup>3</sup> Soil Fertility Consortium for Southern Africa (SOFECSA), CIMMYT- Zimbabwe;

<sup>4</sup> CIMMYT Southern Africa Regional Office, Zimbabwe

**Abstract.** Adaptation is key to shaping the future severity of impacts of climate change on rural communities. As part of an Africa-wide research initiative, a cross-sectional survey of 208 households was conducted in Chinyika and Wedza smallholder farming communities in Zimbabwe. The main objectives of the study were to establish (i) farmers' understanding of climate change and variability, (ii) degree of access to climate change information, and (iii) current adaptation strategies. Fifty-eight per cent of farmers reported having access to climate change and variability-related information through the national media, including radio and television. Notable concerns were raised over inadequacies of such information, apparent lack of reliability, as well as issues of timing and frequency of dissemination that directly influenced utilisation of the information on appropriate farmers' adaptation strategies and decision-making. The study also indicated that farmers were already

responding to climatic changes and seasonal variability. Common adaptation strategies include adoption of suitable crop varieties, practising winter ploughing, water conservation techniques such as tied ridges, and use of leaf litter and manure. However, the link between such behavioural changes and access to climate change information could not be clearly defined. Long-term sustainability of agricultural systems in the context of global climate change requires that smallholder farmers are able to access relevant and appropriately packaged climate change information to enable them to make informed decisions. This has policy implications for strategies to provide farmers with climate change information for development and transformation of smallholder farms into economically sustainable units.

**Keywords:** access to information; adaptation strategy, smallholder farming communities.

### The impact of climate change on the household economy: a case of drought impact in Malawi

Franklin Peter Simtowe and Aliou Diagne

*The Africa Rice Center (WARDA), Benin*

**Abstract.** Drought is one of the most serious adverse climate hazards to hit most of the developing world, including Malawi, over the past several decades, although its frequency, intensity and magnitude have increased over the past two decades. This study examines the impact of drought among households in Malawi. It identifies factors that explain who and what is at risk, and why (the underlying factors behind the vulnerability) - including human-induced global climate change. The specific objectives of the study are to: (1) assess the impact of drought on food and livelihood security situation in Malawi; (2) analyse households' drought-coping mechanisms and identify factors that influence the choice of such mechanisms; and (3) examine the extent of household resilience to drought and its determinants.

Results indicate that drought had a negative impact on household food security, consumer prices, water availability, and forestry and fisheries resources. Results further revealed that irrigation improved household resilience to the impact of drought. The knowledge of whether or not a drought will occur (early warning) also improved the household's resilience - those with prior expectation of the occurrence of drought recovered from the shock much more quickly than households that lacked prior knowledge. The findings suggest that there is scope for using early-warning systems and irrigation to mitigate the negative impacts of climate change.

### Potential impact and adaptation of climate change on smallholder farming and food security in Shire Valley, Malawi

Isaac R. Fandika<sup>1</sup> and Shamie Zingore<sup>2</sup>

*1 Kasinthula Agricultural Research Station, Malawi;*

*2 CIAT-TSBF, Chitedze Agricultural Research Station, Malawi*

**Abstract.** Climate change is among a number of serious pandemics that the Shire Valley in southern Malawi is facing: HIV/AIDS, chronic malnutrition, and land and soil fertility decline. The region is very vulnerable to the effects of changes in weather patterns from both physical and the socio-economic viewpoints. This paper objectively and subjectively analyses the physical adverse effects of climate change on smallholder farming and food security, and consequent adaptations, based on previous reports and current experiences. Several reports show strong evidence for climate change in increased disasters going back to the 1991-92 Southern Africa droughts, which caused suffering to over 6.1 million people. Physically, farmers in Shire Valley are experiencing extreme temperature and evaporation change, such that certain crops are grown near their limits of maximum temperature tolerance. Disasters have continued to escalate in Shire Valley since the 1990s. The number of districts affected has increased from nine in 2001 to 16 and 22 in 2002 and 2003, respectively, causing deaths and damaging homes and crops, with the highest levels in Shire Valley. The impacts of climate change due to floods and erratic rain are causing soil erosion resulting in river silting, soil fertility losses and soil moisture deficit. Both disasters result in serious damage to crops and high pest and disease incidences, causing annual food insecurity. Both disasters are also responsible for the destruction of fish and wildlife habitats, displacement of people and environmental degradation in the valley. Impacts resulting from changes in the precipitation pattern, shortages of fresh water resources, loss of already scarce vegetation cover, increased desertification and associated socio-economic impacts need detailed studies. It is observed that climate change is a threat to national security in the Shire Valley, for it not only reduces natural resources, but also increases the amount of resources needed for animal and plant use. The Malawi government is adapting to climate change through high-efficiency, water-conserving irrigation technologies, integrated soil water and nutrient management research, and breeding of heat- and drought-resistant crop varieties that adapt to new climatic conditions and disease and pest pressure. But the limitation to these adaptations is that improvements in agriculture have always depended on the investment that is made in agricultural research and infrastructure. It would help to identify, through research, the specific ways that farmers can now adapt to the present variations in climate.

**Keywords:** Shire Valley, Climate change, drought, floods, Malawi



## Vulnerability to climate change and climate variability in the Greater Horn of Africa

J. Kinyangi, M. Herrero, P. K Thornton,  
J. A. van de Steeg, A. Omolo and A. Notenbaert

*International Livestock Research Institute (ILRI), Kenya*

**Abstract.** The ability of African institutions and people to adapt to climate change impacts is limited by social, technological and environmental factors, including widespread poverty, fragile ecosystems, weak institutions and ineffective governance. By scoping vulnerability to climate change and climate variability, we propose a framework for developing adaptive capacity through regional institutions involved in climate science research and policy implementation. Survey information from project partners is used to scout for gaps in regional climate data, as well as gaps in assessment of climate-sensitive sectors and projects. Climate-sensitive sectors represent environmental conditions encompassing biophysical endowments in agriculture, water and health, as well as human capital within social and institutional structures. Basic knowledge elements were combined with spatial mapping to identify dynamic drivers of vulnerability at different spatial and temporal scales. The resulting output provided trends in present and future vulnerability of the human population, climate sectors and agricultural livelihood systems. By deriving hotspots of change, their characterisation is intended to help decision-makers to define areas where policy efforts could be directed to reduce vulnerability and to facilitate adaptation. Through a systems approach, this study maps human population projections and describes evolving livestock systems as robust indicators of climate impacts on crop-livestock-production systems. The study presents a regional framework for increasing adaptive capacity in the Horn of Africa. It aims to support future planning and to inform climate-change projects, their design and implementation through targeting the most vulnerable people and institutions.

## INFORMATION AND COMMUNICATION STRATEGIES

### Searching online for information on climate change in ACP countries

Thierry Helmer

*CIRAD, France*

**Abstract.** The Scientific and Technical Information System (SIST) project was designed by the French Ministry of Foreign and European Affairs. One of its objectives is to create an open-source mechanism that is available, free of charge, in the nine SIST project countries of Africa. SIST has three main objectives: (1) facilitate access to electronic scientific and technical information available on the internet, regardless of form; (2) popularise access to new information and communication technologies to enable scientists to communicate with each other, be creative and share information; and (3) facilitate publishing on the internet, even without being conversant with IT.

SIST has a federated search engine that makes it possible to query all types of resources available on the internet and summarise the research results. SIST can query online databases, websites, open archives, RSS flows and document repositories, and then present the results (web articles, annual files, bibliographic references, full texts, current events, project profiles, statistics, etc.) in a standard form. SIST is a mechanism that allows for the rapid creation of thematic portals and observatories without any intervention at the information source's end (SIST uses information in its original format; no reformatting is required). Its alerting service ensures selective daily data dissemination to its subscribers.

### Strengthening capacity-building and training in climate change in ACP countries

Aissétou Dramé Yayé

*African Network for Agriculture, Agro-forestry and Natural Resources Education (ANAFE), Kenya*

**Abstract.** Cognisant of the major challenges linked to climate change, the academic community and its partners, at a symposium organised in July 2008 in Malawi by African



Network for Agriculture, Agro-forestry and Natural Resources Education (ANAFE), considered aspects of the following four major themes: (1) development and capacity-building for better global competitiveness in Africa; (2) conservation of biodiversity and sustainable agricultural production; (3) the global trend to enhance bio-energy production; and (4) the effectiveness of African agricultural education institutions.

This presentation refers to the symposium's conclusions and recommendations, and focuses on the inclusion of climate change in the higher education curricula - teaching teachers at this level to produce didactic materials that include local knowledge and are adapted to the needs of Africa, and the promotion of agricultural research that maximises the contribution of biodiversity to agricultural production. The symposium unanimously agreed that African higher education in its present form is not well equipped and needs substantial ongoing political support, as well as strong interministerial cooperation through networks such as ANAFE.

**Keywords:** climate change, ANAFE, Higher Education

## Information and communication strategies for coping with climate change

**Rod Harbinson**

*Panos London, UK*

**Abstract.** Information and communication strategies can make a valuable contribution to both the mitigation of, and adaptation to, climate change, through enhancing the communication processes involved in developing joined-up solutions to this global problem. The media provide a powerful tool in societies for increasing widespread awareness of both the causes and effects of climate change. It is important that the volume and accuracy of media coverage is comprehensive so that the whole of society is informed, including those most marginalised in society. To ensure this, media institutions require both the capacity to fulfil this goal, and commitment to the climate change issue.

Tools such as remote sensing can be used for measuring and monitoring climate change. ICTs can play a critical role in translating and conveying scientific forecasts (such as from climate models) to local populations, which can help to inform local adaptive strategies. Using ICTs such as web 2.0 to develop social networks can increase dialogue and



*One of the information and communication tools used during the seminar*

encourage local populations to become involved in shaping external adaptive support programmes to their needs. ICTs such as mobile telephones and radio can also prepare people for disasters and provide early-warning systems for extreme weather events. Methodologies such as participatory video can give a voice to the local experiences of people in creating adaptive responses to changing climate patterns. They can enhance the comparative assessment of such experiences and help to build a common body of best practice on which sound policies can be built. Debating forums can provide platforms of networked governance as participatory means to develop climate change policies.

This variety of methodologies and technologies have different relevance depending on the situation in which they are applied. A key question in evaluating their relevance is the degree to which they are accessible and open to input and use by all the stakeholders involved.

## Communication for Development in climate change adaptation: challenges and efforts

**Federica Matteoli**

*Research and Extension Unit (NRRR), Natural Resources Management and Environment Department, Food and Agriculture Organization of the United Nations (FAO), Italy*

**Abstract.** Climate change adaptation (CCA) requires multidisciplinary, multi-stakeholder action and a process of social learning for adaptive livelihoods. Within this framework, communication plays a key role. Communication for Development (ComDev), an approach that combines participatory communication methods and processes with

a variety of tools ranging from rural radio to ICTs, is central to CCA. It enables rural people and institutions to: (i) facilitate equitable access to knowledge and information; (ii) promote people's participation in, and collaborative approaches to, climate change adaptation; (iii) enhance the capability of development institutions; and (iv) support innovative research and advisory services.

FAO and the Italian Ministry of the Environment and Territory have launched a joint project, Communication for Sustainable Development Initiative (CSDI), to support the application of communication strategies and approaches to CCA. CSDI aims to strengthen and up-scale communication services in selected countries, and to make available suitable methods and tools at the international level through knowledge networks and partnerships. The project strategy is based on three main components. (1) At the normative level, to systematise approaches, best practices, training materials and policies on the application of ComDev to CCA, and make it available at the international level. (2) Provide support to field projects through Communication Action Plans, including the design of communication strategies and services, to be piloted at field level. (3) Promote networking and partnerships for capacity-building and advocacy for mainstream ComDev services. An example of a Communication Action Plan developed by CSDI is the support for agriculture and forestry research and extension activities in Congo (DRC).

The project intends to: develop and test a model for communication in community-based CCA; support field projects in Africa, Asia, Latin America, the Caribbean and the Near East; systematise best practice for ComDev services in support of research and extension systems; support regional platforms, consultations and knowledge networks on ComDev and CCA; expand the world repository on locally adapted agricultural technologies and support a specific section on adaptation options; and expand FAO partnerships in ComDev to other institutions.

### **Media coverage of climate change in the Southern African Development Community (SADC) region: the Case of Mozambique, Swaziland and Zambia**

**Parkie Mbozi**

*PANOS Southern Africa, Zambia*

**Abstract.** Mass-mediated messages, when properly planned and systematically executed, contribute to shaping and affecting science and policy discourses as well as increasing public understanding and action. The public learns a large amount of science through consuming mass-mediated messages. Questions have, however, been asked about the

effectiveness of the mass media in promoting awareness of climate change. This prompted Panos Southern Africa to commission a study to investigate media coverage, community awareness and national responses to climate change and change adaptation. It intended to examine how media in southern Africa handled the issue of climate change. It focused on current trends, strengths and weaknesses in print and electronic media.

The results showed that the knowledge base of journalists in climate change and climate change adaptation was limited. Their attitudes towards featuring climate change in their media were equally not very supportive; the media (editors and journalists) don't consider climate change a sellable topic. There is neither specialisation on the subject, nor journalists specifically assigned to report on it. The media also indicated a lack of incentives and support to cover climate change issues. This leads to limited coverage of climate change issues in the media, yet the public relies on media for both news and information. Public understanding of climate change and climate change adaptation is limited. The countries studied were yet to finalise policies and legislation that directly address issues of climate change and climate change adaptation. There was also limited coordination on climate change issues in all three countries.

### **Agrimonde: farming and food systems of the world in 2050?**

**Sébastien Treyer**

*AgroParisTech, ENGREF, France*

**Abstract.** Current population growth forecasts suggest that one of the major challenges in coming decades will be to adapt agricultural product supply to the growth in demand for food, while at the same time ensuring more sustainable production, in both social and environmental terms. The trends observed at present - the increase in food prices that is perturbing agricultural markets, the emergence of new agricultural production areas, the effect of climate change on the variability of agricultural yields, opportunities relative to bio-energy and changes to diet, notably in developing countries - will have effects on the balance between supply and demand at the global level. Preserving the resources of our planet, while alleviating poverty and reducing inequalities, is a major challenge for sustainable development, as well as for global geopolitical equilibria and relationships between industrialised Northern countries and developing countries.

The study 'Farming and food systems of the world' has been conducted for the past two years (2006-08) by INRA and CIRAD. It aims to foresee the role of policies and regulations, and of the agricultural knowledge, science and technology system at the world, European and French scale, under different scenarios for world change, taking into account the plurality of Southern countries and contexts. This foresight exercise will provide CIRAD and INRA with the means to anticipate and prepare for the future in terms of both resources and the orientation of public-sector research, and their strategic positioning at international level. In addition, it should facilitate the understanding of work by international expert forecasting groups, so that French experts are better prepared to play an active role in such groups, and so that innovative alternative scenarios can more easily be brought into discussion in these international expert groups.

The operation is inspired by, and based partly on, the discussion of the scenarios built for the Millennium Ecosystem Assessment, and is set in the dynamics initiated by the International Agriculture Assessment of Science and Technologies for Development, an intergovernmental process launched in 2004. The outcomes include publication of a preliminary report on the study in June 2008, followed by discussions, further analysis and debate on the report until publication of a full report in December 2008.

The project will lead to permanent foresight intelligence which will be used to set up and develop relevant research programmes via the construction of a perennial simulation platform.

*Handover of CTA publications to partners*



# ANNEXES

## PROGRAMME

**Sunday 26 October 2008**

18:00 - 21:00 REGISTRATION

**Monday 27 October 2008**

### SESSION 1 OPENING CEREMONY

08:00 - 09:00 REGISTRATION (CONTINUED)

09:00 - 10:00

- Mr Issa Martin Bikienga, Deputy Executive Secretary of CILSS
- Mr Amos Tincani, Head of European Union Delegation
- Dr Hansjörg Neun, Director of CTA
- Mr Laurent Sedogo, Ministry of Agriculture, Hydraulics and Fisheries of Burkina Faso
- Dr Achim Steiner, Executive Director, UNEP (video message)

10:00 - 10:30 COFFEE BREAK

### SESSION 2 KEYNOTE PAPERS

Chairperson: Dr M.V.K. Sivakumar (WMO, Switzerland)

Rapporteur: Dr Assize Touré (CSE, Senegal)

10:30 - 12:00

- Presentation of the programme and objectives of the seminar  
(André Vugayabagabo, CTA, Prof. Akke Van der Zijpp, Wageningen UR, The Netherlands)

- European Union strategies concerning climate change in ACP countries  
(Mr Amos Tincani, Head of Delegation of the EU in Burkina Faso)

- Main messages of the high level conference FAO High-Level Conference on World Food Security and the Challenges of Climate Change and Bio-energy (Dr Michele Bernardi, Climate Change and Bio-energy Unit (NRCB) Environment, Climate Change and Bio-energy Division, Natural Resources Management and Environment Department, FAO, Italy)
- ICM and climate change (Oumy Ndiaye, Head of CCSD, CTA, The Netherlands)

12:00 - 12:30 DISCUSSION

12:30 - 14:00 LUNCH

### SESSION 3 LEAD PAPERS (CROSS-CUTTING THEMES)

Chairperson: Dr M.V.K. Sivakumar (WMO, Switzerland)

Rapporteur: Dr Assize Touré (CSE, Senegal)

14:00 - 15:40

- Bio-energy and development in sub-Saharan Africa: are the politics conducive?  
(Charles Jumbe, Centre for Agricultural Research and Development, Bunda College, Malawi)

- Vulnerability; climate change and livestock: challenges and opportunities for the poor  
(Dr Philip Thornton, Dr M. Herrero, ILRI, Kenya)



- Reducing vulnerability of the African livestock production systems (ALPS): the role of pan-African policy initiative on the impacts of climate change (O.Y. Akinbamijo et al., ILRI, Kenya)
- Climate variability, desertification and biodiversity in Africa: adaptation, an integrated approach (Al Hamandou Dorsouma, Sahara and Sahel Observatory, Tunisia)

15:40 - 16:10 DISCUSSION

16:10 - 16:30 COFFEE BREAK

#### SESSION 4 CARBON SEQUESTRATION ISSUES

16:30 - 17:00 • Politics and economics of forest carbon  
(Eric Bettelheim, Executive Chairman and General Counsel, SFM, UK)

- Helping smallholder tree farmers in Africa participate in carbon trading: a case of Siakago, Kenya (Prof. James B. Kung'u, Kenyatta University, Kenya)

17:00 - 18:00 PANEL

Panelists: Eric Bettelheim, Pr J. B. Kung'u  
Moderator: Rod Harbinson (Panos London, UK)  
Rapporteur: Mukelabai Mukufute Matongo (Zambia)

19:00 - 21:00 OPENING COCKTAILS

### Tuesday 28 October 2008

#### SESSION 5 PANEL - IMPACT OF LIVESTOCK CARBON EMISSION ON CLIMATE CHANGE

08:00 - 08:20 • Livestock in climate change (Dr Pierre Gerber, Livestock Policy Officer, AGAL FAO, Italy)

08:20 - 09:40 PANEL

Panelists: Pr. Gouro (CIRDES, Senegal), Prof. Akke Van der Zijpp (WUR),  
Dr Didier Richard (CIRAD), Thornton Philip (ILRI)  
Moderator: Dr Pierre Gerber (FAO, Italy)  
Rapporteur: Dr Yemi Akinbamijo (AU-IBAR, Kenya)

09:40 - 10:15 • Presentation of e-discussion results (questions 1, 2 and 3)  
(Y. Akimbamijo, S. Nouala, AU-IBAR, Kenya)

- INTRODUCTION TO PARALLEL SESSIONS  
(André Vugayabagabo, CTA; Prof. Akke Van der Zijpp, WUR, The Netherlands)

10:15 - 10:40 COFFEE BREAK

## SESSION 6 PARALLEL SESSIONS (ORAL PRESENTATIONS)

PARALLEL SESSION 1: CROPPING SYSTEMS  
 PARALLEL SESSION 2: AGRO-PASTORAL SYSTEMS  
 PARALLEL SESSION 3: BIO-PHYSICAL ISSUES  
 PARALLEL SESSION 4: SOCIO-ECONOMIC ISSUES

	Cropping systems	Agro-pastoral systems	Bio-physical issues	Socio-economic issues
Chairperson	• Dr Jan Verhagen	• Prof. A. Gouro (CIRDES)	• Dr Lea Herberg (GTZ)	• Dr Mario Herrero (ILRI)
Rapporteur	• Julienne Traore • Pascal Gbnou	• Dr Mamadou Lamine Dia • Hamadoun Mahalmousou	• Dr Raphaël Kaume Marambii • Prof. Dickson Nyariki	• Dr Tesfaye Beshah
10:40 - 11:40	Presentations	Presentations	Presentations	Presentations
11:40 - 12:30	Discussion	Discussion	Discussion	Discussion
12:30 - 14:00	Lunch	Lunch	Lunch	Lunch
14:00 - 14:50	Presentations	Presentations	Presentations	Presentations
14:50 - 15:30	Discussion	Discussion	Discussion	Discussion
15:30 - 15:50	Coffee Break	Coffee Break	Coffee Break	Coffee Break

### PARALLEL SESSION 1: CROPPING SYSTEMS

Chairperson: Dr Jan Verhagen (WUR, The Netherlands)  
 Rapporteurs: Mrs Traore Julienne (INERA, Burkina Faso), Mr Pascal Gbnou (Benin)

10:40 - 11:40	<ul style="list-style-type: none"> <li>• The effect of climate change on agricultural systems and crop production - analysis of three countries (Robert Chakanda, Center for Genetic Resources, The Netherlands)</li> <li>• Impact of climate change on the dynamics of gum arabic production in Senegal (Mame Sokhna Sarr, ISRA/CNRF Dakar, Senegal and UCAD Senegal)</li> <li>• Impact of climate variability on production systems in Niger: the Gaya and Aguié zones (Amadou M. Laouali, Institut international de recherche sur les cultures des zones tropicales semi-arides, Niger)</li> <li>• Farmers in the extreme north province of Cameroon and climate change: emigration or adaptation? (Félix Watang Zieba, Université de Ngaoundéré, Cameroon)</li> <li>• Rainfall deficit and pineapple production in Allada, Benin (Cyr Gervais Etene, Université d'Abomey-Calavi, Benin)</li> </ul>
11:40 - 12:30	DISCUSSION
12:30 - 14:00	LUNCH
14:00 - 14:50	<ul style="list-style-type: none"> <li>• Dry cereals production systems in the Sahel zone: land degradation and poverty (Baraïma Diall, Association pour le développement des activités de production et de formation, ADAF, Mali)</li> <li>• Climate risks and development of rice production in the highlands of (Guy Wokou, Université d'Abomey-Calavi, Benin)</li> </ul>

- Climate change and dynamics of production systems of the lowlands in Burkina Faso (Y. Dembele, INERA, Burkina Faso)
- The effect of climate change and adaptability on arable food crop farmers in south-western Nigeria (T.G. Apata, Joseph Ayo Babalola University, Nigeria)
- Use of seasonal forecasts in predicting agricultural yields and gross domestic product in east Africa (P. A. Omondi, IGAD Climate Prediction and Applications Centre, ICPAC, Nairobi, Kenya)

14:50 - 15:30 DISCUSSION

15:30 - 15:50 COFFEE BREAK

## PARALLEL SESSION 2: AGRO-PASTORAL SYSTEMS

Chairperson: Prof. A. Gouro (CIRDES, BURKINA FASO)

Rapporteurs: Dr Mamadou Lamine Dia (Mauritania)

Hamadoun Mahalmoudou (CILSS, Burkina Faso)

- 10:40 - 12:00
- Climate change and sustainable livestock production (Dr Didier Richard, CIRAD, France)
  - Vulnerability of agro-pastoralists to climate change in the area around Parc W in Burkina Faso (Jacques Somda, IUCN, Guinea Bissau)
  - Evolution of annual rainfall and impact on the distribution zones of the riparian tsetse fly in Senegal (M.T. Seck, B. Sall, Laboratoire national d'élevage et de recherches vétérinaires, LNERV, Senegal)
  - Conflict prevention and natural resource preservation strategies in Mali (Jérôme Dakouo, Programme d'appui aux collectivités territoriales, PACT, Mali)
  - Impacts of climate change on agro-pastoral communities in the Tahoua and Tillabery regions of Niger (Sylvain Garraud, Sylvain Garraud, Coopération allemande, Niger)
  - Coping mechanisms and their efficacy in disaster-prone pastoral systems of the Greater Horn of Africa (GHA) (Dr Jean Ndikumana, ILRI, Kenya)

12:00 - 12:30 DISCUSSION

12:30 - 14:00 LUNCH

- 14:00 - 15:00
- Pastoral agenda and climate risk minimisation strategies in the Sahelian region of Senegal (Mame Arame Soumare, FLSH, Université Cheikh Anta Diop, Senegal)
  - Agro-pastoral activities, natural resources management and desertification control (Mama Djaouga, LEA/FSA/UAC, Benin)
  - Households' vulnerability and livelihood diversification in changing state climate in rural region, Nigeria (Emem Bassey Inyang, Nigeria)
  - Impact of climate change on fisheries in ACP countries (Ann Gordon, The WorldFish Center, Egypt)
  - Participatory information platform on the adaptation of vulnerable communities to climate change (Amadou Sall, InfoClim, Senegal)

15:00 - 15:30 DISCUSSION

15:30 - 15:50 COFFEE BREAK

### PARALLEL SESSION 3: BIOPHYSICAL ISSUES

Chairperson: Lea Herberg (GTZ, Germany)

Rapporteurs: Dr Raphaël Kaume Marambii (Land Information Network, Kenya)

Dickson Nyariki (University of Nairobi, Kenya)

10:40 - 11:50	<ul style="list-style-type: none"> <li>• Best practices on sustainable land management and forestry for reversing land degradation and mitigation of the impacts of climate change (Dr Tesfaye Mebrahtu, GTZ, Ethiopia)</li> <li>• Contribution of agro-forestry management practices to biodiversity, livelihoods and socio-economic wellbeing of rural communities in Southern Africa (Felix K Kalaba, Copperbelt University, Zambia)</li> <li>• Agro-forestry, a viable choice in climate change adaptation in West Africa (Adessou Kwaku Sena, Lomé, Togo)</li> <li>• Caribbean: integrating biofuels into existing agricultural systems (M. R. Wilson, Sugar Industry Research Institute, Jamaica)</li> <li>• The 'power' of an invasive species: exploring Casuarina farms for biomass gasification in The Bahamas (Dr Devon O. Niel Gardner, School of Sciences and Technology, College of the Bahamas, Bahamas)</li> </ul>
11:50 - 12:30	DISCUSSION
12:30 - 14:00	LUNCH
14:00 - 15:00	<ul style="list-style-type: none"> <li>• Addressing land degradation in Tanzania: contemporary issues related to policy and strategies (Hector Mongi, Ministry of Agriculture, Food Security and Cooperatives, Tanzania)</li> <li>• Climate change and farmers' strategies for sustainable management of farmlands: the pilot project in the central plateau (Zondoma Province - Burkina Faso) (Dr Hubert N'Djafa Ouaga, coordinator of the climate change programme, Centre régional AGRHYMET, Niger)</li> <li>• Monitoring and predicting weather, climate and related events for improved decision-making in the Caribbean (Adrian Trotman, Caribbean Institute for Meteorology and Hydrology, Barbados)</li> <li>• Strategies for promoting smallholder farmers' stewardship of ecosystem services in Africa: wielding the stick or dangling the carrot? (Dr O.C. Ajayi, World Agroforestry Centre, ICRAF, Malawi)</li> </ul>
15:00 - 15:30	DISCUSSION
15:30 - 15:50	COFFEE BREAK

### PARALLEL SESSION 4: SOCIO-ECONOMIC ISSUES

Chairperson: Dr Mario Herrero (ILRI, Kenya)

rapporteur: Dr Tesfaye Beshah (ILRI, Ethiopia)

Parkie Mbozie (Panos, Zambia)

10:40 - 12:00	<ul style="list-style-type: none"> <li>• Vulnerability and adaptation to climate change: the case of the Ejura-Sekyedumase district of Ghana (Dr K. Godwin, Crops Research Institute, Council for Scientific and Industrial Research, Ghana)</li> <li>• Reducing vulnerability through natural hazard mitigation, using hazard analysis critical mitigation points (HACMP) (Steve V. Maximay, Trinidad and Tobago)</li> </ul>
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- Vulnerability, poverty and adaptation to climate change in Burkina Faso (Pr Léopold Some, CNRST/INERA, Burkina-Faso)
- Endogenous adaptation strategies and vulnerability of rural communities to climate change in Benin (K. S. Hounkponou, Benin)
- The ‘vulnerability identity matrix’ approach for evaluating households’ responses to climate change impacts (Delali B.K. Dovie, University of Ghana, Ghana)

12:00 - 12:30	DISCUSSION
12:30 - 14:00	LUNCH
14:00 - 15:00	<ul style="list-style-type: none"> <li>• Impacts of climate change on farm income in Burkina Faso (Mathieu Ouedraogo, INERA, Burkina Faso)</li> <li>• Adaptation of production to climate change and market accessibility (Perlive Rahaga Rabenitany, Madagascar)</li> <li>• The implications of global climate change for market dynamics and information and communication strategies (Janet K. Ngombalu, Kenya)</li> <li>• Prioritising farm-level skills that can assist grassroots communities in Africa to cope with climate change (K.D. Nkwanga, Jandira/Luwube, Nature Palace Botanic Garden, Uganda)</li> <li>• Climate change information access and adaptation: the case of smallholder farming communities in Zimbabwe (T. Chamboko, University of Zimbabwe, Zimbabwe)</li> <li>• The impact of climate change on the household economy: a case of drought impact in Malawi (Franklin Peter Simtowe, Africa Rice Center, ADRAO/WARDA, Benin)</li> </ul>
15:00 - 15:30	DISCUSSION
15:30 - 15:50	COFFEE BREAK

## SESSION 7

### PANEL - FUNDING ADAPTATION AND MITIGATION PROGRAMMES ON CLIMATE CHANGE IN ACP COUNTRIES, DONORS/INSTITUTIONS

15:50 - 16:35	<ul style="list-style-type: none"> <li>• Sustainable agriculture and climate change - GTZ perspectives and research approaches in Africa (Dr Kerstin Silvestre Gracia, Lea Herberg, GTZ, Germany)</li> <li>• Impact of climate change on interactions between soil degradation and agricultural production systems in the CILSS zone: policies and strategies implemented by CILSS (Edwige Botoni, Dramane Coulibaly, CILSS, Burkina Faso)</li> <li>• Adaptation programmes to climate change (IDRC/DFID) (Dr Innocent Butare, IDRC, Bureau régional de Dakar, Senegal)</li> </ul>
16:35 - 17:30	PANEL

Panelists: Dr Kerstin Silvestre Gracia (GTZ), Lea Herberg (GTZ),  
 Dr Innocent Butare (IDRC), Dr Dramane Coulibaly (CILSS)  
 Moderator: Rod Harbinson (PANOS London, UK)  
 Rapporteur: Dr Elisabeth Maeda (Ministry of Agriculture, Tanzania)

SESSION 8	POSTER PRESENTATIONS
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17:30 - 18:30	POSTER PRESENTATIONS
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- CROPPING SYSTEMS
- AGRO-PASTORAL SYSTEMS
- BIOPHYSICAL ISSUES
- SOCIO-ECONOMIC ISSUES

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#### CROPPING SYSTEMS

- Estimating crop coefficient model for upland rice (NERICA) under sprinkler irrigation system (C.O. Akinbile, Federal University of Technology, Akure, Nigeria)
- Rice production and rainfall/hydrological constraints around the town of Dangbo in Benin (Dr Afouda Fulgence, Université d'Abomey-Calavi, Benin)
- Rainfall crisis and cotton production in 2007 in the département des Collines in Benin (Yabi Ibouaïma, Université d'Abomey-Calavi, Benin)
- Market garden cropping on the shores of Lake Dang in north Cameroon: what are the socio-environmental stakes? (Baska Toussia, Daniel Valérie, Université de Ngaoundéré, Cameroon)
- Comparison of quality protein maize (QPM) and ordinary maize in pig feeding in Togo (K. S. Ekoue, Institut togolais de recherche agronomique, ITRA, Togo)
- Practising profitable agriculture and environmental conservation in rural Uganda: the CELAC experience (Mary Nakirya, Kampala, Uganda)
- Some crop management practices in Jamaica and Dominica for combating the effects of global climate change (Leslie Simpson, Caribbean Agricultural Research and Development Institute, CARDI, Guyana)

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#### AGRO-PASTORAL SYSTEMS

- Effects of rainfall, temperature and humidity patterns on production levels in crop-livestock systems in Uganda (S. L. Mubiru, National Livestock Resources Research Institute, NaLIRI, Uganda)
- Gender, pastoralism and climate change in northern Kenya: vulnerability and adaptation (Akinyi N. Omolo, Kenya)
- Effects of gradient and climate change on forage diversity in sylvo-pastoral systems in Senegal (Mayécor Diouf, ISRA/CNRF, Senegal)
- Climate change and the development of water resources in the Lac de Guiers area (Senegal): effects on potentials access and use (Aïssatou Wade, Senegal)
- Identifying the implication of climate change on agriculture and livestock production for ASARECA (J. A. Van de Steeg, ILRI, Kenya)
- Livestock movement and migration during crisis situations in the Great Horn of Africa (Dr Jean Ndikumana, ILRI, Kenya)

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## BIOPHYSICAL ISSUES

- Abiotic factors influencing ecological diversity and productivity of baobab in the agro-forestry systems of Benin (**A. E. Assogbadjo, Benin**)
- Transforming waste to wealth: *Gmelina arborea* fruit pulp potential for ethanol production as biofuel resource (**Jonathan C. Onyekwelu, Federal University of Technology, Nigeria**)
- Commercial algae farming for sustainable energy and carbon-free environment (**Robert Kibaya, Kikandwa Rural Communities Development Organization, Uganda**)
- Changing adversity to assets: biofuel generation potential of developing countries from municipal organic wastes (**Tayagwisa Muziri, Midlands State University, Zimbabwe**)
- Managing drought for food security (**Joachim Ibeziako Ezeji, Nigeria**).
- Water management and development issues in the dry areas of Cameroon (**Anselme Wakponou, Cameroon**)
- Poverty and land degradation: the effect of the rural women's role on climatic change in Uganda (**Ednah Karamagi, Uganda**)
- Sustainable agriculture as an adaptation strategy to climato-edaphic constraints in north Cameroon (**Dr C. Bring, Université de Ngaoundéré, Cameroon**)
- Solar cookers offer alternatives for cooking in atoll countries (**Koin Etuati, SOPAC, Fiji**)

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## SOCIO-ECONOMIC ISSUES

- Lessons learned from vulnerability and risk reductions in selected Pacific Island countries (**Netatua Pelesikoti, SOPAC, Fiji**)
- The potential impact and adaptation of climate change on smallholder farming and food security in Shire Valley, Malawi (**Isaac R. Fandika, Kasinthula, Agricultural Research Station, Malawi**)
- Vulnerability to climate change and climate variability in the Greater Horn of Africa (**J. Kinyangi, ILRI, Kenya**)

**Wednesday 29 October 2008**

**SESSION 9 INFORMATION AND COMMUNICATION STRATEGIES**

**Chairperson:** Dr Hansjörg Neun (CTA, The Netherlands)

**Rapporteur:** Dr Khady Kane Toure (UCAD, Senegal)

08:00 - 09:35	<ul style="list-style-type: none"><li>• Searching online for information on climate change in ACP countries (Thierry Helmer, CIRAD, France)</li><li>• Strengthening the capacity-building and training in climate change in ACP countries (Dr Aissetou Drame Yaye, ANAFE, Kenya)</li><li>• Information and communication strategies for coping with climate change (Rod Harbinson, PANOS London, UK)</li><li>• ICM strategies for climate change in ACP countries: CTA experiences (Oumy Ndiaye, Head of Department, CTA, The Netherlands)</li><li>• Communication for Sustainable Development Initiative (CSDI) applied to NRM, climate change and food security (Federica Matteoli, NRR, FAO, Italy)</li><li>• Media coverage of climate change in the SADC region: the case of Mozambique, Swaziland and Zambia (Parkie Mbozi, PANOS, Zambia)</li><li>• Presentation of e-discussion results (question 4) (Y. Akinbamijo, S. Nouala, AU-IBAR, Kenya)</li></ul>
09:35 - 10:05	DISCUSSION
10:05 - 10:20	INTRODUCTION TO WORKING GROUPS (André Vugayabagabo, CTA, Prof. Akke Van der Zijpp, WUR, The Netherlands)
10:20 - 10:50	COFFEE BREAK
10:50 - 12:30	WORKING GROUPS <ul style="list-style-type: none"><li>• CROPPING SYSTEMS</li><li>• AGRO-PASTORAL SYSTEMS</li><li>• BIOPHYSICAL ISSUES</li><li>• SOCIO-ECONOMIC ISSUES</li></ul>
12:30 - 14:00	LUNCH
14:00 - 17:00	WORKING GROUPS - CONTINUED

**SESSION 8 POSTER PRESENTATIONS - CONTINUED**

17:00 - 18:00	POSTER PRESENTATIONS <ul style="list-style-type: none"><li>• CROPPING SYSTEMS</li><li>• AGRO-PASTORAL SYSTEMS</li><li>• BIOPHYSICAL ISSUES</li><li>• SOCIO-ECONOMIC ISSUES</li></ul>
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## Thursday 30 October 2008

### SESSION 10 TV PROGRAMME ON CLIMATE CHANGE AND FIELD VISITS

07:30 - 11:30	Field visits
12:00 - 13:00	LUNCH
14:00 - 15:30	TV Programme (French)
15:30 - 15:50	COFFEE BREAK
15:50 - 17:20	TV Programme (English)
17:30 - 18:45	Screening of the movie <i>Le Choix</i> (Idrissa Ouedraogo)

## Friday 31 October 2008

### SESSION 11 CONCLUSIONS AND RECOMMENDATIONS

Chairperson: Dr Hansjörg Neun (CTA, The Netherlands)  
Rapporteurs: Dr Khady Kane Toure (UCAD, Senegal)  
Rod Harbinson (Panos London, UK)

08:00 - 08:30	• Agrimonde: which perspectives for agriculture and food in 2050? (Dr Sébastien Treyer, AgroParisTech / ENGREF, France)
08:30 - 10:30	Presentation of working group results and discussion
10:30 - 10:50	COFFEE BREAK

### SESSION 12 CLOSING CEREMONY

11:00 - 12:00	CLOSING CEREMONY
12:00 - 13:00	REFRESHMENTS
13:00 - 14:30	LUNCH

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## OPENING REMARKS

### Opening speech by Dr Hansjörg Neun, Director of CTA

Honourable Minister of Agriculture, Hydraulics and Fisheries,  
Honourable Minister of Animal Resources,  
Honourable Minister of the Environment,  
Head of the Delegation of the European Union to Burkina Faso,  
Deputy Executive Secretary of CILSS,  
President of the Local Organising Committee,  
Ladies and Gentlemen, dear Colleagues,

It is a great privilege and a real pleasure for me to greet you at the opening of the CTA seminar on the 'Implications of climate change for sustainable agricultural production systems in ACP countries: getting information and communication strategies right'. I should like to start by expressing my deep gratitude to the authorities and the people of Burkina Faso for the warm welcome we have received since our arrival.

I should like to express all my gratitude to His Excellency Laurent Sedogo, Minister of Agriculture, Hydraulics and Fisheries for having agreed to hold this seminar in Burkina Faso. Thank you for giving us your full support, alongside the Local Organising Committee, led by Mr Alphonse Bonou, who has done a remarkable job in organising and preparing this event. I should also like to thank the Burkina Ambassador in Brussels, Mr Ouedraogo, for his role in facilitating the preparation of this seminar.

Excellencies, Ladies and Gentlemen,

I had the pleasure of living in Burkina Faso with my family from 1986 to 1993, first working for OFNACER and then coordinating the CILSS PAROC project. So I am familiar with problems of drought, desertification and food security in the Sahel.

*Le Choix (The Choice)* is a film, produced by Idrissa Ouedraogo in 1986, that received an award at FESPACO, 1987. It tells the story of a family in Oahigouya who did not have enough food any more and decided to migrate to Bobo Dioulasso. We will show this remarkable film on Thursday evening at the French Cultural Centre.

When CTA selected Burkina Faso to organise this seminar, I did not have a choice, it had to be this country.

As concerns the theme 'climate change and agriculture', CTA did not have a choice there either. It has - unfortunately - become an unavoidable, imperative choice.

Excellencies, Ladies and Gentlemen,

The increase in oil prices, the food crisis, the soaring cereal prices, the sub-prime real estate crisis in the United States, the financial crisis, the global recession and at last the sudden startling drop in oil prices last week ...

Do we have a choice? Certainly not. We are all affected by these crises. And the people worst affected are the poor people of this world, the farmers and the rural communities in Africa, especially the Sahelian part, and in the Caribbean, the Pacific and elsewhere.

The question before us is whether all these crises will jeopardise the efforts required to respond to climate change.

Personally, I believe we should speak about a crisis in the economic system, and even a crisis in humanity, a societal crisis.

Is our society on the brink of collapse, like other cultures before us, like the Mayas, for instance, on the Yucatan peninsula in Central America? I will not go into this subject here.

Jared M. Diamond, a professor at the University of California, wrote a book called *Collapse - How Societies Choose to Fail or Succeed*. The book deals with factors that have, in history, contributed to the extinction of societies, factors such as:

- deforestation;
- soil problems such as erosion, salinisation and loss of fertility;
- overtaxed natural resources such as water, the environment, fish resources, forests, energy sources;
- population growth, etc.

Remember that Al Gore, in his film *An Inconvenient Truth*, gives an impressive presentation of problems of climate change, the exponential population growth and our planet as a limited biological system:

- annual growth is ~ 87 million/year = Germany
- population
  - 1800 ~ 1 billion
  - 1900 ~ 1.7 billion
  - 1950 ~ 2.5 billion
  - 2008 > 6.5 billion
  - 2050 ~ 9 billion (7.7-10.6)

Remember that all these people need to eat, and that agriculture contributes to about 30% of climate change.

I feel that two things are certain.

(1) We cannot continue doing 'business as usual'. We need to change our paradigm, our values and our standards if we want to protect the globe and be able to feed our children and our grandchildren.

(2) We need to mobilise substantial investments in agriculture and to decelerate the effects of climate change.

The *Stern Review* offers the most comprehensive analysis of the economics of climate change. It was released in October 2006 by Lord Nicholas Stern (Head of the Government Economics Service in Britain and previously Chief Economist at the World Bank).

Its main message is that it takes only 1% of the gross global product to stabilise CO<sub>2</sub> emissions at 500-550 ppm. This represents ~ \$US550 billion. Even though these figures make you dizzy, they are more or less equivalent to what was recently proposed to solve the so-called financial crisis.

In the ACP countries, climate change must also be viewed in the context of agricultural development and the commitments pledged by various regional and international bodies.

In 2005, the heads of state of the African Union, through the Maputo Declaration, pledged to devote 10% of the GDP to agricultural development by the year 2010. The present-day international economic situation certainly does not contribute to the fulfilment of this goal, which was difficult to achieve for all the ACP countries even before all these crises.



Excellencies, Ladies and Gentlemen,

At its high-level conference in June 2008, the FAO showed how heavily climate change affected agricultural development and food/nutritional security in the most vulnerable countries. I am pleased to say that our programme presents the main findings of that conference.

CTA and its partners have decided to deal with this subject at the practitioners' level with and for you:

- who have field experience and have done research;
- who have practical lessons to share and have also come to listen;
- who will then take these lessons back to your respective countries so as to use them in your role of agents of change;
- who will provide information for your governments and your agricultural policy decision-makers so that they shall become agents of climate change.

CTA was created through the Lomé Agreement in 1983, renewed in Cotonou in 2000. Its mandate is to facilitate information access and exchange, communication and capacity-building for stakeholders. CTA is funded by the EDF and works for 79 countries in Africa, the Caribbean and the Pacific.

This international seminar will stress information and communication strategies for two major categories of stakeholder: political decision-makers and rural communities in the ACP regions.

During the past 2-years, CTA has developed activities to promote information-sharing on climate change, including policy briefs in Brussels and a special edition of *Spore*.

I am especially pleased that the agenda includes a presentation by CIRAD, the centre that has created a special research engine called SIST. Many thanks to Mr Sor and Mr Helmer for having configured SIST so that we can find information on climate change easily.

Providing information that is adapted to the users' needs plays a decisive role when formulating appropriate intervention strategies and strategies to prevent the harmful effects of climate change on the environment, agriculture and livestock production in the ACP countries.

CTA intends to contribute to information-sharing, capacity-building for ACP partners and the formulation of information and communication strategies. That is what this seminar is all about.

Excellencies, Ladies and Gentlemen,

Experts, in their recommendations, unanimously agree that the time to act is now because tomorrow will be too late.

Expert studies all show that the amounts of money needed for adaptation and alleviation programmes now are far lower than the sums that will be needed at a future time to deal with natural disasters resulting from climate change.

Before ending this address, I want to express my sincere gratitude to our partners who have contributed to this seminar, namely:

- CILSS and the European Union Delegation;
- the International Development Research Centre (IDRC);
- GTZ and RIPIECSA;
- and all of you, the participants, for having accepted our invitation to participate in this seminar.

I should like to apologise if I have forgotten any of our partners.

Thank you.

**Address by Mr Issa Martin Bikienga, CILSS Deputy Executive Secretary,  
Permanent Inter-State Committee for Drought Control in the Sahel**

Minister of Agriculture, Hydraulics and Fisheries,  
Minister of the Environment,  
Ladies and Gentlemen, members of Government,  
Excellencies, Ladies and Gentlemen, Heads of Diplomatic Missions,  
Director of CTA,  
Ladies and Gentlemen attending this meeting,  
Dear Guests,

Allow me first of all to thank the Government and people of Burkina for the facilities made available to us for the organisation of this international seminar on the 'Implications of climate change for sustainable agricultural production systems in ACP countries' and wish all the participants welcome to Ouagadougou.

The Permanent Inter-State Committee for Drought Control in the Sahel is honoured to be part of this meeting devoted to a phenomenon that threatens the very basis of development of the Sahelian countries. Further, CILSS has been interested in climate change for a long time, since the major drought spells of the 1970s, that led to the creation of CILSS, are direct consequences of climate change.

Ladies and gentlemen,

Individually, none of the countries in West Africa has the resources, in the broad sense of the term, to cope with the challenges of climate change. This means that the fight against the effects of climate change in our sub-region must draw on synergetic efforts within the framework of our joint sub-regional integration structures.

That is why, since the January 2007 international conference in Ouagadougou on reducing the vulnerability of natural, economic and social systems in West Africa to climate change, my institution has been at the centre of a regional movement to deal with the negative effects of climate change on the development of West Africa.

Ladies and gentlemen,

The scientific knowledge we have on potential climate change in West Africa and its expected impact on the natural, economic and social systems comes essentially from foreign research.

Our national and regional scientific and technical organisations must become more involved in examining the problem of developing appropriate policies and measures in West Africa to fight against the effects of climate change. In this area, the content and approach of the CILSS regional 'Climate change adaptation capacity support' project could serve as a pilot case and a catalyst.

You now understand my insistence in inviting the scientists, planners, development operators and political decision-makers attending this conference to participate actively in the aforementioned efforts. Contributions from all sides should become part of a common effort to develop a sub-regional, or even a worldwide action plan to fight against the effects of climate change.

Ladies and gentlemen,

Before ending this address, I should like to express my deepest gratitude to CTA, who we partnered in organising this event. I also wish to acknowledge the technical and financial partners who have stayed with us as we organised this conference and in our various programmes.

Thank you.

### **Speech by Mr Amos Tincani, Ambassador, Head of Delegation, European Commission to Burkina Faso**

Mr. CTA Director,  
Mr. President of the local Organising Committee,  
Representatives of the Ministries,  
Members of the diplomatic corps and embassies,  
Representatives of the technical and sponsoring partners  
Honourable guests,  
Ladies and Gentlemen,

It is a real pleasure for me to take the floor to welcome you to the opening of this seminar on the 'Implications of climate change for sustainable agricultural production systems in ACP countries' that CTA, the ACP-EU Technical Centre for Agricultural and Rural Cooperation, has organised and that the city of Ouagadougou has the honour of hosting this week.

CTA was created in 1983 by the ACP-EU Council of Ministers, and is funded by the European Union. Its mission is to provide the ACP states with better access to information, research, training and innovation in agricultural and rural matters and to strengthen the ACP countries' capacity to produce, acquire, exchange and exploit information in this field in order to help design and implement strategies and programmes key to reducing poverty, promoting sustainable food security and protecting natural resources, to meet the goal of increased autonomy for the ACP states.

In Burkina Faso, the EU's environment-related actions are at two levels.

1) Cross-cutting interventions that use tools such as environmental impact studies and strategic environmental evaluations to decrease negative environmental impacts. For example, under the 10th EDF, the Government has pledged systematically to carry out environmental impact studies prior to large-scale investment projects and to generalise the adoption and implementation of plans to mitigate negative environmental effects, to develop activities that facilitate the establishment of de facto buffer zones in order to reduce the pressure of the agricultural front, and to ensure protection of the areas bordering the protected areas.

2) Sectoral interventions through the implementation of environment-enriching projects and programmes. In this vein, the European Commission is funding two major programmes: the 'Conservation and rational use of protected areas adjoining Benin, Burkina Faso and Niger and their zones of influence', known as the ECOPAS Regional Parc W Programme. The main goal is to reverse the process of degradation of natural resources and to preserve the biodiversity in the Parc W regional complex for the benefit of the populations living in the periphery of the protected areas and their zones of influence. The programme, which was started in 2001, enabled Parc W to qualify for a MAB/UNESCO programme in 2002, when the Parc W complex was granted the status of 'transborder biosphere reserve', the first in Africa and the biggest in the world (over 3 million ha).

Another important programme, the 'Promotion of alternative domestic energies in the Sahel' (PREDAS), was started in 2002. Its main goal is sustainable management of natural resources and poverty alleviation in the nine CILSS member states. Its specific goal is to create a framework conducive to the organised and sustainable management of domestic energy resources by supplying fuelwood to the most impoverished populations, regularly and at lowest cost.

These efforts could be jeopardised in the medium and long term because of the climate change that we are experiencing, and the attendant risk of social and environmental consequences that very seriously compromise the livelihood of rural populations in the ACP states. We need to prepare for this risk, which should motivate all of us to reflect urgently on devising natural resource management strategies that could ensure sustainable use of soils and water resources, limit the degradation of biodiversity and take account of certain emerging issues, in particular the growing demand for renewable energy. But the efficiency of interventions depends on well managed information and reliable communications.

With this in mind, the conclusions of your workshop could contribute to the thinking on environmental issues, and could introduce ideas of great use for our continuous efforts in development cooperation in this field.

I am pleased to see this seminar emphasising information not only for political decision-makers, but also for rural communities, thus focusing on stronger political dialogue at the decision-making level, and on reinforced information and communication for rural communities directly concerned with climate and environmental change.

With these words of welcome, I am expressing the hope that this seminar, also attended by some of my colleagues, will live up to your expectations. I will be very interested in the results and will be anxious to receive them.

Let me finish with a word of hope. Climate change is not new to the Sahel. In the 1970s it was called 'drought', but it was the same phenomenon. And in the 1980s, with assistance from the international community and especially from the NGOs, the Sahelian farmers successfully introduced better-adapted agricultural techniques.

We can do it again.

Thank you, and have a fruitful meeting.

## The Minister of Agriculture, Hydraulics and Fishery resources

Ladies and Gentlemen of the Government,  
Excellencies the Ambassadors and Heads of Diplomatic Missions,  
Representatives of the international and inter-African organisations,  
Director of CTA,  
Participants,  
Honourable Guests,  
Ladies and Gentlemen,

Burkina Faso is pleased that Ouagadougou was chosen to host this seminar and, on behalf of the Government and people of Burkina, I wish to welcome all of you who have honoured our invitation.

My wishes of welcome and for a pleasant stay are especially addressed to the erstwhile representatives of the scientific community who have accepted to devote a little of their precious time to sharing their experiences on a very relevant and topical subject, the phenomenon called climate change.

I wish all the participants a pleasant stay in the capital of Burkina Faso.

Mr Director of CTA,

You have devoted this week's seminar to the theme: 'Implications of climate change for sustainable agricultural production systems in ACP countries: getting information and communication strategies right'.

Congratulations on this very timely initiative. The climate change theme touches on the current challenges facing developing countries in their fight against poverty and food insecurity.

By choosing a Sahelian, agricultural country such as Burkina Faso to host this seminar, you are being true to your commitment and that of your institution to work for sustainable agricultural development in ACP countries in general and especially in Africa, led by the countries of the Sahel.

With this in mind, I very much hope that the results of this seminar will lead to concrete actions that can enable us to attenuate the harmful effects of climate change on agricultural productivity.

I am convinced that you will achieve this goal thanks to the quality of the participants and the diversity of skills represented here to discuss this question.

Ladies and Gentlemen,

As you know, the agricultural sector is still the basis of economic growth in developing countries. In the ACP countries as a whole, for instance, it occupies over 70% of the working population, accounts for about 30% of the GDP and is the main source of food and income.

At present, the contribution from the agricultural sector is jeopardised more than ever before by the climate change phenomenon and its increasingly pronounced social and environmental consequences. Climate change is thus a serious threat to sustainable growth in agricultural output.



In the West African sub-region, recent evidence comes to mind. During the past two intercrop seasons, Burkina Faso, Senegal, Togo and other countries suffered from floods and erratic rainfall that caused consequences we all know about.

To the Director of CTA and the distinguished participants, I say thus that the most effective means must be developed, with the greatest immediacy, to improve access to information on climate change, on the one hand, and on the different feasible strategies to cope with this change, on the other.

I am pleased that your seminar has decided to think along these lines and emphasise experience-sharing on the impacts of climate change, and strategies for access to information and communication on this phenomenon.

In its fight against poverty and for sustainable development, Burkina Faso gives high priority to natural resources management. My country, furthermore, has ratified all the conventions on environmental and natural resource management. Through its agricultural development and research services, and with support from its partners-in-development, Burkina is striving to improve agricultural productivity through land recovery, fertilisation and management strategies, water management, adoption of new farming techniques, rangeland management, the fight against deforestation, etc.

Furthermore, Burkina Faso has developed the concept of eco-citizenship, a concept seen as a tool for informing, sensitising and, above all, querying our fellow citizens about the stakes and challenges of environmental protection so that they will bear it in mind in all their daily lives.

Ladies and gentlemen,

May your discussions be frank, fruitful and constructive, and may your work lead to relevant recommendations on information and communication strategies and on possibilities to reduce or reverse the harmful effects of climate change.

I should like to remind you that this seminar is being held in a period marked by a special situation brought about by the food crises, and that your proposals are much awaited since they should contribute to the effective implementation of food security programmes in the various countries.

Before ending my speech, I should like to thank CTA again for taking the initiative and making the effort to organise this meeting.

And on behalf of us all, I also want to thank all the partners-in-development who are working relentlessly and tirelessly with us to ensure sound natural resource management and sustainable growth of agro-sylvo-pastoral, fishery and wildlife production.

Last, to the participants and the honourable guests,

I wish your meeting full success and hereby declare the 2008 CTA international seminar open.

Thank you.

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## CLOSING REMARKS

### Closing Remarks of HE Tumiisime Rhoda Peace, Commissioner for Rural economy and Agriculture, AUC, Addis Ababa, Ethiopia

Minister of Agriculture,  
Representative of the Minister of the Environment,  
Mr Amos Tincani, Head of the EU delegation  
Dr Hansjorg Neun, Director of CTA  
The Representative of CILSS  
Distinguished participants to the conference  
Ladies and Gentlemen,

#### Preamble

First and foremost, I would like to applaud the presence of the international organisations, and in particular those of you visiting the African continent for the very first time; and the efforts of the organisers of the 2008 edition of the CTA Annual Seminar.

It is of great importance to us here in Africa that we have been accorded the honour of hosting the CTA Annual Seminar 2008.

Let me also acknowledge with great excitement a full house with our partners, potential partners and a broad spectrum of participants, which indicates a high degree of commitment to the mitigation and adaptive responses to climate change on your part and the high premium placed on this historic conference.

It is with a great sense of contentment that I state the position of the African Union at the closing ceremony of a most timely conference on the global implications of climate change on our food production systems in the ACP states, and the potential role of the timely dissemination of information.

The current initiative is greatly applauded by the African Union and it is very much in line with our thoughts. The choice of Africa for such a conference is also very warmly received, not just because Africa is home to the largest groups that are vulnerable to the impact of climate change, but also because it allows the African Union to play a very significant role in a phenomenon that is now shaping and guiding our very existence in Africa and the ACP states. Consequently, my desire to be here at the closing ceremony of a much needed conference signifies the endorsement of the African Union of CTA's initiative on climate change in 2008. I am aware that the development started way back in 2007 from AU-IBAR, our Nairobi Office responsible for livestock issues, and I should also like to place on record the appreciation of the African Union to CTA for broadening the geographic and thematic scopes, and the International Steering Committee for their untiring efforts to facilitate the conference.

Mr Minister of Agriculture  
Ladies and Gentlemen,

#### The ACP and climate change

With the persistent global threats on fragile ecosystems, we ignore at our peril the writing on the wall - of climate change and vulnerability. Without compromise, it is no longer business as usual for the ACP food production systems.

The sentiments aired in the pre-conference electronic discussions, moderated by the AU-IBAR under my watch at the African Union, have captured in a very succinct manner the feelings and fears of the major actors and stakeholders of the rural economy and agricultural sectors of the ACP states. I have also followed keenly the considerable interest that the subject of climate change has elicited in the very wide spectrum of diverse participants in the e-discussions. I am comforted to note that there is a growing awareness on the phenomenon of climate change, and I am pleased to note that a lot is being done to contain the exigencies of today regarding the impacts of climate change on our food production systems.

We all recognise that food is big business! Therefore securing the timely availability of food is uncompromisable in ensuring peace, growth and economic stability. It is common knowledge that climate change is affecting (and will continue to affect) food security in both production and availability. There is sufficient scientific evidence that food security is at risk because of the adverse impacts of climate change. If this link between climate change and food security is neglected, we compromise the achievement of Millennium Development Goal number 1.

In recent years, the African continent has been increasingly affected by natural and climate-related disasters such as drought, floods, tropical cyclones, wild fires and locust invasions, affecting our socio-economic development.

In response, African Ministers responsible for environment and disasters therefore developed and adopted a Disaster Risk Reduction Strategy and an Implementation Plan in 2004 and 2005, respectively, to address climate-related disasters. At the African Union, the Department of Rural Economy and Agriculture is currently executing the Climate for Development in Africa (*ClimDevAfrica*) Programme, jointly with the United Nations Economic Commission for Africa and African Development Bank. ClimDevAfrica is an African development programme to integrate climate risk management into pertinent policy and decision processes throughout the continent. The rationale of the programme is to strengthen the climate-resilience of economic growth and the Millennium Development Goals through mainstreaming climate risk management in sensitive sectors.

The causes of climate change are many. However, science informs us that emissions of greenhouse gases, such as carbon dioxide, emanating from various human and industrial activities, are responsible for the increase in global warming. On the African continent alone, there are increasing threats of carbon dioxide accumulation resulting from erratic deforestation activities and loss of forest flora through bush fires, amounting to some 500,000 ha lost per year. This grim scenario is often complicated by growing industrial activity and motor vehicles that create poor stewardship of environmental security in Africa. It is now very clear that there is need for a consistent, coherent and concerted effort if we are to succeed in containing the nagging impacts of climate change in the ACP. The current menace faced by the farming community knows no territorial or spatial limits. It is equally important that we join forces to develop regional and transboundary antidotes that are science-based and sustainably implementable by our member states.

Mr Minister of Agriculture  
Ladies and Gentlemen,

### **Why support Africa?**

I am sure that the vulnerability of Africa, and indeed of the ACP in general, has dominated the e-discussion and your working groups. From a meteorological perspective, the greatest impact of climate change is on climatic extremities of dryness and flooding. Frequency of drought is on the increase unabatedly. Africa experienced almost 1000 mm reduction in average rainfall in the past 80 years. This is a phenomenon that is attributed to climate variability and change. There are more than 15 states in Africa that are on the verge of emergency water stress, and the Niger, Senegal and Volta rivers experienced decrease in average discharge of 40-60%. The low reservoir levels reduce potential for agriculture, energy and fisheries production and

manufacturing, and lead to human and animal migration, increase in conflicts, and ultimately political insecurity.

There have been incidences of crop failure and loss of livestock due to increased frequency and intensity of drought and loss of grazing. The ultimate effect is the negative consequences for sustainable livelihood and development, as well as loss of habitat and biodiversity.

In addition, it is useful to consider a few examples of climate change as macro-economic indicators of member states.

Climate change has had, and continues to have, grave negative impacts on the economies of many Africa countries. For example, drought cost Zimbabwe and Zambia about 8-9% of GDP in 1992, Nigeria and Niger about 4-6% of GDP in 1984, and Kenya about 16% of GDP in 1998-2000.

There have also been reports of loss of life and property due to landslides, and increasing public and veterinary health challenges such as Malaria and Rift Valley Fever.

It is therefore imperative that Africa and the other Member States of the Pacific and the Caribbean require strategic support to help cope with the menace of climate change, and climate-proof our food production systems. It is also common knowledge that Africa is potentially the continent most vulnerable to the effects of climate change. Left uncontrolled, the impending variability in climatic trends will precipitate a domino effect that ends in poverty and other negative impacts of climate change. This is mainly because Africa (in particular) is intrinsically weak in adaptation and mitigation capacities, economic, social and institutional frameworks. The ultimate need, which is the core issue of CTA's Annual Seminar 2008, is for climate-related information and communication systems. This is one luxury we cannot afford to miss.

Mr Minister of Agriculture  
Ladies and Gentlemen,

From the African Union's perspective, it behoves us to elicit responses at all levels, employing all means at our disposal through political advocacy. In this regard, I wish to assure you that we will leave no stones unturned to facilitate politically meaningful engagements at all levels of governance. We will also push for the accelerated ratification of protocols such as the UN Framework Convention on Climate Change, the UN Convention to Combat Desertification and the Convention on Biological Diversity by all Member States.

Other areas where we will strengthen our advocacy include:

- climate insurance schemes, e.g. in Ethiopia;
- afforestation, forest and range management and protected areas programmes, and establishment of green belts by many Member States, e.g. Algeria, Burkina Faso, Senegal, Nigeria, Mauritania, Niger and Kenya;
- incorporation of climate change in water resources management, e.g. Tanzania;
- coastal erosion control, e.g. beach nourishment in The Gambia;
- development of early warning systems and national policy frameworks for response to flood management, e.g. Ethiopia and Mozambique;

At continental level, there are considerable investments in climate change. Some of the current African Union Commission (AUC) climate change-related programmes include:

- development of an Action Plan for the Implementation of the Green Wall for the Sahara Initiative;
- establishment of a Continental Observatory System for the African Monitoring of the Environment for Sustainable Development (AMESD);

- implementation modalities for the Continental Strategy and Policy on Disaster Risk Reduction;
- strengthening early warning systems on food security;
- implementation of guidelines for transboundary water management.

The Heads of State and Government are currently considering ways and means of climate-proofing our food production and environmental systems. Climate change was the sub-theme of 2007 January Summit, where there was a Declaration and Decision which called on Africa's cooperation partners. The call was centred on supporting Member States and Regional Economic Communities effectively to integrate adaptation and mitigation measures into their development plans, and to implement them. It also requested the AUC, the UN Economic Commission for Africa and the African Development Bank to develop and implement the Plan on Climate Change and Development in Africa, and to report on progress biennially.

It is also noteworthy that the 40th Session of the Conference of African Ministers of Finance, Planning and Economic Development, convened in Addis Ababa from 2-3 April 2007, adopted a resolution on climate change which, among other things, called for full support for the implementation of the Climate Information for Development (ClimDev) Africa Programme, and to integrate climate change into economy planning and management at Member States' level.

Mr Minister of Agriculture  
Ladies and Gentlemen,

### **Where do we go from here?**

Following five hectic days of deep reflection on a multi-faceted global phenomenon, it is pertinent to proffer a few options as potential ways forward. We will strengthen our renewed commitment to advocacy among Member States and the Regional Economic Communities on the following fronts:

- mainstream climate change into country PRSPs;
- promote public-private partnerships;
- promote and increase financial resources in implementation of joint integrated water resources management;
- invest in low-cost alternative (renewable) energy sources to alleviate deforestation;
- develop coherent policy;
- mobilise funds for the African Environment Facility to fund climate change activities;
- build capacity for Africa to take the opportunity of the CDM and other funding support.

Mr Minister of Agriculture  
Ladies and Gentlemen,

In conclusion, and from a global perspective, the effects and consequences of climate change are of global dimensions, and do not respect national boundaries. Hence the 1997 Kyoto Protocol represents a global effort to foster agreement among nations on measures that need to be taken in order to reduce the rate of greenhouse gas emissions. This calls for the need to simplify the procedures and rules in the current funding mechanisms to support Africa in building her resilience to climate change.

At the policy-maker level, coherent regional and national policy frameworks targeting mitigation/adaptation strategies are imperative. These frameworks will allow the development of ecology-specific policies that will guide the natural resource management of the diverse production systems.



Parliamentary groups and lobbyists (e.g. environmentalists) do have a crucial role in communicating these policy frameworks to their peers. The bottom-up approach should sustain pressure until positive change is achieved. The African Union's Department of Rural Economy and Agriculture is currently engineering high-level discussions on how to achieve the above objectives.

Before closing my remarks, I would like to take this opportunity to express my sincere appreciation to the Government of Burkina Faso and the European Union for meeting the enormous logistical demands necessary for the fruitful deliberations achieved at the CTA Annual Seminar 2008.

Thank you all and I wish you a safe journey back home.

### **Closing speech by Dr Hansjörg Neun, Director of CTA**

Honourable Delegate Minister to the Minister of Agriculture, Hydraulics and Fishery,  
Head of the Delegation of the European Union to Burkina Faso,  
President of the local organising committee,  
Dear participants,  
Ladies and Gentlemen,

We have come to the end of our seminar on the 'Implications of climate change for sustainable agricultural production systems in ACP countries'.

During the past week, we have heard more than 85 enlightening presentations and participated in very interesting discussions on:

- best practices in sustainable soil and forest management to curtail soil degradation and attenuate the impacts of climate change;
- problems and development of bioenergies in ACP countries;
- the effects of climate change on agro-pastoral communities and cropping systems.

The seminar also included very lively debates on:

- carbon sequestration;
- the impact of greenhouse gas emissions from livestock production on climate change;
- the funding of climate change adaptation programmes in ACP countries.

These exchanges made it possible to identify and propose information and communication activities related to climate change, and to reflect on potential partnerships for programme implementation.

First of all, let me congratulate you for the quality of the work done during the seminar.

Mr Minister,  
Mr Head of Delegation,  
Ladies and Gentlemen,  
Dear participants,

The fight against climate change offers an opportunity for sustainable development in the ACP countries, to the extent that it allows us to improve the management of our natural resources.

The experiences we shared during this week, through presentations; our field visits, where we heard about the achievements of rural communities; and the report that we saw on the special broadcast on 'Climate Change'; show that simple gestures and changes of mindset and conduct can make all the difference.

The seminar thought about information and communication strategies for disseminating and sharing these experiences, strategies that should especially include the following recommendations:

- the development of community radio broadcasting, cell phones and exchange visits to share good initiatives between rural communities;
- the dissemination of agro-meteorological information on floods, rainfall, drought, and crop water use to help rural communities cope better with the impacts of climate change;
- the dissemination of knowledge on climate change and local adaptation strategies to the local communities;
- support for regional, national and local initiatives in formulating and implementing information and communication strategies on climate change, following our seminar in the ACP regions.

Let me assure you that CTA will take all necessary steps to make its contribution and develop appropriate partnerships to implement these recommendations.

Mr Minister,  
Mr Head of Delegation of the European Union,  
Ladies and Gentlemen,

Allow me to thank all our partners who contributed to this seminar. My first thanks, of course, go to the Ministry of Agriculture, Hydraulics and Fisheries, CILSS, IDRC and GTZ.

I want to acknowledge the local steering committee's contribution to designing and organising the seminar and to carrying it out during this last week.

My gratitude also goes to the speakers, who were kind enough to share their experiences with us.

The sessions' chairpersons and rapporteurs have had to devote part of their rest time to preparing the conclusions to our discussions, which we have just adopted. I thank them most sincerely.

I want to thank the interpreters for the quality of their work, and the journalists who have kept us informed regularly through the seminar newsletter *Climate in Peril*.

I should like to thank CILSS, especially Mrs Edwige Botoni, who, with her team, handled the logistics throughout the whole seminar.

Lastly, thanks to all the participants for their contributions and involvement during the sessions. We would like to apologise for any problems that may have occurred. Problems are inevitable in an event such as this. I wish you a very good trip home.

Thank you.

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**Address by the Minister of Agriculture, Hydraulics and Fishery resources  
at the closing session of the International Seminar of the Technical Centre  
for Agricultural and Rural Cooperation (CTA) 2008**

Ladies and Gentlemen of the Government,  
Excellencies the Ambassadors and Heads of Diplomatic Missions  
Representatives of the international and inter-African organisations  
Mr Director of CTA  
Participants  
Honourable Guests  
Ladies and Gentlemen,

After five days of intense thought and discussion, you have come to the end of your meeting on climate change communication strategies and the implications of climate change on agricultural production systems.

This meeting has enabled you to share information on the many facets of the effects of climate change. I am also convinced that you will continue to nurture the hope that, at your own level and within your own sphere of expertise, you will be able to continue researching solutions to outstanding questions.

For five days, through presentations, screen projections and field visits, you have been considering subjects of interest that I could summarise as follows:

- the impacts of climate change on agricultural, animal and forestry production systems;
- the vulnerability of agro-pastoral populations to climate change;
- climate change and natural resource management;
- communications strategies and climate change;
- politicians and climate change adaptation strategies.

Mr Director of CTA  
Honourable Guests  
Ladies and Gentlemen,

As concerns the objectives of this seminar and the hope I expressed at the opening session, I see that the targeted results have been amply fulfilled.

Your conclusions, recommendations and proceedings are evidence of the commitment you felt when broaching all the issues. No effort has been spared to ensure the success of the Ouagadougou seminar.

You have made proposals and worked out strategies to involve all stakeholders, especially the highest-level decision-makers, in information and communication on climate change, and remedies to cope with such change.

Ladies and gentlemen,

As you know, our countries are engaged in agricultural revival strategies vis-à-vis the food and financial crises that are hitting regions around the world, especially ours.

Your suggestions on reducing the effects of climate change are welcome as they will provide effective support for forthcoming actions.

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That is why I want to reassure you that I will be your spokesman to my colleagues and before the highest authorities to ensure your proposals are carefully examined and wisely implemented.

I would also like to ask you, when you are back in your home countries, to share your Ouagadougou experience and the seminar outputs, at your own level, with everyone working to advance sustainable agricultural development.

Lastly, I encourage you to continue your activities in the field and your scientific research so that we can fight effectively against the harmful effects of climate change.

Before concluding, I want to thank CTA and all our partners, once again, for organising this important consultation.

On behalf of all of us, I want to reiterate my gratitude to our partners-in-development who are supporting our poverty alleviation and food insecurity policies.

Wishing you a good journey back to your country, family and workplace, I declare the 2008 CTA international seminar closed.

Thank you.

## RADIO SCRIPT WINNERS

AUTHOR	COUNTRY	RADIO	TITRE
Jean-Paul Ntezimana	Rwanda	Radio Salus	Rainfall retention protects soil
Pius Sawa Murefu	Uganda	Radio Sapientia	Sekedo, a drought-resistant sorghum for Karamoja
Gladson Makowa	Malawi	The story workshop	Effect of manure in crops during erratic rain season
Frederic Takang	Cameroon	Abakwa FM	Endangered Raphiales: an environmental threat, a danger for the culture and the economy of the grassfields
Adama Zongo	Burkina Faso	Radio Rurale	Organic manure at your fingertips
Mariama Sy	Senegal	Afia FM	Fissel farmers don't pick up straw after harvesting, a method that protects land from heat
Kwabena Agyei	Ghana	Classic FM	A tale of two changes and movements: mangoes to the rescue
Sachia Ngutsav	Nigeria	Radio Benue	Forests shall heal the land again
Lamine Togola	Mali	Radio Fanaka	Natural phenomena and their consequences for the life of rural communities
Savitri Mohapatra	Benin	WARDA	Growing NERICA is a farming solution for coping with climate change
Rachael Awuor	Kenya	Ugunja Community Resource Centre	Getting ready to meet different weather patterns
Dominic Mutua	Kenya	Radio Mangelete	Drip irrigation
Félix Houinsou	Benin	Radio Immaculée Conception	How to modify production systems in Africa to cope with climate change
Joshua Kyalimpa	Uganda	Africa Farm Radio	New rice variety for Africa to save wetlands
Andrew Mahiyu	Malawi	NASFAM	Livestock management practices



## ARTICLES ON ADAPTATION ACTIVITIES ON CLIMATE CHANGE IN ACP

AUTHOR	COUNTRY	TITLE
Duncan Mboyah	Kenya	Climate change wreaks havoc to pastoralist communities in Kenya
Ismaila N. Senghore	Gambia	Climate change triggers migration in the Gambia's North Bank Region
Jean Paul Ntezimana	Rwanda	Water dams: the shelter for farmers against climate change
Busani Bafana	Zimbabwe	Changing conditions for livestock farming in Zimbabwe's Matabeleland
Angella Nabwowe	Uganda	Shifting livelihoods in the face of pest infestations
Fidelis Zvomuya	South Africa	Small-scale farmers banking on traditional seeds to cope with climate change
Pilirani Semu-Banda	Malawi	Harsh impact of climate change on Malawi's agriculture
Sanday Chongo Kabange	Zambia	Floods and droughts force Zambian farmers to change their livelihoods
Pius Sawa	Uganda	Climate change: drought-coping mechanisms by farmers in Uganda
Motheolane Chakela	Lesotho	Commotion as frost turns agriculture upside down
Wezi Tjaronda	Namibia	Conservation agriculture in northern Namibia yields good results
Gerard Guedegbe	Benin	Information and participation to reverse the curse
Absalom Shigwedha	Namibia	Communal subsistence farmers in Namibia tackle climate change
Ebby Nanzala	Kenya	Silkworms weaving a sustainable future
Ochieng' Ogoto	Kenya	Kenya's Makueni District farmers change livelihoods in response to climate change
Innocent Kilayo	Chad	Mobilisation des paysans contre la disparition des lacs
Herbert Houngnibo	Benin	Les vents, bourreaux des producteurs de bananes
Aristide Komze	Cameroon	Le retour tardif des pluies désoriente les paysans
Mama - Adama Keita	Guinea	Les houles menacent la pêche artisanale
Mohamed Gueye	Senegal	Une bonne gestion de l'eau peut rapporter gros
Euloge Aïdasso	Benin	Les prévisions météorologiques sauvent les agriculteurs
Gnona Afangbedji	Benin	Des recettes culturelles contre la colère des dieux
Jean Vincent Tchienehom	Cameroon	Sauver le palmier raphia

# ACRONYMS AND ABBREVIATIONS

• <b>ACP</b>	African, Caribbean and Pacific	• <b>ICRISAT</b>	International Crops Research Institute for the Semi-Arid Tropics
• <b>ADAF</b>	Association pour le Développement des Activités de Production et de Formation (Mali)	• <b>ICM</b>	information and communication management
• <b>ALPS</b>	African livestock production systems	• <b>ICT</b>	information and communication technology
• <b>ANAFE</b>	African Network for Agriculture, Agro-forestry and Natural Resources Education	• <b>IDH</b>	Investir Dans l'Humain (Togo)
• <b>ASALs</b>	arid and semi-arid lands	• <b>IDRC</b>	International Development Research Centre
• <b>ASARECA</b>	Agricultural Research for Development in Eastern and Central Africa	• <b>IFPRI</b>	International Food Policy Research Institute
• <b>AUC</b>	African Union Commission	• <b>ILRI</b>	International Livestock Research Institute
• <b>AU-IBAR</b>	African Union - Interafrican Bureau for Animal Resources (Kenya)	• <b>INADES-Formation</b>	Institut Africain pour le Développement Economique et Social (Burkina Faso)
• <b>BROSDI</b>	Busoga Rural Open Source and Development Initiative (Uganda)	• <b>INERA</b>	Institut de l'Environnement et de Recherches Agricoles (Burkina Faso)
• <b>CaFAN</b>	Caribbean Farmers Network	• <b>INFOIR</b>	Information Outreach and Impact Review (CTA)
• <b>CCA</b>	climate change adaptation	• <b>IPCC</b>	Intergovernmental Panel on Climate Change
• <b>CCAA</b>	Climate Change Adaptation in Africa	• <b>IRDI</b>	International Development Research Centre (Senegal)
• <b>CDM</b>	Clean Development Mechanism (of the Kyoto Protocol)	• <b>IWMI</b>	International Water Management Institute
• <b>CELAC</b>	Collecting and Exchange of Local Agricultural Content (Uganda)	• <b>KIRUCODO</b>	Kikandwa Rural Communities Development Organization (Uganda)
• <b>CGIAR</b>	Consultative Group on International Agricultural Research	• <b>NaCRRRI</b>	National Crop Resources Research Institute (Uganda)
• <b>CIDA</b>	Canadian International Development Agency	• <b>NaLIRRI</b>	National Livestock Resources Research Institute (Uganda)
• <b>CILSS</b>	Comité Permanent Inter Etats de lutte contre la Sécheresse dans le Sahel	• <b>NAPA</b>	National Adaptation Programme of Action
• <b>CIMH</b>	Caribbean Institute for Meteorology and Hydrology (Barbados)	• <b>NARO</b>	National Agricultural Research Organization
• <b>CIP</b>	International Potato Center	• <b>PACT</b>	Programme d'Appui aux Collectivités Territoriales (Mali)
• <b>CIRAD</b>	French Agricultural Research Centre for International Development	• <b>PINReM</b>	Participatory integrated natural resources management
• <b>CIRDES</b>	Centre international de recherche-développement sure sur l'élevage en zone sub-humaine	• <b>PRSP</b>	Poverty Reduction Strategy Paper
• <b>COP13</b>	UN Conference of the Parties, thirteenth session	• <b>RAWDP</b>	Rural Africa Water Development Project (Nigeria)
• <b>CSDI</b>	Communication for Sustainable Development Initiative	• <b>RIPIECSSA</b>	Recherches Interdisciplinaires et Participatives sur les Interactions entre les Ecosystèmes, le Climat et les Sociétés en Afrique de l'ouest
• <b>CSE</b>	Centre de Suivi Écologique (Senegal)	• <b>RSS</b>	Really simple syndication
• <b>CTA</b>	ACP-EU Technical Centre for Agricultural and Rural Cooperation	• <b>SADC</b>	Southern African Development Community
• <b>DFID</b>	Department for International Development (UK)	• <b>SARI</b>	Selian Agricultural Research Institute (Tanzania)
• <b>ECTAD</b>	Eastern Caribbean Trading Agriculture and Development Organization	• <b>SIST</b>	Scientific and Technical Information System (of CIRAD)
• <b>ESA</b>	Projet Eau Sol Arbre (Cameroon)	• <b>SMS</b>	Short message service
• <b>FAO</b>	Food and Agriculture Organization of the UN	• <b>SOPAC</b>	Secretariat of the Pacific Islands Applied Geoscience Commission
• <b>FENOP</b>	Fédération nationale des organisations paysannes (Burkina Faso)	• <b>SWAp</b>	Sector Wide Approach
• <b>FESPACO</b>	Panafrican Film and Television Festival of Ouagadougou	• <b>UICN</b>	International Union for Conservation of Nature
• <b>GCC</b>	global climate change	• <b>UNCED</b>	UN Conference on Environment and Development
• <b>GDP</b>	gross domestic product	• <b>UNDP</b>	United Nations Development Programme
• <b>GHA</b>	Greater Horn of Africa	• <b>UNEP</b>	United Nations Environment Programme
• <b>GIS</b>	Geographic information system	• <b>UNFCCC</b>	UN Framework Convention on Climate Change
• <b>GTZ</b>	German Technical Cooperation (Deutsche Gesellschaft für Technische Zusammenarbeit GmbH)	• <b>VIM</b>	vulnerability identity matrix
• <b>ICPAC</b>	Climate Prediction and Applications Centre (Kenya)	• <b>WASWC</b>	World Association of Soil & Water Conservation (Malawi)
• <b>ICRAF</b>	World Agroforestry Centre (International Centre for Research in Agroforestry)	• <b>WOCAT</b>	World Overview of Conservation Approaches and Technologies
		• <b>WMO</b>	World Meteorological Organisation
		• <b>ZALF</b>	Leibniz-Centre for Agricultural Landscape Research (Germany)





## TECHNICAL CENTRE FOR AGRICULTURAL AND RURAL COOPERATION (ACP-EU)

**T**he Technical Centre for Agricultural and Rural Cooperation (CTA) was established in 1983 under the Lomé Convention between the ACP (African, Caribbean and Pacific) Group of States and the European Union member states. Since 2000, it has operated within the framework of the ACP-EC Cotonou Agreement.

CTA's tasks are to develop and provide services that improve access to information for agricultural and rural development, and to strengthen the capacity of ACP countries to produce, acquire, exchange and utilise information in this area. CTA's programmes are designed to: provide a wide range of information products and services and enhance awareness of relevant information sources; promote the integrated use of appropriate communication channels and intensify contacts and information exchange (particularly intra-ACP); and develop ACP capacity to generate and manage agricultural information and to formulate ICM strategies, including those relevant to science and technology. CTA's work incorporates new developments in methodologies and cross-cutting issues such as gender and social capital.

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