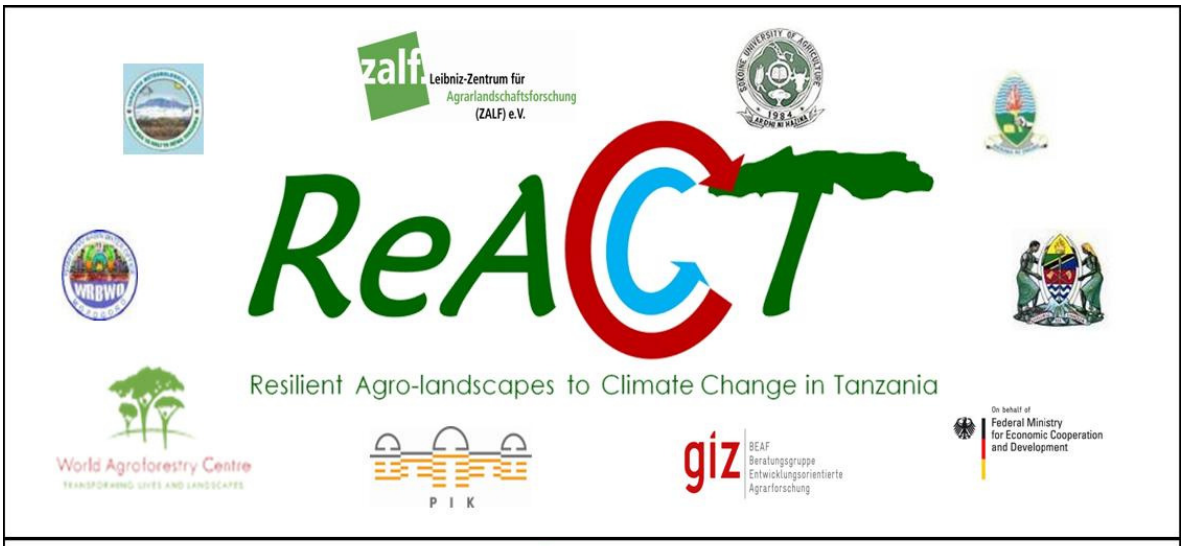
International Conference on "Food Security in the light of climate change and Bioenergy"

Tanzania challenges for policy-science interfaces in a nutshell.

Report of the final conference Better-iS and ReACCT

Venue: Livingstone Beach Resort, Bagamoyo, Tanzania 5- 7th December 2011

Compiled by Aichi KItalyi



Biofuel Evaluation for Tanzanian Technological Efficiency using Renewables – integrated Strategies

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Acronyms:

Acronym	Description
AIS	Agricultural Innovation systems
BEAF	Beratungsgruppe Entwicklungsorientierte Agrarforschung
Better-Is	Biofuel Evaluation for Technological Tanzanian Efficiency using Renewables – integrated Strategies
CCAA	Climate Change Adaptation to Agriculture
GAP	Good AGricultrual Practices
GHG	Green House Gasses
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GTZ (formerly)	Deutsche Gesellschaft für Technische Zusammenarbeit
ICRAF	International Centre for Research in Agroforestry or World Agroforestry Centre
IDRC	International Development Research Centre
IFPRI	International Food Policy Research Institute
IRA	Institute for Resource Assessment of Univeristy of Dar es Salaam
IUW	Institute for Environmental Economics and World Trade
LDCs	Least Developed Countries
MAFC	Ministry of Agriculture Food Security and Cooperatives
OECD	Organisation for Economic Co-operation and Development
OUT	Open University of Tanzania
PIK	Potsdam Institute for Climate Impact Research
ReACCT	Resilient Agro-Landscapes to Climate Change Tanzania
SUA	Sokoine University of Agriculture
TANSEED	Tanzania Seed Company
TATEDO	Tanzania Traditional Energy and Environment Centre
UDSM	University of Dar es Salaam
WI	Wuppertal Institute
WRBWB	Wami Ruvu Basin Water Board
ZALF	*Leibniz Centre for Agricultural Landscape Research*

Acknowledgement

We would like to thank the rapporteurs Mrs. Caroline Kilembe and Ewald Gervas Emil as well as the secretariat team Dr. Goetz Uckert and Harry Hoffman. Speacial credits are given to the facilitator Dr. Aichi Kitalyi and to the overall Coordinator Dr. Stefan Sieber.

Foreword

This conference brings together new findings of three projects financed by the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ). External researchers, policy actors and master students are highly welcomed to present their concepts. The three best research contributions will be awarded. The three-days event will be accompanied a field excursion.

In the past decades, Climate Change (CC) challenges research in manifold scientific disciplines. Evidence on the need for better adaptation strategies to CC caused growing efforts to tackle new challenges in agriculture sciences. Increasing food insecurity has resulted into a key policy issue, which is even more considerable, when linked with issues on increased bioenergy demand. CC related to energy demands should be seen in a holistic system, with interrelated new strategies focusing especially rural poor in small-scale agriculture. New in-depth methods on feasibilities, sustainable development and economic viability in mixed rainfed crop-livestock farming systems, which pose a major future challenge, will be intensively discussed at the conference.

The enhanced development of strategies related to CC adaptation and the use of bioenergy in Tanzania in a period of four years of intensive research will be summarised in various conference sessions:

Conference sessions:

A. Climate, Hydrological and crop modelling: Chair Dr Siwa Msangi
B. Local Adaptation and Good Practices: Chair Dr. Severin Polreich
C. Economics, Social and Environmental Bioenergy potentials: Chair Dr Goetz Uckert
D. Science-Policy interface: Implementation and Dissemination: Chair: Dr Aichi Kitalyi

Participants were:

1. Distinguished guests from outside Tanzania
2. Government representatives
3. Enterprises representatives
4. National academic and research institutions
5. Research Students
6. Non-government Organisations
7. Farmer representatives
8. ReACCT project Team Members
9. Better-is project Team Members
10. ZALF/IFPRI Food Security Project Team Members

1. Opening Session: Monday 5, December 2011.

1.1 Welcoming address and introductions

This international conference carrying the theme, "Food security in the light of climate change" aimed at concluding implementation of three *Bundesministerium für Wirtschaftliche Zusammenarbeit und Entwicklung (BMZ)* BMZ funded projects. The conference opening was officiated by Mr. Mtambo the Director Food Security Division in the Ministry of Agriculture, Food Security and Cooperatives (MAFC). The conference was hosted by the World Agroforestry Centre (ICRAF), Tanzania country office. Dr. Aichi Kitalyi, the former ICRAF Country Representative and the conference facilitator started day one of the conference by introducing her successor Dr. Anthony Kimaro and requested him to give a word of welcome.

Dr. Kimaro acknowledged the presence of participants from collaborating institutions in Germany, national partners, frontline extension workers and farmers from research areas. He made reference to the three closely related projects and the centre of the conference theme "food security, Climate Change (CC) and Bioenergy" as:

- Climate change impact assessment and adaptation options in vulnerable agro-landscapes in East Africa popularly known as Resilient Agro-landscapes to Climate Change in Tanzania (ReACCT)
- Strategies to use biofuels value chain potential in sub-Sharan Africa to respond to Global Change: enhancing low-productivity farming and linking to Small and Medium Enterpirse (SME), popularly known as Biofuel Evaluation for Technological Efficiency using Renewables –intergrated Strategies (Better-Is)
- Strategies for Adapting to Climate Change in Rural Sub-Saharan Africa: Targeting the Most Vulnerable

Dr. Kimaro pointed out the fact that Food Security, bio-energy and climate change are interlinked and interrelated; currently at the centre of discussion by global forums, national and international institutions. The World Agroforestry Centre is implementing various research activities to address the issues and is of the opinion that these will contribute towards policy and program development that will enhance communities' adaptation to climate change. He also noted that research findings from these projects will streamline agricultural issues in climate change programs aiming at reducing Green House Gas (GHG) emissions. He posed a question to conference participants on how climate change resilient agricultural systems that will provide alternative energy, while increasing land productivity can be developed

1.2 General overview of the three projects, by Dr. Stefan

Dr. Sieber of the *Leibniz Centre for Agricultural Landscape Research e.V. (ZALF)*, Institute for Socio-Economics and the overall project coordinator presented an elaborate and holistic picture of the three projects, which can be sited from the following links *better-is.com reacctanzania.com ifpri.org* . The presentation covered; a brief on implementing partners,

concept, methods, approaches, overall results and suggestions for further research. Dr. Stefan summarized the main achievement of the four years research implemented by a consortium of national and international research partners as:

- Strong networking
- Huge and diverse stakeholders involvement ie. from farmers to policy decision making levels
- Research results to support planning and decision making
- System analysis in an integrated analysis
- Implementation and huge component of participation

Dr. Stefan acknowledged contribution of all implementing partners, researchers and students who participated in the three projects and informed participants that detailed research results will be presented by the researchers in the coming sessions.

1.3 Conference Participants and Introductions

The conference attracted over 80 participants drawn from :

- German Institutions and members of the project consortium namely; *Leibniz Centre for Agricultural Landscape Research e.V. (ZALF)*, Institute for Environmental Economics and World Trade (IUW) , Wuppertal Institute for Climate, Environment and Energy (WI), Potsdam Institute for Climate Impact Research (PIK) and University of Hannover,
- International Food Policy Research Institute (IFPRI)
- Government representatives, (MAFC, ARI-Dakawa, ARI-Ilonga, WRWBO, DoE, TMA)
- National academic and research institutions (Sokoine University of Agriculture -SUA, University of Dar es Salaam -UDSM, Stockholm Environment Institute Africa Centre at IRA –UDSM, Open University of Tanzania – OUT)
- PhD and Msc. Research Students, enumerators (SUA, UDSM, University of Hannover)
- Non-government Organizations (Africa Biofuel, Wildlife Conservation society of Tanzania, Diligent, FELISA, Tanzania Forest conservation Group/MJUMITA MKUHUMI project at Kilosa, ICRAF, REPOA)
- Front line Extension workers – Laela – Sumbawanga, Kinole in Morogoro region
- Farmer representatives (Kinole village smallholder farmer, Jatropha large scale farmer – Gairo)
- ReACCT project Team Members (Researchers, Consultants, students, station curators and enumerators)
- Better-is project Team Members (Researchers and enumerators)
- ZALF/IFPRI Food Security Project Team Members

Dr. Stefan Sieber led a formal introduction of all participants from outside the country including Dr. Siwa Msangi the IFPRI representative. Introductions for those representing the Government of the United Republic of Tanzania was led by Ms. Caroline Kilembe, who started by introducing

the official guest Mr. Karim Mtambo the Director National Food Security from MAFC. All the other participants in the room introduced themselves giving their institutional affiliations and their connection to the three projects in brief..

1.4 Conference outputs and participant's expectations

The main purpose of the conference was to share with broader stakeholder group in Tanzania research results from three BEAF/GTZ funded climate change adaptation projects referenced above. This is expected to contribute to knowledge and information on various issues on food security in the light of climate change and bio-energy and specifically in the design of the National Adaptation Program of Action (NAPA) and the national biofuels policy. Participants response to the question on their contribution to and expectation from the conference revealed the richness in the room in terms of knowledge and expertise. Networking and knowledge sharing was the main expectation of most conference participants. It was evident that participants will benefit from the wealth of experience and knowledge among the participants who represented stakeholder groups from local and international institutions. At the same time participants expected to learn from the research findings, which included climate, crop and hydrological modeling as well as socio-economic perspectives of climate change adaptation and mitigation. Other areas of interest included:- Polices on how to balance food security and bio-energy with the land demand; impact of bio-energy initiatives on food security; climate change impact on farmers; potential mitigation and adaptation strategies and dissemination strategies.

1.5 Official opening speech by Mr. Karim Mtambo.

Mr. Mtambo acknowledged the conference organizers for choosing Tanzania to host the conference. He extended special word of welcome to distinguished guests from outside Tanzania. He introduced the historical areas around Bagamoyo such as Kaole village and the link to the Late David Livingstone the Scottish explorer of 1866-1873. Another touristic attraction mentioned by Mr. Mtambo was areas around Bagamoyo, which include Sadani National Park a global breeding site for turtles and where one can find lions going to the beach. He presented the opening speech, making special reference to the situation in Tanzania from his own work and life experience. He also did a Kiswahili brief on his speech for the benefit of participants from the field i.e. the farmers. He defined the four pillars of Food security in terms of "*availability, accessibility, utilization and stability"* implying that farmers can produce biofuels crops and generate income to access food. He cautioned researchers and academicians to make sure that they conduct more adaptive research than doing basic research for academic purpose only. Research recommendations should be applicable, citing research on Jatropha as a biofuels crop should go a step forward into value addition and better understanding of infrastructural requirement for more benefits. He expressed his commitment to participate in the three days of the conference to contribute to conference deliberations, get to know the research results and share it with

relevant government officials and other stakeholders for further development of the agenda.

2. Session A: Climate, Hydrology and crop modeling approaches:

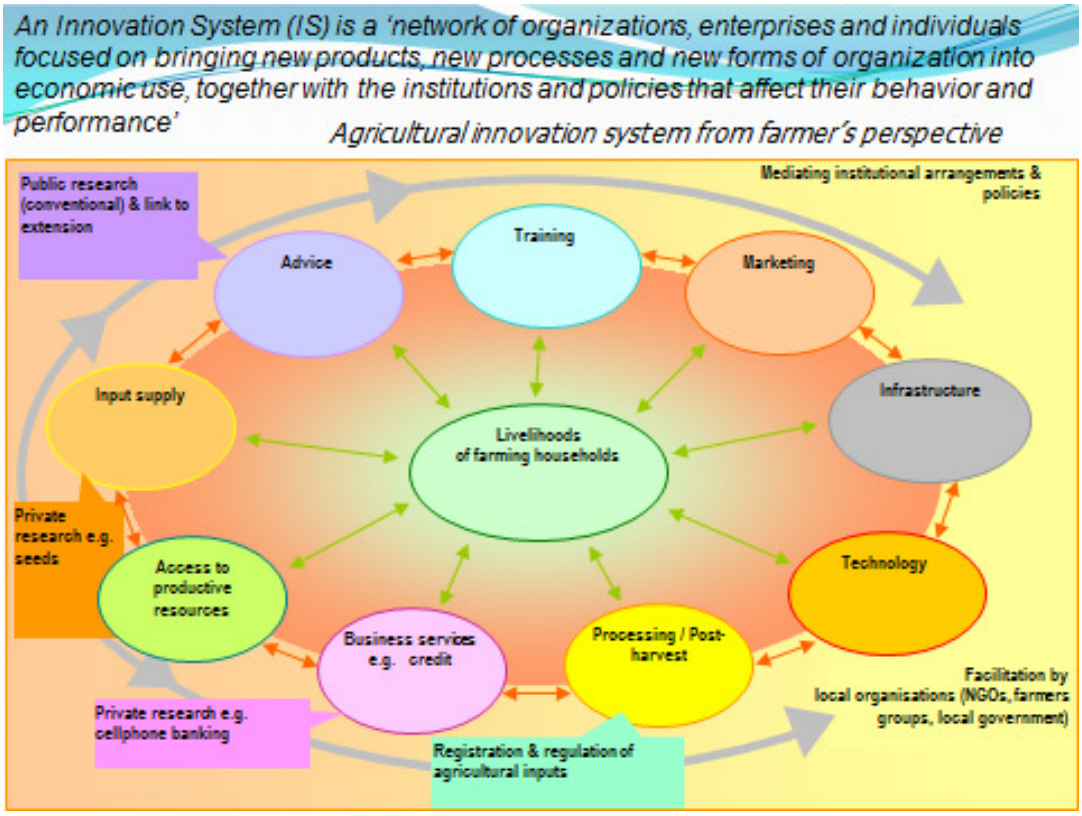
Chairperson: Dr. Siwa Msangi of IFPRI

2.1 Key Note: Climate change impacts on agriculture and enhancing capacity to adapt in Tanzania by Prof. Amos Majule, Deputy Director Institute of Resources Assessment (IRA), University of Dar es Salaam.

The presentation aimed at sharing experience on how climate change and variability impacts on agricultural production drawing from the Tanzania National Adaptation Program of Action NAPA and case studies conducted by University of Dar es Salaam, Institute of Resource Assessment (IRA). The IRA case studies included:

- IDRC/CCAA funded projects
- UDSM/NORWAY research projects
- Study commissioned by the Ministry of agricultural and food security
- Dissertations of Master students
- Workshops and seminars etc

The IRA project research focus is on strengthening the capacity of individuals and organisations within the agricultural innovation systems in less favoured areas and more favoured areas of Tanzania to adapt to the challenges and opportunities arising from CC & V. The project targets 8districts in Tanzania mainland namely:- Mufindi, Iramba, Kongwa, Rungwe, Kyela, Manyoni, Bahi and Njombe. Dr. Majule presented a conceptual framework of agricultural innovation system centered on livelihoods of farming households as shown in Figure 1.



Participatory Action Research is recommended with major thrust in:-

- Strengthen farmers' capacity to access and use quality information, training and products in order to adapt to climate change and climate variability
- Strengthen the capacity of private and public sector stakeholders to make agricultural innovation systems work more efficiently, equitably and responsively to climate change and climate variability
- Share lessons for scaling up successful strategies for capacity strengthening (individuals, organizations and systems) within agricultural innovations systems to adapt to climate change and climate variability

In conclusion the presenter recommended:

- Mainstreaming climate change issues into research and development agenda in agricultural sector
- Strengthen AIS by maximizing interactions among institutions involved
- Integration of different knowledge, agricultural development programs/projects at community level is crucial: This will avoid confusions to the farming communities
- Needs for strengthening environmental unit and
- Expand access to rural finance and cost-sharing programs

2.2 List of presentations for Session A.

- Regional Climate modeling by Matthias Buchner, Potsdam Institute for Climate Impact Research (PIK
- Climate change-related agricultural research in Tanzania by Prof. Siza Tumbo, Soil and Water Management Research Programme, Sokoine University of Agriculture –SUA
- Resilient Agro-landscapes to climate change in Tanzania. Crop Jans Bobert, *Leibniz Centre for Agricultural Landscape Research e.V. (ZALF),* Richard Festo, Japhet Kashaigili, Kurt_Christian Kersebaum, Henry Mahoo and Siza Tumbo
- The Hydrology of the Ngerengere Catchment under climate and land use change by Dr. Marco Nathkin, Dr. Ottfried Dietrich, Meike Schäffer, Dr. Gunnar Lischeid *from Leibniz Centre for Agricultural Landscape Research e.V. (ZALF).*
- Climate change and bioenergy in Tanzania: Key linkages between Energy, Agriculture and the Environment by Dr. Siwa Msangi, Simla Tökgoz and Wei Zhang, Environment and Production Technology Division, IFPRI
- Simulation of water productivity for maize under drip irrigation in Morogoro Tanzania by Richard Festo – Msc. Research study
- Spatial Prediction of soil water retention in the Ngerengere sub-catchment, Morogoro, Tanzania. By Jacob Kaingo , Msc. Research study, Department of Soil Science, SUA
- Impacts of Land use/cover and climate changes on Kihansi hydrology by Ms. Augustina Alexander, Msc. Research Study, University of Dar es Salaam

2.3 Summary from the session Chair Dr. Siwa Msangi

- Pulling together messages to our main target audiences
  - Policy-makers & decision-makers at national/regional level
  - Extension officers & resource managers
  - Farmers & farmer groups
  - Researchers & the wider scientific community
- Policy/decision-makers
  - Share information on weather [Majule] – ICT can be a good way [Tumbo & Bobert]
  - Bring innovation systems perspective to climate policy [Majule]
  - Strengthen environmental agencies [Majule]
  - Improve nat'l-level crop forecasting [Tumbo]
  - Need sustainability-focused policies [Msangi]
  - Roads are critical for CC adapation [Msangi]
  - Think of design of bioenergy value chain [Msangi]
  - Need good infrastructure to support data collection for crop modeling [Bobert]
  - Need synthesis of soil studies w/regional database for good benchmarking [Kaingo]
  - Land use matter for hydrology flows – affects hydropower & ag [Nathkin/Alexander]
- Extension/Resource managers
  - Train farmers to monitor/use weather information (temp/rain) [Majule]
  - Help farmers to profit from knowledge generated by crop models [Bobert]
  - Land use matter for hydrology flows – affects hydropower & ag [Nathkin/Alexander]

- Farmers & Farmer groups
  - What information do extension officers need to give you to make better decisions? [Majule]
  - Your land use decisions have implications for water flows & flood risk [Nathkin/Alexander
- Researchers/Scientific community
  - Need to share success stories to allow for scaling up at policy level [Majule]
  - Big uncertainties exist in precipitation forecasts – can be a problem for hydro modeling [Büchner]
  - *How* you downscale climate projections matters to the outcomes [Büchner]
  - Need to simulate yield reductions at each stage to get accurate projections [Festo]
  - PTFs need careful calibration to enhance their reliability for soil studies – should also look at other methodologies/functional forms [Kaingo]

2.4 Plenary discussions; questions and answers plus comments

Question directed to Prof. Majule: What was the methodology used in the survey and what is the researcher's advice on predicted changes in cropping pattern for different areas in the country in the wake of climate changes. Which are the suitable crops in response to temperature changes in the research sites Mbeya and Singida. A concern was raised on the high crop losses reported in the presentation, which was seen to be too high and possibly unrealistic.

Response: A questionnaire was executed using a sample of 52 households, with various questions on different factors, response to droughts, effects of diseases and pests in different seasons etc for the last 30 years. It was reported that values projected are averages for different intensities of crop pests. Percentage loss generated was based on the differences between light and heavy pest infestation. The data is from memory recall, but there are some similarities observed from different villages. The research is on-going so more information can be generated in future.

Observation directed to Mr. Richard Festo who made presentation on crop modeling focusing on moisture limitation schemes. Is it possible to go further and look into integration with nutrient response especially Nitrogen making reference to another presentation in this conference by Mr. Jans Bobert. Why was it that there was decline in yield with higher rates of fertilizer? Could the 90kg N per hectare in Morogoro soils cause nutrient toxicity? Follow-up research to understand the moisture-nutrient interactions was suggested.

Question:. How do we transfer the research information to farmers. A lot of research conducted in the country. How can the research results be synthesized and translated to usable form.

Response on dissemination of results: Dr. Goetz Uckert, informed participants that research findings will be discussed and presented in publications because one of the aims of

researchers is to publish. The key issue is on how best to package the findings to different levels of knowledge or education is an importance aspect to address.

Additional input to Prof. Tumbo presentation. Prof. Majule shared with participants a number of CC research projects implemented by IRA and partners, some regional based and others specific to the country. A full list can be provided but some of the projects can be accessed from website.

Observation: Who are the end users of the research findings? Can the farmers make use of the models? It is important to package generated information in different levels. The information presented should be filtered out to find out what can be directly applied by the farmers and what should go to middle level actors as well as policy makers.

Comment: Ms. Praxeda Kalugendo brought up the problem of inefficient use of water, which is very much related to ongoing discussions on climate change, water scarcity and increasing water demand. There is unsustainability use of water. How can this information reach farmers to inform them on efficient water use?

Question to Prof. Majule. How do farmers use the sophisticated meteorological data in their farming practices? What is the frequency of data collection and how can the data be accessed.
Response: The aim of installing the meteorological data recorders is to provide some learning to the farmer groups and the information is used to compare with local or indigenous knowledge on weather and climate issues. They are developing models associated with capacity-building so as to build a better understanding on how to use climate change information.

General remark on local knowledge on climate change: It was observed that some of the weather indicators from local knowledge include sounds or noises from animals or birds. Ms. Zainab Lukengere a farmer from Kinole referred to a bird locally known as Selenzi, which in the past, its occurrence was associated to timing for planting paddy. The birds are disappearing probably due to vegetation changes but also the knowledge is not with the young generation any more. Farmers are interested in knowing how best to make use of the information collected, suggesting that learning materials can be produced and these can be put in Rural Resource Centers.

Mr. Isack Yonah, TMA representative gave a definition of climate change and climate variability: Climate is long term change (>30 years) in climate pattern, caused by different factors; Some of them are anthropogenic (e.g. from deforestation or the increase of industries producing GHG emissions). Increased frequency of extreme weather events like droughts and floods, greater climate variability and shift in seasons are also impacts of climate change. Some natural influences include sun spots and volcanic eruptions. Crop breeders should be involved to produce varieties which can adapt to the changes in growing season.

Response to researcher-breeders interactions: Mr. Jans Bobert responded to the question of involving crop breeders in the project, saying that there were some interactions between researchers in this team and breeders as well as seed companies. Specifically he mentioned interaction with the late Dr. Moshi of ARI Ilonga. The ReACCT group had good relations with breeders at Ilonga research station and also some interaction with TANSEED. Breeders are already working on some varieties. However he stressed that in order for there to be good results the interaction has to be two-way. Dissemination is not just the responsibility of the researchers in the 'ivory tower' – the stakeholders have to be interested in research results and also provide researchers with feedback.

Mr. Mtambo the Director from the Ministry was requested to inform participants briefly the mode of interaction among the different sub-sectors in the ministry e.g between researchers and extension and seed agencies.

Response from the Director of FS in MAFC: Agriculture is the mainstay of Tanzania. Climate change is real and this is affecting agriculture declining yields. Most of the areas in Tanzania are food insecure. The environment unit and the food security division interact with each other within the Ministry, and are working on mainstreaming climate change in agriculture activities and it is already in the policy. Adaptation and mitigation of climate change is of prime importance in agriculture. He further advised conference organizers to ensure that the good information presented in the sessions is filtered and packaged so that it can be used by policy makers, extensions workers and farmers.

3. Session B: Local Adaptations and Good Practices
Chairperson: Dr. Severin Polreich - ZALF

3.1 List of Presentations for Session B Overview of NAPA & National Early Warning Systems –Tanzania by Caroline Kilembe, Ministry of Agriculture, Food Security and Cooperatives

- Scenario and model-based choice of good agricultural practices by Severin Polreich, Jans Bobert, Khamaldin Mutabazi, Stefan Sieber
- Enhancing resilience of African farmers to weather and climate risks: We must address the vulnerability trajectories now by Mutabazi, K.D, Sokoine University of Agriculture
- The Role of Short Rotation Technology in fuel wood supply in Rungwe District, Tanzania by George Karwani
- Improving food security through climate variability coping strategies. a case of selected villages in Morogoro, Tanzania by Daninga, P.D

3.2 Plenary discussions on Session B:

Question to Ms. Kilembe: With regard to food security and early warning system, what is the food security policy orientation? Which crops should be grown where? Noted that in the 1940s there were directives of growing crops in areas where ecologically they were not suitable, like having maize in semi-arid areas. What is the current policy in terms of assuring food security in the country?

Response contributed by Ms. Kilembe and supported by Mr. Mtambo. The National Food security policy is not in place yet, but the government there is information on crop suitability for all seven agro-ecological zones in the country. However the government cannot force farmers to grow recommended crops making reference to Masasi (Ondoa Njaa Masasi), where farmers were forced to grow cassava for food security. Kiswahili saying, unaweza kumpeleka punda kisimani lakini huwezi kumlazimisha kunywa literal translation – you can take a donkey to the well but you cannot force it to drink the water. With the current situation of freedom and media influence, it is not easy for government authority to force farmers to grow certain crops.

Question to Dr. Mtabazi. You acknowledged there will be positive and negative impacts on climate change. How are farmers prepared to capture positive aspects of Climate change?

Mutabazi: On how farmers are prepared to respond to positive and negative climate change impacts. The agricultural systems will respond differently with some areas having deficit food and others surplus. It is important to develop linkage mechanisms between the surplus and the deficit areas.

Question to Mr. George Karwani: You are silent about what is happening in tea plantation in terms of wood use. Tea plantations do have fuel wood production plans so what can you say about that. You also talked of two species in the short rotation but one of them is not a bioenergy species eg. Persia Americana is a fruit specie and not frequently used for fuel wood.

Response: 23000 cubic meters of wood is required for tea curing. 30% is supplied by farmers, 10% is from the tea plantations. Persia Americana is also used as fuel in that area. This depends on the area. The calorific values for different species are different, but farmers can use it depending on the scarcity of fuel wood. Currently farmers are removing the old avocado trees and plant new varieties.

Question to Daninga: You have a graph given you show crop yields declining consistently in the last five years and you attributed to rising temperature. The question is whether the farming practices, rainfall conditions were the same so that you can rule out the contributions of the other factors?

Response: Agreed that crop yield is a function of many factors, but there was an assumption that in the farmer conditions other factors remained constant. Farmers were not using fertilizers, but noted that these were farmer perceptions and higher yields were attained when they had good rains and low yields when there were no rains.

Observation from Mr. Francis August of Africa biofuel: Green energy is one adaptation strategy. There are some misconception and negative attitudes with regard to biofuel production of biofuel production some unfound. For food security adoption of clean energy crops such as *Croton megalocarpus*, which is environment friendly and therefore can contribute to carbon dioxide sequestration and is economically viable.

Question to Dr. Severin: The question is with reference to use of small scale irrigation as a GAP No. 3, worried on the quantity of water, which can be available in such projects and application logistics and development costs for small scale farmers.

Response: Costs of the water harvesting equipment's are relatively high so up-scaling potential is not high. There is need for strategies with rural communities to work out best way of facilitating thisCow pea could be an alternative crop, which is more water use efficient. 200mm per year can be sufficient to produce vegetable and grain. Scenario 2030 is not the general increase in temperature or changes in water but rather the variability to be tackled.

Qestion to Mutabazi: Adaptation practices have not been adopted in consideration of the fact that climate change is dynamic. Wondered how scientist are prepared to face the climate change challenges and advice on what crops should be grown to in drought prone areas and also with increasing temperatures.

Response: Started by explaining that adaptation strategies are normally on long term basis, while coping strategies are short term, but there are structural changes in the system which tend to make adaptation and coping strategies overlap. Dr. Mutabazi used a battle terminologies to respond to the question. Saying it is a battle against CC and the farmers are soldiers in the forefront. The enemies are tactics and thus the need for coordinated efforts to fight it. Researchers act as an intelligence system to inform on the causes of CC and expected changes. Policy makers are providing enabling environment and the rules of the game for good fight and defense.

3.3 Summary from Session Chair

Caroline Kilembe:

- NAPA development process is bottom up approach and action-oriented for long term sustainable development, to protect life and livelihoods.
- Agriculture ranked as national priority but most vulnerable (marine management had the least priority).
- Crop monitoring and early warning information under MAFC identified strategies for adapting climate change challenges.
- 5-11 regions in Tanzania are very vulnerable to food insecurity.

Severin Polreich

- Assessment of GAPs need to be interdisciplinary:

1. Assessment of future scaling-up potential (identifying dissemination bottlenecks in context with future scenarios).
2. Crop performance in future (crop modeling with future climate data)
3. Validation (participatory on-farm trials).

Khamaldin Mutabazi
- adaptation strategies can be also inadequate adaptation strategies in the long term.
- poor farmers could be less vulnerable than better-off farmers depending on specific frame conditions.
- poverty and vulnerability analysis of 6 villages show high dependency of experiences of farmers towards probability of poverty.

George Karwani
- Short crop rotation technology SRC can contribute to substitute woodfuel from other resources.

Philip Daninga
- Farmers perceptions (CC),income generation outside of agriculture should be considered.

4. Session C: Economic, Social and Environmental Bioenergy potential.
Chairperson: Dr. Goetz Uckert- ZALF

4.1 List of Presentations for Session C

- **Socio-Economic Impacts of the Jatropha Chain in Tanzania by J. Shuma (Key-note) - TaTEDO**
- The Implications of Green Growth Strategies in OECD and Emerging countries for least Developed countries by Ulrike GroteEco
- Energy Community and outgrower Development: The Bagamoyo Sugar project by Rommert Schramm - Eco-Energy
- Biomass production and consumption in Tanzania: National and regional patterns by Katrin Bienge, Katharina Kennedy (WI) and Dr. Justus von Geibler – Wuppertal Institute
- Jatropha outgrower schemes by Jan Gevaert – Diligent
- Sufficiency and sustainability of Agroforestry: What matters today or tomorrow? by Anja Fasse – Institute for Environmental Economics and World Trade
- Better-is field research strategy and the feasibility of sunflower oil as substitute for fossil fuel: The examples of Laela by Goetz Uckert and Harry Hoffmann – ZALF
- Session related Master thesis: Analysis of water consumption by Jatropha curcas, Moringa olifeira and Eucalyptus salinga in Mpanda district, Rukwa region by Prisca Ntabaye - SUA

- Certification options of sustainable Jatropha production in Tanzania: a cost-benefit analysis by Anna Segerstedt - Institute for Environmental Economcs and World Trade

4.2 Session C: Presentation summaries

4.2.1. The Tatedo presentation included an overview of the potential, opportunities and obstacles of liquid biofuel production in Tanzania. The information presented was supported by data drawn from case studies in Kisarawe district, Arusha region and Leguriki village. The data provided information on Jatropha supply chain as well as soio-economic impacts for large scale as well as smallholder production systems. Other issues covered included environmental and health impacts and gender aspects of Jatropha production. To sum up the presenter noted that:-

- Jatropha farming in Tanzania is not yet sustainable
- Policy makers have to take into account a existing challenges with various players and stakeholders and the uncertainties that surround their current and future production and conversion to speed up its development
- In order to ensure its sustainability and reduce negative socio-economic impacts, both local and external investments should be encouraged.

4.2.3. Green Growth Strategies in OECD and Emerging Countries for Least Developed Countries by Prof. Ulrike Grote

The presentation centred on energy and food security with three key questions:-

- What key sectors in the LDCs are likely to be affected by green growth policies?
- What are the opportunities and threats arising from green growth policies?
- What should governments in LDCs do to maximize opportunities and minimize threats of green growth policies?

She further analysed net energy imports for developing and developed countries, opportunites and threats in promotion of liquid biofuels in least developed countries. Finally she looked into Green growth strategies and policy instruments in the energy sector in LDCs. To sum up she had some suggestions for the Energy Sector; in agriculture and food exports and in the Natural resources sector:

4.2.4. Eco-energy presentation

Rommert Schramm, the Eco Energy representative at the conference, presented the Bagamoyo sugar project a 7800 and 3000 hectares state farm and outgprwers, respectively. Production is to start in the third quarter of 2014. The project aim at contributing to national sugar, ethanol and power production. The presentation included global population growth trends between 1950 and 2100. Reference is made to sugar and fuel consumption in Tanzania up to 2030 and the projects major aim of contributing to national plans for self-sufficiency in sugar, as well as domestic renewable energy generation and consumption.

4.2.5. Jatropha outgrower schemes – Jan Gevaert

The major focus of this presentation was on the on-the-ground experiences of the dutch company "Diligent", representated in the conference by the country representative Jan Gevaert. The company started their activities in Tanzania in 2005 during the hype of Jatropha whereby the views on the former "wonder crop" is meanwhile more complex.
Diligent works with outgrowers who are recommended to plant their jatropha plants in hedges to meet two objectives: Fencing of their property on the one hand and creating additional income on the other. The company is currently working with 60.000 farmers and is planning to increase this number to 100,000 during 2012. The current price is 270/TSH per kg for farmer and 300/= per kg for the group as a whole. Diligent field officers collect the seeds and pay the outgrowers directly. In their pressing facility in Arusha does the company use three expellers to extract oil and to add value to the presscake as meanwhile approximately 46% of the income is created by non-oil products. This includes especially seed cakes briquettes produced as firewood substitutes. Additionally can those seed cakes also be mixed with rice husks and saw dusts to produce pellets (250/TSH per kg) which are used in special stoves (45,000/TSH per piece). Sediments after oil extraction are processed to industrial soap.
According to Mr. Gevaert Jatropha does not do well in plantation structures. In contrast does the outgrower system, in combination with diversification of the byproducts, guarantee economic viability. However, literature derived yield data of up to 10 tones per hectare as reported by the TATEDO representative were perceived as unrealistic. Future plans of Diligent Tanzania include an expansion to areas in Shinyanga and Mwanza where great deforestation took place. Current export markets are mainly Europe and North-America.

4.2.6 Anja´s Fasse presentation

Anja addressed sustainability of agroforestry in decreasing environmental pressure on natural resource. She presented analysis of the key detrminants of sustainable agroforestry using a case study from Tandai village in Uluguru mountain slopes. In summary she noted that:-

- Income level has an impact on the energy amount and energy composition.
- Even with high annual tree growth rates (15 kg), only 30% of the households are sustainable.
- Sustainability is mainly affected by soil quality, land security and firewood
- substituts
- Jatropha is one possibility of an additional energy source to increase sustainability.
- High income households produce more Jatropha trees compared to low
- Income households. They are even more scarce in family labor and pay higher wages.
- By implementing a Jatropha value chain, they could employ low incomehouseholds for Jatropha harvest or processing. New Income possibilities and wage effects _Social accounting matrix and CGE modelling.

4.2.7. Better-is field research strategy and the feasibility of sunflower oil as substitute for fossil fuel: The examples of Laela" by Goetz Uckert and Harry Hoffmann – ZALF

Core element of the presentation were on the one hand insights of the four case study regions of Better-iS (presented by H.Hoffmann) and a detailed analysis focusing on the suitability of sunflower oil as fossil fuel substitute on the other.
The case study areas of Better-iS were, in chronological order: Tandai (Morogoro region), Laela (Rukwa region), Mpanda (Rukwa region) and Kigoma (Kigoma region). Reasons to choose those sites were mainly the existance of bioenergy projects, be it decentralised electricity production (Laela), ourgrower schemes (Kigoma, Mpanda) or exotic Jatropha curcas usages (Tandai). Furthermore were three different bioenergy crops (Jatropha (Tandai, Laela, Mpanda), sunflower (Laela) and palm oil (Kigoma)) incorporated in the studies.
In his part of the presentation, Dr. Uckert examplified the data analysis by focussing on the potential usage of sunflower oil as fossil fuel substitute in Laela/Rukwa region. As general framework, he explained the energy consumption patterns, yield estimations, food sufficiency issues as well as soil erosion problems. All presented data was derived out of a detailed survey conducted in late 2010 in the village.
As general remark, Dr. Uckert highlighted that the potential analyses realied by the Better-iS team are, up to now, only preliminary and that peer-reviewed publications are on their way to be submitted.

4.3. Plenary discussion

The Director of Food Security from the Ministry commended the Diligent model where Jatropha is produced in the hedges. However, he also was skeptical on the high yields of > 8 tons per hectare mentioned in one of the presentations , which he reckoned has not been reached even in India where they are more advanced with Jatropha farming. Apart from this issue, the combined approach to tackle food security, and climate change via incorporating bioenergy in the production portfolio, as it is done by Diligent, is promising.
Subsequently, a farmer from Tandai explained that they use Jatropha as carrier plant for spices such as black pepper. For allowing this, a change in perception was necessary as Jatropha was a taboo plant because it was found in graves only - meanwhile have farmers with more than 2000 plants can be found. Up to now, no market for Jatropha seeds exists.
The Director for Food Security also mentioned that it is important to consider having the infrastructure to process the Jatropha into biodiesel within the country so that it can be used to substitute fossil fuel. 6 kg of Jatropha can produce 1 liter of biofuel. Important to do varietal screening for Jatropha the local accessions in the country has low oil yields.
It is important to encourage medium scale production before establishing large scale producers which are normally foreign investors citing the case of Moringa plantations. The infrastructure issue was raised as crucial making reference to Kinole, where farmers have produced Jatropha seeds but buyers cannot reach them easily. The Driector Food security in the ministry stressed that Food Security will generally not be threatened if biofuel production is realized on medium production by Tanzania smallholder farmers and especially if the infrastructure to process jatropha seeds is put in place. Large scale farming

will threaten food security especially if dominated by foreign companies and there is no investment in infrastructure.

Question directed to Prisca Ntabaye: Did you assess the trees as agroforestry species or as woodlot species. Eucalyptus might not be an Af species because of the condemnation for high water use but can inhibit growth of other plants underneath (allelopathic effects) and therefore is not a good agroforestry species. Eucalyptus might be a good species for woodlot where it is not mixed with other crops.

4.4. Key issues from Session C.

TATEDO: Jatropha production could have some positive environmental impacts especially in terms of reduced GHG-emissions and deforestation. Generally, the production depends on small scale producers but the farmers are poorly paid and yields are low. Jatropha production is not sustainable in large scale systems. Importance of coming up with policy framework for Jatropha production with involvement of various stakeholders was raised. For sustainability it is good to encourage local and external production.
Agro-ecoenergy: Generally, energy and food demand are increasing but food needs should always be given priority. Any success of bioenergy projects depends on strong interaction with local community and development issues at various levels (national, regional international and local community).
Univeristy of Hannover Grote noted that production needs an assemsnet of stability. Small groups should not be maginalised and need for increasing agricultural productivity. She also called for better committement to governance and policy issues as well as financing mechanism. Institute for Environmental Economics and World Trade: A standardized assessment of sustainability in the forefront of project realization was urgently requested. Marginalization should be avoided at any costs – one tool could be to increase agricultural productivity. At governmental level, more commitment of pro-poor policies and good governance should be included in policy implication which includes especially the involvement of the private sector.
Anja: Sustainability, Jatropha as a possibility option for increasing energy sustainability, land security and firewood extraction. Jatropha as a possibility for substitute parts of the increasing fuel wood needs.
Prisca: Resulting of her assessed water use of three species she noted that the specieis were threatening water availability
Severin and group: Model results cannot be generalized. There is need for further research. Tanzania has not reached stability levels in food production self sufficiency
Jans: Generally, the Tanzanian land is good for Jatropha production although high input levels are required to increase Jatropha production. For economically viable production, higher yields as well as mechanization should be introduced in the system. Furthermore additional research is highly necessary. Currently, large scale export of Jatropha oil is not an option in Tanzania.

5. Session D: Science-policy interface: implementation and dissemination.
Chairperson: Dr. Aichi Kitalyi – Consultant ICRAF

5.1 List of Session D Presentations:

- *EcoDev, EcoEnergy Community and Out grower Development by Rommert Schram of EcoEnergy*
- Establishment and Operation of a Hydrological Monitoring Network in the Ngerengere River Catchment, Tanzania by Meike Pendo Schäfer, Dr.Ottfried Dietrich, Dr.Marco Natkhin
- Water policy in water resources management and participation of Wami/Ruvu Basin water Board (WRBWB) in the ReACCT project
- Rural poverty and employment effects of large-scale biofuel investments: the case of sugarcane in Malawi and Tanzania by Raoul Hermann (GDI)
- Famer field schools and gender in climate change and bio-energy by Aichi Kitalyi, Consultant ICRAF
- Biofuel value chain evaluation – the adapted ScalA-BF TOOL by Götz Uckert (ZALF)
- Function and application of the ReACCT tool by Severin Polreich, Stefan Sieber

5.3 Plenary discussions including questions and answers:

Questioned if Eco-energy is so promising, why did the Sekab project fail so flatly.
Response: Sekab had same vision to Eco-energy and what happened with the program was mainly a financial issue. Sekab had a problem with financing from commercial banks. On the other hand Eco-energy financing is through Development banks such as ADB.
Ms. Praxeda Kalugendo Water Resources Officer from the Wami Ruvu Water Basin was requested to comment on the effects of Eco energy water extraction in the Wami basin. In response Ms. Kalugendo reported that Eco energy intake is far downstream in Wami river, which is not currently water stressed but there is need for better planning on water extraction in the basin. Admitted that so there is no good monitoring system in place.

5.4. Summary of keys issues from the session Chair.

5.4.1. Eco-energy presentation by Rommert Schram

- People centered approaches yield better and more sustainable results
- Empowering people to create their own wealth
- Focusing on profit making from beginning
- Understanding change process starting with social, technical and application including social or attitude change to technical/competence building to application

5.4.2 Meike Schafer (ZALF)

- Hydrological monitoring suffer lack of appropriate equipment's, but poor understanding of importance of the equipment's, vandalism is a problem where equipment have been installed.
- The project showed that data collection benefit more from manual readings than from automatic high tech equipment's.
- Participatory approach in data collection and good coordination on the ground is crucial

5.4.3.Kalugendo Praxeda Wami Ruvu Basin Water Office

- There is paucity of data on the hydrological status of the basin to inform decision makingThe basin has no hydrological monitoring system and also it is not well equipped to monitor water extraction from the basin.There are ongoing efforts to engage water user associations to report water extraction

5.4.4. Raoul Herman – Rural Poverty and employment effects of large-scale bio-fuel investments.

Dr. Herman a researcher from German Development Institute is working with the Leibnitz Univesitat Hannover team in planning for a research project that will build on experiences with large scale sugar production in Malawi. Linked to GIZ: A Policy oriented research to inform the ministry and development community in German has to be established. Private agriculture investments in Africa are currently becoming a controversial issue due to land grabbing problems. Some work done on jatropha investments in Namibia from 2008. Currently doing research in Malawi and now planning for Tanzania. Plans to move beyond the food vs fuel debate and land grabbing debate. Building on business model rather than thinking of large scale vs small scale models. What are the lessons from the existing investments in biofuel in the country? Focus now on sugar cane. Southern Africa is a key sugar cane production area with long term experience. Sugar cane has large potential in supporting communities. The ethanol technology well established in Brazil. Kilombero is the target site, where there is large scale sugar cane production but with integrated out grower schemes. Consulted sugar board of Tanzania encouraged comparing the different cases in the country and Identify best practices for replications most of the schemes started way back in the 1960s. It is interesting to observe long term changes. Issues of labour market

Topics: Institutional arrangement, different designs of value chain and ways of integrating smallholders. Issues: self-sufficiently require increased productivity support poverty reduction. Different models ; traditional outgrowers very small on rainfed to large scale irrigation based producers. Small producers not well integrated in input and extensions services support system. Block farming model being tested where there are a number of collective actions, which can increase security and risks but there could as well be problems with group dynamics. Some cases like company run farms. Integrating block farming with irrigation. Look at the different models and look at factors of Important to increase productivity. There are a lot of land and labour market issues to consider on large scale

production. Plan to observe the changes short term immediate risk responses due to labor market changes term risks. Qualitatively and quantitatively looking at the changes in the rural economy, secondary effects in uUpstream-downstream industries. Looking at environmental issues as well. Kilombero surrounded by forest reserve and national pack there could be interesting issues on energy use, deforestation and water scarcity issues. Household surveys (Income consumption, nutritional and labour markets) and group discussions will be used to get data from sugar cane growing areas.

- Noted it is important to undertake research to study effects of private agricultural investments in large scale biofuel projects on poverty in the wake of growing concerns on land issues, food security and labour markets.

5.4.5. Aichi Kitalyi Farmer field schools and gender

- Farmer field school approach is a useful learning approach which can be used to integrate local knowledge in new technologies as well as introducing new technologies.
- Kinole village in Morogoro has successfully introduce new rice variety – Nerica through the FFS approach
- Consideration of gender issues in climate change and biofuel projects/program is imperative and this can be best achieved within the FFS approach
- There is dearth of gender disaggregated data to support climate change and biofuel research and development programs.

6. Closing session

The closing session included a word from Dr. Kimaro the ICRAF Country Representative, Ms. Caroline Kilembe, Ministry of Agriculture Food Security and Cooperatives and Dr. Stefan Sieber of ZALF overall project Coordinator. Dr. Kimaro gave some highlights on what transpired in the last two days. Noted that the bioenergy industry is at very infancy stage and information gathered should be used to inform the process of identifying energy alternatives. ICRAF as part of the team have been instrumental in providing support on the ground but is also very much interested in participating in the process of producing dissemination materials. ICRAF is committed to production of publications from the research to communicate to stakeholders through extension pamphlets and policy briefs. Dr Kimaro acknowledged that the two days have been very useful in terms of developing partnerships and formed basis for future collaboration. ICRAF will also like to contribute to mainstreaming of gender issues in CC and bioenergy issues.

Ms. Kilembe addressing participants on behalf of the Ministry of Agriculture, Food Security and Cooperatives, particularly on behalf of the Director of Food Security division, thanked program organizers and all participants for their contribution. Madam Kilembe made special mention of the farmers for their active participation despite some language barriers. She

encouraged scientists to be focused and work on translating project results and success into actions at all levels from farmers to policy makers.

Dr. Stephan Sieber expressed the value of the collaboration, which has grown in the last four years. Jointly the team managed to tackle some of the challenges in the process. Suggested to the team on working on future collaboration and develop more proposals. There has been technical advancements but with some controversial discussions, which is healthy. The high participation rate of different people is the main uniqueness of the three projects. There was great learning through the cross-cultural interactions. Finally Dr. Sieber stressed the importance of filtering the information to understandable language to end users was stressed.

Field Excursion:
7th of December 2011
Visit 1: SEDC (Sustainable Energy and Development Center) including MFP (Multi-Functional Platform) demonstration plant in Mbezi Juu)

Solar dryer for fruits and vegetables

Biogasplant

Visit 2: Sugarcane plantation of EcoEnergy (formally SEKAB) in Bagamoyo