LACAf & GSB in Africa

Workshop Report

April 1 – 4, 2014
Kruger National Park, South Africa
& Maputo, Mozambique

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& Maputo, Mozambique

Organizing committee

Luís Augusto Cortez
Emile van Zyl
Fabiana Gama Viana
Nelda Rousseau

Rapporteurs

Mauro Berni
Paulo Manduca
Felipe H. Gomes
Marco Ospina
Klaus Dalgaard
João Guilherme Leite

Editor

João Guilherme Leite

Campinas, April 2014.

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Bioenergy Workshop in South Africa and Mozambique April 1 – 4, 2014

Terms of reference

Rationale

LACAf [and GSB] Projects, in the framework of BIOEN Project/FAPESP, aims to explore the main questions, potentials and constraints for implementing ethanol programs in tropical countries, particularly considering the cases of Colombia, Guatemala, Mozambique and South Africa, aiming to support consistent decision making towards to implement modern and sustainable bioenergy. In this context, one essential task is to study the reality of developing countries in Africa, Latin America and Caribbean in order to identify, model and evaluate production models for biofuels and bioenergy that could be successful in these countries. Possibly the Brazilian production model is not directly transferable to the different local characteristics of the studied countries, but offers a good starting point, for planning and evaluating purposes.

It is worth to note that the concept of 'production model' is more comprehensive than 'production system' (FAO, 1996; von Maltitz and Setzkorn, 2012), because it goes beyond the technological aspects of the biofuel production usually evaluated (Mandal et al., 2002; Wicke et al., 2007) and includes also direct and indirect socio-economic implications and institutional conditions, as schematized in Figure 1. Thus, the production model includes the production system.

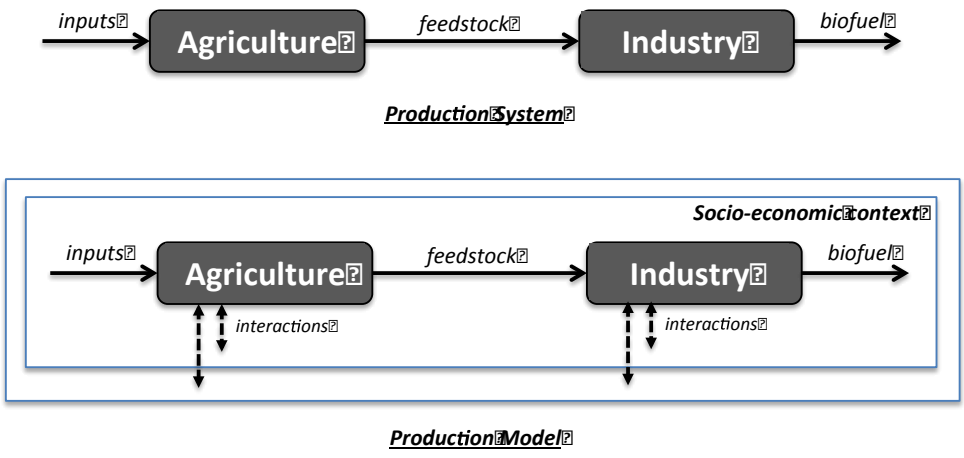

Figure 1 Production System and Production Model concepts

Since information from the field and direct interlocution with local stakeholders is essential aspects to be taken into account, the LACAf project combines experts from different fields and countries with the aim of exploring sustainable sugarcane ethanol

production systems, establishing an open and fruitful discussion, where the participation of local players is very important. Under these guidelines, two sequential 3-day meetings of the Global Sustainable Bioenergy and LACAf projects were proposed during March 31st through April 6th in South Africa (Kruger National Park) and Mozambique (Maputo) with the following objectives:

1) Update participants on activities associated with various parts of the project.
2) Include, hear from, and interact with representatives from the LACAf countries.
3) Enrich project participants with new perspectives.
4) Advance development of a vision for project-responsive environmental research.

Format, participants, and draft schedule

Both meetings are structured in terms of sessions considering:

1) Progress of LACAf-I Project,
   http:// 208.67.2.44/gsb/lacaf/index.php/lacaf-cane-i (NOT FULLY WORKING)
2) The GSB Project,
   http://bioenfapesp.org/gsb/
3) Perspectives from the LACAf countries, particularly South Africa and Mozambique,
4) Bioenergy & the LACAf countries (discussion),
5) New proposals on Geospacial Analysis, Socio-Economic Aspects, and Environment Impact.

In addition, the program features four "Topical Presentations" from persons who the GSB and LACAf projects are interested in interacting with and can learn from. Funding was requested to support travel and lodging expenses for Brazilian and international participants.

Invited participants

Already covered by LACAf-I Project (10):

Edgar Beauclair- Department of Agriculture, ESALQ/USP

Luís Augusto Barbosa Cortez- FEAGRI, UNICAMP

Luiz Augusto Horta Nogueira- UNIFEI

André Nassar – ICONE

Manoel Regis L V Leal- CTBE

Fernando Bertolani – CTC

Felipe H. Gomes (Pedológica)

Klaus Dalgaard – Post-Doc LACAf-I, NIPE-UNICAMP

João Guilherme Leite - Post-Doc LACAf-I, NIPE-UNICAMP

Rubens Lamparelli, NIPE-UNICAMP

Brazilians (8): Covered by additional Fapesp Fundings

Luiz Martinelli- Center of Nuclear Energy and Agriculture, ESALQ/USP

Jansle Rocha- FEAGRI, UNICAMP

Suani Coelho, IEE-USP

Marcelo Cunha, IE-UNICAMP

Antonio Bonomi, CTBE

Marco Ospina, FEAGRI, UNICAMP

Rui da Maia, Universidade Técnica de Mozambique

João Chidamoio, Ahead Energy

Foreigners (10):

Americans (6):

Virginia Dale– Environmental Sciences Division, ORNL

Keith Kline- Environmental Sciences Division, ORNL

Lee Lynd- Thayer School of Engineering, Dartmouth College

John Sheehan- Institute on the Environment, University of Minnesota

Steve Perterson, Dartmouth College, USA

Tom Richards, PennState University, USA

Africans (4):

Mosad El-Missiry - Regional Integration and Infrastructure, NEPAD (Africa)

Ibrahim Assane Mya, NEPAD

Francis Yamba – CEEEZ, Zambia

Others suggested by NEPAD

Suggested topics for discussion

-Sugarcane and cassava as feedstock: potential and constraints

- Biofuels in African countries: perspectives, recent evolution and national programs

- Capacity building requirements in African countries for biofuel production.

- Potential for ethanol use as fuel (in transport and cooking)

- Legal and regulatory aspects of biofuels production in Mozambique (feedstock, processing, distribution, etc.)

- Biofuels in Africa: for domestic or/and global markets?

Bioenergy Workshop Kruger National Park

Progam

PRELIMINARY PROGRAM	
DAY 1 – APRIL, 1	
8:30 – 9:00	**WELCOME & MEETING OVERVIEW** Emile van Zyl, Stellenbosch University – welcome & workshop objectives Luís Augusto Barbosa Cortez- UNICAMP - LACAf Project overview Lee Lynd- Thayer School of Engineering, Dartmouth - GSB Project overview
9:00 – 10:30	**SESSION I: Discussion about Why Bioenergy in Africa?** ***Chair:*** **Emile van Zyl, Stellenbosch University** "Sustainable bioenergy production in Southern Africa" Emile van Zyl – Stellenbosch University (South Africa) "The Replicability of Brazil's Bioenergy Model in Africa" Klaus Dalgaard – Post-Doc LACAf-I, NIPE-UNICAMP ***Round table and Discussion with:*** Luiz Augusto Horta Nogueira- UNIFEI Lee Lynd- Thayer School of Engineering, Dartmouth ***Rapporteur: Mauro Berni –NIPE/UNICAMP***
10:30 – 11:00	**COFFEE BREAK**
11:00 – 12:30	**SESSION II: Determining the Bioenergy Potential in Africa: how much can be produced?** ***Chair:*** **Luis Cortez- UNICAMP** "Constraints in Land Use for Biomass Production in Mozambique" André Nassar - AGROICONE "Determining the Biomass Potential in South Africa and Mozambique" Fernando Bertolani – Sugarcane Technology Center – CTC Edgar Beauclair- School of Agriculture - ESALQ/USP "Increasing ethanol production in Southern Africa: Opportunities and challenges" Johann Gorgens - Stellenbosch University ***Round table and Discussion with:*** Rui da Maia - Universidade Técnica de Mozambique John Sheehan - Institute on the Environment, University of Minnesota Kalaluka Munyinda – CEEEZ, Zambia ***Rapporteur: Paulo Manduca - NIPE/UNICAMP***
12:30 – 14:00	**LUNCH**
14:00 – 16:30	**SESSION III: Geospatial Analysis in Africa: can land use be optimized?** ***Chair:*** **Keith Kline- Environmental Sciences Division, ORNL** "Land use mapping/Change analysis using time series of satellite images" Jansle Rocha- FEAGRI, UNICAMP "Mixed crop-livestock detection/mapping using remote sensing" Rubens Lamparelli, NIPE-UNICAMP "Pasture Intensification" John Sheehan- Institute on the Environment, University of Minnesota

	Round table and Discussion with: João Chidamoio - Ahead Energy, Mozambique André Nassar, AGROICONE, Brazil ***Rapporteur: Felipe H. Gomes – Pedológica, Brazil***
DAY 2 – APRIL, 2	
8:30 – 9:45	**SESSION IV: Food and Energy Security In Africa** ***Chair:*** **João Chidamoio, Ahead Energy, Mozambique** "Modern bioenergy and its potential role towards enabling a sustainable future for southern Africa" Annie Chimphango – Stellenbosch University "Socioeconomic impacts in Mozambique due to sustainable sugarcane bioethanol production scenario" Marcelo Pereira da Cunha - IE-UNICAMP ***Round table and Discussion with:*** Rui da Maia, Universidade Técnica de Mozambique Manoel Regis Lima Verde Leal, CTBE ***Rapporteur: Marco Ospina, Feagri-Unicamp***
9:45 – 10:00	**COFFEE BREAK**
10:00 – 11:30	**SESSION V: Environment Issues for Biofuels Production in Africa** ***Chair:*** **Suani Coelho, IEE-USP** "Opportunities to Design Biofuel Systems for Multiple Environmental Services and Socioeconomic Benefits" Virginia Dale– Environmental Sciences Division, ORNL "What we know about environmental and social consequences of biofuels production and we should avoid in the future" Luiz Martinelli- Center of Nuclear Energy and Agriculture, ESALQ/USP "Energy Security and Human Development: Pathways to Sustainability" Tom Richards, PennState University, USA ***Round table and Discussion with:*** Mike Jackobson, PennState University, USA Edgar Beauclair, School of Agriculture - ESALQ/USP ***Rapporteur: João Guilherme Dal Bello– Post-Doc LACAf-I, NIPE-UNICAMP***
11:30 – 12:45	**SESSION V: Issues Concerning the Productive Model and Industry** ***Chair:*** **Emile van Zyl, Stellenbosch University** "An overview of the South African sugar industry" Luke Brouckaert, South African Sugar Industry "The New Approach of the Sugar Industry to Diversity Processing to Include Biorefineries and Integrate Bioenergy and Valuable Bio-Product Production" Steve Davis, SMRI, South Africa "What Scale Should We Consider?" Manoel Regis L V Leal- CTBE ***Round table and Discussion with:*** Antonio Bonomi, CTBE Nico Stoltz, South African Sugar Industry ***Rapporteur: Klaus Dalgaard – Post-Doc LACAf-I, NIPE-UNICAMP***
12:45 – 13:30	**LUNCH**
13:30 – 17:00	**TSB TECHNICAL VISIT**

SESSION I

Discussion about why bioenergy in Africa

Chair: Emile van Zyl, Stellenbosch University (South Africa)

Talk Title: Sustainable bioenergy production in Southern Africa

Speaker: Emile van Zyl – Stellenbosch University – South Africa

Rapporteur: Mauro Berni

Abstract: Bioenergy, particularly biofuels, have played a pivotal role in Africa in the past and could help address the need for energy expansion in the future, especially when considering up to 80% of African countries rely on traditional firewood to meet their energy needs for that Africa has to embrace modern bioenergy technologies with higher efficiencies. Lignocellulose is globally recognized as the preferred biomass for the production of a variety of fuels and chemicals that may result in the creation of a sustainable chemicals and fuels industry. Within the African context bioenergy/biofuels production has to be integrated with food production to (i) provide local energy and (ii) promote food security by providing alternative markets, and very important, should be (iii) socially-beneficial to the rural population at large.
The Chair of Energy Research (CoER): Biofuels focuses on the technological interventions required to develop commercially-viable advanced (2nd) generation lignocellulose conversion technologies to biofuels in Southern Africa. The CoER : Biofuels research program undertook to develop both biochemical (CBP yeast development) and thermo-chemical technologies for complete conversion of plant biomass to biofuels. Some examples for energy integration between lignocellulosic conversion processes and adjacent industrial processes (including existing bio-based industries) to achieve more attractive financial returns, will be discussed.
Finally, the sustainable production of sufficient food and modern bioenergy/biofuels to enable social transformation in southern Africa will be contextualized in a common vision and road map established in close collaboration between Stellenbosch University, NEPAD as political implementation arm of the African Union, and the fast experience from the Bioenergy programme of FAPESP in Brazil, coordinated by the CoER: Biofuels.

Main addressed points:

- ✓ Traditional bioenergy production in Africa
- ✓ Biomass potential of Africa at large
- ✓ Biofuel production in South Africa
- ✓ Bioenergy value to South Africa
- ✓ Opportunities for sugarcane in sub-Saharan Africa

Main conclusions:

Nowadays in Africa only produce a fraction of the world ethanol, and even Africa's sugar production is rather modest with South Africa been the biggest producer, producing about half of the sugarcane in sub-Saharan Africa (SADC) (≈ 20 Mt/annum), using an area of 325000 ha.

Africa ranks fourth in sugarcane production and 39 countries cultivate sugarcane in this continent. Major African sugarcane producers are Mozambique, Cameroon, Egypt, Madagascar, South Africa and Zimbabwe etc.

Studies in workshop show that about 6 MHa of arable land in SADC countries (primarily Mozambique, Angola, Tanzania, Zambia, Zimbabwe and Malawi) are suitable for sugarcane production at an average yield of >65 t/ha or more. Conservatively, this means that the total

South Africa sugar industry can be replicated every year for at least 15 -20 years in Southern Africa!

Ethanol is today the most important biofuel in the global economy, representing the largest volumes of biofuel production and consumption. Most of the global bio-ethanol production is in Brazil (sugarcane) and the USA (corn), although there is significant global interest to increase production in various parts of the world, also in Southern Africa. Sugarcane ethanol is widely considered to be more environmentally beneficial than corn-based ethanol, due to improved carbon- and energy-balances.

Talk Title: Communication and Consulting Challenges in Biofuels

Speaker: Luiz A. Horta – UNIFEI, Brazil

Rapporteur: Mauro Berni

Main addressed points:

The role of consultation and communication in bioenergy projects is necessary!

Main conclusions:

Due its several relevant nexus with Society, Agriculture and Environment, which create conditions for multiple benefits and impacts, bioenergy requires a clear strategy of stakeholder involvement aiming to build and support the development of sustainable bioenergy programs.

Consultation and communication in bioenergy projects bioenergy to promote the transition from poverty, poor health, environmental degradation to more food, better health and stronger local economy.

Ensure that stakeholders are continuously engaged, that stakeholder engagement does not end project planning but is used to its fullest extent during implementation and as a warming monitoring and evaluation mechanism.

Must be ensure that stakeholders are continuously engaged, that stakeholder engagement does not end project planning but is used to its fullest extent during implementation and as a warming monitoring and evaluation mechanism.

Talk Title: The Replicability of Brazil's Bioenergy Model in Africa

Speaker: Klaus Dalgaard, LACAf's pos-doc (Brazil)

Rapporteur: Mauro Berni

Abstract: During his administration, Brazil's president Lula (2003-2010) repeatedly stated in official visits to African countries that "helping Africa to realize its full development potential is [official] state policy" in Brazil. The help offered by the Brazilian government to many African states almost invariably included assistance to develop bioenergy programs in those countries. In his speeches, Lula touted the idea that his country's successful experience with biofuels could easily, and should, be replicated throughout the African continent, wherever the soil and climate conditions are similar to Brazil's. However, scepticism abounds regarding the extent to which the Brazilian bioenergy model can be replicated in other countries. This research addresses the question of whether the Brazilian bioenergy model is replicable in Africa. It begins with a brief process tracing of Brazil's foreign policy initiative to promote biofuels in African states, followed by a description of what is meant by the "Brazilian bioenergy model". It is argued that one cannot legitimately discuss the concept of "replicability" where the Brazilian model is not fully replicated in all its aspects. Instead, any form of partial replication implies adaptability, rather than replicability, of the Brazilian bioenergy model. It is concluded that the degree to which the Brazilian model is adapted depends on the specificity of local context in which the adaptation takes place.

Main addressed points:

The possibilities replicability of Brazil's bioenergy model in Africa.

Discussion of differences in the Brazilian and African contexts, which may challenge replicability of the Brazilian bioenergy model in Africa.

Main conclusions:

During his administration, Brazil's president Lula (2003-2010) repeatedly stated in official visits to African countries that "helping Africa to realize its full development potential is [official] state policy" in Brazil.

The help offered by the Brazilian government to many African states almost invariably included assistance to develop bioenergy programs in those countries.

In his speeches, Lula touted the idea that his country's successful experience with biofuels could easily, and should, be replicated throughout the African continent, wherever the soil and climate conditions are similar to Brazil's.

However, scepticism abounds regarding the extent to which the Brazilian bioenergy model can be replicated elsewhere, or even if its success is unique to its own context.

The presentation discusses some of the opportunities that Brazil's bioenergy model can offer to African countries, according to the Brazilian government's official discourse. The speaker concluded that, if these challenges can be surmounted, the opportunities presented by the Brazilian bioenergy model outweigh its potential hazards in Africa, but that the local political, economic and social contexts in African countries must be taken into account.

SESSION II

Determining the bioenergy potential in Africa – how much can be produced considering sugarcane?

Chair: Luís Cortez, Unicamp (Brazil)

Talk Title: Constraints in land use for biomass production in Mozambique

Speaker: André Nassar – AGROINCONE (Brazil)

Rapporteur: Paulo Manduca – Unicamp (Brazil)

Abstract: Agricultural activities have altered our planet's land surface. The expansion of agricultural feedstock for biofuel production has potential to change land cover and land use in Latin American and African countries. Besides being economically viable, sustainable biofuels production must consider its impacts the environment, food production and in local livelihood, which are greatly affected by land use. A comprehensive assessment of biofuel sustainability requires an analysis of land use.

The main objective of the presentation is to explore the land use impacts of biofuels production in Latin America and Africa. Special attention will be given to the case of sugarcane ethanol expansion in Mozambique. To fulfil the main objective, the following specific objective must achieved:

(1) Build a base map of land cover;
(2) Analyze recent land use dynamics and identifying a pattern of land use change;
(3) Simulate land use change according to biofuel production scenarios;
(4) Evaluate potential GHG emissions due to land use change.

Having good quality and updated GIS information on land cover and land use is a pre-requirement of land use analysis. Such information was not available for Mozambique, so researchers identified the need for building the most actual land cover and land use map for Mozambique. Two maps were produced for the reference years of 2001 and 2013, merging satellite imagery, secondary data and maps based on and local information. Sugarcane mapping received special attention. Land use trends were identified and historical (2001-2013) GHG emissions due to sugarcane expansion were accounted.

Next steps of the project consist of forward-looking analysis of the potential sugarcane ethanol in Mozambique and its impacts. Such analysis will build on achievements presented above and will consider national legislation, logistics and infrastructure, profitability of sugarcane mills, internal and international market restrictions and incentives.

Main addressed points:

Land availability

- Restrictions
    - Soil
    - Climate
    - Topography
- Precipitation data: problems in defining the database source
- Legislation and sustainability restrictions
- Agricultural zoning maps?
- Available environmental set aside areas
- Land cover and carbon stocks

Main conclusions:

- There is uncertainty as to the calculation of costs at the grid level

- A probability index for bioenergy production might be useful expressed as: P = f(suitability, yield, distance to market, distance to inputs, minimum suitable size, others?)
- The probability parameters can be adjusted according to observed location of sugarcane
- Future biofuel production must be located in areas that has all sustainability requirements
- Need to identify parameters that will change according to technology

Talk Title: Determining the biomass potential in South Africa and Mozambique

Speaker: Fernando Bertolani – CTC (Brazil)

Rapporteur: Paulo Manduca – Unicamp (Brazil)

Main addressed points:

Objectives

• Identify potential areas to sugar cane production in Mozambique

• Quantify the different production potential of sugar cane crops

Databases

- Project – Embrapa
- Soil map (Local, FAO and USDA classification and others)
- Slope classes
- Preservation areas
- Rainfall

Sugarcane production

Potential production – soil and climate characteristics

Environmental restrictions – slope < 12%

Rainfall restrictions - < 900 mm per year

Main conclusions:

Validate data

- Climate
- Rainfall
- Rain distribution
- Water balance

Compare with existing data

- Agricultural Zoning

Talk Title: Increasing ethanol production in Southern Africa: opportunities and challenges

Speaker: Johann Gorgens - Stellenbosch University (South Africa)

Rapporteur: Paulo Manduca – Unicamp (Brazil)

Abstract: Bio-ethanol is today the most important biofuel in the global economy, representing the largest volumes of biofuel production and consumption. Most of the global bio-ethanol production is in Brazil (sugarcane) and the USA (corn), although there is significant global interest to increase production in various parts of the world, also in Southern Africa. Sugarcane ethanol is widely considered to be more environmentally beneficial than corn-based ethanol, due to improved carbon- and energy-balances.

Previous studies have shown potential availability of up to 6 million hectares of agricultural land for sugarcane cultivation in Southern Africa, without negatively affecting food production, biodiversity or ecologically sensitive areas (Watson et al., 2011). Furthermore, Southern Africa has a well-established sugar industry, with various plans for expansion outside of South Africa. Sugar producers in South Africa primarily supply the local market, but also export a portion of sugar produced. However, international sugar prices are not attractive, providing possible economic incentives for conversion of part of the available sugar stream into ethanol, as per the Brazilian model. A third option for increasing production of ethanol is through the use of lignocellulosic plant biomass, preferably in the form of agricultural and forestry residues/wastes, as feedstock. Significant progress has been made towards commercialisation of technologies for cellulosic ethanol production, but cost of production remains a key barrier.

Expansion of ethanol production in the Southern Africa context is therefore not limited by feedstock availability, with various opportunities for expansion of sugarcane (and grain-based) feedstocks, diversion of export sugar and use of lignocellulose as feedstock. There are concerns around sustainability of such feedstock supply, which warrants further investigation, but substantial opportunities remain even when taking such considerations into account. The economics of ethanol production remains as a key barrier to expanded production. The South African sugar industry awaits clarification on pricing of bio-ethanol for blending into the local fuel pool, to ensure economic benefits in diversion of export sugar to ethanol. Similarly, previous efforts at establishing dedicated ethanol production facilities based on first generation technology, have been hampered by lack of coordination in regulations and mandated blending. The production of cellulosic ethanol is likely to be best achieved by either (i) utilising a zero-cost or negative-cost waste stream for biomass processing, such as paper sludge from paper/pulp mills and xylose-rich effluents from such facilities, or (ii) integration of cellulosic ethanol production into a first generation production plant, to maximise process integration and conversion efficiency, as a means to minimise capital and operational expenses for cellulosic ethanol production. Concerted efforts are required from governments in the region to create sufficiently attractive commercial opportunities that will warrant economic viability of expanded ethanol production.

Main addressed points:

- Bio-energy in the existing sugar industry
- Small-scale ethanol production
- Sugarcane crop development for bio-energy
- Alternative scenarios for ethanol production

Main conclusions:

Biorefineries

- Define possible biorefinery scenarios, experimental investigation, modelling and comparisons
    - Efficiency, economics, environmental impacts
- Co-products from sugarcane lignocellulose:
    - Furfural – ethanol/butanol – electricity
    - Organic acids – ethanol/butanol – electricity
    - Hemis biopolymers – ethanol/butanol – electricity
    - Ethanol – lignin-derived chemicals – electricity

Alternatives to consider

- Expansions in the existing sugar industry
- New, large-scale distilleries
- New, small-scale distilleries
- Biorefineries
- Crop development
- Zero- or negative-cost feedstocks, e.g. wastes from paper
    - Paper sludge to ethanol
    - spent sulphite liquor (xylose) to ethanol

SESSION III

Geospatial analysis in Africa: can land use be optimized?

Chair: Keith Kline, Oak Ridge National Laboratory – ORNL (USA)

Talk Title: Geospacial analysis in Africa: Can land use be optimized

Speaker: Jansle Rocha

Rapporteur: Felipe Haenel Gomes

Abstract: Agriculture dynamics is a challenge for keeping an updated global land use dataset, which is essential to fully analyse land potential for bioenergy crops and calibrate yield potential models. Multitemporal satellite imagery has high potential for mapping and monitoring agricultural dynamics such as land use changes and land use intensification. The recent increase in availability of satellite sensors with a variety of spatial, spectral, radiometric and temporal resolution has resulted in new demands for the development of digital classification methods that could be adapted for global scale mapping. The main goal is to present methodologies for detecting land use changes/intensification with examples in Brazil and potential applications in Africa.

Main addressed points:

- Multitemporal satellite imagery has high potential for mapping and monitoring agricultural dynamics such as land use changes and land use intensification.
- Increase in image availability with a variety of spatial, spectral, radiometric and temporal resolution resulted in new demands for the development of digital classification methods that could be adapted for global scale mapping.

Main conclusions:

- Main goal is to present methodologies for detecting land use changes/intensification with examples in Brazil and potential applications in Africa.

Talk Title: Geospacial analysis in Africa: Can land use be optimized

Speaker: Rubens Lamparelli

Rapporteur: Felipe Haenel Gomes

Abstract: Compared to cropland and forestland, pastureland appears considerably more promising as a large-scale source of bioenergy. The potential to intensify food production from pasture, thereby making land available for other purposes including bioenergy, appears to be much larger than for cropland. A substantial literature supports the notion that planting bioenergy crops, especially perennials and especially on degraded land, can improve pasture organic matter and fertility in. In this context It is ironic that while pastureland likely has the greatest potential for bioenergy production, the main criticisms of bioenergy from a land use perspective are directed at clearing of forestland and competition with food crops. There are many initiatives trying to assess how much are pasture area available to, mainly which that are based on statistics data but none of those conclusive. An indirect way to assess it could be to identify where is occurring the pasture intensification that in most of cases have found as a management system mixing crop and livestock. The Space-based remote sensing using time-series has been used successfully in land use mapping. Therefore the goal of this work is explore the possibilities of identify this type of system using Modis time-series through its spectral behaviour. Assuming that is true will be possible identify this kind of pattern in other places and assess indirect area available to energy expansion.

Main addressed points:

- Pastures appears to be considerably more promising as large source of bioenergy because it has a potential to intensify food production making land available for other purposes, including bioenergy.
- Using these pastures, especially on degraded lands with perennial plants, can increase organic matter content and consequently the fertility.
- Nevertheless, criticism uses the perspective that the production of bioenergy is related to clearing of forestland and competes with food crops.
- There are many initiatives trying to access how much pasture area are available to, mainly which that are based on statistics data but none of those conclusive.

Main conclusions:

- An indirect way to assess the data needed could be to identify where is occurring the pasture intensification. In most cases it has found as a management system mixing crop and livestock.
- The goal of using remote sensing in this work is to explore possibilities of identify the pasture intensification using Modis time-series through its spectral behaviour.
- Assuming that is true, will be possible identify the kind of pattern in other places and assess indirect area available to energy expansion.

Talk Title: Geospacial analysis in Africa: Can land use be optimized

Speaker: John Sheehan

Rapporteur: Felipe Haenel Gomes

Abstract: Sustainably increasing agricultural production on existing managed lands is a key strategy for meeting anticipated food and energy needs from a finite amount of land. Use of climatically-defined "bins" is a leading approach for evaluating the potential of intensifying per hectare agricultural production and related yield gaps. This approach is well developed for row crops (Licker et al, 2010, Mueller et al, 2012), but has not previously been applied to pasture land.
The potential for intensifying global pasture-based livestock production is evaluated based on the gap between today's lowest and highest livestock density within climatically similar bins. Increasing densities to their climate-appropriate, maximum currently-attainable level would allow existing pastureland to support 3.75 fold more animals. Bringing the poorest- performing pastures up to 50% of their maximum attainable density would double the global stock of grazing animals. The potential for intensifying pasture appears to be several-fold larger than that for grain cops determined using a similar approach, although further study is needed to address several key points. In particular, including animal performance (weight gain per ha per year) may substantially increase the intensification potential estimated here.
Future work and potential implications for bioenergy and economic development will be briefly discussed.

Main addressed points:

- To increase agricultural production in a sustainable way on existing managed lands is a key strategy for meeting anticipated food and energy needs from a finite amount of land.
- Potential for intensifying global pasture-based livestock production is evaluated based on the gap between today's lowest and highest livestock density within climatically similar bins.

Main conclusions:

- Is possible to increase the productivity of livestock considering increasing densities of animals per hectare according to the appropriate climate.
- Bringing the poorest-performing pastures up to 50% of their maximum attainable density would be double the global stock of grazing animals.

SESSION IV

Food and energy security in Africa

Chair: João Chidamoio, Ahead Energy (Mozambique)

Talk Title: Food and energy security in Africa

Speaker: Annie Chimphango – Stellenbosch University – South Africa

Rapporteur: Marco Ospina

Abstract: The roles of modern bioenergy in the fuel transport system as a greenhouse gas mitigation strategy and a damper to fluctuating oil prices are globally recognised. However, for Africa, the modern bioenergy is a potential catalyst for meeting the critical needs beyond the transport fuel. Modern bioenergy is considered a backbone for meeting food and household energy securities, providing improved health and education services, and a tool for job creation & gender upliftment and agricultural development, thus, boosting local economies. These diversified needs can only be achieved if the needs and interests of the rural poor are mainstreamed in the designing of the bioenergy systems. Therefore, the implementation of sustainable bioenergy systems in Africa should consider business models that are inclusive of all stakeholders to ensure ownership and empowerment of the African poor. This requires identification and optimisation of areas in the bioenergy value chain, thus feedstock production to energy product utilisation, where most of these needs can be met. The paper presents some local initiatives in Southern Africa where bioenergy has potential to improve rural livelihoods. Furthermore, the paper identifies some gaps and weaknesses in the current bioenergy value chain analyses concerning the real impact of bioenergy on rural livelihoods in Southern Africa, which might inform some of the LACAf/GSB activities.

Modern bioenergy and its potential role towards enabling a sustainable future for Southern Africa. The new idea either finds a champion or dies…

Southern Africa: 14 countries several with income below the poverty line. More energy is needed in agriculture. Regarding the clean efficient energy source and the level of income populations with lower income use a less clean efficient source of energy, i.e. more time is spent collecting firewood. Charcoal and firewood use increase over the last ten years. In addition available land per person is decreasing.

Three pillars to produce energy: land, food, and water.

The bioenergy role in SADC is beyond fuel. It is a backbone for rural development including employment generation, entrepreneurship, gender up-liftmen.

Opportunities can be saw as limitations and vice verse.

Limitations: technology, policy gaps and finance; poor road infrastructure; lack of Mechanization.

Where to Start: Biomass inventory, assess acceptance, best practices, availability of field residues, definition of business models, pre- processing technology (Promotion of labor-based methods). Value Chain Analysis: production, pre-processing and distribution.

Strategies: Partnership, value addition.

Examples: Co-generation revenue-sharing in Mauritius and other example from India

Monitoring Framework for Bioenergy Sustainability: Evaluate the impact (income increase, wellbeing; livelihood outcome).

Talk Title: Food and energy security in Africa

Speaker: Marcelo Pereira da Cunha – UNICAMP (Brazil)

Rapporteur: Marco Ospina

Abstract: Bioenergy has been considered as one of the alternatives routes of energy production to mitigate greenhouse gases (GHG) emissions, as well as to improve energy security and to promote the rural economic sector – the last one especially in tropical developing countries. Considering liquid fuels, sugarcane bioethanol is recognized as the best current option for sustainable biofuel. In the context of LACAF project, the purpose of this study is to quantify the socioeconomic impacts of a sustainable sugarcane bioethanol production scenario in Mozambique, including all direct and indirect effects along the production chain – depending on the socioeconomic variable, the indirect effects can be the most important one. The scenario includes the estimation of suitable sugarcane expansion area as well as the commercial available technologies in agricultural and industrial phases (this information will be provided by the others researchers involved in the LACAF project) . The methodology used for the socioeconomic impacts evaluation is based on Input-Output Analysis – one of the most used approaches in applied economics for socioeconomic evaluation in the World. The methodology considers the intersectoral relationship in the region of the study – in this case, in Mozambique. Changes on sectors output level, jobs, income and gross domestic product (GDP) are among the socioeconomic variables to be evaluated.

Main discussion points:

Socioeconomics impacts in Mozambique.

The central question is: What are the socio economics impacts and how to measure them?

To answer this question a sector production model can be used. By using this model the direct and indirect effects over the production chain can be analyzed.

A comparison between ethanol and gasoline in Brazil showed that the ethanol sector employs more people than the gasoline sector, however the wages are higher for ethanol.

Possible results in Mozambique: some output multipliers.

Next steps: Applying the method using reliable data from Mozambique and South Africa.

Questions

Lee:

Why not using this approach matching social needs and high productivity technology in order to answer the question of which technology will provide the best results

Partnership between food security and energy security

Marcelo:

It is possible to do the analysis of Mozambique data within one year

Rui:

Recommendation: the model is too economics it has to be more social

I.e. If we create employment in rural areas we will be better off and also it has to deal with how to increase the wages.

Regis:

Marcelo's approach is a tool and therefore needs information to be used.

SESSION V

Environment issues for biofuel production in Africa

Chair: Suani Coelho, USP (Brazil)

Talk Title: Opportunities to Design Biofuel Systems for Multiple Environmental Services and Socioeconomic Benefits

Speaker: *Virginia Dale, Oak Ridge National Laboratory – ORNL (USA)*

Rapporteur: Klaus Dalgaard

Abstract: Characterizing conditions under which resource uses are sustainable can be done using indicators to assess and monitor trends over time. Indicators are needed to assess both socioeconomic and environmental sustainability of bioenergy systems. A team at Oak Ridge National Laboratory (ORNL) has selected key indicators of bioenergy sustainability and proposed how they are best used in particular contexts. The proposed environmental and socioeconomic indicators represent a suite designed to reflect major sustainability considerations for bioenergy. We identified major environmental categories of sustainability to be soil quality, water quality and quantity, greenhouse gases, biodiversity, air quality, and productivity and discussed 19 indicators that fit into those categories. We also identified 16 socioeconomic indicators that fall into the categories of social well-being, energy security, trade, profitability, resource conservation, and social acceptability. The utility of each indicator, methods for its measurement, and applications appropriate for the context of particular bioenergy systems are described along with future research needs. Together, this suite of indicators provides a basis to quantify and evaluate sustainability of bioenergy systems across many regions in which they are being deployed.

The importance of interpreting these indicators of bioenergy sustainability in particular contexts is described. The context of an application strongly affects the choice, measurement and interpretation of sustainability indicators. Context considerations include the purpose of the analysis, the specific fuel production and distribution system, policy influences, stakeholders and their values, baseline attributes, available information, and spatial and temporal scales of interest. Knowing the context is essential for setting priorities for assessment, defining the purpose, setting the temporal and spatial boundaries for consideration, and determining practicality and utility of measures. We consider how this approach might be applied in the context of different systems in Africa.

The ORNL team has also worked with agronomists to analyze how agricultural sustainability can consider the effects of farm activities on social, economic, and environmental conditions at local and regional scales. Adoption of more sustainable agricultural practices entails defining sustainability, developing easily measured indicators of sustainability, moving toward integrated agricultural systems, and offering incentives or imposing regulations to affect farmer behaviour.

Main addressed points:

Landscape design is a plan for resource allocation to manage more sustainable provisioning of energy and other services, which specifically takes into account the context of each place. In the landscape design approach for bioenergy, first you need to set the goals for what you are considering, and that has to involve the key stakeholders. Then we need to consider the strengths of the system. We also address the wastes and inefficiencies of the system. Then we have to evaluate and apply the solutions. As we move forward, we have to monitor and think about an adaptive management approach, taking into account how our solutions change the system and how we can continue to meet the needs identified by the stakeholders.

What enables this sort of landscape design? First is communication across the supply chain: you have to understand what the objectives of the people are, as well as the constraints, and communicate if this approach is different than the ones they are used to. It is key to

have agreement among these stakeholders. Training and education, as well as regulations, can be supportive of such measures.

The pressures and incentives for landscape design are also important. This can include legal demands and regulations that require thinking about clean water and air. The stakeholder concerns are also paramount. The reputation of companies involved is also important. There are some obstacles to developing such a broad approach. One is that you have to consider landowner rights and what they can do within the constraints of the system. Traditional practices are also an issue: people prefer doing what they have always done, rather than doing things in a new way. Thus they need incentives that meet their social and cultural expectations on order for them to move ahead. A lot of upfront planning is required to engage these stakeholder groups.

Main conclusions:

The recommended practices for this kind of landscape design are: stakeholder engagement throughout the entire process; considering management options within the broader context (constraints and opportunities); attention to the site selection, and the environmental and socioeconomic effects in terms of the location and selection of the feedstock, as well as the transport system and refinery process; monitoring and reporting the key measurements of sustainability throughout the process; and, finally, attention to what is really doable within the contextual constraints.

When doing landscape design, you have to think about how negative impacts of bioenergy can be avoided. There are three key things to consider. First is to conserve other ecosystems and social services. Second, you need to consider the local context. Finally, monitoring and adjusting your plans as you go through this process.

Talk Title: What we know about environmental and social consequences of biofuels production and we should avoid in the future

Speaker: *Luiz Martinelli, Center of Nuclear Energy and Agriculture - ESALQ/USP (Brazil)*

Rapporteur: Klaus Dalgaard

Abstract: Biofuels are produced worldwide because countries are seeking alternative energy sources due to energy security issues, and because countries also intend to use biofuels as a way to foster rural development and produce a more environmental-friend source of energy. As a consequence several countries of the world have mandates to add biofuels to their energy grid. One of the main crops used in tropical areas of the world as a feedstock to biofuels is sugarcane. The harvested sugarcane area in 2012 according to FAO was approximately 26 million hectares; of this total 50% is produced in the Americas, 42% in Asia and 6% in Africa. Sugarcane area has been growing constantly since the 60's and the growth of rate has been similar among the three continents. At country level main producers are Brazil and India. Considering that Africa has 55 countries, 40 of them (73%) produces sugarcane, and the main producers are South Africa, South Africa, Egypt, Cameroon, Madagascar, and Kenya.

As any crop, if not well managed sugarcane and sugarcane industry (sugar and ethanol) may have several unattended consequences to the environment and to social aspects. In this presentation I would like to discuss what we know about environmental and social consequences of sugarcane expansion in the world with the hope to bring attention to these concerns as a way to avoid them in the future. Special attention will be given to a comparison between Brazil and Africa main producers and Guatemala and Colombia, which are part of the LACAf project.

I propose to take one of the working hypotheses of the Global Sustainable Biofuel initiative as our overarching question (*Is it physically possible to "make room" for bioenergy while honouring other land use priorities?*) and add a related second question: *"What will be the "environmental and social prices" that we have to pay to "make room" for bioenergy?*

During his administration, Brazil's president Lula (2003-2010) repeatedly stated in official visits to African countries that "helping Africa to realize its full development potential is [official] state policy" in Brazil. The help offered by the Brazilian government to many African states almost invariably included assistance to develop bioenergy programs in those countries. In his speeches, Lula touted the idea that his country's successful experience with biofuels could easily, and should, be replicated throughout the African continent, wherever the soil and climate conditions are similar to Brazil's. However, scepticism abounds regarding the extent to which the Brazilian bioenergy model can be replicated elsewhere, or even if its success is unique to its own context. This paper begins with a description of what is meant by "the Brazilian bioenergy model", followed by a brief process tracing of Brazil's foreign policy initiative to promote biofuels in African states. Next, the paper discusses some of the opportunities that Brazil's bioenergy model can offer to African countries, according to the Brazilian government's official discourse. Lastly, the paper raises some of the challenges faced by two cases of Brazilian government initiatives to promote biofuel programs in Africa: Pro-Renova and Pro-Savana. It is concluded that, if these challenges can be surmounted, the opportunities presented by the Brazilian bioenergy model outweigh its potential hazards in Africa.

Main addressed points:

What is the problem with deforestation? Food fibre and bioenergy production are the most precious ecosystem services that we have. But the production of these depends on other ecosystem services that support agriculture, and these services come from forests. For example: carbon storage. While ethanol fuel emits less CO2 than fossil fuels, the carbon storage lost by deforested areas in order to plan sugarcane is equally significant. Thus, the preservation of 100 thousand ha of Amazon forests saves the same amount of CO2 that would be saved by ethanol produced from sugarcane over the same area of land.

Considering the other ecosystem services offered by natural forests, it is not worth changing the use of natural forests for biofuel production.

Another important natural service offered by natural forests is pollination. Coffee plantation, for instance, depends on pollination. If pollination of coffee plantations is lost due to land use change of natural forests, it is estimated that the coffee industry in Latin America would suffer a loss of 12 trillion Euros.

Moreover, the Amazon forests also create evaporation of rainwater, which is then redirected to other regions through wind currents. The rain in Mato Grosso, Brazil's most important soybean producer, is generated by the Amazon, for instance. This is why it is important to apply the principle of sustainable agriculture.

Main conclusions:

Another consequence of Brazil's agricultural boom is land consolidation. Though many farms in Brazil are relatively small, there are an increasing number of large farms, which leads to the displacement of rural populations to urban centres, making Brazil one of the largest urbanized countries in the world. However, the urban environment is not ready for such massive rural exoduses in developing countries, leading to slum formation. Slums are notorious for sanitation problems that increase water-related diseases. Lastly, the mechanization of large-scale farms in Brazil has destroyed jobs of sugarcane cutters, which, while a hard job is a job nonetheless, providing income for low-skilled workers. Therefore, inequality in land distribution also impacts overall inequality in income distribution. Thus, concentrating land for agriculture on a large scale will eventually lead to such urban, health and economic problems, not only local environmental problems.

Talk Title: Energy Security and Human Development: Pathways to Sustainability

Speaker: *Tom Richard, Pennsylvania State University - PSU (USA)*

Rapporteur: Klaus Dalgaard

Abstract: Energy in all of its forms is one of the enabling features of human civilization. For millennia people have used energy to satisfy basic needs and extend our capabilities – to stay warm in the cold, to see in the dark, to make and trade goods, to transport ourselves long distances at high speeds. Throughout much of the developing world, basic energy needs are still provided by bioenergy resources, often using inefficient stoves whose smoke contributes to serious respiratory health concerns. In many countries modern biofuels are now also part of the mix – commercial-scale combustion for electricity production and combined heat and power, household, farm and industrial anaerobic digestion for electricity and heat, biodiesel and ethanol for transportation. In this context, energy security has two important frameworks within which bioenergy can play a critical role. The first focuses on traditional bioenergy: how can the integrated agricultural, forest and agroforestry systems that provide most basic energy needs improve their productivity and environmental outcomes and feed cleaner utilization technologies to increase efficiency, expand energy availability, and protect human health. The second focuses on modern bioenergy: to what extent can sustainable large scale feedstock production provide large quantities of renewable energy to satisfy growing demand for electricity, power, and transportation? This presentation will discuss these two frameworks, and how effective strategies within each framework can provide available, accessible, usable and stable sources of energy to meet household and community needs.

Main addressed points:

Framing energy security in the same language as those working with food security: availability, accessibility, usability, stability. Availability in terms of energy means that energy resources are sufficient for human needs, and be available in the quantities required, and for those quantities to be sustainable in the long term. Access includes raw infrastructure required to get the energy or food to the consumer, but also affordability. Usability is interesting because there are many different forms of energy, whose variation leads to different end uses. Stability is important because in some parts of the developing world, traditional energy resources may be intermittent, including biomass.

There is a strong correlation between energy consumption and human development. This is not surprising, for two reasons: first, when people have developed they want more things that require energy, so consume more energy in order to satisfy their needs; second, there is a feedback loop, because the availability of energy is a major driver for development – you cannot achieve development without accessible and affordable energy.

Main conclusions:

The quality, quantity, accessibility and affordability of energy are all important for human development, and as we look at opportunities for biomass energy and human development, we want to think about of what is termed as sustainability transitions. When we look at a multi-level perspective for sustainability transitions, we see there are many niche opportunities that people will innovate within, such as aviation fuels today. If these new

systems are successful, they will become integrated into the existing systems, leading to sustainability transitions from one energy system to another. One of the tools we use to think about this kind of system change is a knowledge systems framework, because recognize there are lots of different levels of change and decisions that need to occur for this to happen. This includes: stakeholder engagement, values clarification, system definitions and system boundaries, data modelling, forecasting and back-casting, transition planning, implementation science, communication sciences, decision sciences, business sciences – all of which are important if you want to be successful in energy systems transitions. Once you really understand the system, the values and the people involved, then you can start to look at the technical aspects of these transitions.

SESSION VI

Issues concerning the production model and industry

Chair: Emile van Zyl, Stellenbosch University (South Africa)

Talk Title: South African sugar industry: a brief overview

Speaker: Luke Brouckaert – Sugar Industry (South Africa)

Rapporteur: João Guilherme Leite

Abstract: The paper gives an overview of the current status of the South African sugar industry. The industry produces an estimated average of 2.2 million tons of sugar per season. The industry is a large contributor to the SA economy. It stretches across two provinces of South Africa, namely Mpumalanga and KwaZulu-Natal. Twelve sugar mills span across KwaZulu-Natal, while two mills are situated in Mpumalanga. There are approximately 26 600 registered cane growers delivering cane to the mills of which 25 200 are small scale growers and 1 400 are commercial growers (includes 323 black growers – 21% land reform). Furthermore the paper will highlight the contribution that expansion of the industry into co-generation and ethanol will bring to the SA economy.

Main addressed points:

1. The South Africa (SA) sugarcane industry (overview)

- 26,000 registered growers
- 372,000 ha under sugarcane
- 20 million tons of sugarcane per year
- 17.4% of total SA field crop production
- 14 sugar mills producing 2 million tons of produced sugar
- 79,000 direct jobs
- 350,000 indirect employed

2. The sugar sector

- The sugar sector in SA is basically divided in growers and millers. Because of land related issues the predominant production model in SA is hybrid, characterized by commercial and small scale growers complemented with sugarcane produced by the milling company.
- The sector is supported by two main research institutions aiming at agricultural (SASRI) and processing activities (SMRI).

Currently, the sugar sector faces many challenges. Despite being competitive, particularly at the milling end of the sugarcane value chain the increasing costs of feedstock production represents a great threat to the sugar industry.

Main conclusions:

- The sustainability of the sugar sector in SA is increasingly dependent in exploring the full potential of sugarcane. It includes the diversification of the industry from sugar based to sugar and ethanol. This diversification strategy should be complemented with high focus on energy efficiency and subsidies derived from mandatory blending frameworks. Yet, in the long term the sugarcane industry should exploit the potential of the biobased economy when sugar may become a sub-product of a whole new portfolio of sugarcane products.

Talk Title: The role of research in the Southern Africa sugarcane processing industry future

Speaker: Steve Davis – SMRI (South Africa)

Rapporteur: João Guilherme Leite

Main addressed points:

1. The Sugar Milling Research Institute (SMRI)

- Founded in 1949 with the objective of servicing R&D and technical needs of the South African sugar milling industry
- Formed by the sugar milling industry, CSIR and the University of Natal
- Membership: 14 mills in SA and 13 non-SA based mills (Malawi, Mozambique, Swaziland, Tanzania, Zambia and Zimbabwe)

2. The sugar sector

- Similarly to what was previously presented by Luke Brouckaert, Steve stressed the importance of increasing production efficiency through diversification (sugar + ethanol) and electricity cogeneration.

The biochemical route seems to be a key factor in boosting the production of high value added products, such as organic acids and biopolymers.

Main conclusions:

- Techno-economic modelling is a useful tool in directing research efforts; however uncertainty still exists on whether detailed or broad approaches would be more appropriated.
- Despite that sugar it's likely to remain a major product from the milling industry; current research indicates that value addition should come from the fiber. It would require the liberation of the chemical potential in complex lignocellulosic biomass, which is not a viable option yet.
- In his final remarks Steve Davis also highlighted the importance of innovation in the sugar sector. The need for radical innovation as to products and process seems to be a key factor to the development of new value chains, reduction of technology costs and creation of new waste streams.
- The SMRI, although driven by the 'needs' of the industry, is currently lacking investment into research that would enable to increase the critical mass of the institution, establish collaboration and strategic partnerships.

Talk Title: Key points in the selection of the sugarcane ethanol production model: scale of the distillery and the mechanization level in cane production

Speaker: Manoel Regis Leal – CTBE (Brazil)

Rapporteur: João Guilherme Leite

Main addressed points:

1. Assessment of distilleries

- In his speech Prof. Regis drew a parallel between distilleries under manual and mechanized harvest. The presented results show that under manual harvest the number of employed people increase considerably, however it has consequences on sugarcane production costs that are higher for manual harvest when compared with mechanized.
- Above 1 million tons of processed sugarcane per year the mechanized scenario also presents more competitive indicators associated with industrial investment and investment return rate when compared with the manual scenario.

2. Microdistilleries

- As to microdistilleries there was quite substantial amount of data indicating the low competitiveness of ethanol produced under such low level of technology. Main hindering factors are associated with the low efficiency of the industrial (processing) section of the value chain. Small units are unable to efficiently extract the sugar from the cane and cogenerating electricity, which increase production costs considerably.

The viability of microdistilleries is, therefore, dependent on market opportunities associated with high prices (consumer prices) for ethanol, or the production of high value added products such as alcoholic beverages under which ethanol is a co-product.

Main conclusions:

The mechanization level (harvest activities) and the scale of the distillery is highly dependent on local conditions, particularly associated with labour availability and labour cost, local market/demand for biofuels, agroecological characteristics and the socioeconomic and environmental impacts on local communities. However, when it comes to ethanol production at national and international level, large scale mechanized distilleries are increasingly acknowledged as the predominant production model.

Technical Visit: TSB sugar Industry South Africa

General information

TSB was founded in 1965 and is currently one the largest sugar producers in South Africa, producing approximately 30% of South Africa's total sugar output. Located in the northern irrigated region of South Africa where it TSB operate three mills: Malalane, Komati and Pongola, all situated in the Lowveld of South Africa. TSB's total production capacity stands at approximately 700,000 tons of sugar per annum[1].

TSB in Malalane

The total TSB area under cane amounts to 69,000 hectares. Malalane Mill is one the largest with an area of 24,000 ha, together with Komati Mill (27,000 ha) and Pongola Mill (18,000 ha). However, only 20% of the area under cane is actually managed my TSB as 64% account for commercial growers and 15% for small-scale growers.

The sugarcane fields visited in the Malalane area were under the management of TSB. There is intensive use of technology, which included irrigation in 100% of the cultivated area, high detail soil characterization with precision agriculture techniques e crop rotation (e.g. soybeans).

As the milling activities start earlier in South Africa than in Mozambique the group had the opportunity to see the milling process running. Alike the agricultural activities the industrial process is fairly well developed enabling to achieve high levels of efficiency (sugar production) combined with the cogeneration of electricity.

Similarly to Illovo operations in Mozambique, TSB also engage in a number of social activities with local communities. A highlight of TSB initiatives is its engagement in the land reform process. An example is the cane area in Nkomazi where 62% is currently under Land Reform Beneficiaries.

[1] www.tsb.co.za

1ª Conferência de Bioenergia Workshop LACAf Moçambique 2014

Programa

PROGRAMA PRELIMINAR	
1° DIA – 4 DE ABRIL (SEXTA-FEIRA)	
8:30 – 9:00	**BOAS VINDAS & APRESENTAÇÃO** José Luís Cabaço, Reitor da Universidade Técnica de Moçambique (Moçambique) Luís Cortez; Unicamp (Brasil)
9:00 – 9:20	**RECURSOS ENERGÉTICOS E BIOCOMBUSTÍVEIS EM MOÇAMBIQUE** Ministro de Energia de Moçambique (Moçambique)
9:20 – 9:40	**O PAPEL DO ENSINO SUPERIOR NA FORMAÇÃO DE PESSOAL TÉCNICO PARA O SETOR DE ENERGIAS RENOVÁVEIS COM ENFOQUE PARA OS BIOCOMBUSTÍVEIS** Vice-ministro da Educação de Moçambique (Moçambique)
9:40 – 10:00	**CANA-DE-AÇÚCAR EM MOÇAMBIQUE** Rosário Cumbi, presidente da APAMO (Associação dos Produtores Moçambicanos de Cana-de-Açúcar) e diretor da Açucareira de Xinavane (Moçambique)
10:00 – 10:20	**INTERVALO PARA COFFEE BREAK**
10:20 – 11:00	**COOPERAÇÃO ENTRE BRASIL E MOÇAMBIQUE EM BIOCOMBUSTÍVEIS** Rui da Maia, Universidade Técnica de Moçambique (Moçambique) Luís Cortez, Unicamp (Brasil) Manoel Regis Lima Verde Leal, Laboratório Nacional de Ciência e Tecnologia do Bioetanol (Brasil)
11:00 – 11:20	**O PROJETO GLOBAL DE BIOCOMBUSTÍVEIS SUSTENTÁVEIS E SEUS PROVÁVEIS IMPACTOS EM MOÇAMBIQUE** Lee Lynd, Dartmouth University (EUA)
11:20 – 12:30	**PROJETO LACAF** ***Apresentação*** Luís Cortez, Unicamp (Brasil) ***Diagnóstico e Análise Integrada*** Universidade Federal de Itajubá e Universidade Estadual de Campinas (Brasil) ***Modelagem da produtividade da Cana de açúcar*** Edgar De Beauclair, Escola Superior de Agricultura Luiz de Queiroz (Brasil) ***Modelos de Produção Alternativos*** Manoel Regis Lima Verde Leal, Laboratório Nacional de Ciência e Tecnologia do Bioetanol (Brasil)
12:30 – 14:00	**ALMOÇO**
14:00 – 15:30	**SESSÃO 1: POLÍTICA, PLANEJAMENTO E REGULAÇÃO DA PRODUÇÃO E USO DE ETANOL DE CANA-DE-AÇÚCAR** ***Relator: Klaus Dalgaard, Pos-doc LACAf (Brasil)*** Rui da Maia, Universidade Técnica de Moçambique (Moçambique) Luís Augusto Horta Nogueira, Universidade Federal de Itajubá e Universidade Estadual de Campinas (Brasil)

	Pontos para Discussão (sugestões) - Situação atual dos acordos de cooperação em biocombustíveis entre Brasil e Moçambique? - Perspectivas para os programas de biocombustíveis em Moçambique – mercado interno/externo?
15:30 – 15:50	**INTERVALO PARA COFFEE BREAK**
15:50 – 17:20	**SESSÃO 2: POTENCIAL DE PRODUÇÃO E USO DE ETANOL DE CANA-DE-AÇÚCAR** ***Relator: João Dal Belo Leite, Pos-doc LACAf (Brasil)*** João Chidamoio, Ahead Energy Manoel Regis Lima Verde Leal, Laboratório Nacional de Ciência e Tecnologia do Bioetanol (Brasil) Edgar De Beauclair, Escola Superior de Agricultura Luiz de Queiroz (Brasil) **Pontos para Discussão (sugestões)** - Perspectivas para os biocombustíveis em Moçambique? - Experiência acadêmica (principais resultados) sobre biocombustíveis? - Trabalhos sendo feitos? - Dissertações, projetos, artigos, etc.? - Disponibilidade de dados sobre solo, clima, culturas e uso da terra?
17:20 – 18:00	**ENCERRAMENTO** Rui da Maia, Universidade Técnica de Moçambique (Moçambique) Luís Augusto Barbosa Cortez; Unicamp (Brasil)
2° DIA – 5 DE ABRIL (SÁBADO)	
	VISITA TÉCNICA: Fábrica Açucaeira de Maragra (***a confirmar***)

Sessão I: Política, planejamento e regulação da produção e uso de etanol de cana-de-açúcar

Relator: Klaus Dalgaard

Moçambique é um importante produtor e exportador de açúcar: 450 mil toneladas de açúcar produzido ao ano, das quais 275 mil toneladas são exportadas, produzidos a partir de 3.8 milhões de toneladas de cana ao ano. Se nós pegarmos esses 3.8 milhões de toneladas de cana por ano, e considerarmos 10 litros de etanol por tonelada, feitos com o melaço, que é um componente inevitável da produção de cana, permitiria produzir 38 milhões de litros de etanol ao ano. Qual é o mercado potencial para o etanol em Moçambique, misturando 10% na gasolina consumida hoje? Em torno de 30 milhões de litros por ano, apenas no setor de transporte. Logo, sobraria em torno de 8 milhões de litros de etanol para outros fins, entre eles o álcool para a cocção, por exemplo. Se Moçambique tem a capacidade de produzir etanol nessas quantidades, por que ainda não o faz? Pois já existe uma lei, regulamentos e uma estratégia nacional para a adoção do etanol. Faria sentido ter programas de demonstração? Sim, é preciso mostrar aos moçambicanos que isto é possível e que se faz no próprio país. Mas também existem restrições no âmbito das grandes empresas – por exemplo, e preciso envolver a Petromoc, pois sem ela não há possibilidade de distribuir grande parte dessa produção potencial de etanol.

O órgão do Ministério da Agricultura de Moçambique que estimula investimentos no setor, o CEPAGRE, recebeu entre 2006 e 2012, 117 propostas, dentre as quais 50 eram pra produzir biocombustíveis no país, numa área total de 45 mil hectares. Entretanto, menos que 10% da área atribuída pelo governo foi cultivada por investidores. De fato, muitos desses projetos propunham usar a jatropha como *feedstock*, que tem se mostrado ser um fracasso na prática apesar de parecer uma boa ideia na teoria. Porém, muitos dos projetos de cana também não deram certo. Não se sabe por que.

Em termos de definir para que mercado(s) produzir biocombustíveis em Moçambique – se é o local, o regional, o nacional ou internacional – isso dependerá dos preços dos biocombustíveis em cada um. Afinal, o investidor está preocupado com o risco e o lucro de seus investimentos. É lógico que os produtores de etanol tenham a tendência de vender seu produto no mercado que lhes der mais retorno lucrativo. Mas isso ainda não está claro em Moçambique – isto é, se o preço do insumo será controlado ou liberalizado. Esta incerteza só faz aumentar o risco dos investidores. Entretanto, o mercado doméstico, mesmo dentro das metas (B3 e E10) com as quais o governo moçambicano comprometeu-se a cumprir, é modesto relativo ao potencial de produção de biocombustíveis do país. Logo, é provável que haja excedentes para exportação. Isto é levado em consideração, inclusive, ao adotar os indicadores de sustentabilidade de certificação do mercado da União Europeia, ao produzir biocombustíveis em Moçambique.

Antes de 2011, importava-se um carro a gasolina para cada 4 carros a diesel em Moçambique. Depois de 2011 esta proporção diminuiu para 1:3. Isso se dá ao fato de carros a gasolina serem mais baratos hoje em dia. Isso poderá ter um efeito positivo na demanda por etanol, caso seja misturado obrigatoriamente à gasolina.

A produção de etanol para cocção é extremamente bem-vinda, por causa de altas flutuações no preço do carvão, principalmente na época chuvosa, e também por causa das grandes distancias percorridas pelos consumidores para comprar o carvão. Também diminui os riscos de saúde associados a queima do carvão.

Sessão II: Potencial de produção e uso de etanol de cana de açúcar

Relator: João Guilherme Leite

Esta sessão foi coordenada pelos Profs. Régis Leal (CTBE), Edgar de Beauclair (Esalq) e João Chidamoio (Ahead Energy). Antes do início do debate o Prof. Rui da Maia (UDM) colocou-se a disposição no que diz respeito a qualquer suporte relacionada à coleta de dados em Moçambique. Também enfatizou a importância de novas visitas, desta vez em grupos menores para que o trabalho possa ser direcionado de acordo com interesses específicos.

No âmbito da produção de biocombustíveis em Moçambique João Chidamoio destacou o fato de que estudos com a produção de etanol no país não são inéditos. Trabalhos realizados mesmo antes do desenvolvimento da política Moçambicana para produção de bioenergia já indicavam o potencial do país, com destaque a produção de etanol. João também sublinha o fato de que a grande frota de veículos movidos a gasolina (≈ 70%) está concentrada na região de Maputo (Sul de Moçambique), visto que no Norte do país a maior parte dos veículos é movida a diesel.

O Prof. Beauclair, em sua fala, elucidou sobre o potencial para produção de etanol não apenas em Moçambique, mas em outras regiões – inclusive de clima temperado. Embora muito ainda se diga sobre as matérias-primas mais adequadas e de maior eficiência energética, para o Prof. Beauclair a cana de açúcar quase sempre vence este debate.

Para o Prof. Régis a identificação das potencialidades regionais é parte fundamental para qualquer trabalho visando à produção de biocombustíveis. Nesta discussão o uso e demanda por terras para outros fins exerce grande influência sobre o direcionamento e alocação de recursos para atender demandas de alimento e energia por exemplo. Com o aumento da pressão sobre áreas agrícolas produtivas (excluídas de proteção ambiental, lazer e inaptas a atividade agrícola) cresce a necessidade de aumentar a eficiência energética em termos de '*output*' ou energia produzida por unidade de área, que atualmente está em torno de 30%.

Nas considerações finais o Prof. Luis Cortez agradeceu a participação de todos os presentes e, especialmente, a colaboração do grupo de Moçambique representeado pelo Prof. Rui da Maia e pelo Prof. José Luís Cabaço (Reitor UDM) na organização do evento e colaboração no projeto Lacaf. O Prof. Cabaço em suas palavra de encerramento destacou a importância da parceria entre a UDM e o projeto Lacaf. Destacou-se em sua fala o fato de Moçambique figurar como ator ativo e participante e não como simples objeto de análise.

Visita Técnica: Illovo Açucareira de Maragra em Moçambique

Informações gerais

A Illovo é o maior produtor de açúcar da África onde desenvolve atividades no setor agrícola e industrial em seis países africanos. O açúcar produzido é destinado ao mercado local, regional, europeu (UE) e americano (EUA). Através da cogeração de energia elétrica o grupo é capaz de atender cerca de 90% de sua demanda. No ano de 2012 a produção de açúcar foi da ordem de dois milhões de toneladas[2].

Illovo em Moçambique

As atividades da Illova em Moçambique estão concentradas na zona de Margra. Durante a visita foi possível identificar duas atividades principais, as quais são as áreas em cultivo com cana de açúcar e o processo industrial para fabricação do açúcar. O processo de moagem da cana e produção do açúcar, no entanto, não pode ser visto porque a colheita da cana deve iniciar somente no mês de Maio.

A Açucareira de Maragra possui aproximadamente 9400 ha de cana de açúcar, sendo que destes 6300 são cultivados em áreas concedidas pelo governo Moçambicano à empresa. A área em cultivo e gerenciamento por parte da Illovo é totalmente irrigada. O sistema de irrigação combina inundação com aspersão e beneficia-se de recursos hídricos (i.e. rio) próximos. Tal proximidade, no entanto, também causa preocupação com perdas por inundação das lavouras e instalações industriais no período das chuvas.

As operações agrícolas da Illovo em Maragra, com elevado nível tecnológico, contrastam com as deficiências do setor industrial. Embora tenha sido quase completamente reconstruída na última década (após perdas por enchente na década de 1990) as instalações para moagem e produção de açúcar utilizam tecnologia intermediária.

Embora existam conflitos com comunidades locais, principalmente no que se refere à concessão de uso da terra pela empresa, a açucareira está engajada em um largo número de atividades sociais (construção de escolas, infraestrutura, postos de saúde, esportes e lazer) que tem efeito compensatório. Adicionalmente, a açucareira é uma das maiores empregadoras na região de Maputo.

[2] www.illovosugar.co.za

APENDIX I

Individual reports

This section of the document aims at presenting the personal assessment of the LACAf workshop in Africa from the attendees in South Africa and Mozambique.

Edgar G. F. de Beauclair – Esalq

As atividades transcorreram normalmente segundo a programação descrita no anexo I.

No Workshop realizado na África do Sul, no Kluger Park foi realizada a apresentação que segue no anexo II. Minha participação na mesa redonda do segundo dia do Workshop foi prejudicada por compromissos financeiros de acerto de estadia que deveriam ser pagos APENAS em papel meda local, o que dificultou a transação pela falta de câmbio e uso de cartão de crédito, mas todas demais atividades foram perfeitamente cumpridas. Foram realizados contatos locais, especialmente com os Srs. Luke Brouckaert (General Manager) e Nico Stolz (Specialist Engineer Energy) da Usina TSB, visitada no dia 2/04, onde se pode comprovar que é um empreendimento antigo que segue seus padrões tecnológicos adequadamente dentro das condições ambientais em que esta inserida. Esta unidade não apresentou nenhuma novidade tecnológica e poderá servir para calibrar o modelo de previsão de produtividade para aquelas condições bastante específicas, ou seja, os valores que serão obtidos não poderão ser extrapolados para áreas de expansão, mas poderão ajudar a reduzir ceticismos em relação ao modelo.

Na viagem para Moçambique foi feita uma parada em uma usina local, alterando a programação, já que a visita estava inicialmente prevista para sábado, mas por razões logísticas ela foi antecipada. Lá fomos recebidos pelo CEO da empresa e em seguida foi realizado uma volta no campo, bastante peculiar, pois a cana encontra-se plantada em solos hidromórficos, sujeitos à inundação, num ambiente muito semelhante ao encontrado em Campos, RJ. A cana é irrigada por aspersão em turnos curtos, pois o solo retêm pouca água. Detalhes técnicos foram dados pelo Sr. Steven (Agronomy Manager), que confirmou que também este empreendimento não poderá ser utilizado como modelo de produção. É um projeto antigo resgatado por novos investidores.

Na capital Maputo, foi realizado outro Workshop, que teve bastante impacto na mídia local, com presença de várias autoridades como o Ministro da Energia, Ilmo. Sr. Salvador Namburete, do Ilmo. Sr. Reitor da Universidade de Moçambique Prof. Dr. José Luís Oliveira Cabaço e representantes do governo brasileiro, o Ilmo. Sr. Ministro Conselheiro Paulo G. Joppert, além de técnicos especializados locais.

No Workshop foi realizada a apresentação que consta no anexo III e a participação na mesa redonda de acordo com o programa.

Finalmente, no último dia, foram realizadas reuniões e discussões com toda a equipe que estava presente, onde foram discutidos os trabalhos científicos a serem realizados para o LACAf I, e os passos para formalizar o LACAf II.

Antonio Bonomi, CTBE/CNPEM

(1) Objectives of the Meeting

- Update participants on activities associated with various parts of the Project.
- Include, hear from and interact with representatives from LACAf countries in Africa.
- Enrich project participants with new perspectives.
- Advance development of a vision for project-responsive environmental research.

(2) Bioenergy Workshop – South Africa (Kruger National Park) – April, 1-2, 2014

The workshop was organized in 6 sessions:

- Discussion about why Bioenergy in Africa.
- Determining the Bioenergy potential in Africa – how much can be produced considering sugarcane.
- Geospacial analysis in Africa: can land use be optimized?
- Food and energy security in Africa.
- Environment issues for biofuels production in Africa.
- Issues concerning the productive model and industry.

From the perspective of the work our group will be performing in the LACAf-1, Task III – Production Model, two were the most important presentations in the Workshop:

- Increasing ethanol production in Southern Africa – Opportunities and challenges – Johann Gorgens, Stellenbosh University (South Africa).
- What scale should we consider? – Manoel Regis Lima Verde Leal, CTBE (Brazil).

The most important results of our participation in this workshop were:

- Identification of a possible consultant to help in the construction of the scenarios to be evaluated for the African countries, aiming the construction of the production models for these countries – Dr. Johann Gorgens, Stellenbosh University (South Africa).
- Identification of other Important contacts that are interested in cooperating in the construction and evaluation of the scenarios in South Africa and Mozambique:

  Stephen B. Davis – Sugar Milling Research Institute NPC – Durban, South Africa

  Nico Stolz – TSB – Malalane, South Africa

  Luke Brouckaert – TSB – Malalane, South Africa .

(3) Visit to TSB – sugar plant in South Africa – April 2, 2014

Some key observations:

- Part of the sugarcane is irrigated – main reason for good productivities (> 100 ton/ha)
- Manual planting, cultivation and harvesting of burned cane.
- Soy bean used in the rotation (average 10 and up to 20 sugarcane ratoons).

- No washing of sugarcane in the mill.
- Diffuser is used to extract the sugarcane juice.
- Sugar produced using 3 boiling systems.
- Part of the bagasse and the molasses are sold for animal feed; no ethanol production.
- CHP uses coal and wood to reach the energy demand of the mill (considering that a fraction of the bagasse is sold for animal feed).

(4) Visit to Maragra Sugar Mill in Mozambique – April 3, 2014

The mill is similar to the one that we visited in South Africa, with a few differences:

- Do not have a defined rotation strategy.
- The mill was not operating – only maintenance.
- Mills are used to extract the sugarcane juice.
- All the bagasse is used in the CHP unit; no wood and coal are used.
- All the molasses are exported to South Africa, to be used as animal feed.

(5) Workshop LACAf Mozambique (Hotel Avenida – Maputo) – April 4, 2014

In the first part of the workshop, several presentations/discussions on the LACAf and GSB projects, the academic/research and energy and fuel mandates in Mozambique, as well as alternatives for Brazil and Mozambique cooperation strategies.

In the second part, 2 sessions were covered:

- Politics, planning and mandates in the production and use of ethanol from sugarcane.
- Sugarcane ethanol production and use potential.

The most important result of our participation in this workshop was the establishment contacts that are interested in cooperating in the construction and evaluation of the scenarios in Mozambique:

- Salvador Namburete – Minister of Energy
- Cláudia Baúle – Coordinator Ministry of Science and Technology
- José Luís O. Cabaço – Rector of Universidade Técnica de Moçambique
- Jorge Pondeca – Administrator of Universidade Técnica de Moçambique
- Paulo G. Joppert – Brazilian Embassy.

(6) LACAf Meeting (Maputo – Hotel Cardoso) – April 5, 2014

The major topics discussed in this meeting were:

- LACAf-1 objectives and methodology.
- Papers to be elaborated by each group.
- Additive and project extension to be submitted to FAPESP.
- Preliminary brainstorm on the scenarios to be evaluated in LACAf-1.

Klaus Dalgaard, Nipe

During the South African part of our trip (1-2 April 2014), I made a presentation entitled "The Replicability of the Brazilian Bioenergy Model in Africa", during the workshop's first session ("Discussion about why bioenergy in Africa?"), in which I questioned whether the predominant – i.e. large-scale and technologically-intensive – bioenergy production model in Brazil can, or even should, be replicated precisely in African countries. I argued that while edaphic and climatic conditions in the Brazilian cerrado and the African savannah might be relatively similar, these conditions are insufficient to guarantee full replicability of the Brazilian model. The political, economic, social, historical and cultural contexts in African countries are different from Brazil's, and must be taken into account before considering replicating the Brazilian experience in those countries. I concluded that instead of replicating the full Brazilian experience, we ought to think about adapting the more successful and applicable aspects of the Brazilian model to the specific African contexts where it is appropriate.

In addition, I also served as rapporteur to the workshop's fifth session ("Environment issues for biofuels production in Africa"). A common theme that ran not only through all the presentations in that particular session, but throughout many others in the entire workshop, was that each context is different, and that we must adapt best practices and lessons learned to the specificities of each context, not only in agro-ecological and technical terms, but also in socioeconomic terms – a point of view that resonated with my own presentation.

It was interesting to learn from representatives from the South African sugar industry – in particular, the presentation given by Luke Brouckaert of TSB Sugar – that the main drivers behind interest in bioenergy in Africa are quite different from those that drove the Brazilian ethanol industry's boom in the 1970s. While Brazil's ProAlcool was driven mainly by concerns over energy security and macroeconomic imbalances, the three main African problems that bioenergy could help to alleviate are famine, poverty and unemployment. In that sense, mechanization of sugarcane harvests – as it exists in the Brazilian state of Sao Paulo – is not attractive to African realities, since it would destroy a larger number of jobs in the form of manual cutting of sugarcane (though it's a tough job, it's a paying job nonetheless). Moreover, Mr. Brouckaert also stated that the South African sugar industry is currently struggling – in part due to the high competitiveness of Brazilian sugar exports – and since they have little space left to expand, they are very interested in diversifying end-products made from sugarcane, such as bio-plastics.

In the Mozambican part of our trip (3-5 April 2014), I served as rapporteur in the first plenary discussion session concerning the policies, planning and regulation of sugarcane ethanol production and use. I was also personally responsible for ensuring the participation of a representative from the Brazilian Embassy in Maputo in our workshop, Paulo Joppert, who is an old acquaintance of mine from my hometown of Brasília.

From the workshop, it struck me as interesting that there are many different bioenergy options open to Mozambique – it is not only about making ethanol for compulsory blend mandates in transportation fuels, but there are promising possibilities for producing ethanol for cooking as well as for bioelectricity. In the end, however, much of the discussion of the possible end-uses for sugarcane in Mozambique depends on the economic interests of the private companies that will produce them.

I would also like to add that, before our trip, I personally took the passports of all the Brazilian participants (18 in total) to the Mozambican Embassy in Brasília in order to secure our visas. The visas were not ready on the day they were supposed to, which meant I had to pull some strings to get them all done that same day, before I travelled back to Campinas to deliver the passports back to their owners. I would like to stress that had I not been in Brasilia to sort this out myself, and proverbially twisted the arm of the Mozambican Embassy's staff, it is unlikely that any of the Brazilian travellers would have received their visas, let alone received their passports back, in time for our trip to Africa.

Fernando Cesar Bertolani, CTC

Na viagem realizada na África do Sul, inicialmente participamos do evento denominado "LACAf Bioenergy 2014 Workshop", no Kruger Park, e em seguida realizamos uma visita a usina Malelane. Nessa visita foi possível verificar detalhes de manejo agronômico realizado pelo corpo técnico da usina, como por exemplo, espaçamento, variedades, preparo de solo, sistema de colheita, adubação e correção de solo, etc. Foi possível notar que existem muitas diferenças na condução da lavoura de cana-de-açúcar em relação ao que é realizado no Brasil, devido a peculiaridades regionais (condições climáticas e potencial dos solos).

Em Moçambique também foi realizada uma visita à usina localizada próxima a Maputo, em que fomos recebidos pelo CEO da empresa e em seguida, fizemos algumas observações na área agrícola. Verificou-se que a cana encontra-se plantada em solos hidromórficos, sujeitos à inundação e com problemas na questão de trafegabilidade. Além disso, a cana necessita de irrigação por aspersão em turnos curtos, pois o solo retém pouca água, bem como se verificam prolongados períodos secos.

No dia seguinte a visita foi realizada outro Workshop: "1ª Conferência de Bioenergia/ Workshop LACAf Moçambique 2014", que teve bastante impacto na mídia local, com presença de várias autoridades como o Ministro da Energia, Ilmo. Sr. Salvador Namburete, do Ilmo. Sr. Reitor da Universidade de Moçambique Prof. Dr. José Luís Oliveira Cabaço e representantes do governo brasileiro, o Ilmo. Sr. Ministro Conselheiro Paulo G. Joppert, além de técnicos especializados locais.

Finalmente, no último dia, foram realizadas reuniões com toda a equipe que estava presente, sendo discutidos os artigos a serem publicados, bem como as definições das próximas etapas de trabalho dentro dos projetos LACAF I e II.

Felipe Haenel Gomes, PEDOLOGICA

Foram realizadas as atividades conforme o esperado. Na primeira etapa, sul-africana, foi realizado o "LACAf Bioenergy 2014 Workshop", no Kruger Park, sendo que a apresentação que coube a mim foi a intitulada "Potential Production of Sugar Cane of Mozambique" realizada pela Pedológica em conjunto com o CTC e faz parte do LACAf I.

Estavam no evento dois representantes do TSB, um dos maiores grupo proprietários de usinas da África do Sul, responsável por cerca de 30% da produção de açúcar do país. Eram eles o Sr. Luke Brouckaert (diretor geral) e Nico Stolz (Engenheiro especialista em energia) que nos levaram a uma visita a uma das unidades do grupo (usina Malelane). A visita contemplou tanto a indústria como a área agrícola. Na área industrial não apresentou muita diferença para as usinas brasileiras. Na área agrícola pudemos verificar o sistema de irrigação por pulverização, com pulverizadores menores que os normalmente utilizados no Brasil. No que diz respeito aos solos, na área que visitamos ocorria um solo fértil, rico em bases e com presença de argila de atividade alta, resultando em um solo bem diferente dos normalmente encontrados no Brasil. O principal limitante químico é o pH elevado devido a presença de sais, e por isso utilizavam gesso para promover a lixiviação dos mesmos, minimizando o problema.

Após o evento no Kruger Park fomos a Moçambique onde já no primeiro dia fizemos uma visita a uma usina de produção de açúcar. Lá fomos recebidos pelo diretor geral da empresa e o diretor da área agrícola Sr. Stephen de la Harpe e em seguida fomos ao campo para conhecer a área agrícola. A situação é bem particular, com toda a cana-de-açúcar plantada em solos que ficam inundados temporariamente (solos de várzea – hidromórficos), os quais necessitam de um sistema de drenagem. Para isso, eles possuem um sistema de irrigação e drenagem peculiar o qual permite o cultivo da cana-de-açúcar. Porém já tiveram perdas graves por inundação por causa de cheia do rio Incomati. O plantio de cana-de-açúcar em várzeas não é o modelo previsto para ser implantado em Moçambique, sendo utilizado apenas porque, assim como no Brasil em áreas tradicionais ou com poucos recursos (Pernambuco, Norte do Rio de Janeiro, Espirito Santo, dentre outros), existem terras disponíveis e com fácil acesso à irrigação. Porém são áreas limitadas e com pouca possibilidade de expansão, além de inadequadas ambientalmente falando por se tratar de áreas de mananciais.

No dia seguinte em Maputo foi realizado uma conferência intitulada "1ª Conferência de Bioenergia/ Workshop LACAf Moçambique 2014" o qual teve destaque na imprensa local, pois contou com a presença de várias autoridades como o Ministro da Energia, Ilmo. Sr. Salvador Namburete, do Ilmo. Sr. Reitor da Universidade Técnica de Moçambique Prof. Dr. José Luís Oliveira Cabaço e representantes do governo brasileiro, o Ilmo. Sr. Ministro Conselheiro Paulo G. Joppert, além de técnicos especializados locais.

No último dia da viagem, foram realizadas reuniões e discussões com toda a equipe que estava presente, onde foram discutidos os trabalhos científicos a serem realizados para o LACAf I, e os passos para formalizar o LACAf II.

Jansle Vieira Rocha, UNICAMP/ FEAGRI

Bioenergy Workshop Kruger Park, África do Sul, 01-02 de abril de 2014

1ª Conferência sobre Bioenergia, Maputo, Moçambique, 04-05 de abril de 2014

Tem este a finalidade de relatar a minha participação nos eventos supracitados.

30/03/2014

- Viagem São Paulo – Joanesburgo – Nelspruit - Kruger Park: partida 31/03/2014 e chegada em 31/03/2014

01/04/2014

Manhã

- Kruguer Park: Abertura do Bioenergy Workshop e apresentação sobre "Bioenergy in África" gerais na parte da manhã;

Tarde:

- Apresentação oral do tema "Land use mapping/Change analysis using time series of satellite images", dentro da sessão Geospatial Analysis in África: can be land use be optimized?" (slides em anexo)
- Discussões sobre os temas apresentados na sessão Geospatial Analisis.

02/04/2014

Manhã:

- Apresentações e discussões dos temas "Food, energy security, environment and produtive model"

Tarde:

- Visita à usina TSB

03/04/20114

- Viagem à Maputo, Moçambique, e visita à Usina Maragra

04/04/2014

- 1ª. Conferência sobre Bioenergia, com apresentações de membros da academia e órgãos do governo moçambicano e de pesquisadores do LACAf

05/04/2014

- Reunião técnica da delegação brasileira para discussão dos projetos LACAf e estruturação dos artigos a serem submetidos no âmbito dos projetos

06/04/2014

- Viagem de retorno: Maputo-Joanesburgo-São Paulo

Paulo Manduca, UNICAMP

I have studied the Southern Africa in my master degree and in my PhD. I haven't studied Africa after 2002. At that time the political context was going from the civil war and South African engagement against leftists governments in Angola and Mozambique to the detente era in which ANC conquered the power in South Africa and those two former Portuguese colonies have just abandoned the Marxism to adopted liberal government line. In this LACAf's trip I got the chance to take notes about how evolved the regional arrangement and its impacts on the regional development.

The strongest perception is how integrated Mozambique and SACU (South Africa, Lesotho, Swaziland, Botswana) are! In the border there was no further problems for people and goods cross over. Mozambique and South Africa are members of the Southern African Development Countries (SADC). It is an association between countries from the Sub-Saharan Africa to promote regional integration and general development. SADC has adopted common strategies on agriculture, water, infrastructure etc.

The Southern African countries itself are the most able players in Southern Africa. South Africa, specially, because It has an advanced logistical system, knowledge over regional issues and capital. During the last decades of the Portuguese mandate, South Africa had kept tied control over Mozambique. SA took central role when has built logistical system (ports, roads and railways) integrating both countries as only one system.

For long time the South African capital has been unable to flow because the political crisis. Now there is a new environment in the region and South Africans investors are looking for opportunities in Mozambique and the Mozambique's government are looking for investors from anywhere. South Africa remains as the best partner for non-African investors in the region.

In the sugarcane sector, there is a strong sugarcane industry for sugar only. But this industry faces right now strong competition with Brazilian sugar in its own market. Some mill's workers told the way is to invest abroad since there are no affordable lands in country. This is in process.

In fact there is row opportunities for sugar and ethanol. In September 2013 Durban held the Sugar & Ethanol Summit supported by sugar/ethanol players in Africa. It is growing fast and Brazil's players have to pay attention on it.

Mauro Donizeti Berni, UNICAMP

Bioethanol is today the most important biofuel in the global economy, representing the largest volumes of biofuel production and consumption. Most of the global bioethanol production is in Brazil (sugarcane) and United States (corn), although there is significant global interest to increase production in various parts of the world, also in Southern Africa and Mozambique.

Sugarcane ethanol is widely considered to be more environmentally beneficial than corn-based ethanol, due to improved carbon- and energy-balances.

Expansion of ethanol production in the Southern Africa context is therefore not limited by feedstock availability, with various opportunities for expansion of sugarcane (and grain-based) feedstocks, diversion of export sugar and use of lignocellulose as feedstock. There are concerns around sustainability of such feedstock supply, which warrants further investigation (Stellenbosch University), but substantial opportunities remain even when taking such considerations into account. The economics of ethanol production remains as a key barrier to expanded production. The South African sugar industry awaits clarification on pricing of bio-ethanol for blending into the local fuel pool, to ensure economic benefits in diversion of export sugar to ethanol. Similarly, previous efforts at establishing dedicated ethanol production facilities based on first generation technology, have been hampered by lack of coordination in regulations and mandated blending.

Mozambique has the potential to become one of the major biofuel producers in Africa, and other agribusiness ventures are booming too. The ProCana bioethanol company will process its cane in a Brazilian-built sugar-ethanol factory. It will lay miles of track to link the plant up with the national rail network. Once the operation is up and running, ProCana will raise US$ 290 million from hedge funds for a project to plant 20,000 hectares of sugarcane and a bioethanol unit. Last year, the Central African Mining & Exploration Company invested US$ 150 million in an ethanol plant, while Petromoc spent US$ 550 million to develop biofuels. In spite of the impressive economic turnaround achieved over the past few years, Mozambique remains largely a rural country, suffering from widespread poverty, vulnerability to natural disasters and economic shocks, and major socioeconomic imbalances between its rural and urban populations High Level Panel of Experts on Food Security and Nutrition (HLPE). The potential for sugarcane ethanol production is great, both for domestic use or exports. It enjoys tax exemption to export to Europe. Mozambique: 2013, Production: 3.6 million tonnes of cane sugar, 47,400 hectares, (Center for Promotion of Commercial Agriculture, CEPAGRI, Maputo, MZ).

Timetable participation in Workshop

30th March – 6th April, 2014

Bioenergy Workshop – South Africa (Kruger National Park) – April, 1-2, 2014

The workshop was organized in 6 sessions:

- Discussion about why Bioenergy in Africa.
- Determining the Bioenergy potential in Africa – how much can be produced considering sugarcane.

- Geospacial analysis in Africa: can land use be optimized?
- Food and energy security in Africa.
- Environment issues for biofuels production in Africa.
- Issues concerning the productive model and industry.

Visit to TSB – sugar plant in South Africa – April 2, 2014

Some key observations:

- Part of the sugarcane is irrigated – main reason for good productivities (> 100 ton/ha)
- Manual planting, cultivation and harvesting of burned cane.

Visit to Maragra Sugar Mill in Mozambique – April 3, 2014

The mill is similar to the one that we visited in South Africa, with a few differences:

- The mill was not operating – only maintenance.
- Mills are used to extract the sugarcane juice.

Workshop LACAf Mozambique (Hotel Avenida – Maputo) – April 4, 2014

Discussions on the LACAf and GSB projects, the academic/research and energy and fuel mandates in Mozambique, as well as alternatives for Brazil and Mozambique cooperation strategies. Finally, discussion about sugarcane ethanol production and use potential.

LACAf Meeting (Maputo – Hotel Cardoso) – April 5, 2014

The main topics discussed in this meeting were:

- LACAf-1 objectives and methodology.
- Papers to be elaborated by each group.
- Additive and project extension to be submitted to FAPESP.

Marco Túlio Ospina Patino, FEAGR/UNICAMP

Local support was essential for this excellent forum to discuss bioenergy issues in Africa. Important conclusion can be drawn from the information collected during the visits to the factories and fields. The information gathered and the contacts made are essential to increase the necessary information to write the papers about South Africa and Mozambique.

The two countries are in different stages of development within their sugar cane sectors. In South Africa institutional as well as cooperative agreements and coalition between business groups is a fact. Therefore in the South African case they can work together with the government. In the case of Mozambique is clear the influence of South African producers and therefore an expansion approach will have to consider this influence.

Bioenergy projects in Africa have to be developed in an integrated form with projects of food production in order to support food security and to spread social benefits for rural populations. Both field visits in South Africa and Mozambique were clear examples of this approach and also showed potential for expansion.

After these workshops the question of why? Begins to have practical and concrete answers. In the case of South Africa although there is small room for area expansion the country can take a competitive advantage by introducing industrial flexibility in its production model. The Mozambican sugar cane can take competitive advantage by increasing returns to scale and cost reduction provided by sugarcane area expansion.

Moreover answers for the questions of how? and how much? will need more interaction with African stakeholders, they already showed some hints for these answers. South Africans are working in the integration of molasses production to have a dynamic role in the feed market. Mozambicans are working on regulation of land uses and biofuels production in order to increase the land availability and legal framework definition to sugarcane area expansion projects.

The papers I will be involved with:

As leading author:

- Social and economic impact indicators of expansion of bioenergy crops: the case of sugarcane in Mozambique and South Africa.

As Co-author:

- Biofuels a bridge toward the food security in development countries. Leading author: Annie Chimphango (Stellenbosch University).

- Socio-economic trade-off and economic margin of production. Leading author: Michael Jacobson (Penn State University).

- Socioeconomic impacts in Mozambique due to sustainable sugarcane ethanol production scenario. Leading author: Marcelo Cunha (UNICAMP).

- Environmental and social aspects on biofuels production: how lessons learned and improvements in Brazil can be shared with African countries. Leading author: Suani Coelho (USP).

Manoel Regis Leal, CTBE

1. Objectives of the meeting

The central purpose of the meetings was to present the LACAf Project to key people in South Africa and Mozambique and to establish contacts that could provide the information needed to develop the project.

A second and more immediate objective was to get a perception about the views and plans of these two countries with respect to bioenergy in general and ethanol in particular.

2. Accomplishments

The meetings and parallel discussions were very fruitful in accomplishing the objectives of the meeting, especially in identifying potential partners for the development of the project by providing important and reliable information about ethanol potential, existing regulatory and legal framework, targets, feedstock options, local agricultural practices, sugarcane sector performance and cost induces and, last but not least, local support when project group members need to make local field work.

Some important contacts made, in my point of view, are:

South Africa

- Johan Görgens (U of Stellenbosch): ethanol potential, alternatives and constraints in SA.
- Luke Brouckaert and Nico Stoltz (Tsb Sugar, Malalane Mill): performance indices of the SA sugar industry, future plans for ethanol and electricity production, problems and bottlenecks of the SA sugar industry and contact with the sugarcane sector.
- Steve Davis (Sugar Milling Research Institute – SMRI): technology development in SA for the sugar industry, potential joint research projects and publications with Unicamp, CTBE, ESALQ and other Brazilian institutions.

Mozambique

- Dr. José Luis Cabaço (Dean of the Universidade Técnica de Moçambique – UTM): open contacts with the Academia in Mozambique and interchange programs with Brazilian institutions
- Salvador Namburete (Minister of Energy of Mozambique): open doors in government institutions and provide official information about biofuels targets and legislations promoting biofuels.
- Marcelina Matavéia (?): information about legal framework for biofuels, barriers and bottle necks for the deployment of biofuels.
- Several technical people from the Maragra Mill: exchange views on potential production of ethanol and electricity, irrigation technology and strategy, outgrower cane production and bottlenecks and difficulties.

Besides these new contacts, the events provided opportunity for continuing discussions with old contacts from the University of Stellenbosch, Universidade Técnica de Moçambique and the American partners.

3. Visit to the mills

One mill in each country was visited (Malalane Mill in SA and Maragra Mill in Mozambique) and we had the opportunity to discuss with the technical people from the agricultural and industrial areas about the performance of these areas and the critical points of the present situation. Contacts were established for future consultations.

4. Final Comments

The meetings exceeded my expectations in receptivity and openness of our hosts and the interest in collaborate with LACAf project. Good and important contacts were made and the expectation for collaboration is high, proving once more the importance of direct contact when information is needed. Now, we need to follow up the discussions and plan for future collaboration. To maintain their interest it is important that we provide them with information in areas of their interest.

João Guilherme Leite, Nipe

The objective of this report is to briefly describe my impressions on the 'Lacaf Bioenergy Workshop' held in Nelspruit (South Africa) and Maputo (Mozambique) from 1st to 5th of April 2014. In this report three main issues will be explored: (i) the current state of bioenergy developments in South Africa and Mozambique as to the agricultural and industrial sector, (ii) the exchange of experiences between African and non-African participants and its relation with Lacaf project; and (iii) cooperation possibilities with African partners in pursuing research products (e.g. papers).

The presentations and discussions held during the five days of workshop were of particular importance to casting light on the current state of bioenergy in South Africa and Mozambique. In this respect the highlights were the technical visits to sugar mills, one in each country. Despite the leading role of South Africa in the development and implementation of sugarcane technology, when it comes to bioenergy production both countries seems to walking in the same pace. A main hurdle is the production of cost effective ethanol fuel able to compete with more conventional fossil fuels. Both Mozambique and South Africa have developed regulatory frameworks in order to establish mandatory ethanol blending. However, sugar cane mills remain cautiously optimistic due to the low prices of ethanol, which increases the need for ethanol subsidies.

Yet another important aspect of the workshop was related to the scientific debate among Lacaf members and collaborators. After the presentations the group had the opportunity to discuss research headlines and consequences to the overall objectives of the project. Among the African collaborators there was a general positive view towards biofuel production, i.e. ethanol from sugarcane. Despite the raised positive outcomes of biofuel production, such as job creation, infrastructure investment and reduction of GHG emissions, the economic advantages associated with ethanol needs further investigation. To illustrate this argument Anne Chimphango from Stellenbosch University studding a number of small scale bioenergy projects found that most of them fail as a business as soon as the external inflow of money (funding) stops.

Finally, the workshop was a unique opportunity to establish cooperation strategies with African partners. In this respect a work plan with João Chidamoio from UDM was agreed in which a schedule of activities and data collection strategy will be defined in the near future. Under the production model project the idea is to engage undergraduate students from UDM in data collection and field work in Mozambique. Such collaborative approach seems to be a paramount condition in strengthening the partnership among Lacaf members and in establishing a solid ground for relevant scientific production.

Suani Coelhe, USP

1. Objectives

The main purpose of this travel to South Africa (SA) and Mozambique (Moz) was to participate in the meetings Bioenergy Workshop Kruger National Park, in South Africa and the First Bioenergy Conference (Lacaf) in Mozambique in the context of the LACAf Project.

The researcher has also been participating in the discussions on Environmental and Social aspects of this project..

Besides the participation in the conferences, there were also technical visits to sugar mills in each country (TSB in SA and Maragra in Mozambique) where the local situation of sugarcane sector could be learned and meetings with the Lacaf project members.

2. General Comments from the activities developed in the two countries

2.1. Current situation on energy in SA and Moz

The two major problems, mainly in Moz, are energy access and the use of traditional biomass, as in several other African countries. Moz has only 20% of the population with electricity access according to the World Bank (figure 1). Traditional woody biomass (figure 2) accounts for 80% of energy consumption in households for cooking and heating (further details in EUEUI, 2012).

In fact, as it is well known, there are significant differences between the two countries regarding development level.

SA is part of the BRICS and Moz is still in the group of developing countries (DCs). These differences must be taken into account when discussing policy proposals, including for biofuels.

2.2. Current situation in sugarcane sector

In both countries there are sugarcane mills producing sugar but they do not seem so much interested in producing ethanol, even from the molasses (by-product of sugar production); it is a different situation in Sub Saharan countries, where sugar mills look very interested in producing ethanol. In SA the interest is still lower than in Moz. However the Government of Mozambique as well as some local stakeholders seems to be enthusiastic about biofuels.

The Government of Mozambique stressed the interest on biofuels in the Maputo workshop, showing the existing legislation on biofuels already established. However the fact is that, according to local stakeholders, the launch of biofuels program has not happened until now.

On the other hand, information received states some negative vision on biofuels. It seems there are studies from local NGO´s concluding that biofuels are negative for the small farmers, since they are supposed to dislocate the farmers and also wages paid by the industries are not enough to replace the revenues from their previous crop plantations.

Regarding bioenergy, there is a lack of information on the possibilities of using the residues of sugarcane (sugarcane bagasse from sugar production) to produce electricity surplus mainly in rural areas, contributing to reduce the rates of lack energy access in the country.

Regarding environmental issues, information received states that there is some environmental legislation but enforcement does not exist and policies must be improved.

Moreover the main environmental (and social) issue is the use of traditional biomass, which is responsible for the deforestation in the country as well as diseases due to indoor pollution (due to the inefficient use of wood for cooking and heating), mainly for women and children, as in other African countries.

3. Suggestions

3.1. Scenarios

Considering the information received and mentioned above, it was suggested by this researcher to develop three scenarios, in order to allow the Government of Mozambique to decide:

- First scenario: Sugar oriented (aiming to increase sugar production in the country
- Second scenario: Ethanol oriented (aiming to introduce ethanol production from sugarcane for local consumption and/or for export)
- Third scenario: Bio-electricity oriented (aiming to produce more electricity from sugarcane bagasse through more efficient technologies and to export the surplus to local households in rural areas)

The three proposed scenarios can of course be combined according to the decisions of the Government.

3.2. Harvesting of sugarcane

Considering the need to increase the number of jobs mainly in rural areas (as in other African countries), the main suggestion is to keep manual harvesting of sugarcane (but establishing labor legislation to forbidden the harvesting of green cane, since this is an extremely difficult labor). Further on the mechanical harvesting can be analyzed, together with a capacity building program following the experience of Sao Paulo.

3.3. Capacity building

Considering the extreme need for more skilled workers in all sectors, a significant collaboration of the project can be a capacity building program, not only for farmers and potential workers in industrial plants, but also to start the development of a service sector, including the production of spare parts for equipment, as happening in Sub Saharan countries (Cogen for Africa project).

3.4. Social issues

This is maybe one of the main issues to be developed in the project (together with environmental issues). Studies and collaboration on labor legislation, food security, replacement of traditional biomass, improvement of energy access (using sugarcane residues), issues related to land tenure (an extremely important issue in Africa in general).

3.5. Environmental issues

These are very important issues to be addressed, including

- Cooperation to reduce deforestation
- Studies on different environmental issues such as water consumption, water quality, air emissions, etc

- Development of studies on best practices to be implemented (and how), together with adequate policies

4. Proposal for collaboration with the Government of Mozambique

It is well known that Mozambique, together with Brazil and several other countries, is a member of the GBEP – Global Bioenergy Partnership – where the co-chairs are Brazil and Italy.

Considering that GBEP with FAO and UNEP has launched the Sustainability Indicators for Biofuels, and taking into consideration that several other countries are already developing studies on these indicators, one possible cooperation with the Government of Mozambique could be the development of such indicators for sugarcane sector. The experience of Sao Paulo State, where these indicators are already starting to be developed for ethanol mills, could be shared with Mozambique, hopefully contributing to reduce the negative perception of some stakeholders in the country.

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L A Horta Nogueira, UNIFEI

1. Objectives and program

The main objectives of this mission, involving seminars and visit to sugar mills in South Africa and Mozambique, were to identify and contact stakeholders and possible partners for LACAf project, especially considering the data and information required by the project, as well as to and learn the African perspective on fostering bioenergy programs, in order to access properly the perceptions, aims and constraints in this context.

2. Program developed

Date	Date/ Location	Attendees	Focus
April 1, 2	Kruger Park, South Africa	GSB, LACAf, industry and academic representatives from South Africa and Mozambique	Rationale and potential for bioenergy in Africa, geospatial analysis, food and energy security, environmental issues, production models.
April 2	Malalane, South Africa	LACAf representatives	Technical visit to the TSB Malalane Sugar plant (crushing about 1.83 million tons of cane per harvest season).
April 3	Maragra, Maputo Province	LACAf representatives	Technical visit to Fábrica Açucareira de Maragra (owned by Illovo Group, South Africa, processing yearly about 450 thousand tons of cane)
April 4	Maputo	LACAf, academic, government and industry representatives from Mozambique, Lee Lynd	Need and potential for bioenergy in Mozambique, lessons from the Brazilian experience, information exchange, future collaborations.
April 5	Maputo (Hotel Cardoso)	LACAf representatives, Lee Lynd	Plans for LACAf-1, discussing and defining targeted papers

(Modified from Lynd, L.)

3. Main remarks

a. The meetings allowed understanding better the local constraints at same time that it was clear the local interest on biofuels. Particularly in Mozambique was observed a strong motivation, although diffuse, to promote bioenergy production in the context of sugarcane industry expansion. Just the molasses stream currently available are

enough to produce the ethanol volume required to introduce E10 in Mozambique (about 30 million liters per year)

b. It was interesting to see that, accordingly the regulatory framework in place and the production facilities in operation, ethanol blends for automotive use are almost ready to be introduced, but electricity generation and ethanol use as cooking fuel present interest as well, particularly in Mozambique.
c. It was also clear that in South Africa there are two main constraints to ethanol introduction: the relative low availability of land suitable for sugarcane culture and the strong position of this country as producer of alternative fuels based on coal (using FT process), which responds for about 30% of national consumption of liquid fuels.
d. The technical visits were useful to verify the technology level currently adopted, similar to adopted in Brazil, and the farm management and productivity, comparable as well.
e. The issues of related to Consultation and Communication processes seems crucial to assure good prospects for bioenergy development in this context, looking for to define and develop ways to get an effective public participation and engage stakeholders in project conception, implementation and evaluation.

3. Local reference

Among the several people contacted during this week in Africa, it should be mentioned as the more relevant and possibly useful for the forthcoming activities:

People	**Function/Company**	**Observation**
Luke Brouckaert and Nico Stolt	TSB Sugar, Malelane Mill, South Africa	active managers, informed about sugarcane industries prospects and challenges in Southern Africa
Steve Davis	Sugar Milling Research Institute - SMRI, South Africa	reference on industrial technology for sugarcane processing
Dr. José Luis Cabaço	Dean of the Universidade Técnica de Moçambique, UTM	leading person in the Mozambique academic context
Salvador Namburete	Minister of Energy of Mozambique	important government official proposing the bioenergy development in Mozambique
Antonio Saide and Marcelina Mataveia	Director and Deputy Director of the Division of New and Renewable Sources of Energy of the Ministry of Energy of Mozambique	executives interested in fostering ethanol production and use in Mozambique, responsible for the legal framework in this field

4. Final Comments

In my opinion, the objectives of this mission were fulfilled. All the participants surely got a more clear perception of the effective potential for promoting biofuels in Southern Africa, at

same time that was possible to notice the local constraints, in terms of production facilities (including feedstock supply), market dimension and infrastructure, and particularly with regards to the knowledge of the advantages and impacts of biofuels programs.

This mission endorsed the LACAf perception that, although bioenergy can play an important role in local development and possible deserves a special attention of national authorities and decision makers, there are relevant limits to be taken into account to replicate the Brazilian biofuel programs model, imposing to understand better the local aims and define an innovative approach, adapting and adjusting our experience. The main challenge possibly is to harmonize short and long term perspectives, setting feasible targets for today and tomorrow.

Rubens Lamparelli, Unicamp

Main Goal

To make contact with the reality and specificities from the both (South Africa and Mozambique) countries, for better understand energy aspects into the context of the energy production with focus on Biofuel from Sugarcane.

General considerations

Two workshops were built. In both had participation of scientific, government and private institutions/people involved in energy question. The workshops had the objective to present the LACAf I project as well as discuss its different aspects considering the expertise of the participants.

Some people had important contribution in the discussion (in South Africa Workshop) as:

1- Dr. Annie Chimphango – Stellenbosch University;
2- Dr. Emile Van Zyl - Stellenbosch University;
3- Dr. Johann Gorgens, Stellenbosh University;
4- Luke Brouckaert, South African Sugar Industry;
5- Steve Davis, SMRI, South Africa
6- João Chidamoio (Ahead)
7- Dr. Rui da Maia (UDM)

From Mozambique

1- Dr. José Luís Cabaço (UDM);
2- Dr. Rui da Maia (UDM);
3- Malela(?) (Ministério da Energia- Departamento de Energias Renováveis);
4- João Chidamoio (Ahead and Mozambique Government consultant).

Summary of my views:

- The culture aspects are very important and present in political decision;
- Issues as food security, energy generation in terms of electricity and infrastructure should be taken into consideration;
- There is great interest in partnership.

My comments about Lacaf II

- In my opinion it was a great opportunity to expose some aspects of Lacaf II that the other participants had yet no knowledge about;
- I would like to highlight that Lacaf I have been an important learning experience which will be of great use in further developments of the project.

Marcelo Pereira da Cunha, Unicamp

This short report describes the main activities developed and accompanied during the first week of April 2014 in South Africa (April, 1-2) and Mozambique (April, 3-5).

Activities in South Africa – Bioenergy Workshop Kruger National Park

During the first day, some presentations were done by researchers already involved in the LACAf-I project to provide:

(i) the arguments and questions related to why enlarging the production and use of modern bioenergy in Africa would make sense;

(ii) the discussion regarding to the bioenergy potential in Africa, especially considering how much sugarcane would be possible to produce, taking into account constraints due to land use. It was clear that Mozambique has a considerable potential for expanding sugarcane area; on the other hand, South Africa has much less available land for it;

(iii) a vision of the opportunities and challenges to enlarge sugarcane bioethanol production in Southern Africa.

Considering my insertion in the project – to provide a socioeconomic impact analysis of a sustainable sugarcane bioethanol production scenario in Mozambique –, this first day of presentations and debates showed clearly that the construction of this scenario will depend on understanding local challenges to enlarge this industry in Mozambique; for example, conditions related to the infrastructure, energy poverty and food security probably will have an influence over the production model (including both agriculture and industrial phase).

The second day, in the morning, was dedicated to presentations and discussions on the food and energy security in Africa, socioeconomic aspects and environmental issues. In this day, I provided a 20 minutes presentation regarding my purpose of research in this project – Socioeconomic impacts in Mozambique due to sustainable sugarcane bioethanol production scenario. To accomplish the target of this study, I've emphasized the necessity to take the output from other colleagues in the project, typically the interaction with Dr. Régis Leal (from CTBE) to evaluate what would be the production model feasible in Mozambique. Some interesting questions rose from the audience; for example, one of them considered the possibility to evaluate the reduction on health expenditure by the African Governments due to the reduction of traditional biomass indoor consumption by electricity (from surplus bioelectricity mills) or ethanol gel for cooking; another question was in the way to provide the potential socioeconomic impacts due to the improvement in the local infrastructure to support the production and consumption of modern bioenergy in Mozambique. At the end of my presentation section, I have mentioned that will be possible to conclude my study in the LACAf-I project until February 2015; the experience in this project would make possible to provide the same study in South Africa, Colombia and Guatemala in two years more, after concluding the Mozambique case.

Finally, after lunch (in second day), the afternoon was dedicated to a technical visit in a sugarcane mill (TSB) close to Nelspruit, in South Africa. The visit was done in the factory, as well as in the field; close to all sugarcane is produced using irrigation, a model that quite does not is applied in Brazil

Activities in Mozambique

Three days were dedicated in Mozambique. In the first one, another technical visit in a sugarcane mill (including the factory and the field) was done – Maragra Sugar Factory. As in South Africa (TSB), irrigation is employed in sugarcane activity in this company as well.

The second day was dedicated to a workshop with researchers (Universidade Técnica de Moçambique – UDM) and technical staff (Ministério de Energia) from Mozambique. A very interesting presentation regarding the overview of energy sector was done by the Minister of Energy of Mozambique, including the announcement of the Renewable Energy Atlas of Mozambique, recently concluded.

Presentations by Brazilian experts on sugarcane sector were done to provide an overview of the history, opportunities and challenges for sugarcane activity in Brazil. Two sessions of debate between Brazilians and Mozambicans experts were conducted with the objective to start understanding the opportunities and challenges for sugarcane expansion in Mozambique to produce modern bioenergy.

The interaction with Mozambicans was excellent; in terms of my research, it was very important to open doors with the academia and Government in Mozambique, specifically considering my necessity to evaluate the Mozambique's Input-Output Matrix. The Instituto Nacional de Estatística (INE) is the Government Agency responsible for this activity; Rui da Maia (from UDM) knows technicians in this agency.

Finally, the third day was dedicated to a meeting among Brazilians experts involved in the LACAf project and Dr. Lee Lynd. The discussions had the target to organize the interaction among the three subprojects in LACAf-I, as well as to discuss the papers that will be submitted in the coming months.

André Meloni Nassar, Agroicone

Juntamente com Edgar Beauclair, Fernando Bertolani e Felipe Gomes, participei das visitas como integrante da equipe que está avaliando o potencial de produção de biocombustíveis no projeto LACAf I. No seminário organizado no Parque Kruger, África do Sul, fiz uma apresentação intitulada "Constraints in Land Use for Biomass Production in Mozambique", em que apresentei o andamento dos trabalhos da equipe, bem como a modelagem econômica que estamos desenvolvendo na Agroicone para alocar a expansão da cana-de-açúcar, em função dos cenários que serão definidos pela equipe do projeto.

O seminário no Parque Kruger trouxe várias novas informações para nosso time mas a mais importante foram os contatos com Luke Brouckaert e Nico Stoltz da TSB, indústria produtora de cana-de-açúcar e açúcar da África do Sul. As conversas paralelas com eles, bem como a visita à unidade localizada na cidade de Malalane, foram muito importantes para entendermos o sistema de produção de cana-de-açúcar e açúcar na África do Sul.

Ficou claro que a África do Sul não possui área disponível para expandir horizontalmente a produção de cana-de-açúcar, o que limita a produção de etanol a partir do suco da cana. Ficou claro também que a irrigação é uma necessidade para se garantir boas produtividades. Em função do uso da irrigação, o sistema de renovação do canavial é bastante diferente do Brasil. Os canaviais não são renovados a cada 5 ou 6 cortes como no Brasil. Não fomos capazes de definir qual o padrão utilizado e de que forma é feita a otimização da idade para renovação, mas há canaviais com mais de 10 cortes sem renovação. Como exceção, foram citados casos com 15 cortes.

Observamos também que o sistema de controle e distribuição da irrigação é sofisticado e completo, no caso da produção própria da indústria. Assim, há grande diferença no emprego de tecnologia, tanto de produção, quanto de irrigação, entre a cana própria e a cana de produtores terceiros. Na cana própria, ficamos bem impressionados com os controles de produtividade e o uso de técnicas de agricultura de precisão para adubação. A cana ainda é praticamente 100% queimada e colhida manualmente.

Uma importante informação de bastidor que a TSB nos passou é sobre o projeto de reconstrução da usina localizada na represa de Massingir em Moçambique. O projeto é para moer 4 milhões de toneladas de cana-de-açúcar por ano. Essa usina estava em funcionamento antes da guerra civil e, assim como as demais 4 usinas em funcionamento em Moçambique, são operadas por empresas da África do Sul (ou empresas de outros países que também operam na África do Sul, como o caso da francesa Tereos). Segundo a TSB, a estimativa de investimento para colocar o projeto em operação total será de US$ 1,2 bilhão, ou seja, US$ 300/tonelada de cana de CAPEX. Embora o valor tenha parecido elevado para nós, pelos números que conhecemos do Brasil, a informação nos foi passada pela TSB. A usina deverá começar a operar somente em 2016.

Os três pontos fortes em Moçambique foram: visita a unidade Maragra da Illovo (empresa sul africana produtora de açúcar), reunião que nossa equipe fez com dois especialistas do IIAM (Instituto de Investigação Agrária), Moisés Vilanculos e Jacinto Mafalacusser e conversas

paralelas com especialistas moçambicanos sobre o potencial produtivo de cana-de-açúcar e a situação das 2 outras usinas que funcionavam antes da guerra civil e que ainda estão paradas (açucareira do Buzi, sul província de Sofala e açucareira do Luabo, sul da província de Zanbezi).

O sistema de produção em Moçambique, nas usinas em funcionamento, se assemelha com o padrão da África do Sul. No entanto, como nossa equipe notou pela visita na usina de Maragra, as usinas em operação privilegiaram a infraestrutura já existente. Ou seja, são usinas bem localizadas do ponto de vista de logística e de oferta de água, mas com canaviais em solos com baixa aptidão para cana-de-açúcar. Nossa avaliação é que esse modelo de recuperar canaviais antigos faz sentido apenas nas usinas que estavam em funcionamento antes do início da guerra civil. Mas uma vez recuperados estes canaviais, e como já dito existem apenas duas usinas restantes, a expansão da cana-de-açúcar se dará com padrão diferente, procurando regiões com maior aptidão e solos que permitem uma produção com menor necessidade de irrigação.

A visita foi relevante também para que a equipe de todos os grupos envolvidos, sobretudo no Lacaf I, pudessem discutir detalhes de cenários, integração das análises e, sobretudo, estrutura de papers que serão submetidos a revistas científicas. Nesse sentido, nossa equipe está elaborando os sumários dos papers que serão produzidos a partir dos dados gerados pelo projeto.

APPENDIX II

Table 1 List of Attendees.

No	Delegate	Address
1	Emile (WH) van Zyl	Stellenbosch University
2	Ina van Zyl	Accompanying person (E van Zyl)
3	Johann F Gorgens	Stellenbosch University
4	Nico Stoltz	TSB
5	Luke Brouckaert	TSB
6	Nelda Rousseau	Workshop organiser
7	Edgar De Beauclair	Luiz de Queiroz College of Agriculture - Esalq (Brazil)
8	Daniela De Beauclair	Accompanying person (E de Beauclair)
9	Luis A. B. Cortez	University of Campinas - Unicamp (Brazil)
10	Luiz A. H. Nogueira	Universidade Federal de Itajubá - Unifei (Brazil)
11	Manoel Regis L. V. Leal	Brazilian Bioethanol Science and Technology Laboratory - CTBE (Brazil)
12	Mauro D. Berni	Núcleo Interdisciplinar de Planejamento Energético
13	Paulo Manduca	University of Campinas - Unicamp (Brazil)
14	Rubens Lamparelli	University of Campinas - Unicamp (Brazil)
15	Keith Kline	Oak Ridge National Laboratory – ORNL (USA)
16	Lee R. Lynd	Dartmouth University (USA)
17	Joao Chidamoio	Ahead Energy - Mozambique
18	Antonio M. Bonomi	Brazilian Bioethanol Science and Technology Laboratory - CTBE (Brazil)
19	Felipe Haenel Gomes	Pedológica (Brazil)
20	Jansle Rocha	University of Campinas - Unicamp (Brazil)
21	João Dal Belo Leite	University of Campinas - Unicamp (Brazil)
22	Klaus Dalgaard	University of Campinas - Unicamp (Brazil)
23	Marcelo Cunha	University of Campinas - Unicamp (Brazil)
24	Suani Coelho	Brazilian Reference Center on Biomass – CENBIO / University of São Paulo - USP (Brazil)
25	Virginia Dale	Oak Ridge National Laboratory – ORNL (USA)
26	André Nassar	Institute for International Trade Negotiations – ICONE (Brazil)
27	Luiz Martinelli	Centro de Energia Nuclear na Agricultura – CENA / University of São Paulo - USP (Brazil)
28	Marco Ospina	University of Campinas - Unicamp (Brazil)
29	Mike Jacobson	Pennsylvania State University - PSU (USA)
30	Tom Richard	Pennsylvania State University - PSU (USA)
31	Erica Smithwick	Pennsylvania State University - PSU (USA
32	Fabiana Gama Viana	University of Campinas - Unicamp (Brazil)
33	Fernando César Bertolani	Centro de Tecnologia Canavieira – CTC (Brazil)
34	Rui da Maia	Technical University of Mozambique (Mozambique)
35	John Sheehan	University of Minnesota (USA)
36	Steve Davis	SMRI, Durban
37	Roy Cowgill	Accompanying person (S Davis)
38	Annie Chimphango	Stellenbosch University
39	José Luís Cabaço	Technical University of Mozambique (Mozambique)
40	Salvador Namburete	Ministry of Energy (Mozambique)

APPENDIX III

Workshop presentations

Available at: http://bioenfapesp.org/gsb/lacaf/index.php/component/users/?view=login

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