The Global Sustainable Bioenergy Initiative: Past, Present & Future

Lee R. Lynd

GSB & LACAf Meeting
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Centro de Energia Nuclear na Agricultura
Piracicaba, Brazil

I. Bioenergy Context & GSB Motivation
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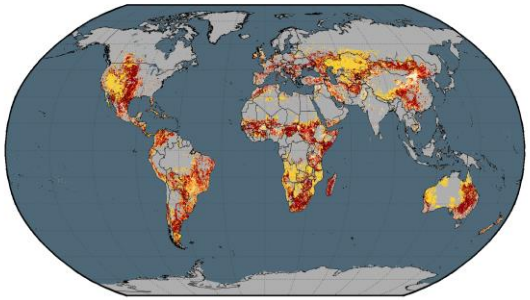
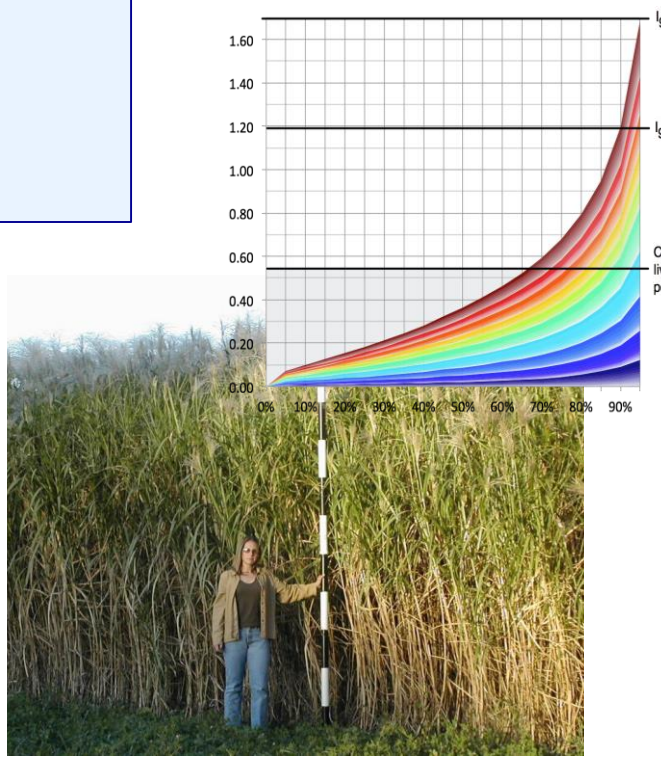
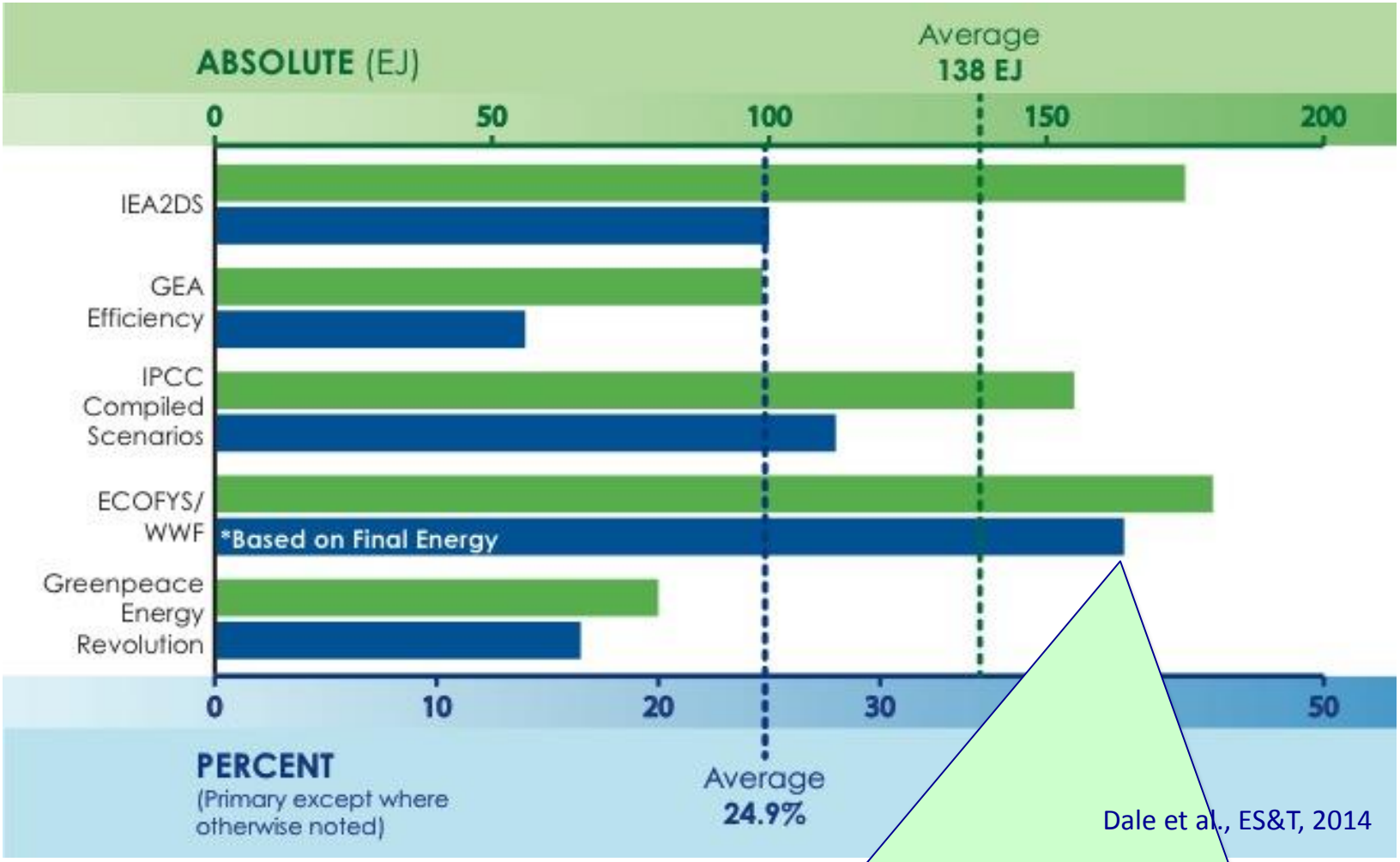




Bioenergy Contribution in 2050: Five Low-Carbon Energy Scenarios

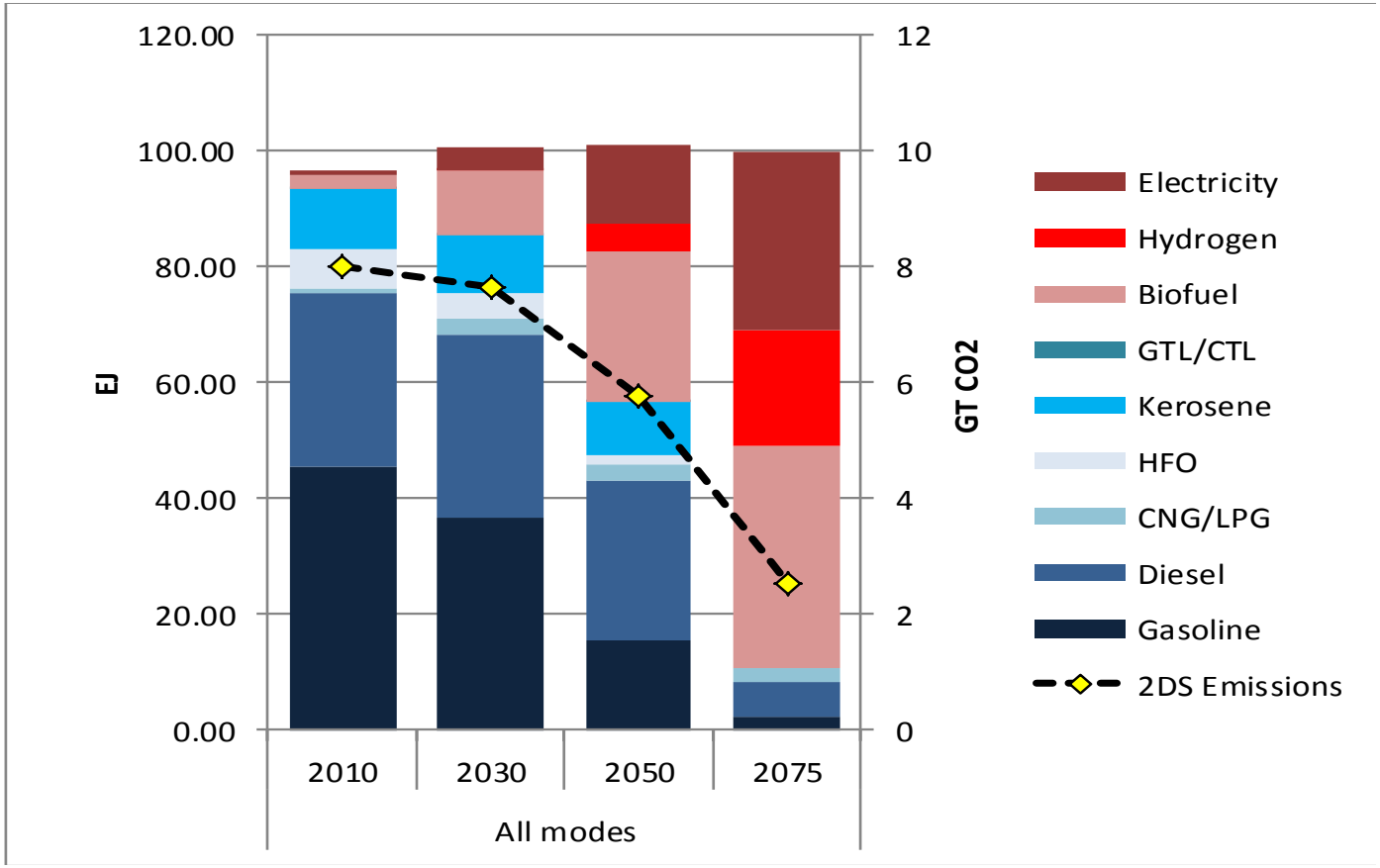


Dale et al., ES&T, 2014

World Wildlife Fund, commenting on their "100% Renewable Energy by 2050" Report: "To achieve … high renewable energy shares, finding a renewable fuel and heat supply is the biggest challenge. The Scenario's bioenergy is therefore … used mainly to provide transport fuel and industrial fuel and heat – i.e. to meet energy demands that cannot be met through renewable electricity or other renewable heat applications."

The Need for Biofuels as Part of a Low Carbon Energy Future

Aggregated global transport energy use, IEA 2DS (Fulton et al., in review)



Even with H2 or batteries providing for almost all energy used in personal vehicles, busses, trains, and half of long-haul trucking, biofuels are still needed for about half of total transport energy.

Bioenergy, Development, and Food Security

Focus on Africa, Where the Incidence of Poverty and Food Insecurity is Highest

None of the Millennium Development Goals (MDGs) can be met without major improvement in the quality and quantity of energy services in developing countries[1].

Africa has about 12 times the land area of India, similar land quality, and 30% fewer people – yet India produces enough food to feed itself and Africa does not. The green revolution bypassed Africa primarily due to serious organizational & institutional weaknesses, not geographically-limited capacity[2]

Consideration of the impact of bioenergy on African food security has tended to focus on land competition and to overlook bioenergy's marked potential to promote rural development. However, potentially productive land is rather plentiful in much of Africa whereas lack of development is the most important underlying cause of hunger.[2]

In Brazil – the foremost example of bioenergy deployed in a developing country context – social development, agricultural development and food security, and bioenergy development have been synergistic rather than antagonistic.[3]

A substantial literature points to disproportionately large benefits to the rural poor from agricultural development as compared to other kinds of development[4]

If done thoughtfully, there is considerable evidence that food security and economic development in Africa can be addressed more effectively with modern bioenergy than without it.[3]

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[1] UN Development Program. Sustainable Energy. http://www.undp.org/content/undp/en/home/ourwork/environmentandenergy/focus_areas/sustainable-energy.html .
[2] Lynd and Woods. A New Hope for Africa. Nature. 2011.
[3] Lynd, Sow et al. Bioenergy and African Transformation. In review.
[4] Christaensen and Demery, Journal of Development Economics, 2011; Ligon and Sadoulet, Background Paper for World Development Report, 2007; UNDP, African Human Development Report: Towards a Food Secure Future, 2012.

Bioenergy Landscape

	Potential Liabilities	Potential Benefits	Predominant View
People	Lost land access → • the poor get poorer • lost capacity for food self sufficiency	• Catalyst for economic & agricultural development • Resilient agricultural systems	Caution, skepticism
Planet			
Land use change	• Lost food capacity • Lost habitat	• Land restoration • More diverse ag. landscapes • Ecosystem C storage	Caution, skepticism
Climate	• Land clearing → carbon release	• Low carbon transport & industrial energy	Need for bioenergy recognized in some circles but motivates limited action
Environmental media (soil, air, water)	Degraded	Improved, particularly when perennial crops replace/ complement annual crops	• In general we know or can reasonably expect to learn how to avoid degraded environmental media • Gap of practice more than knowledge
Profit	Consume government support better spent elsewhere	• Cost-competitive feedstocks • Economic empowerment • Healthier rural economies	• Economic viability essential • Potential liabilities not major concerns provided people & planet benefit

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Main strategic concerns

Notwithstanding strong indications that very large scale bioenergy is needed to achieve a low-carbon energy future and could be a powerful driver for development

Ambivalence and opposition to bioenergy are widespread

Growth of the two largest bioenergy industries in the world – US & Brazil – is stalled

Policy support for bioenergy is getting weaker rather than stronger in many countries

We are not on course to use bioenergy on the scale that appears to be needed for climate change mitigation, and bioenergy is more often seen as negative rather than positive in a development context

Global Sustainable Bioenergy Initiative
"GSB Initiative" (http://bioenfapesp.org/gsb/)

Motivation: The world likely needs bioenergy - for low-carbon energy supply, economic development, and benefits to agriculture - yet seems inclined to turn away from it.

Objective: Expand understanding of the possibility of beneficially producing bioenergy on a very large scale - e.g. 25% of primary energy supply in 2050, consistent with recent low carbon scenarios (IEA, GEA, IPCC).

Working hypotheses:

1. That it is physically possible to "make room" for large scale bioenergy while honoring other land use priorities.

2. That a systemic approach to food and bioenergy production could positively and synergistically impact multiple urgent human needs.

Structure

Stage 1. Continental Conventions (completed)

- Gather input on framing stages 2 and 3
- Continental resolutions
- Recruit participants & funds

Stage 2. Address working hypothesis, unconstrained by current realities.

Stage 3. Analyze implementation paths, recommend policies

GSB Timeline – Selected Events

2009: Steering committee formed (Tom Richard, Nathanael Greene, Lee Lynd)

2010: Constitutional Conventions, extensive consultative process
Europe - Patricia Osseweijer
Africa - Emile van Zyl
Latin America - Brito Cruz & Jose Goldemberg
Asia/Oceania - Ramlan Aziz
North America - Jon Foley & John Sheehan

2011: Papers stemming from the project start to appear
- Royal Society Interface Focus "Global Conversation" paper reporting from conventions
- Nature "New Hope for Africa"

GSB board and executive committee formed

2012
- GSB Visiting Scholar Program established, used (Kline, Lynd, Sheehan, Woods)
- Pasture analysis initiated led by John Sheehan

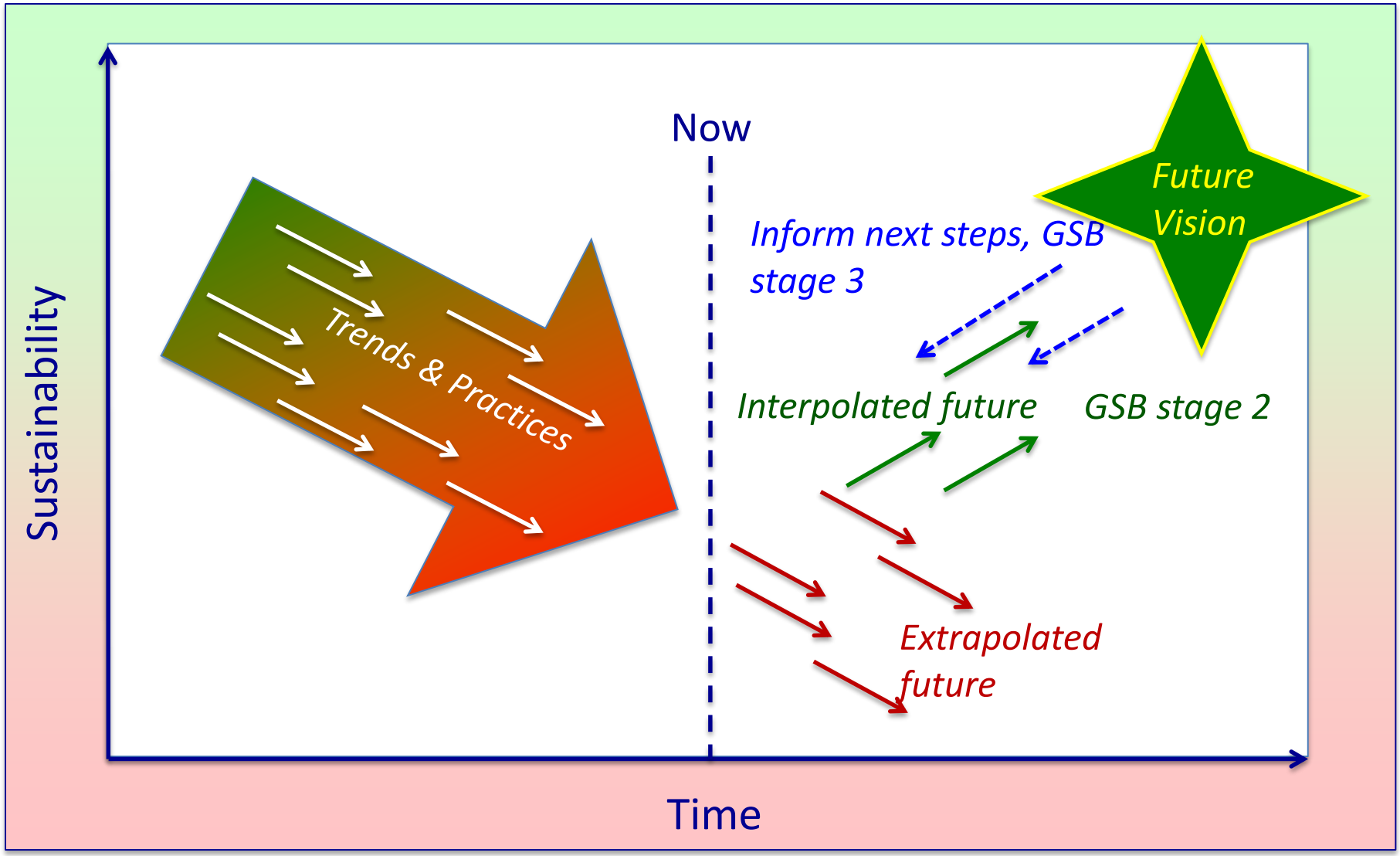
2013
- LACAf project funded
- NEPAD collaboration initiated, led to Bioenergy and African Transformation paper (in review)

2014
- Meetings held in African LACAf countries
- Geospatial proposal submitted

GSB Project: Approach and Differentiation

	Most Bioenergy Projects & Analyses	GSB Project
Focus	Most probable	Most desirable
Expert opinion	Reflected, often sharply divided	Informed, seek new understanding & consensus
Point of reference	Current reality	Future vision
Value	√	√

Future Vision Point of Reference: Extrapolated and Interpolated Resource Futures



GSB Project Status

Bioenergy from Sugar Cane in Selected LACAf Countries
- Diagnosis
- Near-term potential
- Integrated Analysis

Geospatial Analysis & Modeling Relevant to Bioenergy
- Pasture & livestock
- Energy crop models
- Remote sensing & mixed systems

Social Aspects of Bioenergy
- Retrospective
- Predictive

Environmental Analysis of Bioenergy Scenarios
- Water
- Soil
- Biodiversity
- GHG

Status

2 year thematic project Funded, Feb. 2013	Resubmission to FAPESP planned	One-year, one paper project proposal targeted soon Broader thematic project under discussion	Hope to bring into focus at this meeting, submit proposal soon

Coordinator

Luis Cortez	Jansle Rocha	Marcia Azanha Jem Woods	Luiz Martinell

Focus/Questions (evolving)

Opportunities for sugar cane bioenergy in 4 selected countries: Why, how much, and how	Availability and evaluation of pastureland and mixed systems for bioenergy	Social impacts of industrial-scale bioenergy in Brazil & Africa (one-year project)	Field work & biogeochemical modeling of pastureland → bioenergy conversion

Emergent GSB Focus: Production of Bioenergy Feedstocks on Pasture land

Lots of land. At 3 to 3.5 billion ha, pasture is the largest land category managed by humans - twice as large as cropland

Great intensification potential. Analysis thus far suggests much greater intensification potential than cropland using a consistent methodology (Sheehan et al. in preparation).

Large fraction does not have livestock on it. Almost half (FAO, Sheehan et al.)

Minor food supply contribution. 1.3 % of global dietary calories, 2.7% of global dietary protein (Laser and Lynd)

	A	B	C	D	E	F = A*C	G = A*E
Animal Product	Production from Grazing	Animal Product Consumption (kcal/person/d)	Percent of Total Calories	Animal Protein Consumption (kcal/person/d)	Percent of Protein Calories	Total Calories from Pasture	Total Protein from Pasture
Meat	8.4%	252	8.9%	58	17.8%	0.8%	1.5%
Milk	12.0%	127	4.5%	33	10.1%	0.5%	1.2%
Eggs	0.8%	33	1.2%	11	3.4%	0.0%	0.0%
Total		412	14.6%	102	31.3%	1.3%	2.7%
Sources:	1	2	2	2	2	1,2	1,2

Note: Human calories consumption: 2,831 kcal/day; Per capita protein: 325 kcal/day

Sources:

1) Steinfeld et al., 2006; Livestock's Long Shadow: Environmental Issues and Options; Table 2.9; FAO. http://www.fao.org/docrep/010/a0701e/a0701e00.HTM
2) FAO/FAOSTAT; Food Balance Sheet for 2009; Balance as Domestic Supply/Utilization; http://faostat3.fao.org/faostat-gateway/go/to/download/FB/FB/E; accessed 12/31/13

Two prominent criticisms of bioenergy – food competition and deforestation – are largely specific to cropland and forest land, and are much less applicable to pastureland

GEOGLAM RAPP: An Important Opportunity for GSB

The group responsible for most high-level pasture analysis papers in the last 5 years is a network including persons from CSIRO (Australia), IIASA, and FAO among other organizations.

Mario Herrero (CSIRO, formerly International Livestock Research Institute) has developed the most comprehensive global pasture database, seems receptive to collaborating with us.

GEOGLAM RAPP is a new initiative involving Mario and the above network

GEO: Group on Earth Observations.

GLAM: GLobal Agricultural Monitoring.

RAPP: RAnge and Pasture Productivity

Seeks to develop improved land use data bases for range and pasture with intensive use of remote sensing.

Initiative getting underway, looking for sponsors and *test sites*.

Interested in holding their next meeting in Brazil, 2Q 2015.

Relevant to geospatial project, also environmental and LACAf, perhaps social too.

Great opportunity, important connection to make

Meeting Overview: From Aspirational to Operational

Past meetings

One sequential session

Emphasis on introducing participants and perspectives

Future meetings. Expected to be supported by funded projects

This meeting

Parallel sessions

Emphasis on targeted papers (LACAf) and project proposals (Geospatial, Social, Environmental)

Likely last planning meeting

Wednesday

Overview of GSB initiative, projects

Presentations by persons new to the meeting

Parallel sessions

LACAf working session

Introductory presentations and discussion

Thursday

Parallel working sessions

LACAf, Social, Environmental – AM & PM

Geospatial - AM

Friday

Presentation by new participant

Report back

Discussion