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BIOFUEL IN BRAZIL: SOYBEAN AND PALM OIL IMPACTS ON SOCIOECOLOGICAL SYSTEMS

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Presentation Overview

- Biodiesel in Brazil
- Strategies and challenges for agro energy production
- Soybean and palm oil production impacts
- Conclusions

Biodiesel production in Brazil

- Soybean: 70% of biodiesel production
- Large scale biodiesel production
- Soybean expansion
  - Started in 1970
  - Drive by global market forces
  - Government actions: subsides and investments in transportation infrastructure
- World second biggest producer
- Economic benefits vs. Environmental impacts
  - Cerrado and Amazon rainforest replacements

Energy and develpoment

- Political measures to promote rural, social and environmental development
- Palm oil as a major contributor
- Production area doubled during 2001-2009
  - 46 to 109 thousand ha
- Projected scenarios predict major expansion in the next few years

Strategies to avoid the same impacts of soybean expansion

- Palm Oil Agroecological Zoning
  - Only to degraded lands without environmental legal restrictions
  - Removal of native vegetation is forbidden
- Social Fuel Seal
  - Partnerships with small farmers by contractual agreements
  - Tax benefits and priority in biodiesel auctions
- Important measures but targets might not be achieved
- Land use changes challenges and unanticipated effects
- Challenges
  - Remoteness for supervision of palm production poles
  - Displacement of farmers who do not accept palm crop
  - Environmental consequences for communities regardless indirect and illegal direct deforestation

Objectives

- Comparison of soybean and palm oil production impacts
  - Biodiversity
  - Ecosystem services
  - Local community

- Evaluation
  - Land use change
  - Agrochemicals use
  - Soil, Water use and GHG emissions
  - Job creation and inclusive growth

- Indicators assessed in a literature-based inventory of the sustainability of major biofuel production systems, based on current certification and production practices (RSB, RSPO, RTRS) in major production areas.

Land conversion: direct and indirect LUC

- Native forest replacement
  - Lack of accurate data on land cover change
  - Incomplete understanding of its complex causes
- Timeline
  - Soybean - 70’s
  - Palm oil - 90’s
- But our intention is to verify what type of plantation can be **more productive** and **use less land extension** starting from now
- The scenario of **soybean-based biodiesel** production to meet future global biodiesel demand would likely result in the **highest amount of habitat loss compared with alternative scenarios of oil palm-based biodiesel production**

Land conversion: direct and indirect LUC

- Yield productivity for biofuel
  - Palm oil ranks the highest compared to soy
  - Soybean occupies 220 times more land to produce only 57 times more oil than palm.
- On the other hand
  - Infrastructure for production and transportation of soybean is well consolidated
  - Palm oil has increasing faster than for soybean which may drive indirect land use change.
- Indirect land use change
  - Food crops farmers
  - Cattle raising

Agrochemicals use

- The runoff from large use of agrochemicals
- Impacts aquatic biodiversity, rivers and “igarapés” water quality and the health of local communities that lives and cultivates food nearby
- In all agrochemical indicators, palm oil crops present the least amount of input needed and also the least amount of runoff to soil and water
- Less amounts of agrochemicals to the crops reflects in less harm on Amazon and Cerrado ecosystems and on human health

Soil, Water and GHG Emissions

- Soil erosion is a serious problem due its irreversibility and the fact that threats the agriculture productivity by losing plant nutrients and organic matter
- Based on a case study comparing soybean in Brazil and palm oil in Malaysia, palm crops promote more loss of soil than soybean.
- Volume of surface, ground water and rainwater consumed.
- Results from Thailand:
  - Water footprint is similar
- Fossil energy balance
  - Palm oil crops would emit less carbon than soybean
  - 9 times the amount of energy required for its production

Job creation and inclusive growth

- Job creation
- Rural development by family farming inclusion
- Job generation
  - Soybean = 2 workers per 100 ha
  - Palm oil = 1 worker per 10 ha
- Palm oil and income security
  - Has high yield potential and lower production cost than the other major oilseeds
  - Is a permanent crop and requires less labor-intensive which permits the development of other agricultural activities

Conclusions

- Government incentives and increasing energy demands make the expansion of biofuels production in Brazil a virtual certainty
- Although many questions remain, the results of our study suggest that an increase in soybean-based biodiesel production could have greater negative social and environmental effects than those of palm oil crops in Brazil
- From **17 indicators** evaluated, **palm oil was better on 12** regarding biodiversity, ecosystem services and local community impacts
- Soybean production, however, is still the most profitable oil crop and the only one available for large-scale biodiesel production
- Although we used the most recent available data to build this framework, new technologies and best practices might change the indicators results for each case and improve biofuel production
- Crop management practices aimed at increasing yields and/or minimizing ecological costs will further influence the role biofuels play on ecosystem and biodiversity, and partnerships with local smallholders might bring several community benefits.

Indicators	Soybean		Oil Palm		Source / Reference
LUC and ILUC					
Habitat loss (million ha)	76.4–114.2		0.4–5.4		Koh, 2007
Yield productivity for biofuel (t/ha)	0.36		3.68		Basiron and Foong-Kheong, 2013; Basiron and Kook Weng, 2003; Costa e Santos (2008)
Land use in Brazil (thousand ha)	24000		109		IBGE 2011
Average yield (thousand kg/ha)	3.1		12		IBGE, 2011
Area Harvested Growth Rate (2000-2012)	Cumulative	Geometric	Cumulative	Geometric	FAO, 2013
	0.83	0.05	1.42	0.08	
Agrochemicals use (kg)					
Nitrogen input	315		47		FAO, 2013
Phosphorus input	77		8		FAO, 2013
Pesticide/herbicide input	29		2		FAO, 2013
Nitrogen output	32		5		FAO, 2013
Phosphorus output	23		2		FAO, 2013
Pesticide/herbicide output	23		0.4		FAO, 2013
Soil, Water and GHG Emissions					
Fossil energy balance	1 – 4		9		FAO, 2008
Water footprint (m^3/l)	1,875		965 - 2,353		Kaenchan and Gheewala, 2013
Soil loss (t/ha/year)	8		14		Mattsson et al, 2009
Carbon emissions (kg CO_2/t biodiesel produced)	1.387		1.711		Zutphen et al, 2011
Job Creation					
Work force (worker/ha)	2/100		1/10		FAO, 2013 Reporter Brasil, 2008

THANK YOU!

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