

The participation of smallholders in bioenergy supply-chains cases of Brazil

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inputs from research led with
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Foreword on the contributing studies

Assessments of the potentialities of biomass for energy

- ULCOS (2004-2010), with USP/FEA (Morello, Piketty)
- Total (2004-2010), with UFABC/CECS (Favareto, Kawamura)

Analysis of the impacts of bioenergy on livelihood and development

- CIRAD-ATP Envisud (2009-2012), with UFPA/EBMA

+ two European FP7 projects

- Global Bio-Pact (2010-13), with CATIE on biofuel sustainability
- ALCUE-KBBE (2011-14), with CIAT

**=> insights since 2005
from field surveys and literature reviews**

Bioenergy development is about large scales agriculture-wise, not so much energy-wise

		Bioenergy volumes at stake	Biomass	Process yields (hyp.)	Biomass volumes	Annual crop yield (hyp.)	Areas
Current levels of production							
Ethanol	Brazil 2007-09	25 308 MI	sugarcane	65 l/t	389 Mt	78 t/ha	5 Mha
Biodiesel	Europe 2007-09	9 041 MI	rapeseed	370 l/t	24 Mt	3.5 t/ha	7 Mha
			soybean	200 l/t	45 Mt	2.1 t/ha	22 Mha
Charcoal	Brazil 2010	10 Mt	eucalyptus	30%	33 Mt	10 tDM/ha	3.3 Mha
For the supply of one plant (average size modern unit)							
Ethanol	Brazil	164 MI	sugarcane	82 l/t	2 Mt	87 t/ha	23 000 ha
Biodiesel	Brazil	70 450 t	oil palm	2 %	0.34 Mt	15 t/ha	22 680 ha
	Europe	89 400 t	rapeseed	33%	0.27 Mt	3.5 t/ha	78 449 ha
	Argentina	110 000 t	soybean	1 %	0.63 Mt	2.1 t/ha	312 500 ha
Charcoal	Brazil	50 000 t	eucalyptus	33%	152 000 t	10 tDM/ha	152 000 ha
Potentialities for 2nd generation biofuels (Saïdi et al, 2011)							
World		1 321 Mtep	eucalyptus	21%	6 174 Mt	14 tDM/ha	441 Mha
Brazil		280 Mtep			1 310 Mt		93.6 Mha

Some fundamentals of bioenergy scales

unspecific of one biofuel or one country

The relatively low energy content and heterogeneity of biomass + the consumption levels of fossil fuels = potentially unlimited demand of biomass as an energy substitute

A variety of by-products generated during production and transformation processes can become either valuable products or cumbersome waste (glycerine, vinasses, tar...)
=> the scale of operation largely determines outlet opportunities

However scale effects are often not inherent to bioenergy systems and should be distinguished from correlations

- Larger plots do not necessarily get higher agricultural or forest yield than smaller plots
- In transformation processes, increasing scale improves equipment productivity (process speed) more often than yield (/biomass requirements)
- Economies of scale might combine with diseconomies of scale, depending on logistics and other transaction costs

=> the adequate scale varies across situations, according to the limiting factors (inputs, financial capital, infrastructure workforce...)

Is there space for the smallholders?

one issue, several ways to bring it up

Does bioenergy development exclude small holders? What is smallholder contribution to bioenergy development? Do smallholders benefit from bioenergy development? Do energy crops represent valuable options for smallholder agriculture? Can biofuel be pro-poor...

= a diversity of questions revealing the variety of perspectives and different expectations towards bioenergy => unavoidable biases

In Brazil, the issue of the inclusion of small-scale actors in bioenergy supply-chains is tackled diversely according to the cases:

- Sugarcane-to-ethanol: the main social issue has been employment and labour conditions, to a lesser extent the situation of independent land or sugarcane suppliers is evaluated <-> issues of contract fairness and risk sharing
- Oleaginous-to-biodiesel: main focus on the PNPB with the *Selo social*, successes and failures of the PNPB to include family agriculture <-> issues of economic viability and social vulnerability
- Eucalyptus-to-charcoal: smallholder participation is required both for reforestation and for wood supply to the industry <-> issues of cost efficiency

Sugarcane-to-ethanol

periphery stakeholders rather than smallholders

25 Gt ethanol production. Large and increasing scales of production, high level of integration facilitating further economies of scale (electricity production out of bagasse, biorefinery...)

More than technical, the scale determinants are institutional and based in the history of Brazilian society, allowing for the convergence of interests of large/powerful stakeholders (Abramovay, 2009)

The limiting factor in continuing increasing the scale is on the supply radius (< 25km), associated to sugarcane characteristics (must be harvested when reaching its optimal sugar content and processed rapidly)

Sugar and ethanol producers locate their plant where they can own large areas of suitable land and count on the additional land or supply of neighbour farms (37.5% of the supply in Brazil, 43% in San Paulo state)

Independent suppliers are rarely smallholders: more than 10,000 ha average cultivated area in SP

Are smallholders excluded?

(from the sugarcane-to-ethanol supply-chain)

Little technical problem associated with plot size where mechanization is possible

The problems are rather related to the smallholders' investment capacity (access to the best technical package) and access to the markets

When such problems are addressed by joining a large production unit, the smallholder might still be disadvantaged because of lower negotiation power within this institution

“Pervasive role of unequal and rigid power relations in shaping Proalcool's social impacts” (Lehtonen, 2011)

Agro-ecological zoning and certification open negotiation spaces to increase smallholder participation, namely in newly planted areas
=> how far can policy intervention go towards transforming power structures?

In other countries, smallholder strategy include focusing on niche markets
=> to what extent industrial ethanol offer niche opportunities?

Oleaginous crops to biodiesel

and the family agriculture (PRONAF: 84% of BR farms, 24% of area)

The PNPB and its social seal (SCS), with social inclusion as a central objective

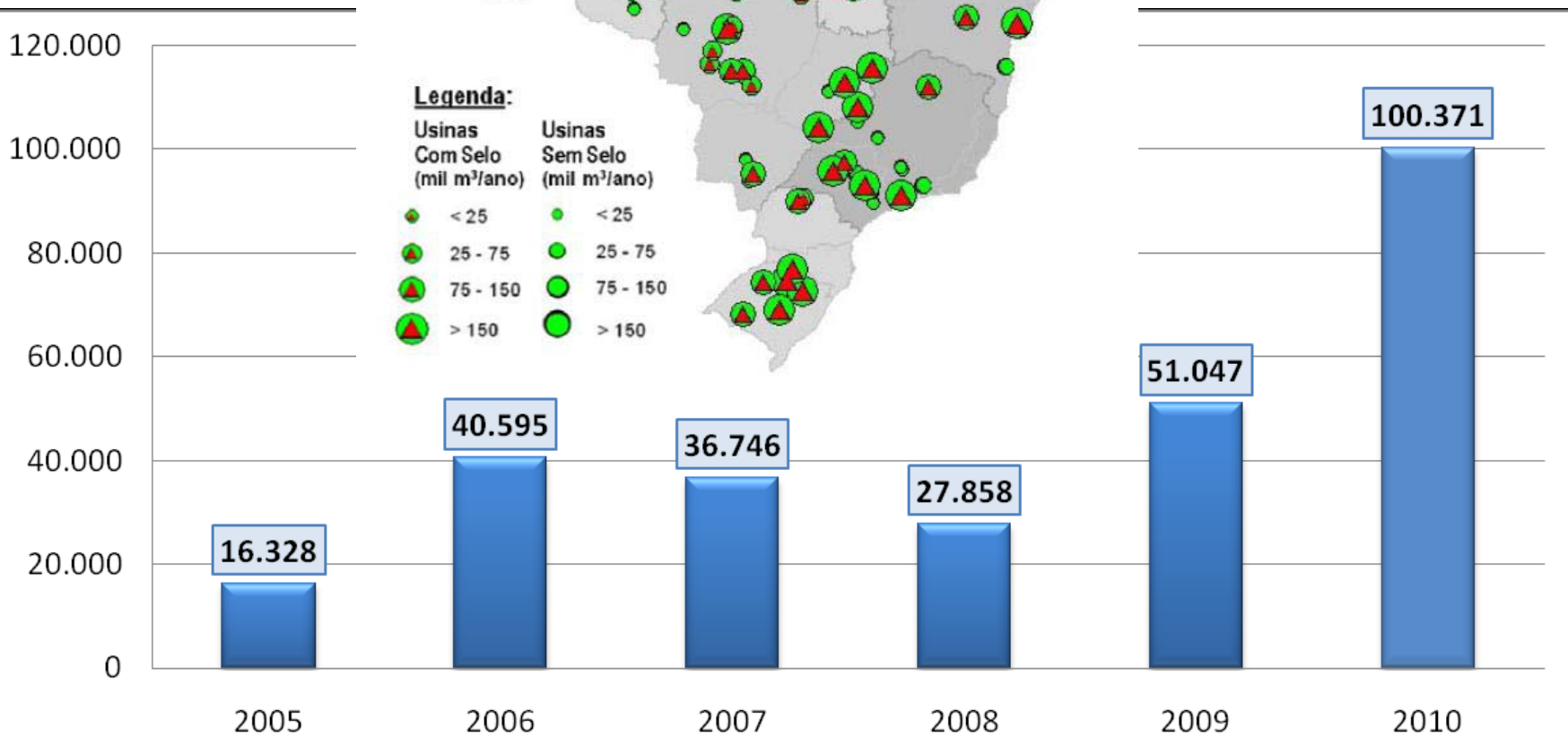
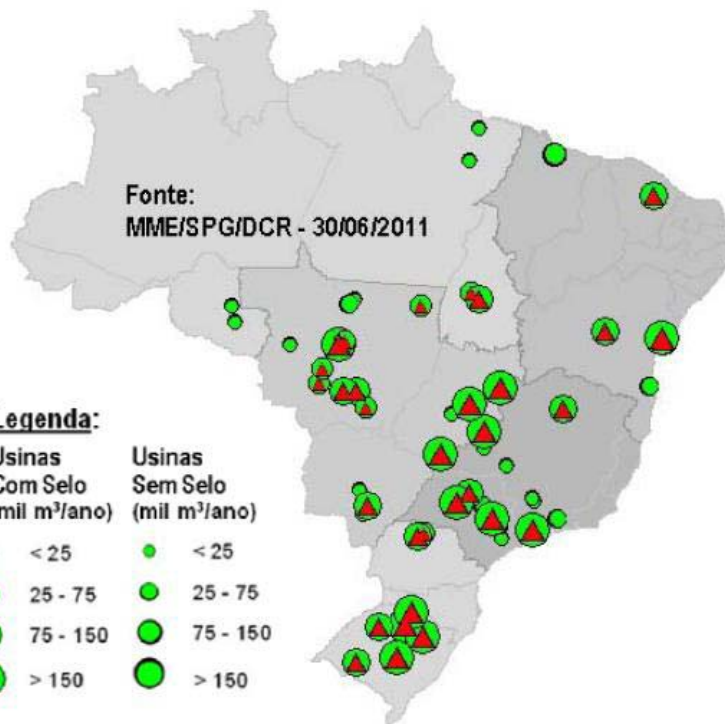
- progressively increasing fuel mandate
- creating a demand to the family agriculture (must represent at least 30 or 15% of oleaginous supply to biodiesel producer for him to get the SCS)
- quarterly auctions with market reserved for buyers with SCS and tax exemptions
- reinforcing organizational capacity (pôlos de biodiesel)

Started in 2005, taking off in 2008. Strong involvement of Petrobras, additionally to Embrapa, BNDES, ANP and 15 ministries

Brazil now produces 2.5 Gt biodiesel, its installed capacity reached 5.8Mm³ in 2011, 82%with SCS

PRONAF families participating to the PNPB

with a growing number of cooperatives (59 in 2010)



Source: Machado, 2012
www.mda.gov.br/saf

Participating family agric. produce soybean

also palm oil, a growing share of castor oil

2008 (representatividade em R\$)



Not the poorest

2010 (representatividade em R\$)



- 94,57% Soja (grão + óleo)
- 4,38% Mamona
- 0,39% Gergelim
- 0,66% Outros

Source: Machado, 2012
www.mda.gov.br/saf

Are smallholders better-off?

(thanks to the oleaginous-to-biodiesel supply-chain)

Oleaginous bought to the FA > R\$ 1billion in 2010, on fragmented markets, still dominated by traditional agents

Smallholders for which castor oil can represent a diversification option have remained

- vulnerable to crises such as the one which affected bean prices
- highly dependent on intermediaries for lack of direct access to the markets

Targeted agriculture in the semi-arid region little reached: insufficient extension services, low productivity

=> further support is required to catch up at many levels

=> need to better account for specific constraints (pedoclimatic, access to credit, organization), risk aversion and priorities

Eucalyptus-to-charcoal

the *fomento florestal* schemes

Importance of charcoal in the energy matrix, for the steel industry

Against unsustainable trends (deforestation, “green deserts”)

Several *fomento florestal* programmes, also including the pulp-and-paper industry

- Public: IEF + ASIFLOR
- Private: outgrower scheme

The success of the *fomento florestal* programme financed by the steel industry is largely determined by the ability of the programme to provide charcoal at a competitive price

Average cultivation costs and harvest cost

Morello, 2009

Modality	Large Scale integrated	Firm-based <i>fomento</i>	ASIFLOR's <i>fomento</i>
Cultivation cost (R\$/ha)	4,748.28	5,383.82	2,776.76
Harvest cost (R\$/m³B)		15.96	

Can smallholders production be competitive?

In the Eucalyptus-to-charcoal supply-chain

Final wood prices depend

- on the required investment for each hectare of plantation and the plantation yield,
- on the way this investment is financed (because of the cost of credit)
- on the transportation costs (because of the distances separating the smallholder plantations from the large firm's charcoal production unit).

=> The fomento florestal programme can be successful in integrating smallholders, under the conditions

- that they are not so small (at least 30ha to put in plantation, implying an exploitation of more than 80 hectares) and
- that production costs can be kept low in areas close enough to the installations where the biomass will be processed

Economic radius, 10% of cultivation cost credit-financed, regions of Minas Gerais

Region Name	Maximum feasible radius ^a		Region Name	Maximum feasible radius
Noroeste de Minas	Not feasible	<- Industrial firm ASIFLOR ->	Noroeste de Minas	44
Norte de Minas	Not feasible		Norte de Minas	48
Jequitinhonha	Not feasible		Jequitinhonha	41
Vale do Mucuri	Not feasible		Vale do Mucuri	64
Triângulo Mineiro/Alto Paranaíba	19		Triângulo Mineiro/Alto Paranaíba	97
Metropolitana de Belo Horizonte	Not feasible		Metropolitana de Belo Horizonte	42
Vale do Rio Doce	Not feasible		Vale do Rio Doce	19
Sul/Sudoeste de Minas	28		Sul/Sudoeste de Minas	104
Zona da Mata	Not feasible		Zona da Mata	Not feasible

Synthesis and conclusions

learning from Brazil

Who are the smallholders?

What is the main purpose of their participation?

To what extent are they better-off thanks to bioenergy development?

What is missing for a better inclusion?

What are the alternatives?

	SUGARCANE-TO-ETHANOL	OLEAGINOUS-TO-BIODIESEL	EUCALYPTUS-TO-CHARCOAL
WHO?	Owner of land apt to mechanization and sugarcane suppliers in the neighbourhood of ethanol plants	Family agriculture that can diversify their activity (enough workforce and land)	Land owner > 80ha with good transport infrastructure
WHAT FOR?	Expand sugarcane supply within limited radius	Social inclusion	Reforestation and wood production
BENEFITS?	Income, possibility to disengage from production	New market, complementarily with staple crops Access to inputs	Income even if lack of workforce (retired hh) Access to credit
MISSING?	Human capital development	Extension service Environmental considerations (soil quality)	Environmental considerations (biodiversity, water...)
ALTERNATIVES	?	?	?

Thank you

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