Brazil-EU Workshop:
Coordinated Call on
Advanced Biofuels

FAPESP
FUNDAÇÃO DE AMPARO À PESQUISA DO ESTADO DE SÃO PAULO

Applied Research to Biomass Production, Logistics, and Feedstock Diversification

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Recent studies on feedstock for sustainable bioenergy

Summarizing

- **Brazil has excellent conditions to produce biomass for bioenergy**
- **Most favorable feedstock:**
  - **Sugar crops: sugarcane**
  - **Oil crops: soybean**
  - **Cellulose crops: eucalyptus**
- **Gaps and Barriers discussed:**
  - **Costs, production technologies, logistics, environmental & social impacts**

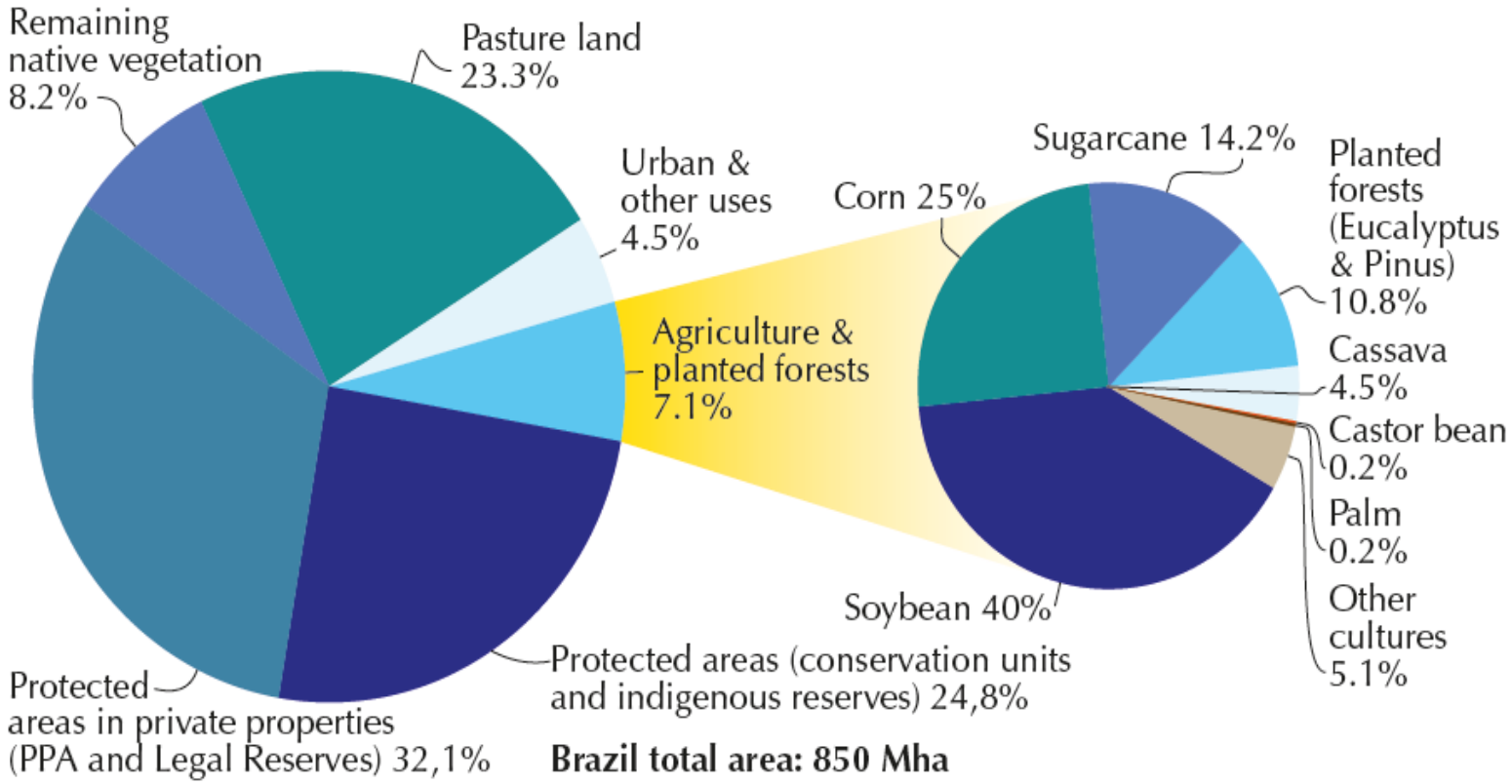
Cantarella et al, (2015)

Environmental Development

journal homepage: www.elsevier.com/locate/envdev

Cortez et al, (2015)

Land use in Brazil: only 7.1% with agriculture and planted forests



Planted areas (Mha): soybean 27; corn 15, Sugarcane 8.5; Eucalyptus+Pinus 6.5

Cortez et al, 2014

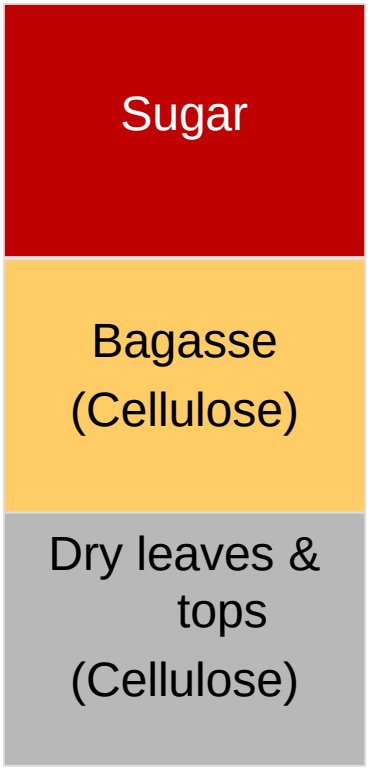
Potential feedstock for bioenergy in Brazil: energy balance and GHG savings

Feedstock	Planted area	Fresh mass yield	Energy balance	GHG	
				Emission	Saving
	1000 ha	t ha^{-1} yr^{-1}	MJ MJ^{-1} Exported	g CO_2eq MJ^{-1}	% Reduction
Sugarcane	8521	84	8.3	24	71%
Corn	15,018	4.8	–	37–43	56–49%
Cassava	2673	38	2.7	45	46%
Soybeans	24,088	3.1	4.5	50–58	40–31%
Peanut	99	4.2	–	–	–
Castor bean	119	1.5	–	–	–
Palm	109	22	8.7	32–37	62–56%
Eucalyptus (m^3)	4874	40[a]	–	17–22	80–74%
Elephant grass	–	25[b]	7.7	15	82%

Cantarella et al, 2015

Energy content of the sugarcane plant

1 t stalk = 1.2 barrels of oil



- **Sugar → Ethanol**
- **Bagasse → vapor and electricity (1/2 Itaipu)**
- **Leaves and tops→ collect for energy or leave on the field**

Sugarcane harvest residues

8-20 t of harvest material remain in the f

Sugarcane harvest residues

How much sugarcane trash should be left on the soil?

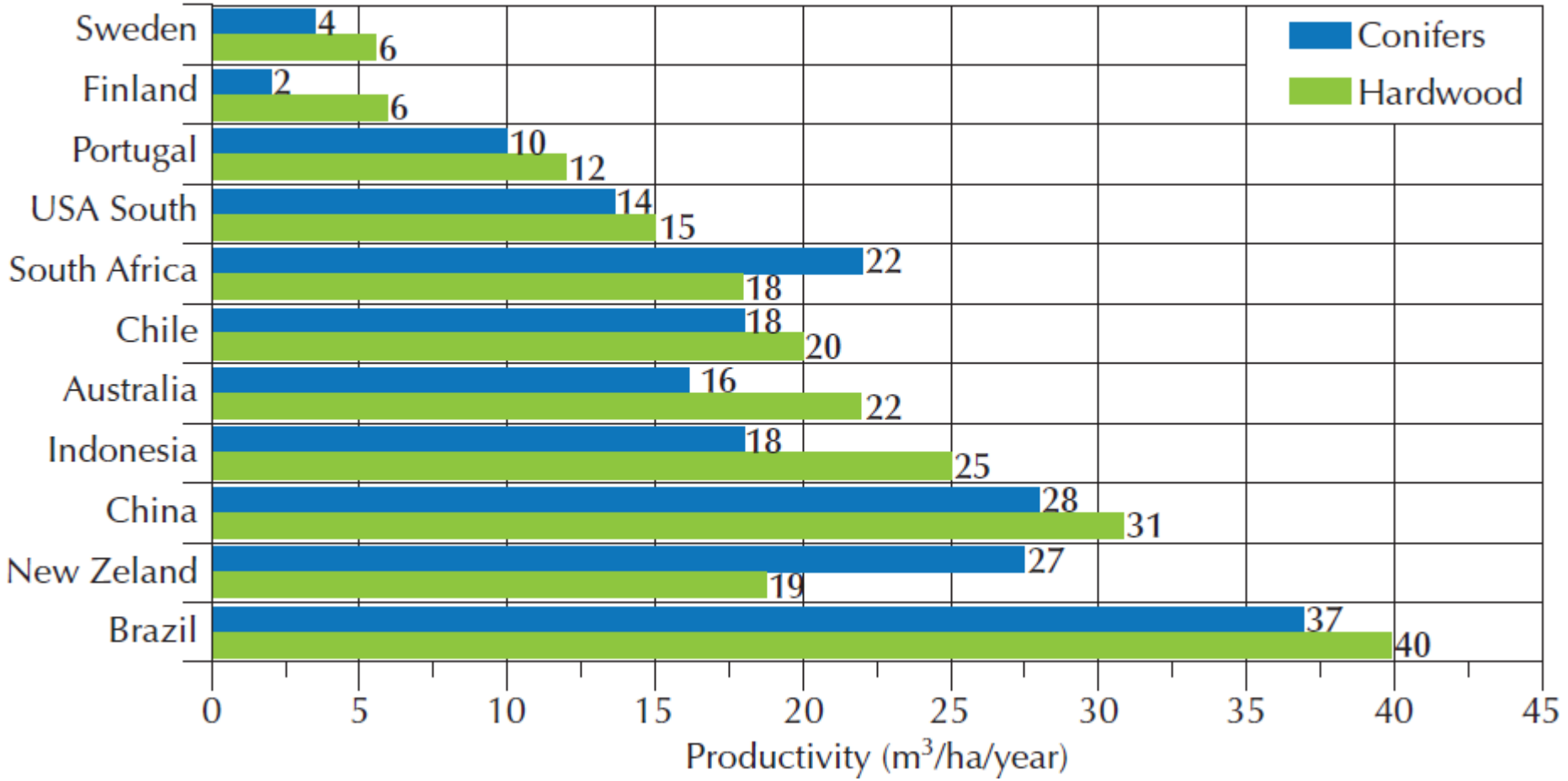
Special number of Scientia Agricola 2013, 70(5)

http://www.scielo.br/scielo.php?script=sci_serial&pid=0103-9016&nrm=iso&rep=&lng=pt

Forests are good option for bioenergy

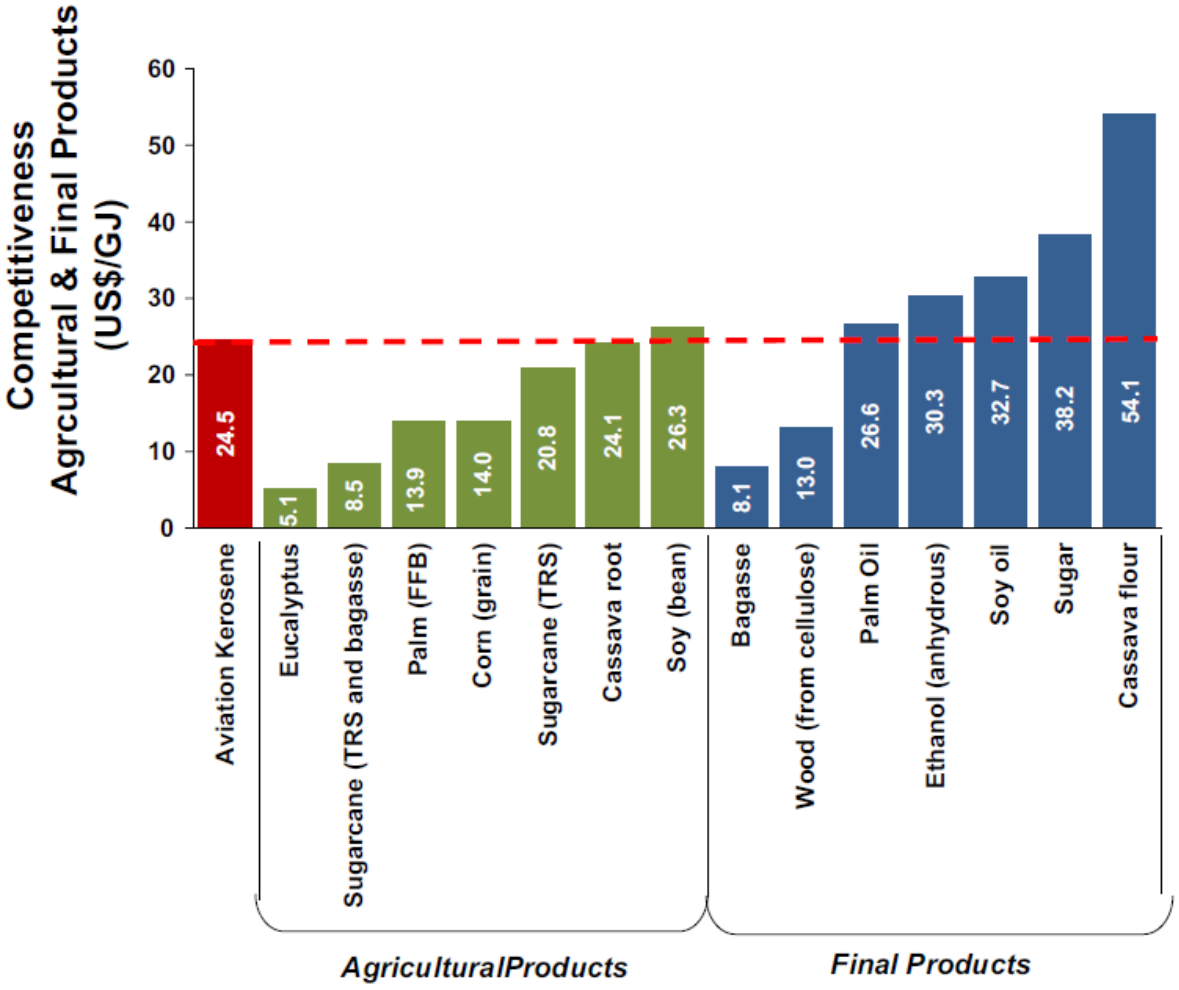
Low soil quality requirements
Good soil cover (protection)
High biomass production
Marginal or degraded land

Yield of planted forests



Cortez et al., 2014

Brazilian Feedstock Competitiveness



Competitiveness Agricultural products: good
Final Products: only for some feedstock

Reference is biofuel for aviation

Cantarella et al, 2015

Feedstock diversification

- **Cellulose**
  - **Bagasse and trash**
  - **Energy cane**
  - **Tropical grasses**
    - **High potential yields > 50 t/ha DM**
    - **Gaps and Limitations:**
      - **Nutrient needs & associated GHGs emissions**
      - **Soil protection (SOM, soil quality & Ecossystem services)**
      - **Logistics**

Feedstock diversification

Oil (non food crops)

Macauba (*Acronomia aculeata*) and other tropical oil palms

- **High potential yields; low water requirement than palm oil. Lack information for large scale cultivation**

- **Jathropha**
  - **Potential but not a domesticated crop (harvest, disease, lack of uniformity)**
- **Camelina**
  - **Adapted to dry climate but low yields; little studies**
- **Algae**
  - **Also far from TRL 3-5**

Feedstock diversification

Urban wastes

- Solid wastes
- Trees and gardening residues
  - Low or negative cost of feedstock
  - Many large urban áreas in Brazil
- Animal fat
  - Feedstock for 14% of the biodiesel in Brazil
- Limitations and Gaps:
  - Logistics and cost of collection and transportation
  - Cost for processing for energy
  - Legislation

Thank you

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