

# Ökobilanz Werkstatt 2011



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20.-22. September 2011

## Land use issues in Brazil due to predicted increase of ethanol use

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# Introduction

- Problem: predicted strong expansion of biofuels in Brazil
- Main reasons:
  - Increase of fleet
  - Intended reduction of oil dependence
  - Promotion of renewable energy
  - Stimulation of agriculture and animal husbandry
- How:
  - Harvested area expansion and construction of more conversion plants
  - Improvement of technology (at farm, conversion, combustion)
  - Potential use of 2nd generation ethanol and H-Bio, besides ethanol and biodiesel

Transport sector:  
48% Diesel fuel  
24% Gasoline  
11% Hydr. Ethanol  
5% Anh. Ethanol  
3% Biodiesel  
9% Others

# Brazil

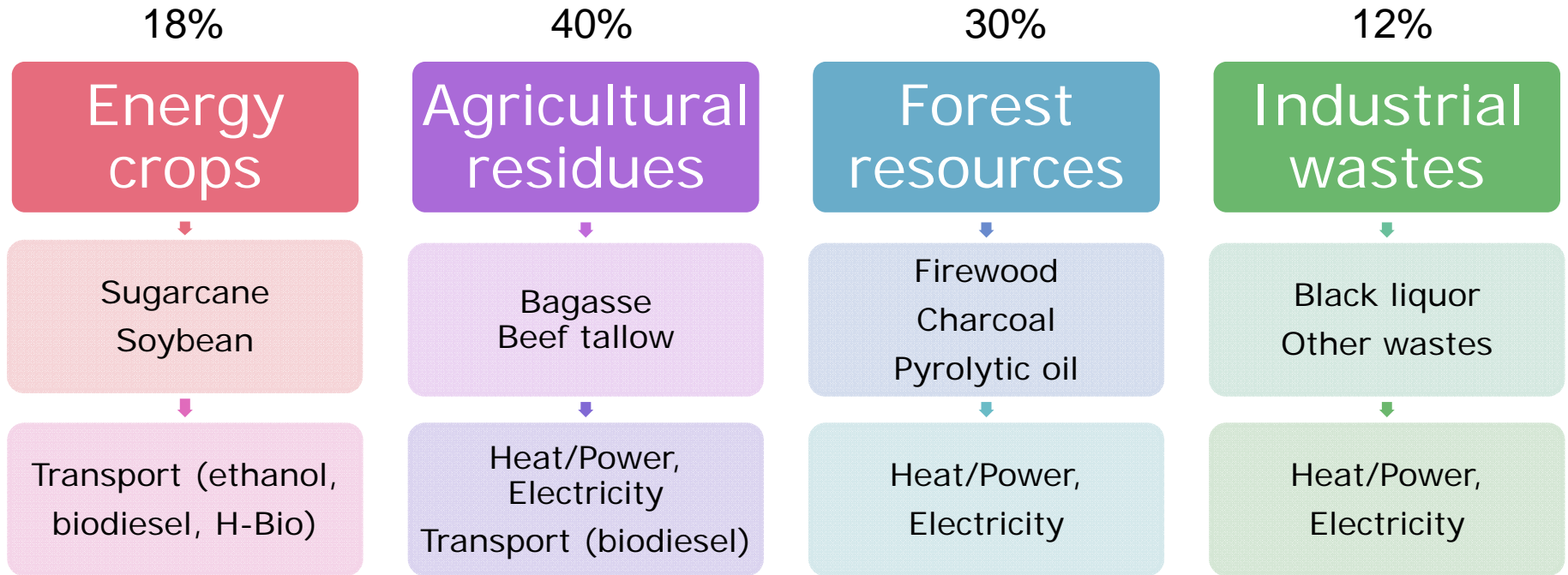


2010	Brazil	Germany	
Land area (km <sup>2</sup> )	8,459,420	348,630	24
Density (inhab. per km <sup>2</sup> )	24	234	1/10
Population (in thousands)	201,103	81,644	2,5
Growth rate (%)	1.2	-0.2	
Total fertility rate (births per woman)	2.2	1.4	
Life expectancy at birth (years)	72	80	
Infant mortality rate (per 1,000 births)	22	4	

US Census  
Bureau, 2011



# Biomass in Brazil



Strong expansion 2010-2030

Biodiesel 10,4% p.a.  
 Ethanol 4,5% p.a.  
 (Brazil 3,5% p.a.)

# Expansion 2010-2030

## ▪ Sugarcane

- Improvement of technology (planting and energy conversion)
- 2nd generation ethanol fuel (from bagasse)
- Use gradually of straw in co-firing (max. 20%)

SUGARCANE	2010	2020	2030
Area (10 <sup>6</sup> ha)	6.7	10.6	13.9
Production (10 <sup>6</sup> ton = Tg)			
Total	518	849	1,140
Sugar	32	52	78
<b>Ethanol</b>	<b>19</b>	<b>39</b>	<b>54</b>
Bagasse	70	119	154
Straw	73	119	160

# Expansion 2010-2030

## ▪ Biodiesel

- 70% soybean oil
- 30% beef tallow
- 5% other oils (cotton, palm, peanut, sunflower, chicken, pork, used oil)

## ▪ H-Bio: diesel fuel + oil/fat (max. 20%)

		2010	2020	2030
Biodiesel	(Tg)	2.3	7.3	17.0
H-Bio	(Tg)	1.8	6.4	9.0
Total Oil/Fat (as soybean)	(Tg)	2.1	6.7	14.6

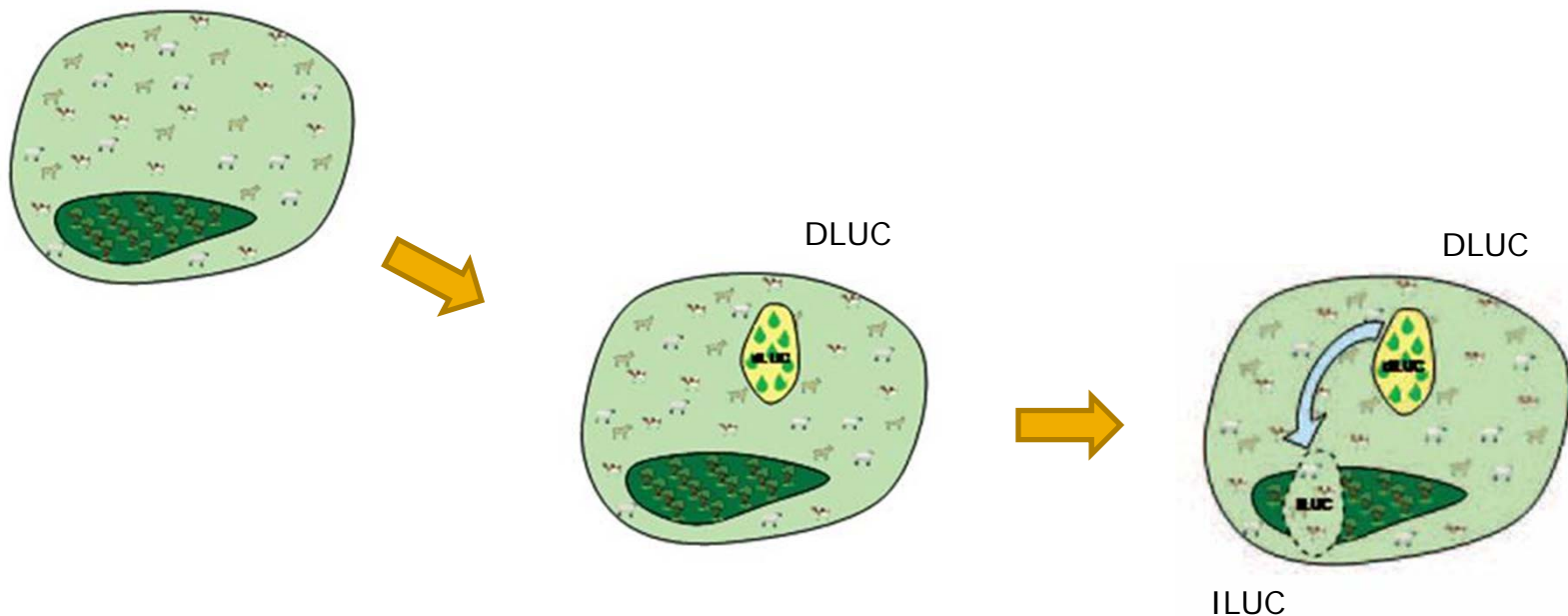




# Land use change

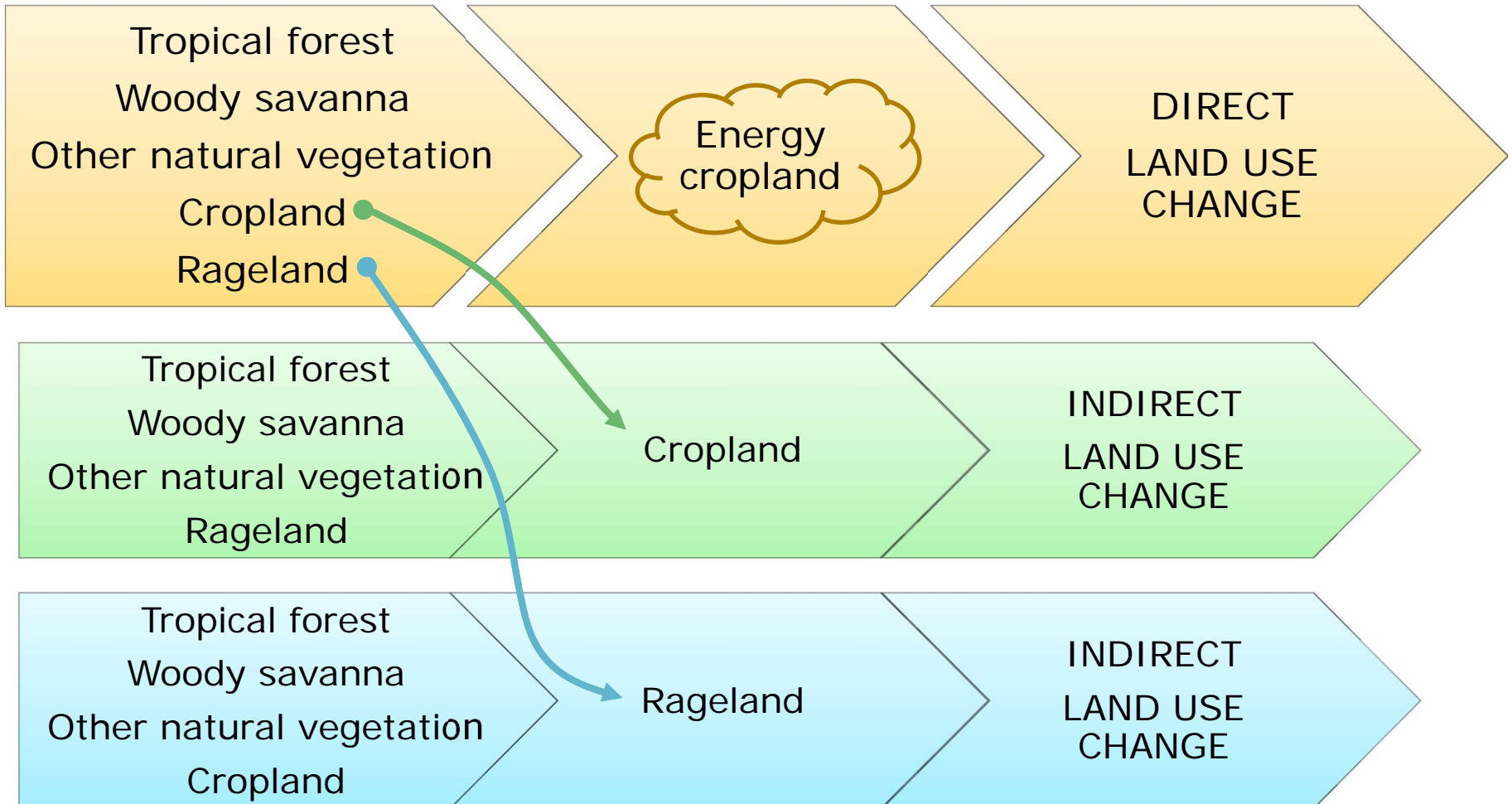
- “Greenhouse gas emissions from human activities which
  - change the way land is used, or
  - affect the amount of biomass in existing biomass stocks.”

LULUCF, 2000



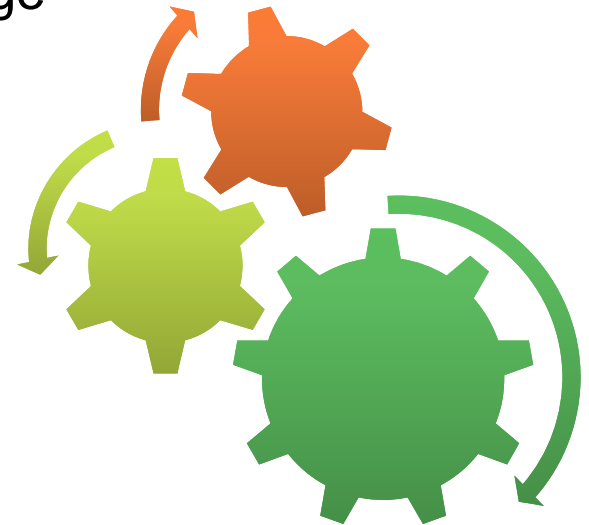
IEA, 2011

# Land use change due to energy crop expansion



# Research Project

- Predicted land use changes caused by energy cropland expansion
  - Time coverage: 2010-2020-2030
- Spatially explicit modelling framework
- Direct land use change + indirect land use change
- Expansion of sugarcane and soybean crops
  - Concurrent fuel vs. food
  - Migration of cattle ranchers
  - Deforestation in Amazon



# Spatially explicit modelling framework



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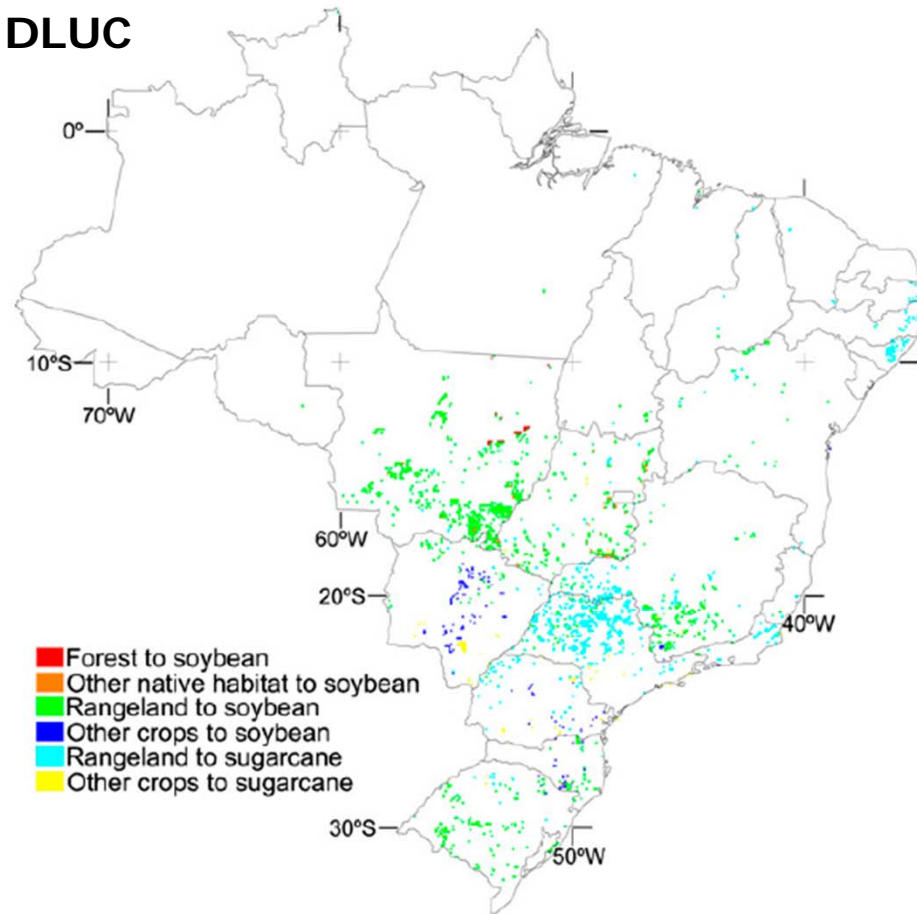
- Central part: LandSHIFT model
  - Reference scenario
    - Potential crop/grassland yield,
    - Altimetry (slope),
    - Road network,
    - Soil fertility
  
- Constraints: preferential occurrence of sugarcane and soybean;  
Proximity to settlements, to cropland and conversion plants

# Uncertainties

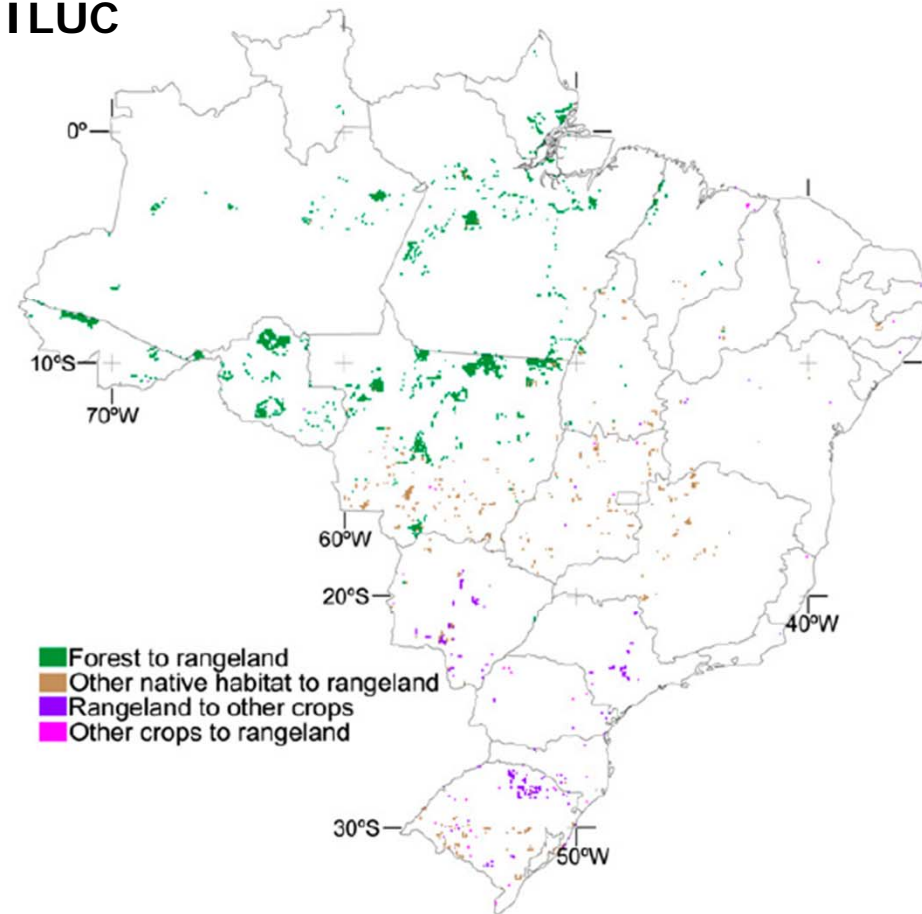
- Demography: pattern of consumption, growing of urban centers,
- Economy: future scenarios, sugarcane as a commodity, reduction of exportation; multiple uses of soybean, expansion of forestation
- Policy: „Forestry code“ in discussion, blending of biodiesel
- Environment: moratorium, global warming changes agriculture
- Bottlenecks: investments in technology, infrastructure

# Scenario 2020 Lapola et al. (2010)

DLUC



ILUC



LAPOLA, 2010

Thank you for your attention