IBEROAMERICAN MINISTERIAL MEETING

Energy Security in the Latin American Region: Renewable Energy as a Viable Alternative"

Round Table 1: *"Overall potential of Biomass and Biofuels in the region: Successful experiences"*

BRAZILIAN BIOFUELS EXPERIENCE

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September 27th, 2006
Montevideo, Uruguay

Outline

- Introduction – The Brazilian Ethanol Program
- Environmental Sustainability of Sugarcane and Alcohol Production
- The Economic Competitiveness of Alcohol Fuel Compared to Gasoline
- Perspectives for the Replication of Brazilian Ethanol Program in Other Developing Countries
- **Conclusions**

Suggestions for replication in other developing countries

- First phase: Macroeconomic feasibility analysis
  - Best crops / costs
  - Countries already producing sugarcane and sugar – potential candidates to alcohol production from sugarcane
  - Production costs evaluation
- Second phase: for the chosen DC´s
  - First phase: Special Policies for local production - consumption
    - Legislation establishing mandatory blend of ethanol to gasoline – 5 to 10% (in volume)
    - Taxes Policy
      - Subsidies for a pre-determinate period
      - Differential taxes for biofuels production and use
  - Second phase: Biofuels export
    - Candidate countries (?) – competitive production costs
    - CDM projects

Barriers in DC's

- Lack of Infrastructure (production and commercialization)
- Lack of Capacity building
- Need for development of a Consumer market
- Few feasibility studies

Perspectives for biofuels trade (2)

- International trade in biofuels: strong barriers still existing
- Need for new approaches and policies:
  - Trade liberalization efforts
  - Kyoto Protocol implementation policies
  - Reduction on GHG emissions.

Perspectives for biofuels trade (1)

- South-North and South-South trade: important for developing countries producing biofuels.
- Biofuel production (Brazil's experience): sustainable production and low production cost.
- Biofuels from developing countries: can be commercialized with developed countries;
- Reduction of carbon emissions from developed countries (Kyoto Protocol).
- Brazilian experience:
  - be repeated in other developing countries
  - allow benefits for developed countries under the Kyoto Protocol.

Perspectives for Developing Countries

- Production of biofuels locally
  - job creation (rural areas)
  - industrial development
  - reduction on oil imports
  - use of degraded lands
- Biofuels exports
  - increase on revenues

Perspectives for Developing Countries

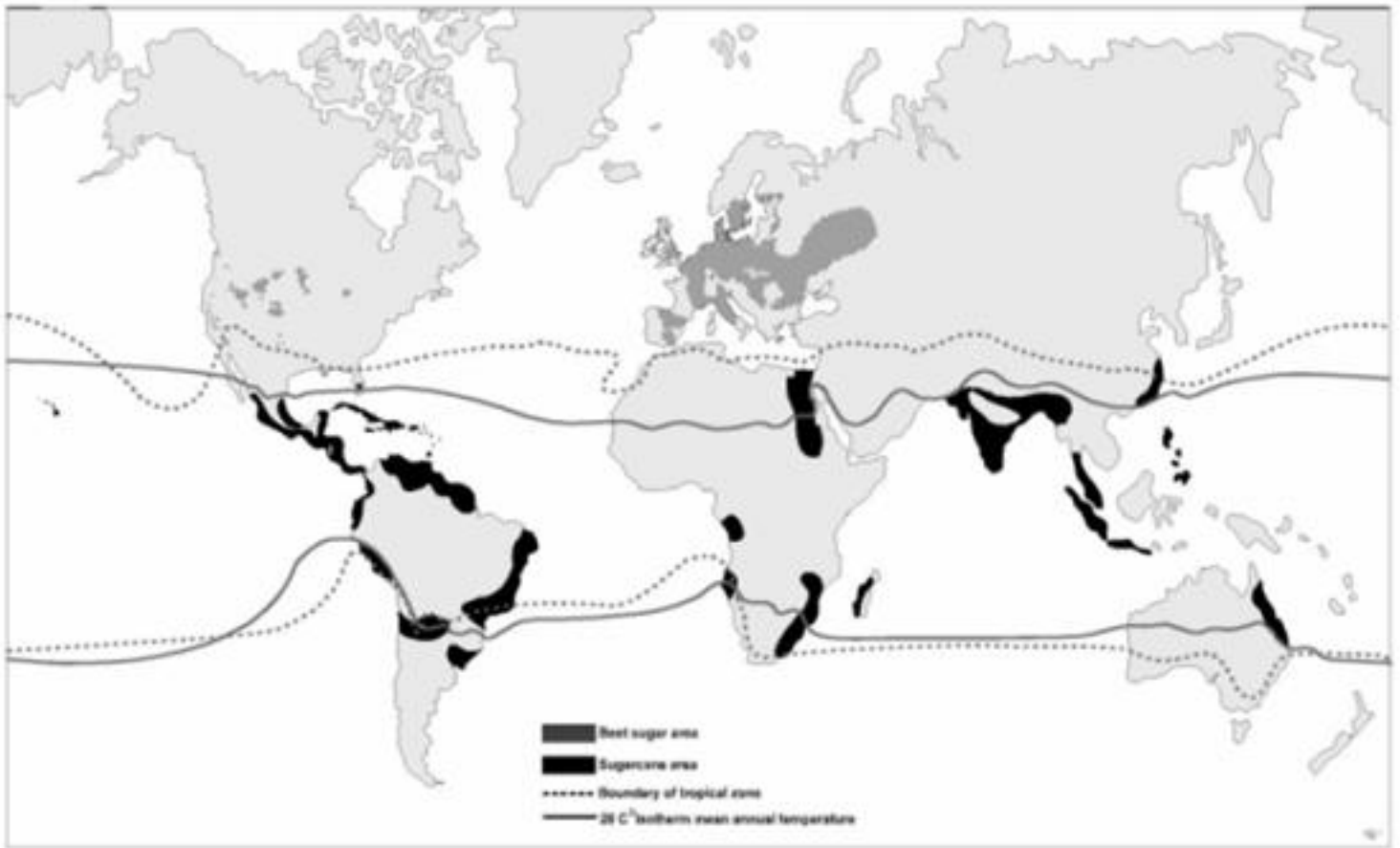


Figure 3.5. Global Distribution of Sugar Beet and Sugarcane Production. Redrawn from Helmut Blume, *Geography of Sugar Cane* (Berlin,1985), 22.

Perspectives for Developed Countries

- Utilization of biofuels produced locally → high production costs
- Import of biofuels from developing countries
- Advantages
  - reduction on Carbon emissions → targets from Kyoto Protocol.
  - Diversification of energy matrix – energy security.

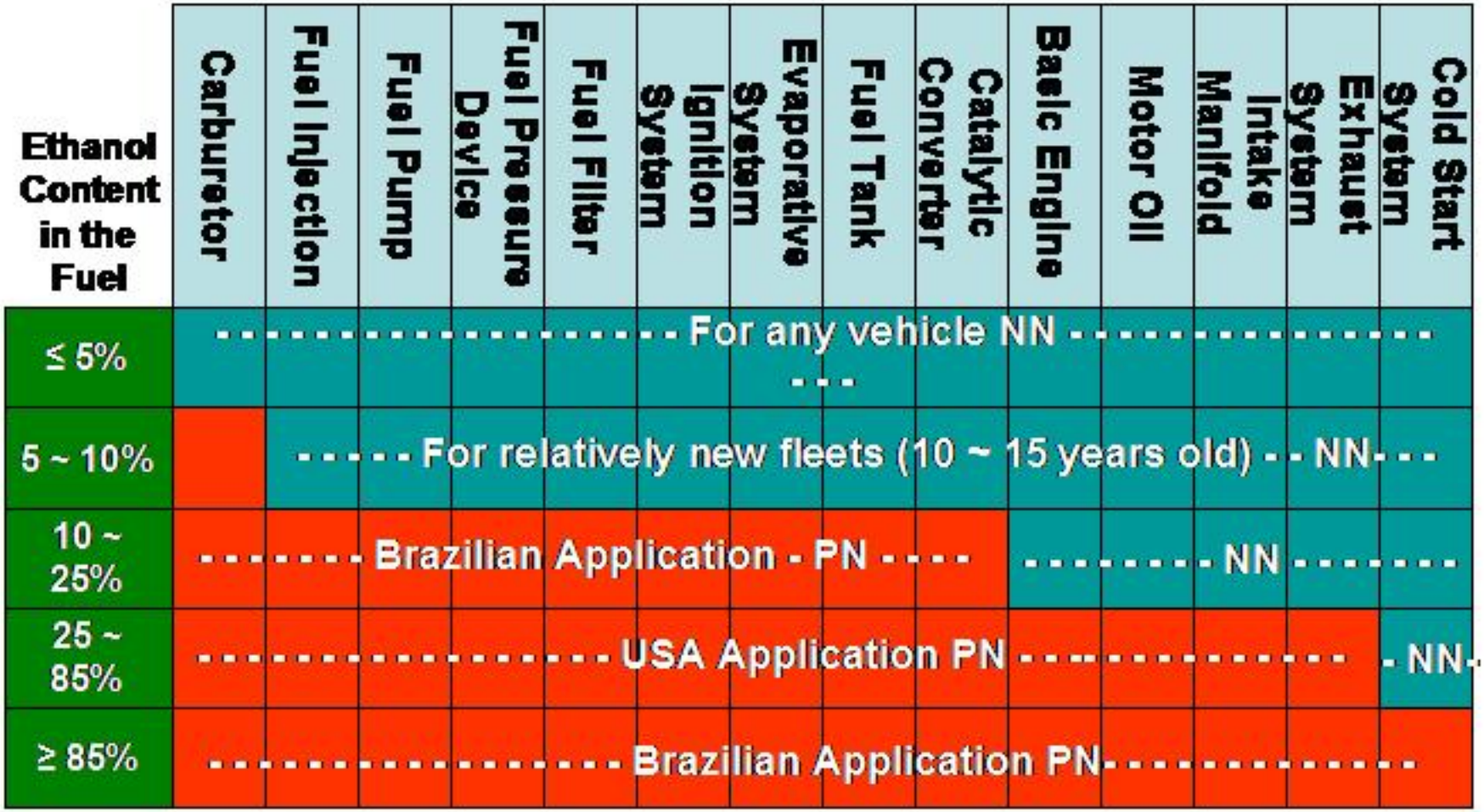
Land use to produce ethanol to be blend to gasoline in 10% (volume basis)

	Unit	World	OECD countries	Non-OECD countries
Gasoline consumption	Billion litres/yr	1165	838	327
Ethanol 10% blend (a)	Billion litres/yr	175	126	49
Sugarcane area necessary for E10	Million ha*	29	21	8
"Suitable" and "very suitable" sugar crops (FAO)	Million ha	383	116	217
All sugar crops (all cultures, FAO)	Million ha	1455	496	959

Source: FAO, 2005[1]
Note: conservatively considered (a) 6,000 liters of ethanol/ha.yr; LHV (gasoline) = 33MJ/liter, LHV (ethanol) = 22 MJ/liter

[1] Source: FAOSTAT (2005)
http://faostat.fao.org/faostat/form?collection=Production.Crops.Primary&Domain=Production&servlet=1&hasbulk=0&version=ed&language=EN

Compatibility of Existing Fleets with Ethanol-gasoline Blend



Source: ANFAVEA, 2005

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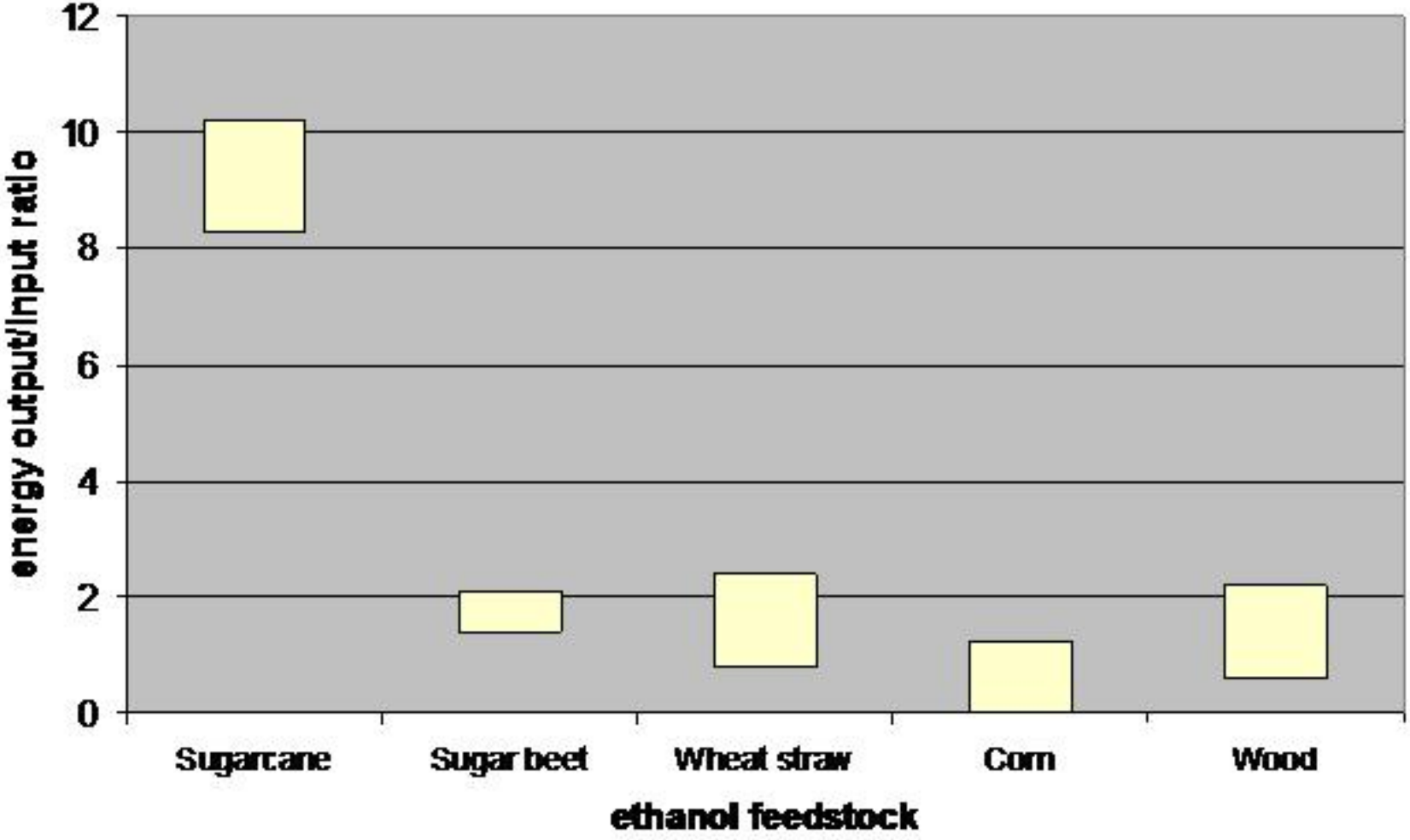
Energy balance of alcohol production from different feedstocks



Sources: (Macedo et alii, 2004; UK DTI, 2003 and USDA, 1995)

Ethanol Energy Balance

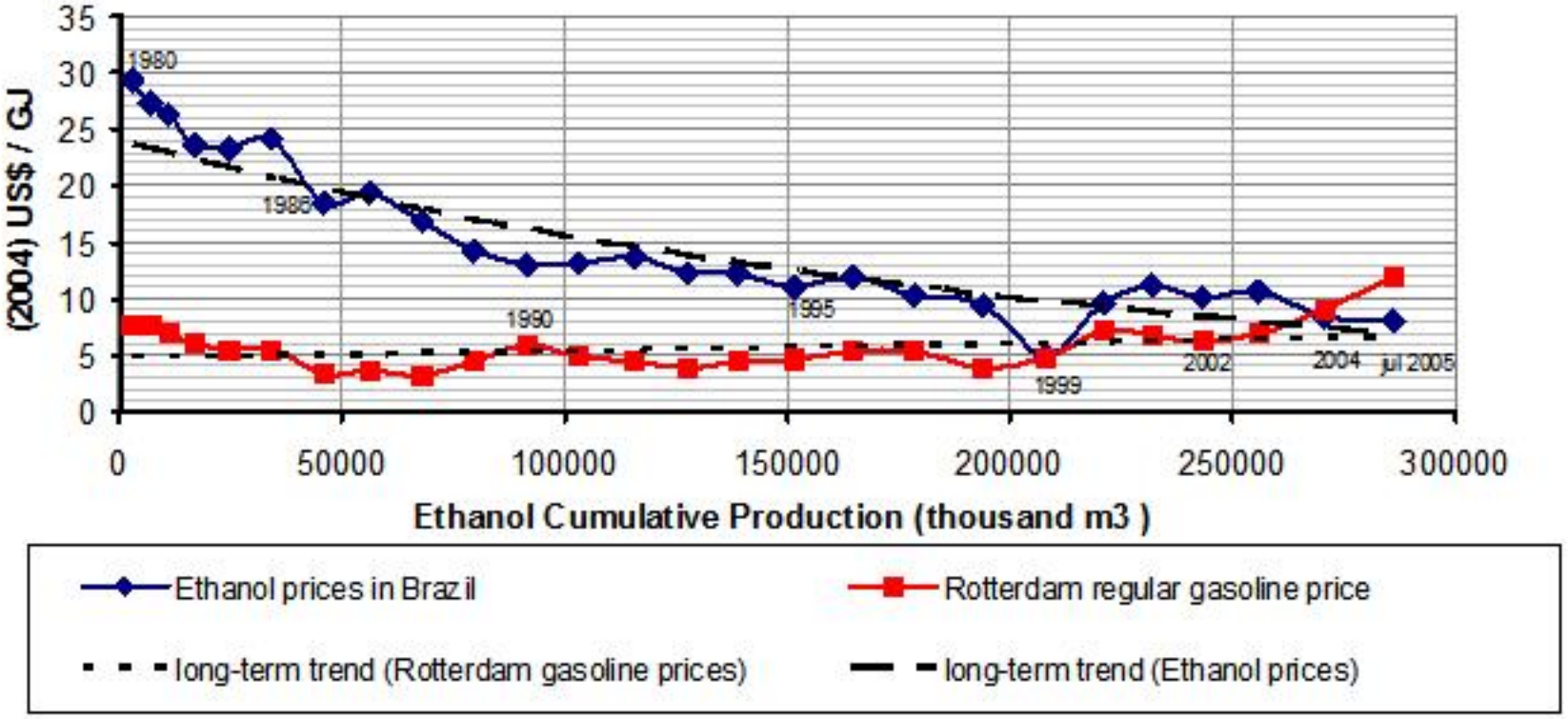
Activity	Energy consumption			
	Scenario 1 (kcal/TC)		Scenario 2 (kcal/TC)	
Sugar cane production (total)	**48,208**		**45,861**	
Agricultural operations	9,097		9,097	
Transportation	10,261		8,720	
Fertilizers	15,890		15,152	
Lime, herbicides, pesticides etc.	4,586		4,586	
Seeds	1,404		1,336	
Equipment	6,970		6,970	
Ethanol production (total)	**11,800**		**9,510**	
Electricity	0		0	
Chemicals, lubricants	1,520		1,520	
Buildings	2,860		2,220	
Equipment	7,420		5,770	
External energy flows	**Input**	**Output**	**Input**	**Output**
Agriculture	48,208	-	45,861	-
Factory	11,800	-	9,510	-
Ethanol produced	-	459,100	-	490,100
Surplus bagasse	-	40,300	-	75,600
Total	**60,008**	**499,400**	**55,371**	**565,700**
Output/input	**8.3**		**10.2**	

Source: Macedo, I et alli, 2004

Ethanol international competitiveness

Ethanol Learning Curve

(Hydrated Ethanol)



Source: Nastari, 2005

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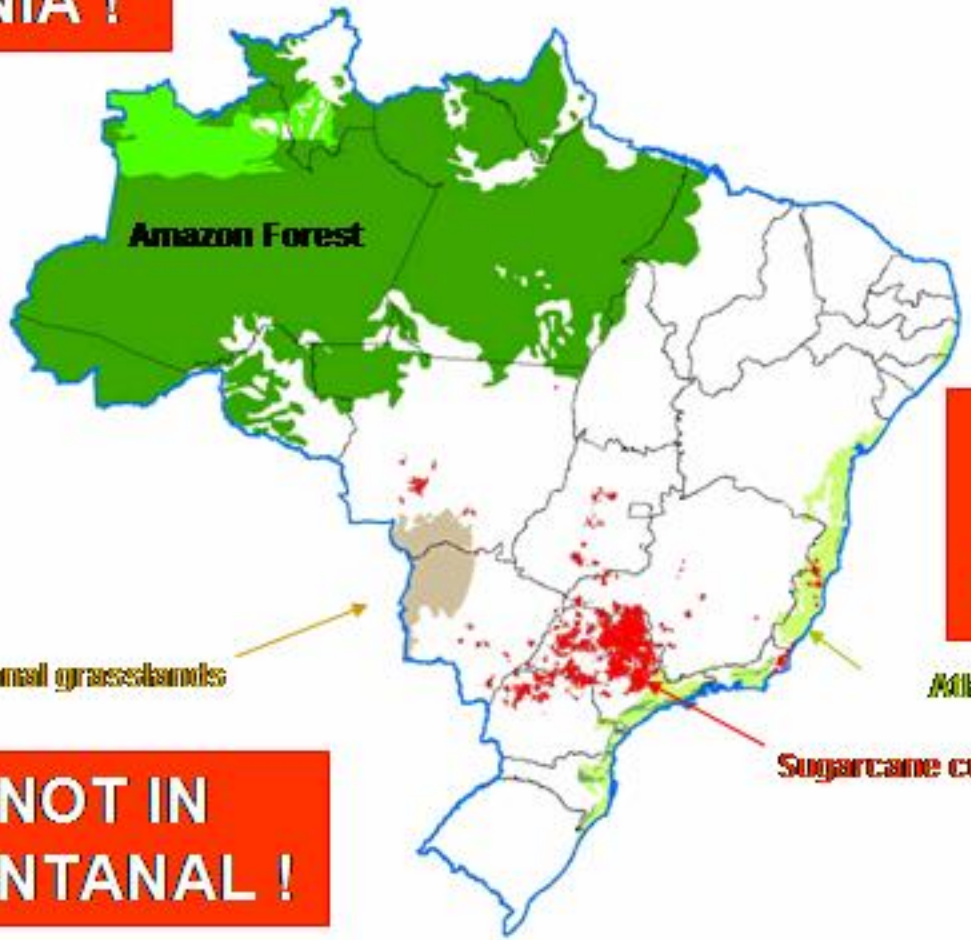
Sugarcane Plantations in Brazil

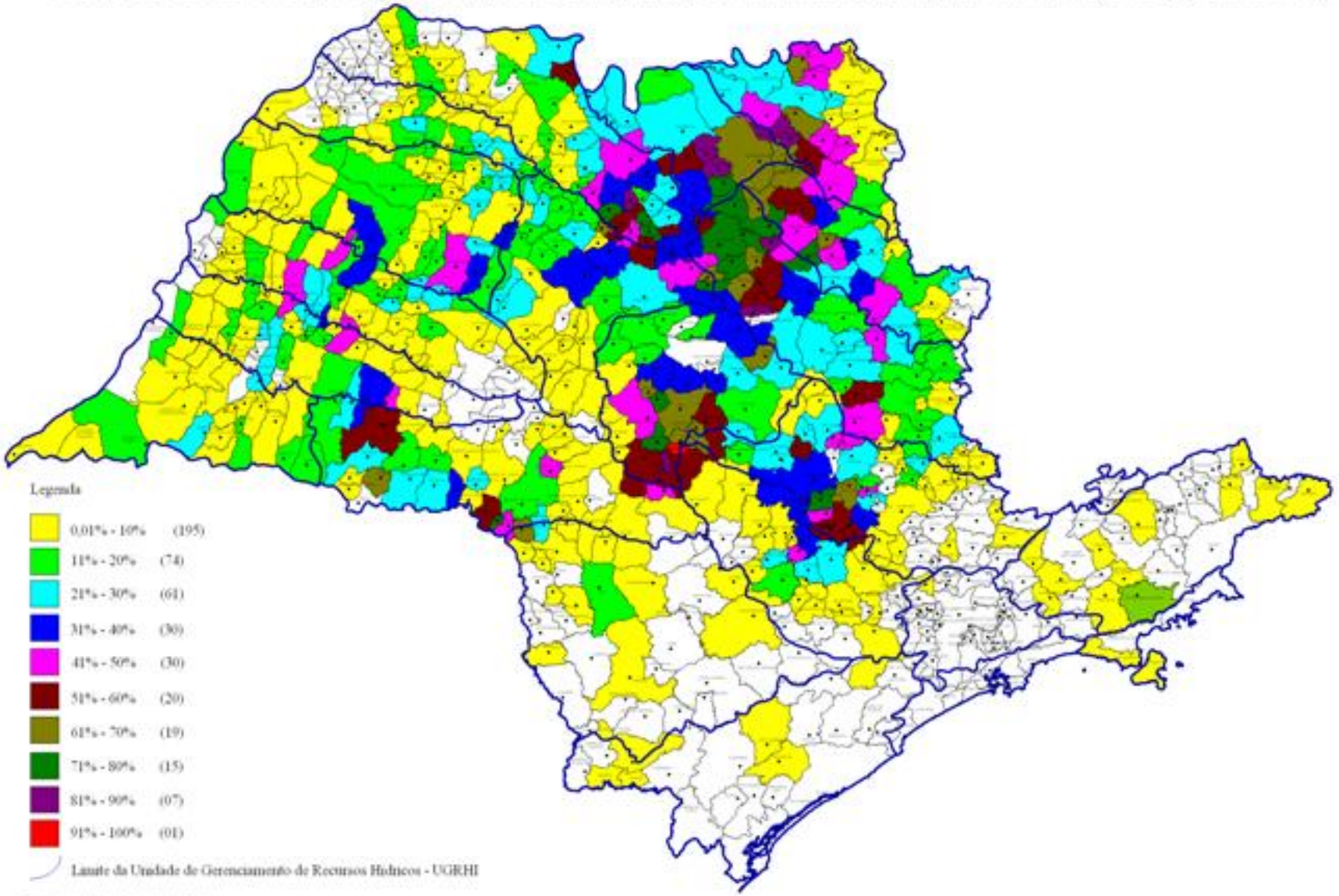
NOT IN AMAZONIA !



NOT IN ATLANTIC RAINFOREST !

NOT IN PANTANAL !

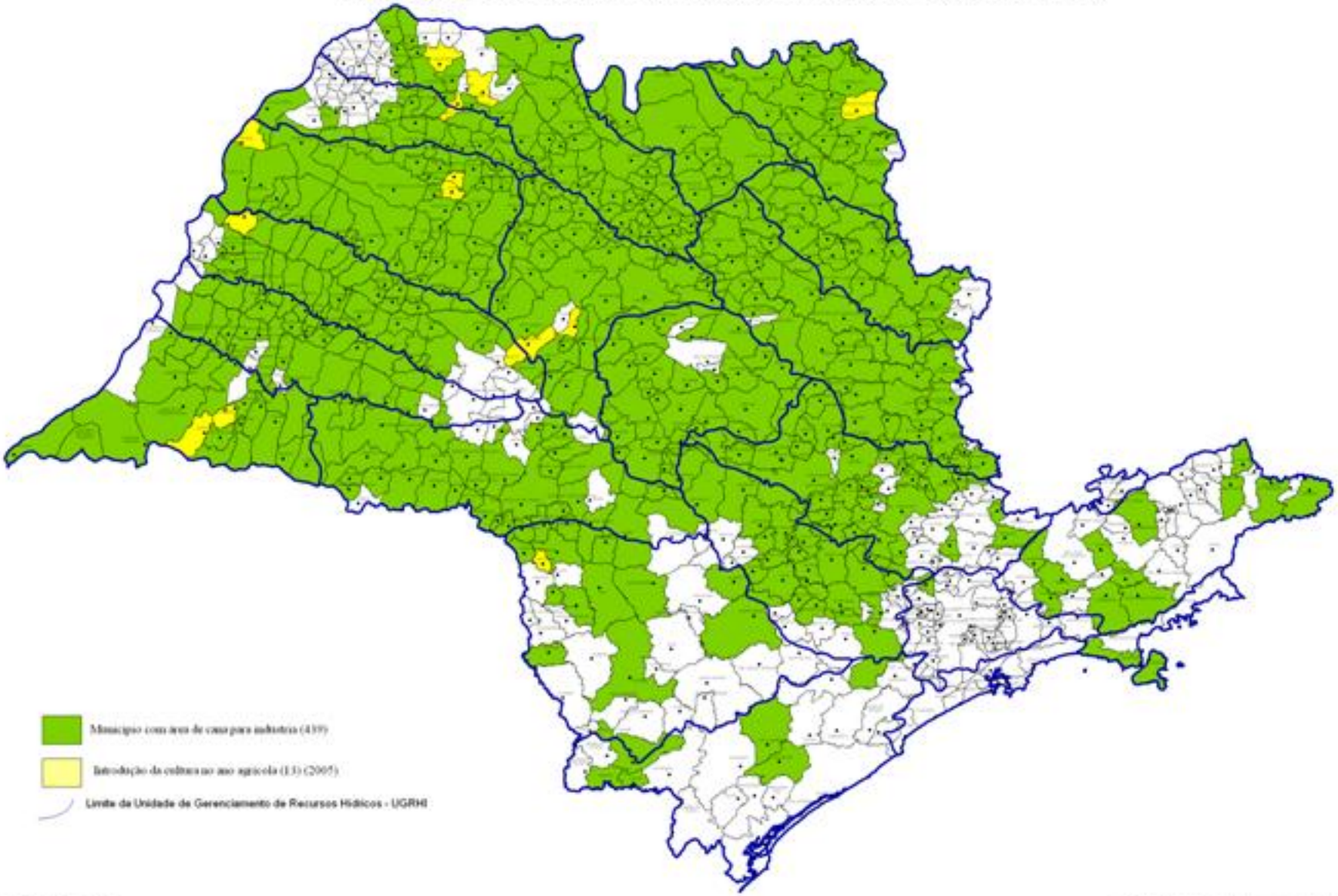
Área territorial municipal e porcentagem de ocupação pela cultura de cana para indústria (Ano agricola 2005)



Fonte: Fundação SEADE , SAA/IEA (2005)
Acesso em 02/05/06 em http://www.saa.sp.gov.br

CPLEA/DGIDA/DIVISÃO DE GEOPROCESSAMENTO

Municípios com área de cana para indústria (Ano Agricola 2005)



Fonte: SAA/IEA (2005)

CPLEA/DSD/AD/DIVISÃO DE GEOPROCESSAMENTO

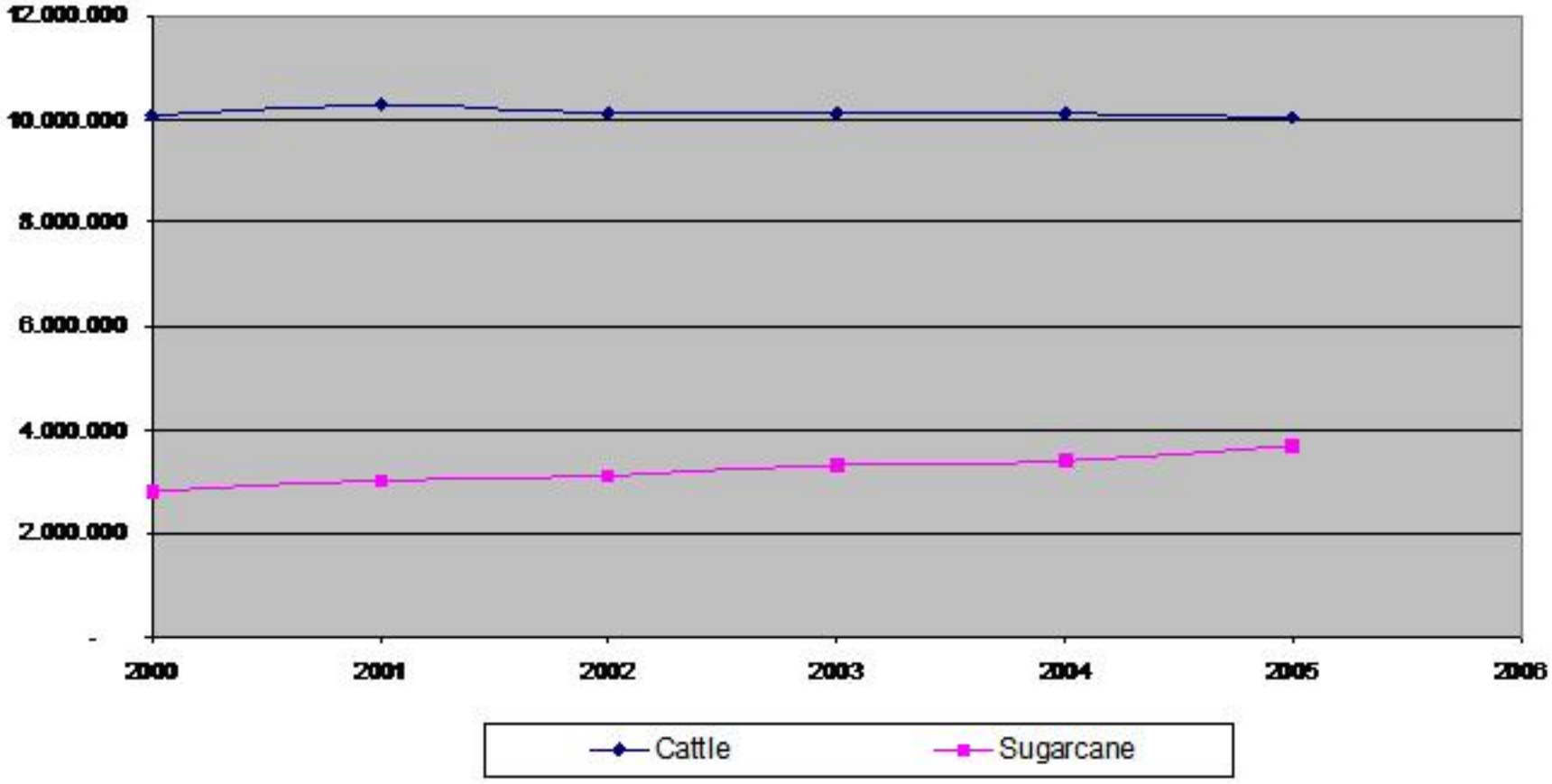
Cattle: Evolution in São Paulo State

	2001	2002	2003	2004	2005
Cattle (heads)	**13,154,649**	**13,457,460**	**13,764,772**	**13,773,913**	**14,072,447**
Pasture (hectares)	**10,288,887**	**10,102,539**	**10,107,540**	**10,118,143**	**10,010,491**
Density (heads of cattle/hectare)	1.28	1.33	1.36	1.36	1.41

Trend to more intensive cattle-breeding

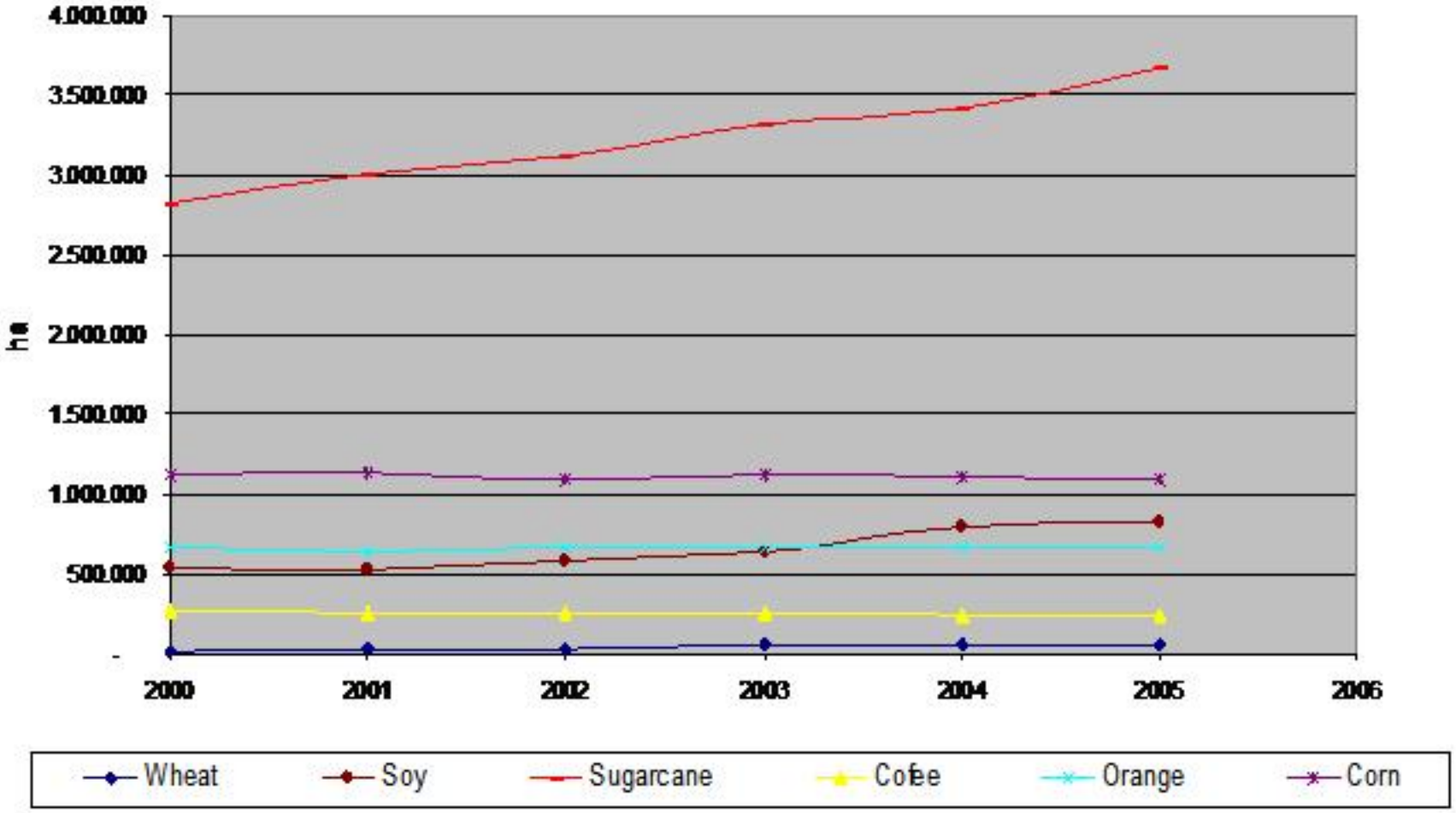
Source: São Paulo State Agriculture Secretary Database (www.iea.sp.gov.br)

Sugarcane Expansion (2)



Source: São Paulo State Agriculture Secretary Database (www.iea.sp.gov.br)

Sugarcane Expansion (1)



Source: São Paulo State Agriculture Secretariat-Database (www.iea.sp.gov.br)

Land Use in São Paulo State

Annual cultures (corn, soybean etc)	12.3%
Perennial cultures (orange, coffee etc)	5.2%
Semi-perennial cultures (sugarcane)	17.5%
SUB-TOTAL CULTURES	**34.9%**
Natural forests	14.2%
Reforesting	5.0%
SUB-TOTAL FORESTS	**19.2%**
Pastures	45.9%
TOTAL	**100.0%**

Source: São Paulo State Agriculture Secretary Database (www.iea.sp.gov.br)

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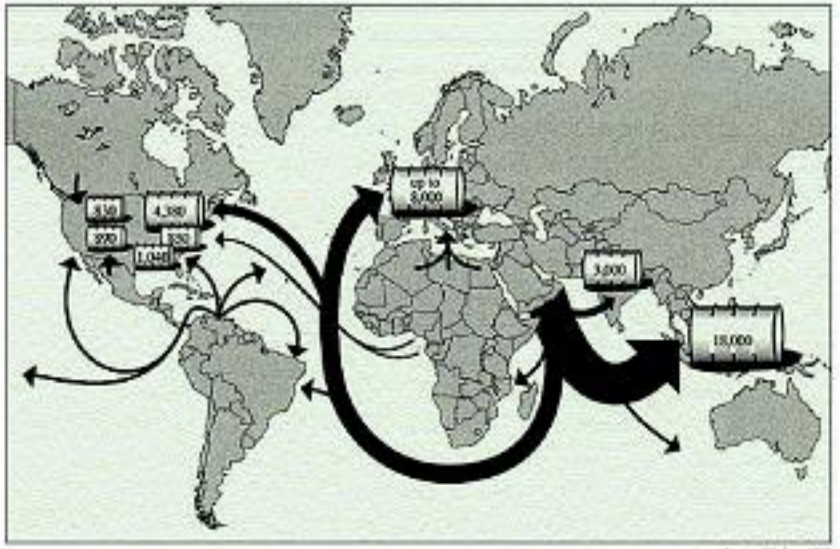
Main Advantagens of Biofuels

- To enhance diversity in energy supply markets and security of supply - they do not require imports of fossil fuels.

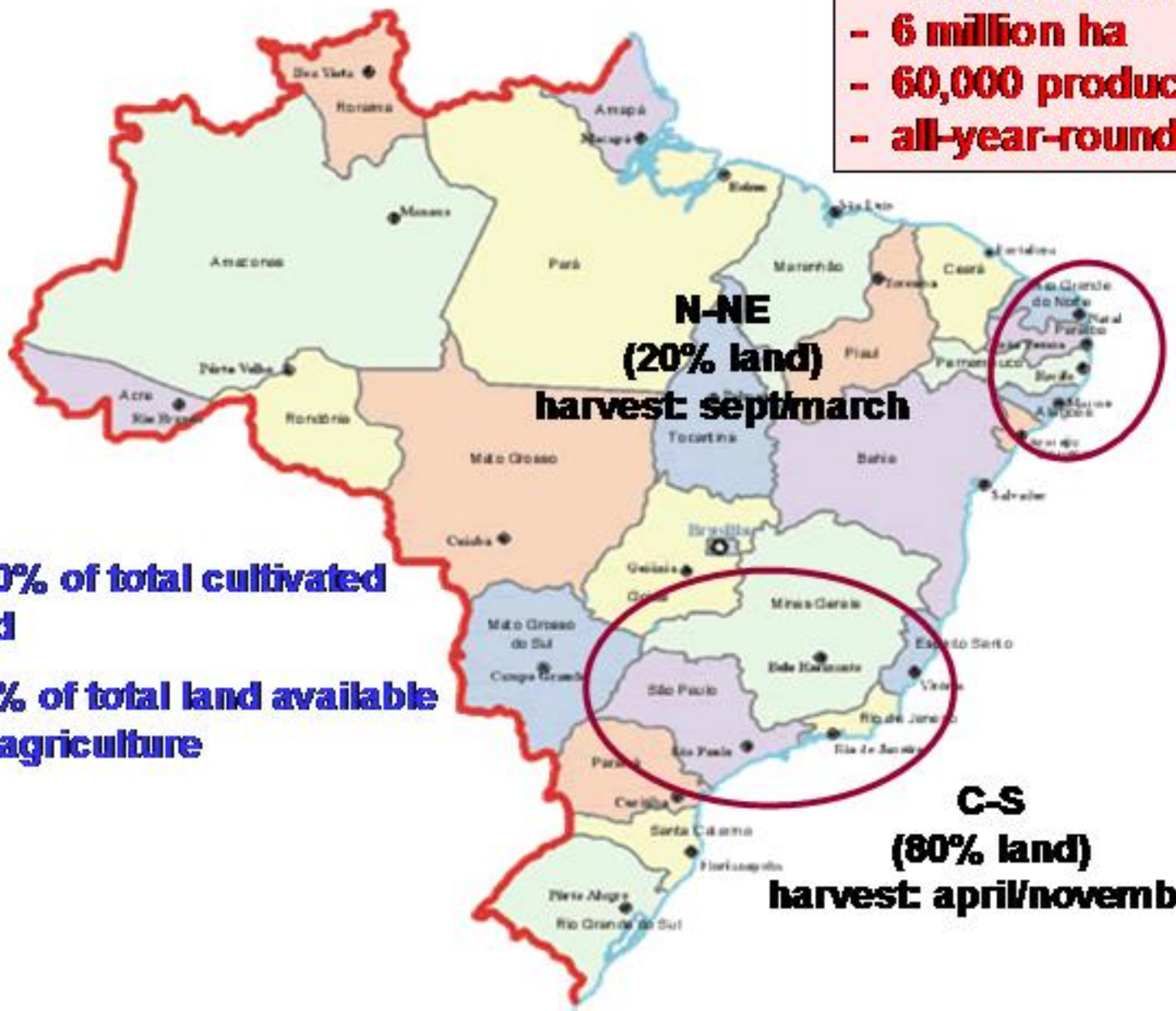


Oil flows throughout the world.
Source: UNDP, UNDESA, WEC, 2002

- To reduce GHG emissions – climate change benefits

Brazil

SUGAR CANE
- 6 million ha
- 60,000 producers
- all-year-round harvest

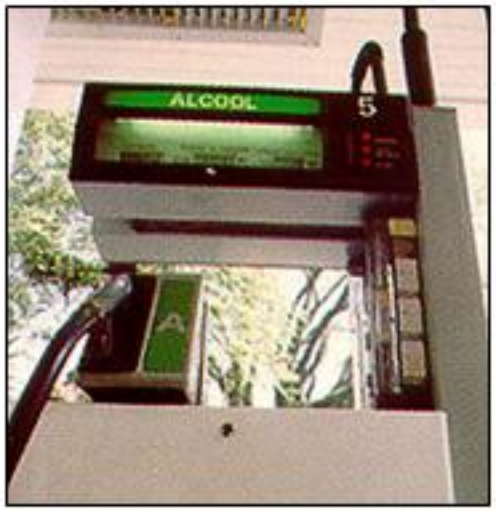


~ 10% of total cultivated land

~ 1% of total land available for agriculture

Introduction - The Brazilian Alcohol Program

- The world largest commercial program on biomass
- Started in 1975 by Federal Government
- Decision from Brazilian Federal Government to produce ethanol in addition to sugar (from sugarcane): objective of reducing petroleum imports (Gulf War).
- High-octane fuel in vehicles, replacing lead and/or MTBE.
- 4,000,000 cars running on pure (hydrated) ethanol in Brazil
- 1,500,000 flex-fuel vehicles (both ethanol and gasoline, any blend)



- all gasoline blended with (anhydrous) ethanol: 20 to 26% of ethanol in volume basis – gasohol
- Nowadays - economically competitive to gasoline

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Conclusions

Biofuels offer an unique win-win opportunity to, simultaneously, enhance exports from developing countries, promote rural development and poverty alleviation, diversify the range of energy sources and reduce oil reliance, meet Kyoto Protocol reduction targets and promote real new investment through the Clean Development Mechanism.