

Environmental Protection Agency

Workshop on Lifecycle Greenhouse Gas Analysis for the Proposed Revisions to the National Renewable Fuels Standard Program

Analysis of Greenhouse Gas Emissions from Land User Change A Closer Look on Brazil

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Washington
11 June 2009

ILUC Emissions: Three Topics

- Projections on land allocation (CARD/FAPRI) at a national level (out of US)
 - Sugarcane: control case minus imports only case
- Per acre emission factors (Winrock International)
 - Step one – step two approach
 - One shot emission in the year zero
- Calculation of total emissions
 - Net expansion in total agricultural land times per acre emissions
 - 100 year period

Projections on Land Allocation (Brazilian Land Use Model)

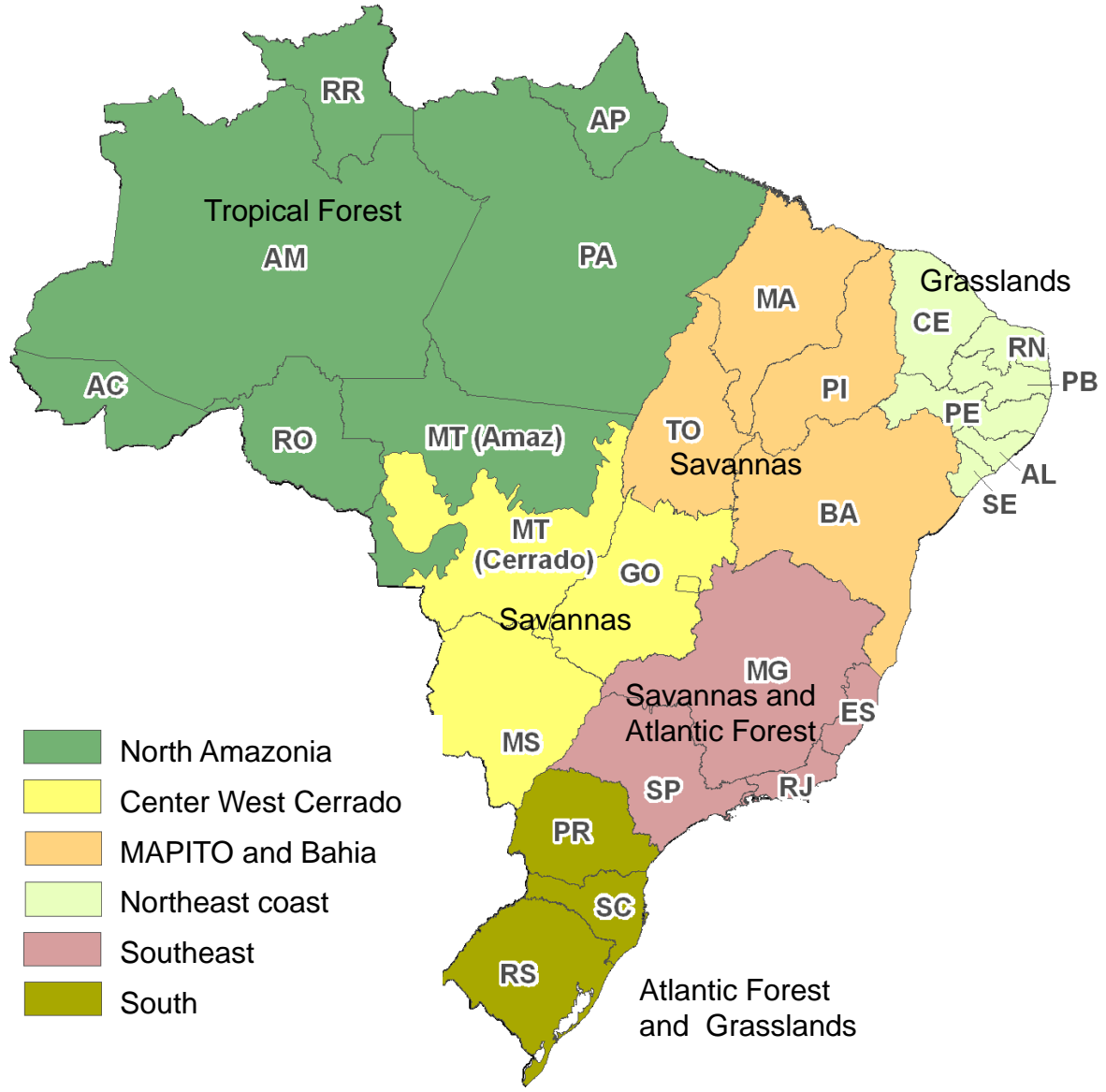
Outputs from CARD/FAPRI model:

- National harvested area: wheat, cotton, corn, barley, soybean, rice and sugarcane.
- Total agricultural land expansion is used for emissions calculations.
- Types of land displaced by the expansion of ag land are not identified.

Improvements to be made:

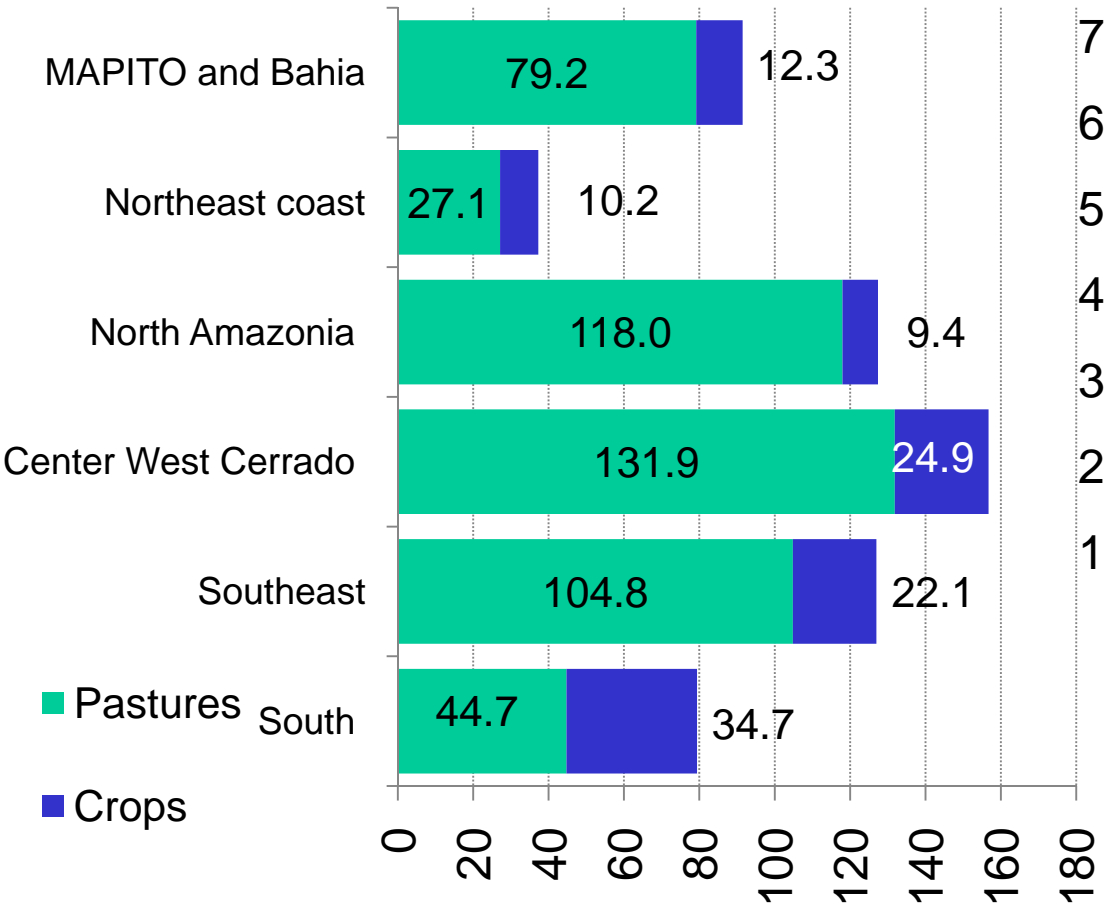
- Regionalize the country:
 - Emissions factors can be connected directly to the results.
- Project pasture land endogenously:
 - Capture pasture intensification due to competition with crops.
- Separate winter (wheat) and second crops (corn) from the land use analysis.
- Include regional land availability taking into account:
 - Legal restrictions;
 - Suitability.

Macro-Regions Used in the Brazilian Land Use Model



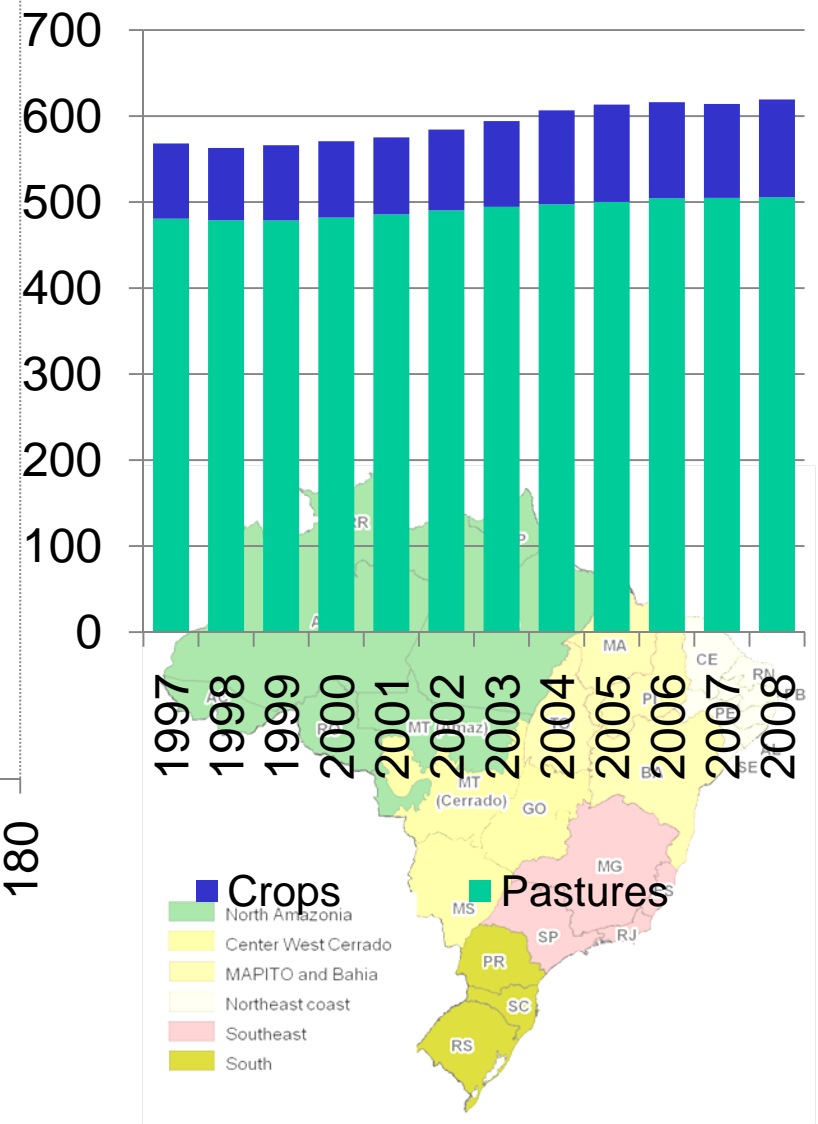
Brazil: Land Allocated to Agriculture According to the BLUM Regions (million acres)

Macro-regions, 2008



Crops: Soybean, Corn (1st crop), rice, cotton, dry bean and sugarcane

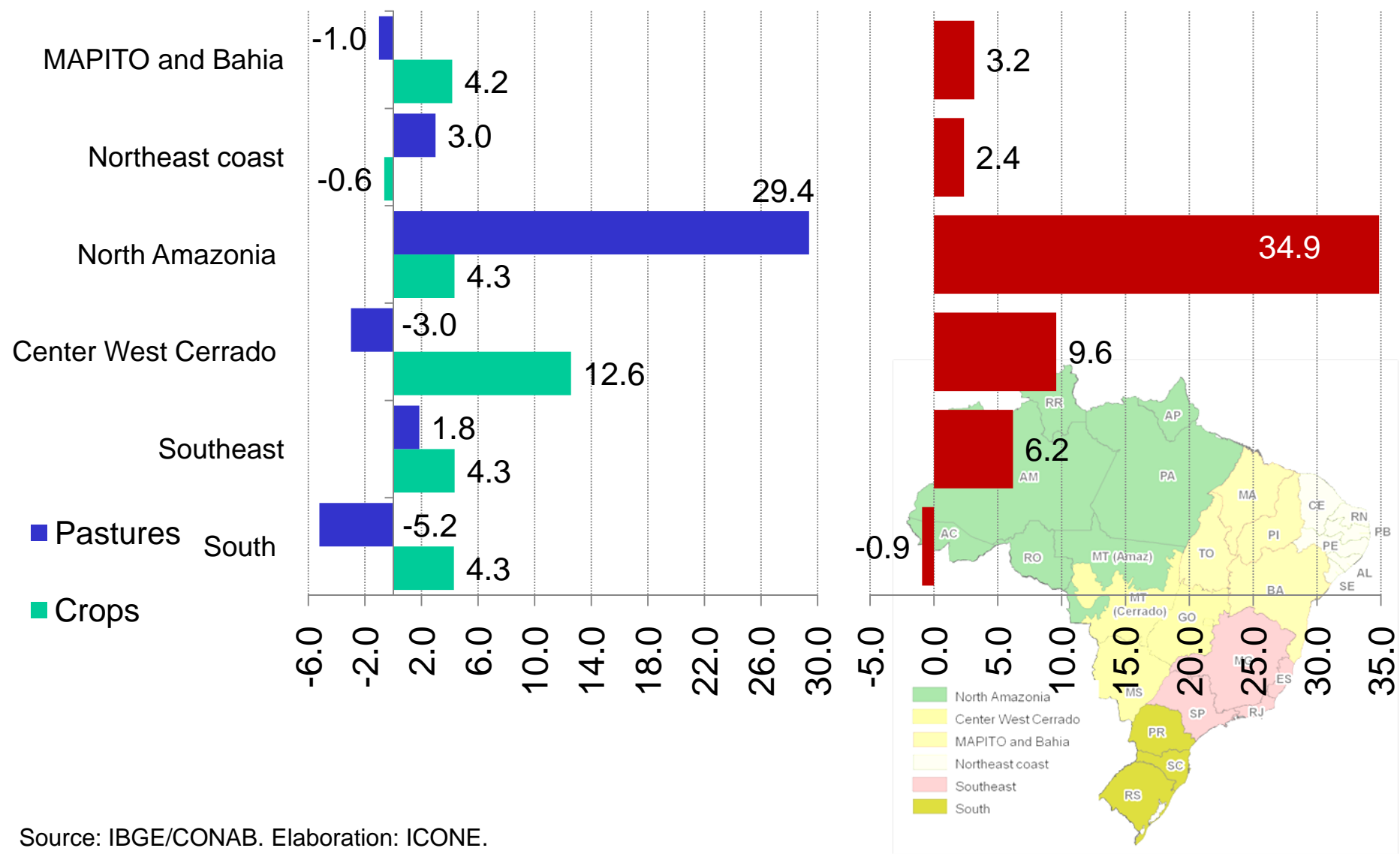
Brazil, 1997 to 2008



Absolute Variation: Land Allocated to Agriculture (million acres, 1997 to current)

Soybean, Corn (1st crop), rice, cotton, dry bean, sugarcane and pastures

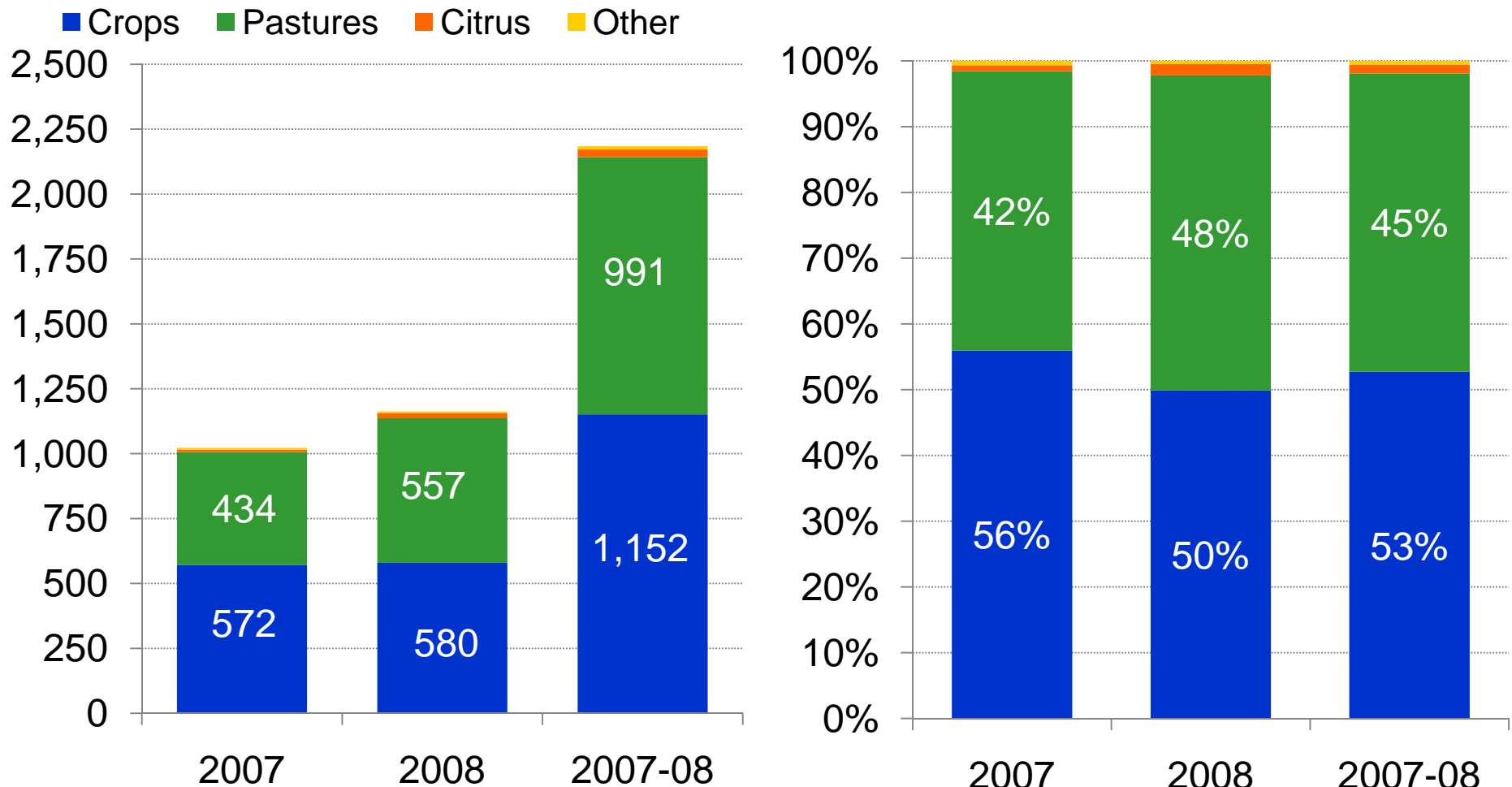
Total ag land



Source: IBGE/CONAB. Elaboration: ICONE.

Example of Direct Substitution: Remote Sensing

South-Central Region: Classes of Land Use Converted to Sugarcane,, 2007 and 2008 (1,000 ha)

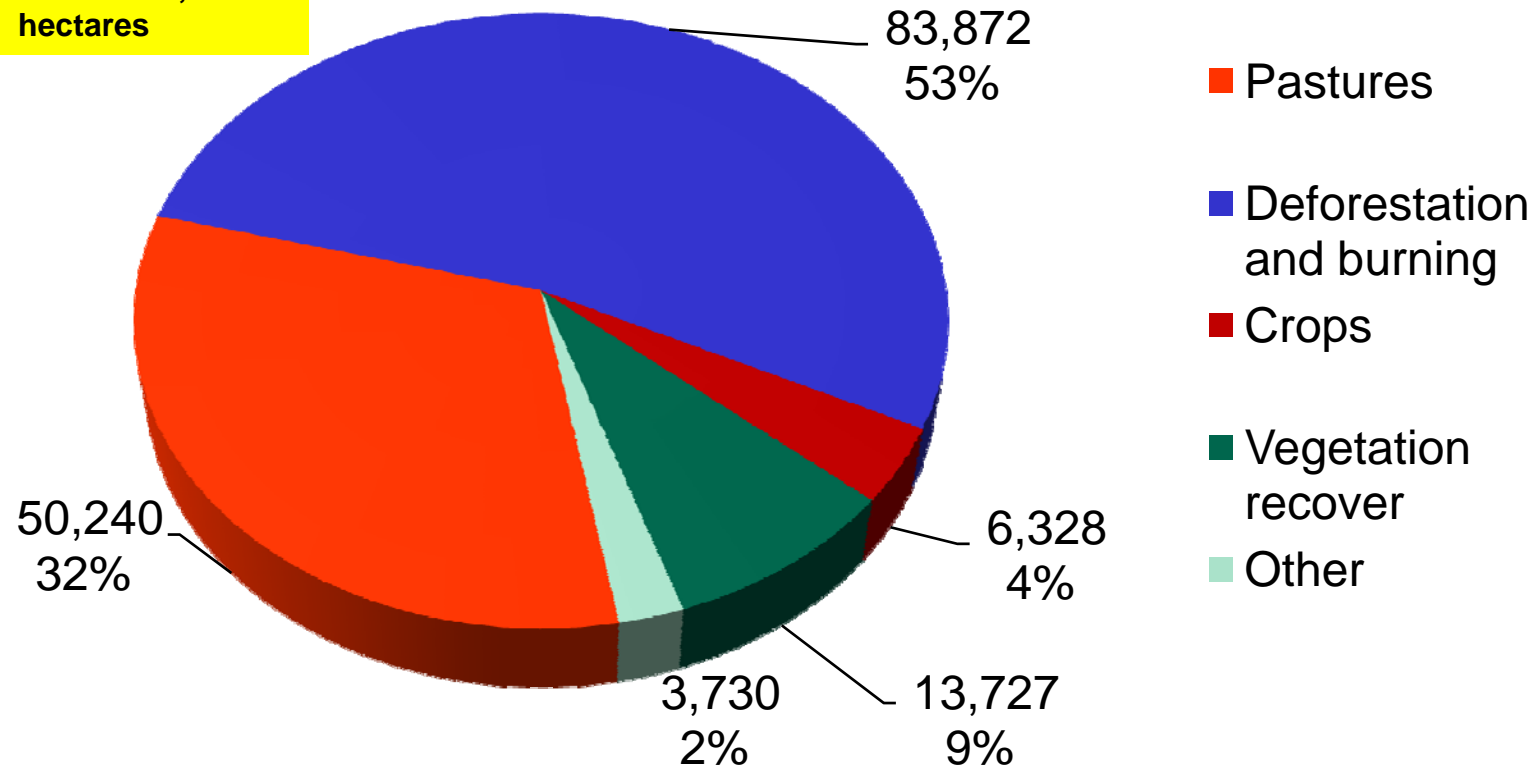


Source: CANASAT/INPE, published in Nassar, A.M., Rudorff, B. F. T., Antoniazzi, L. B., Aguiar, D. A., Bacchi, M. R. P. and Adami, M, 2008. Prospects of the Sugarcane Expansion in Brazil: Impacts on Direct and Indirect Land Use Changes. In: Sugarcane Ethanol: Contributions to Climate Change Mitigation and the Environment. Zuurbier, P, Vooren, J (eds). Wageningen: Wageningen Academic Publishers.

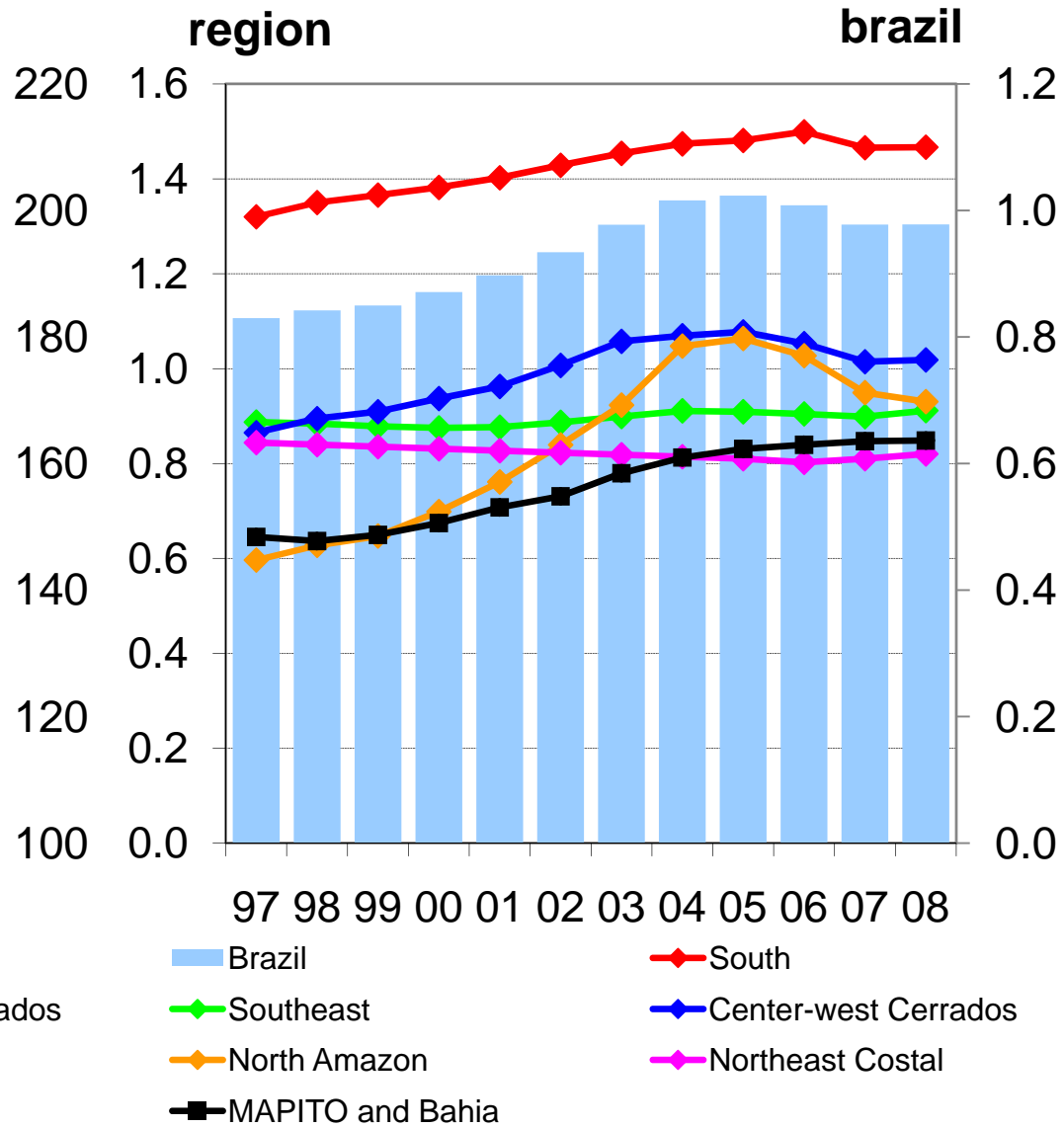
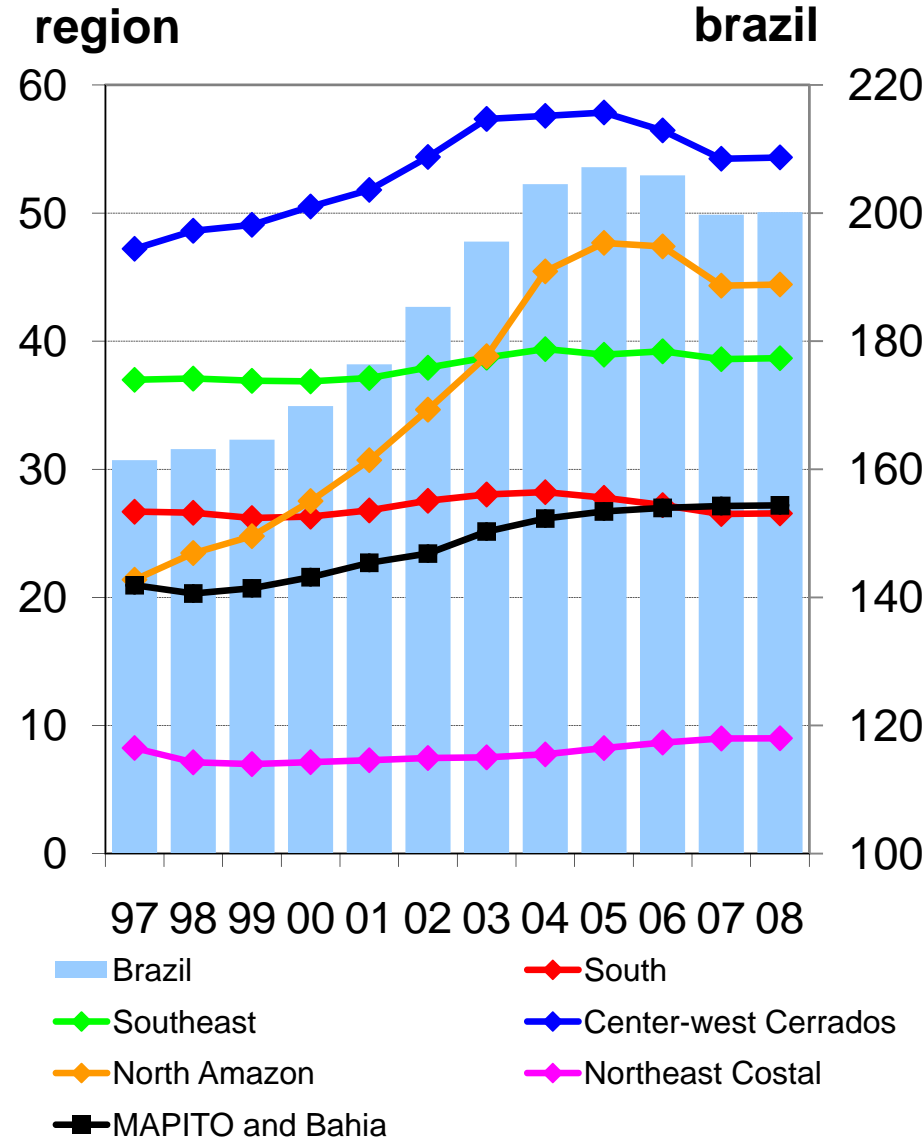
Example of Expansion in the Amazon: Data from Soybean Moratorium Project

Amazon Biome: Deforested Area under Monitoring from 2006 to 2008 by Land Use Classes (hectares)

Total area cleared monitored by the moratorium: 157,896 hectares



Total Herd (1,000 heads) and Stocking Rate (animals/ha)



Brazilian Land Use Model: Land Availability (1,000 acres)

Region		(A) Total Agricultural Land	(B) Pastures suitable for crops	(C) Legally available	(D) Total available	(E) Total available discounting legal reserve deficit
South	1	84,441	14,039	8,382	11,461	6,493
Southeast	2	133,791	74,959	16,691	32,644	26,299
Center-west Cerrados	3	158,570	105,149	31,161	65,555	56,703
North Amazon	4	124,129	96,563	45,293	318,883	261,867
Northeast Costal	5	35,995	0	481	481	-353
MAPITO and Bahia	6	92,157	20,670	61,907	98,872	84,420
Total		629,084	311,380	163,914	527,895	435,430

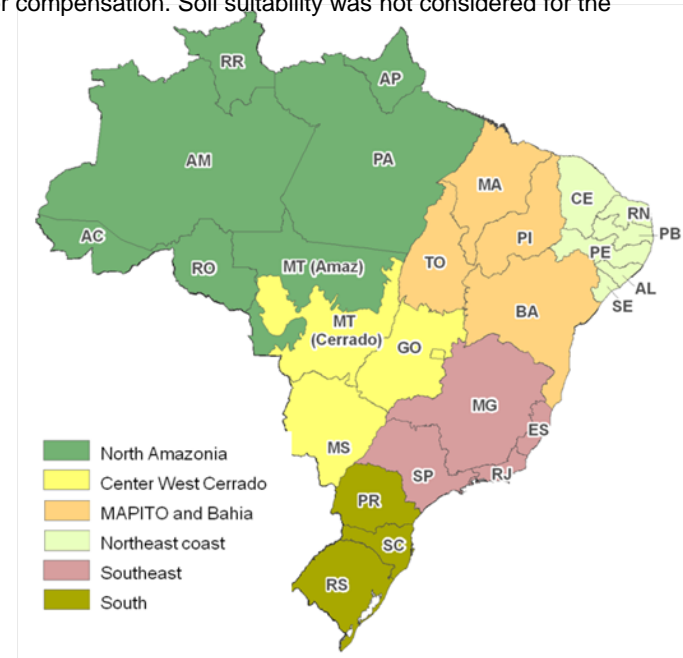
(A) Total land used for soybean, corn (1st crop), cotton, rice, drybeans, sugarcane, commercial forests and pastures.

(B) Pastures that are under slopes below 12 percent and out of semi-arid climate.

(C) Land under remaining vegetation in areas that can be used for crops (slopes below 12 percent). Legal reserve provision (amount of land with natural vegetation that must be preserved) is discounted. Soil suitability was not considered for the calculations.

(D) Land under remaining vegetation in areas that can be used for crops (slope below 12 percent). Legal reserve provision (amount of land with natural vegetation that must be preserved) is not discounted. Soil suitability was not considered for the calculations.

(E) Total land available if the deficits in legal reserve existing in cleared land is eliminated with forest recover or compensation. Soil suitability was not considered for the calculations.



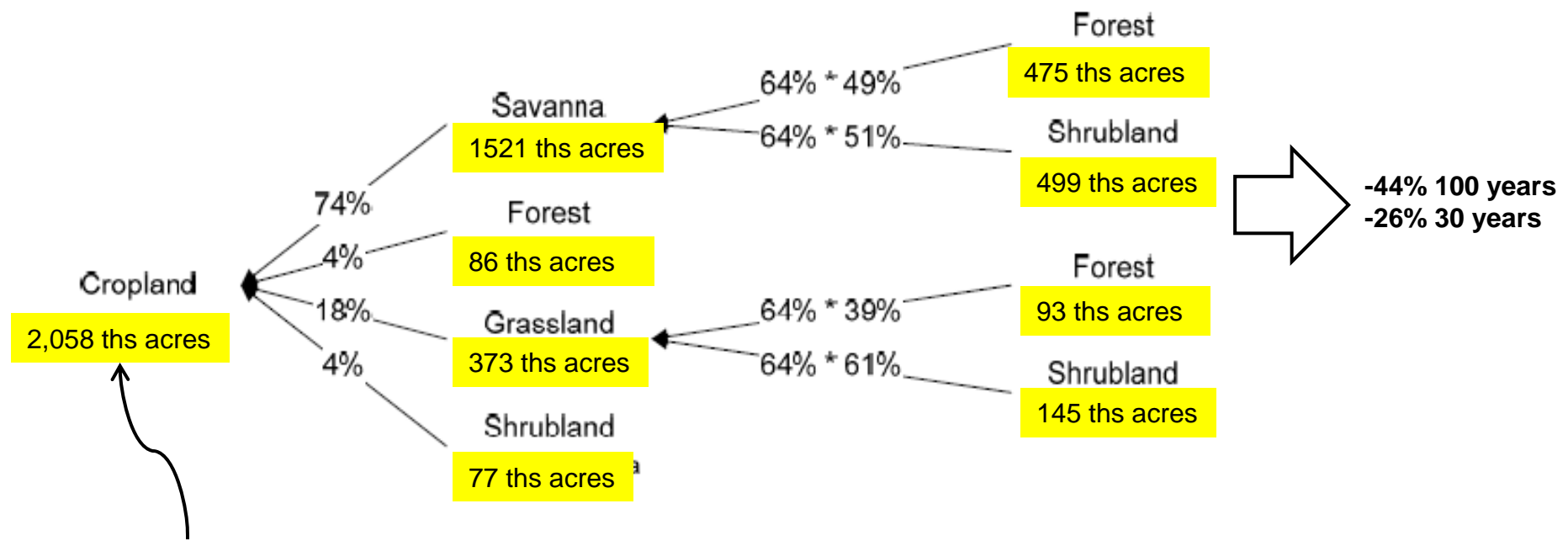
Recalculating Total Emissions Changing Per Acre Emissions Factors for Brazil

Figure 2.6-18.

Brazil Land Use Change Flow Chart with Cropland Expansion and
 Managed Pasture Replacement

STEP ONE – CROP EXPANSION

STEP TWO – PASTURE REPLACEMENT



*Additional land converted in
 Brazil when ethanol demand is
 shocked (Control Case –
 Imports Only Case)*

Source: Figure extracted from EPA's Draft Regulatory Impact Analysis: Changes to Renewable Fuel Standard Program

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