



Trajectories of Land Use in the Brazilian Amazon

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Let's start by looking at changes in land cover and how these changes are concentrated in a few areas.

1 – Important temporal and spatial variations

2 - Intensification of clearing in certain areas (mostly, near roads)

3 – What are the patterns of land use in relation to intensification of forest clearing ?

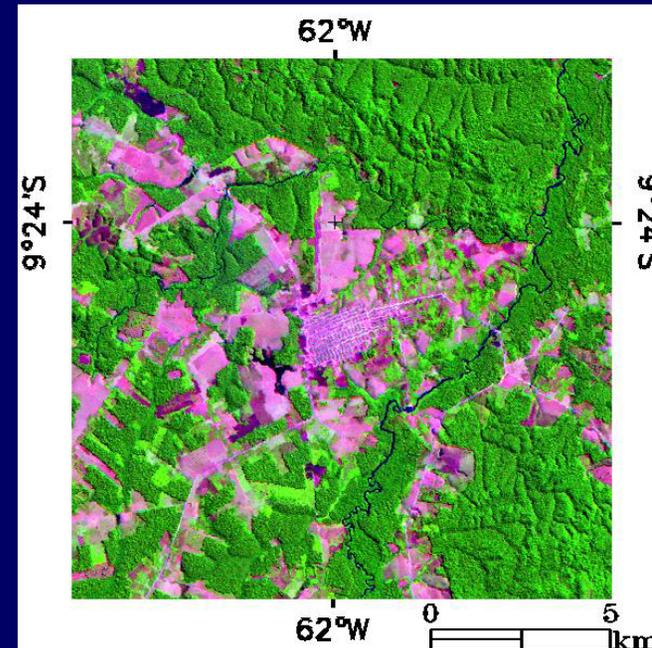
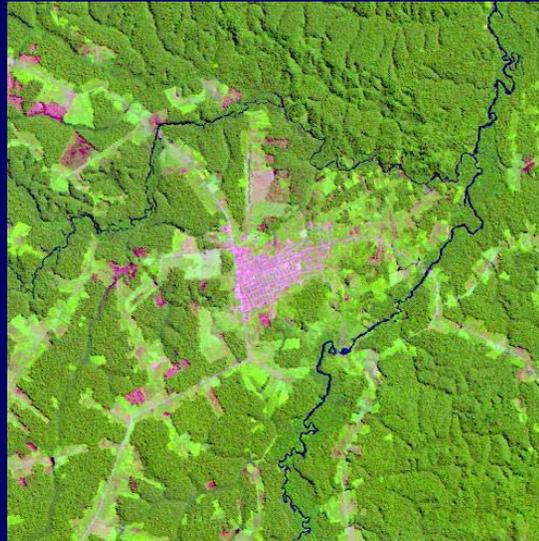
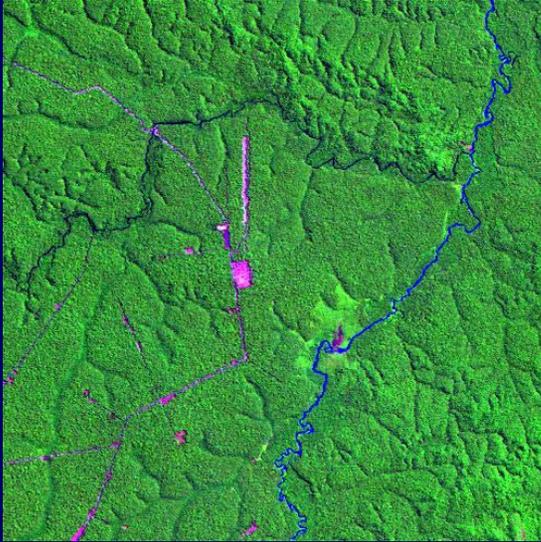
“**Intensification track**” (output (per unit area) increases together with clearing) ?

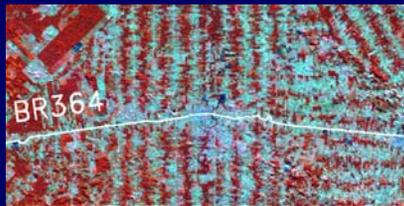
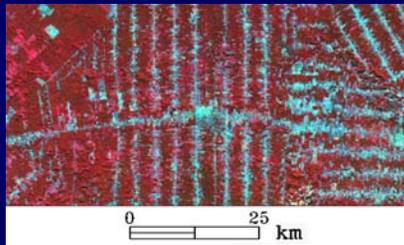
“**Degradation track**” (clearing increases as cleared land loses productivity) ?

Relationship to **frontier long-term evolution** ?

Machadinho d'Oeste: 04/08/84,
07/06/92,
20/07/96

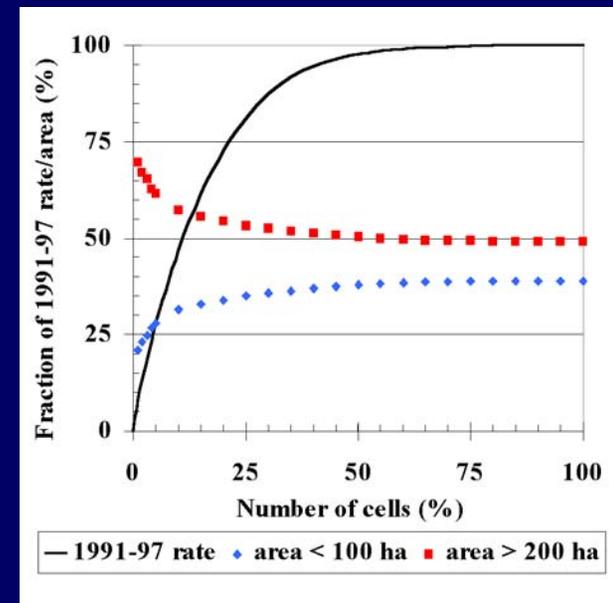
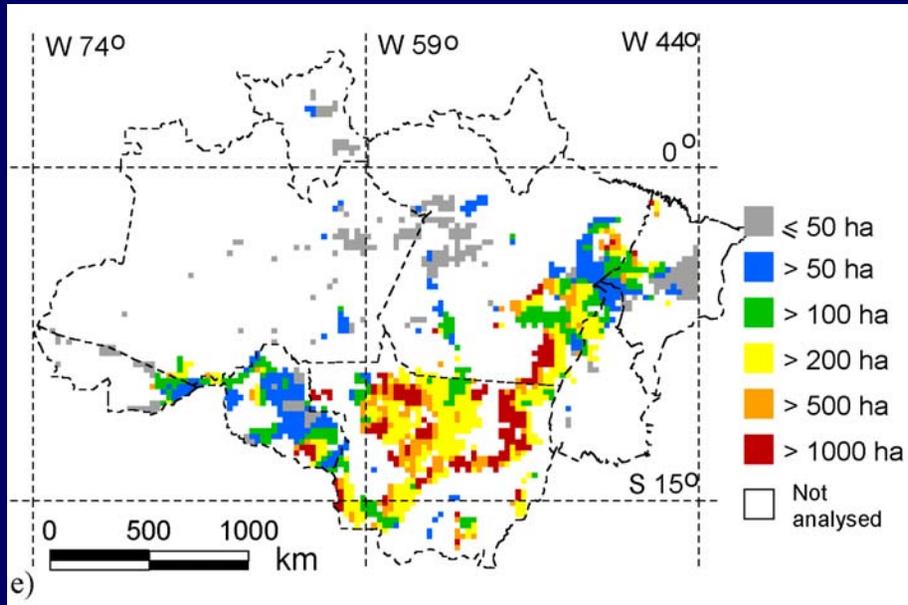
*What can be inferred about
land COVER changes ?*





Imagery: 1977, 1985, 1995 (forest < 20%)

- Clearing concentration & Fragmentation
- Agrarian structure & Fragmentation
- Concentration & Forest Code



Let's see what Census data tell us

Agricultural Census: 1970, 1975, 1980, 1985, 1995/96

*What can be inferred about
land use changes ?*

TABLE I: EVOLUTION OF LAND USE IN LEGAL AMAZONIA IN CENSUS YEARS (PERCENT)

	1970	1975	1980	1985	1995
Deforested areas	3.0	4.0	6.2	7.7	9.5
Total cropland	0.3	0.6	1.0	1.2	1.1
Planted pastures	0.7	1.4	2.6	3.8	6.6
Unused and fallow areas	2.0	2.0	2.6	2.7	1.8
Non-deforested areas	97.0	96.0	93.8	92.3	90.5
Public and protected areas	87.9	84.5	79.6	77.3	76.3
Natural pastures	4.0	4.5	5.1	4.7	3.6
Private forests (a)	5.1	7.0	9.1	10.3	10.6

Agricultural Census: 1985, 1995/96

*What can be inferred about
land use changes ?*

**Table 2 - Agricultural Census aggregated data
(agregated for the states of Mato Grosso, Pará and Rondônia)**

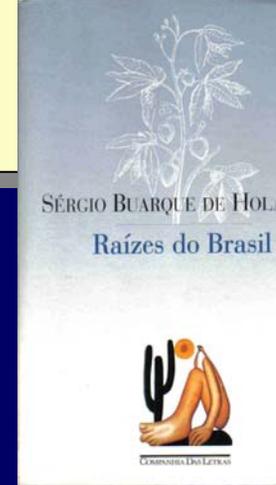
	Fraction of used land by category (% total use)					Total use (%farm area)	Unused >4years (%all uses)	Cattle density (head ha ⁻¹)
	Perm. Crop	Temp. crop	Temp. unused	Pasture (native/planted)	Tree plantation			
1985	2.1	10.3	4.8	82.4 (42/40.4)	0.4	43.4	14.9	0.44
1995	1.7	9.3	2.7	85.7 (21.9/63.8)	0.6	40.6	7.7	0.76

Sources: 1985 (Waniez et al 1997) and 1995/96 Agricultural Censuses (<http://www.sidra.ibge.gov.br>)
 Note: Municipal units with largest areas in use after discarding those with detectable inconsistencies accounting for 90% of total use in 1985 (n1=128) and 99% of total use in 1995/96 (n2=236)

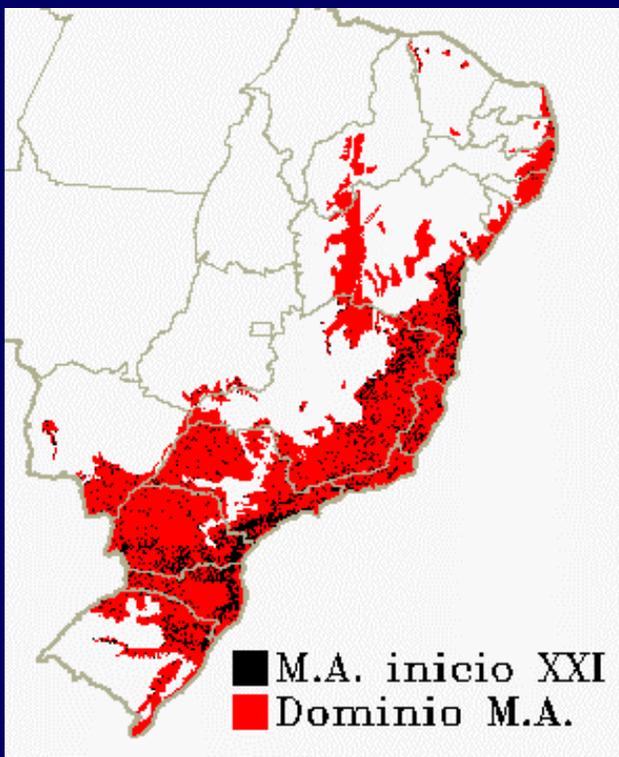
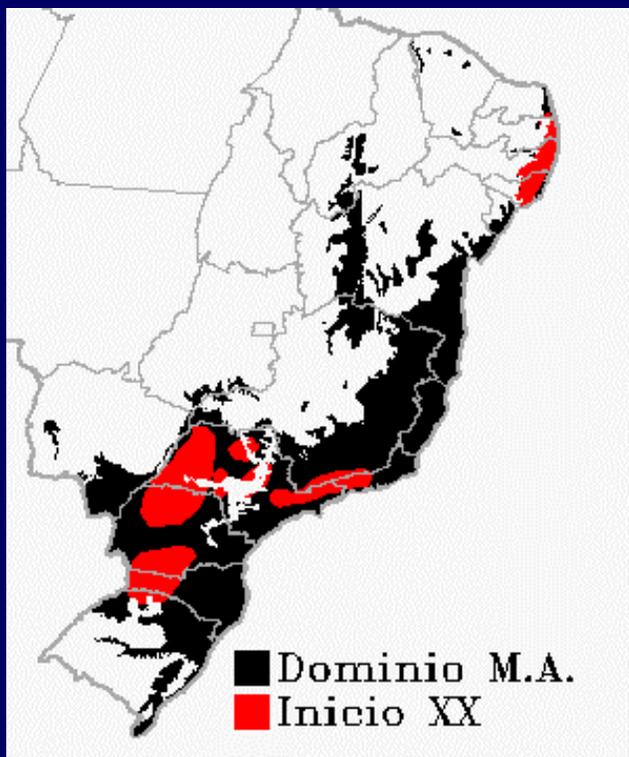
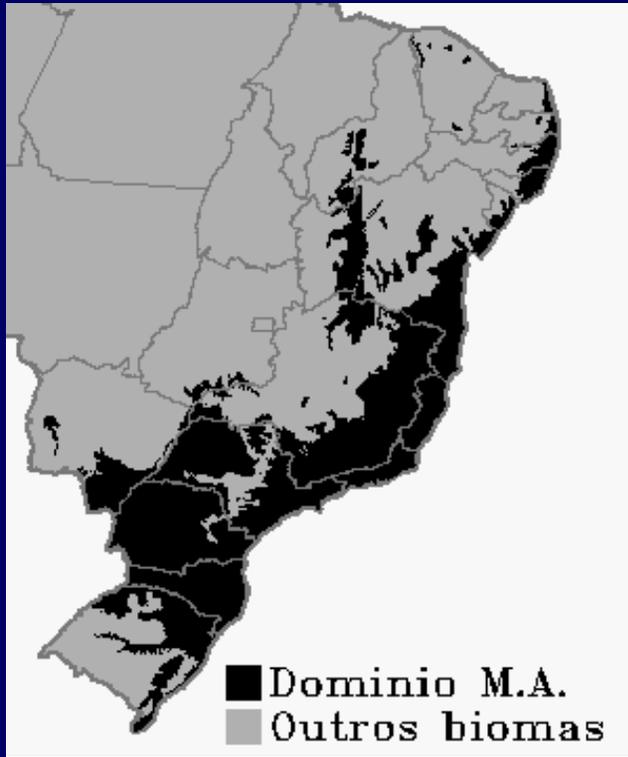


What follows from comparison
of past and present frontiers ?

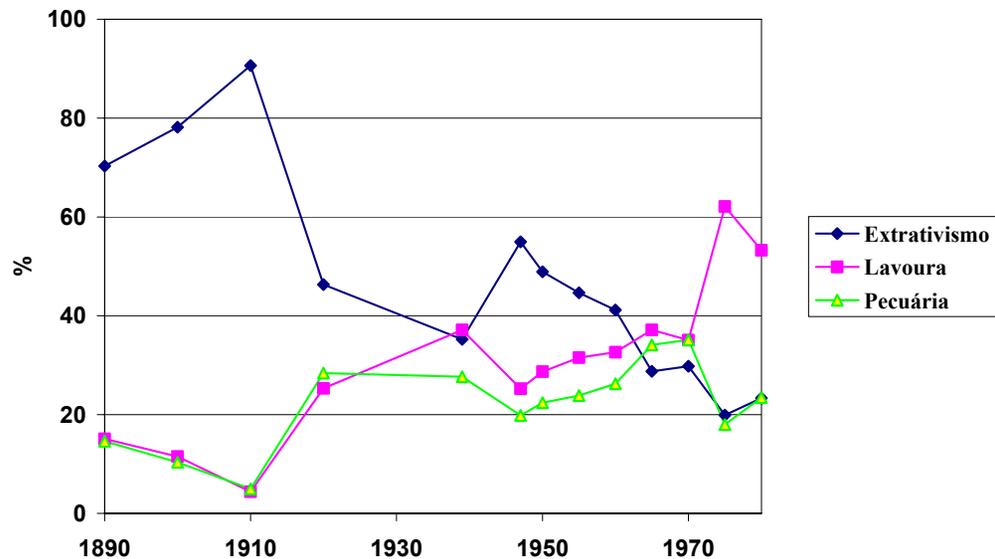
Hollanda 1995, Prado Jr 1994, Silva 1996, Machado 1998; Map: Alves 2005 ©, based on Prado Jr 1994, Machado 1998, SOS Mata Atlantica



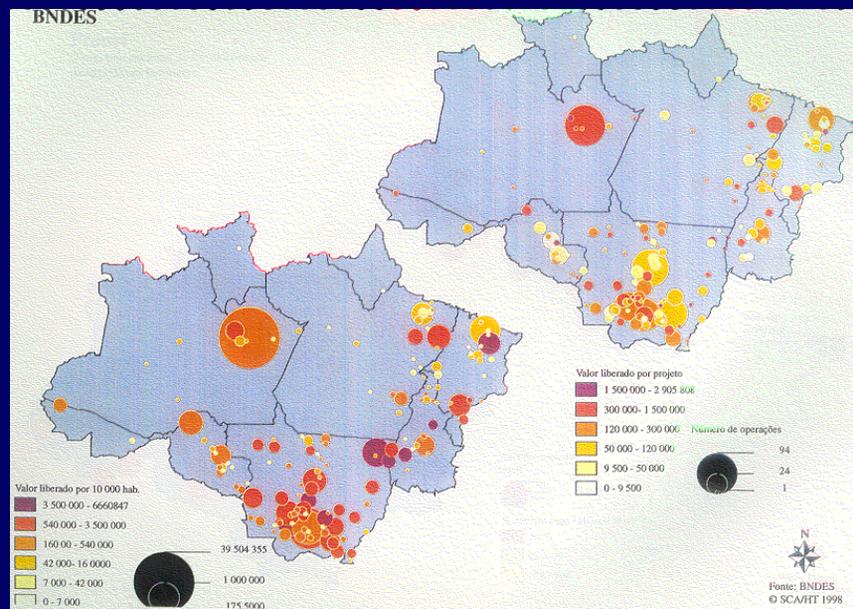
Past frontiers –
“Braço escravo e terra farta”;
Colonial merchantile project/Monoculture;
Land degradation +
no control over Crown/Public lands &
⇒ frontier movement, stagnation ...



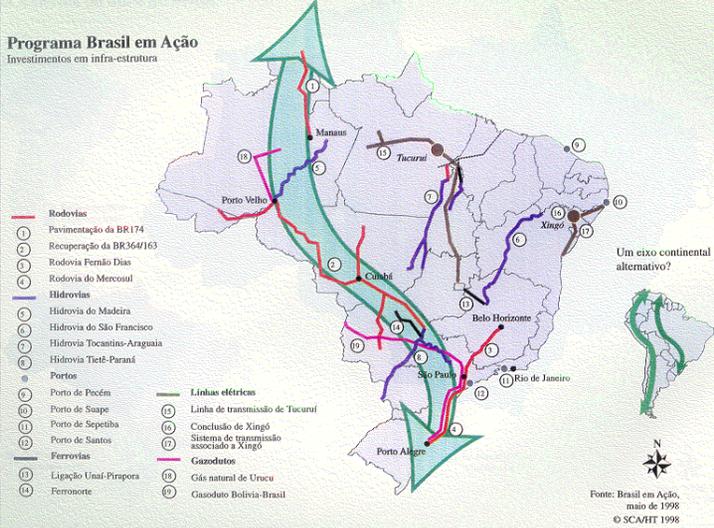
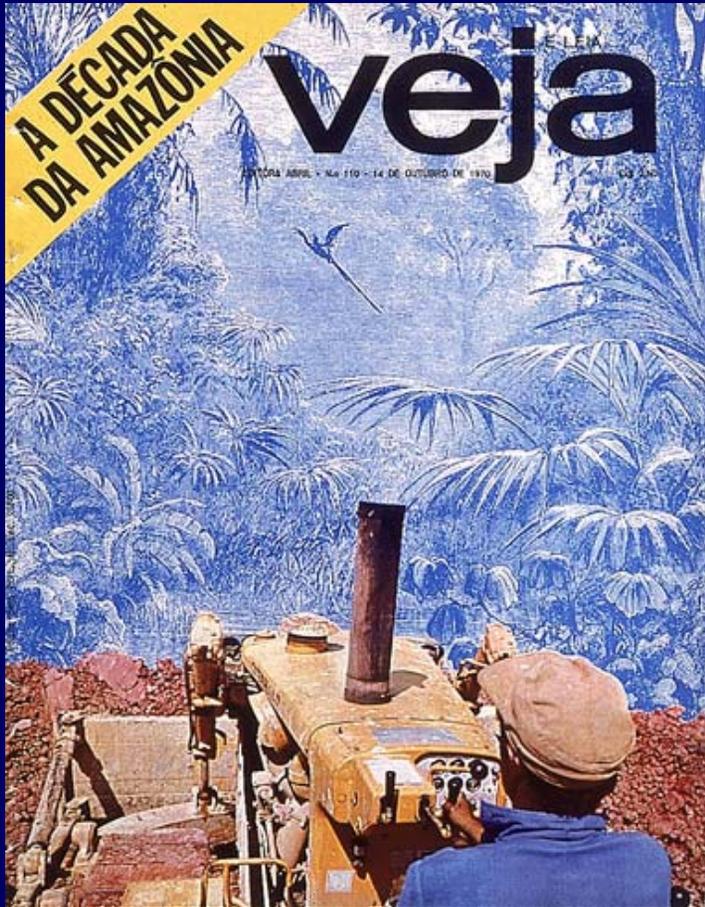
Participação do extrativismo vegetal, lavoura e pecuária no valor bruto da produção agropecuária da região Norte (1890/1980)



Evolution of the Amazon frontier



*Geopolitical design of the frontier;
the frontier in a globalized world*



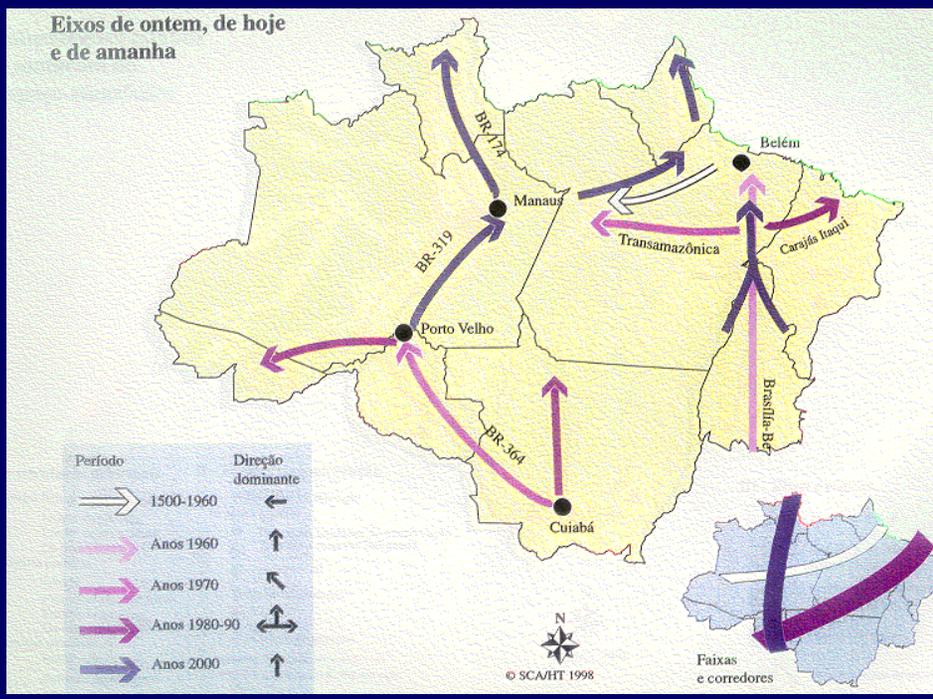
Changes in the frontier (in the perspectives about the frontier ?)

Cattle ranching found not to be profitable in Brazilian Amazon without subsidies (Hecht ~ 1980s)

Cattle ranching found to be profitable in Brazilian Amazon thanks to high local demand of meat (Faminow 1997)

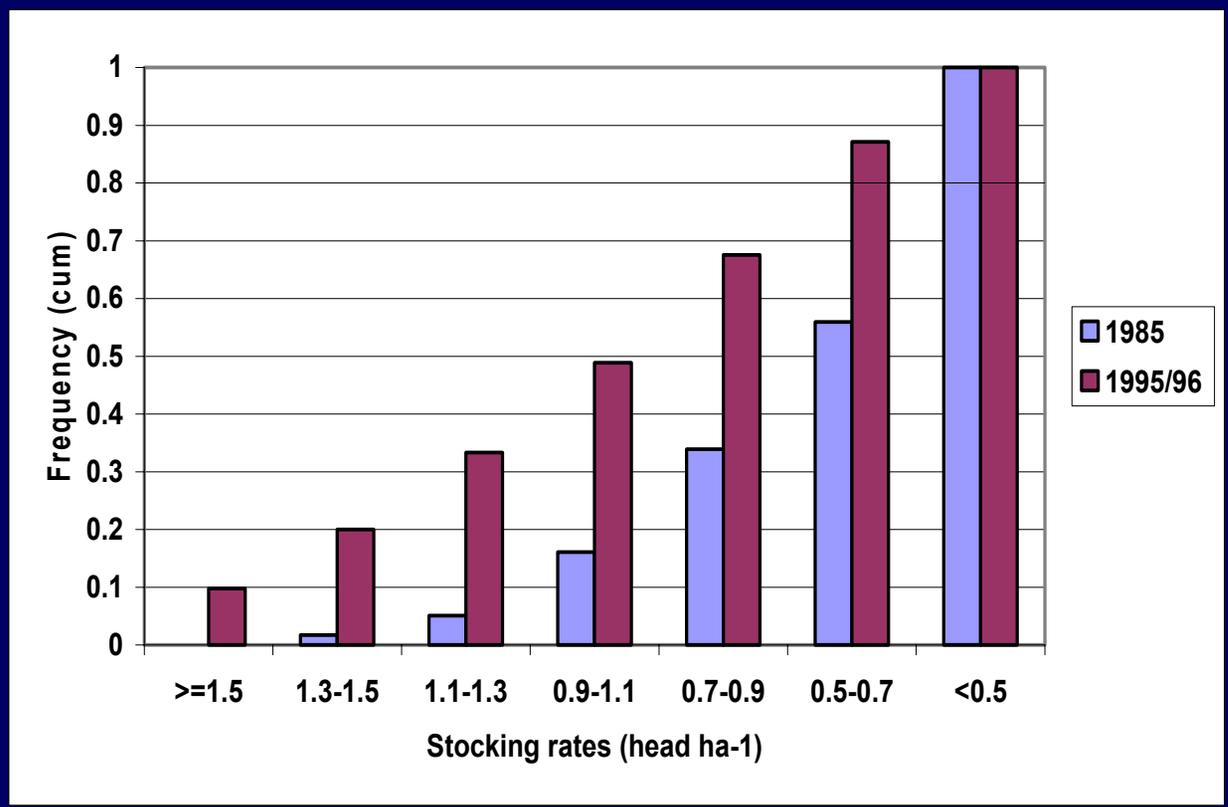
Cattle ranching found to be profitable and competitive since its production is sold nationally (Mertens et al 2002, field evidence)

Soy bean as a major example of development of new market chains (Souza & Busch 1998)



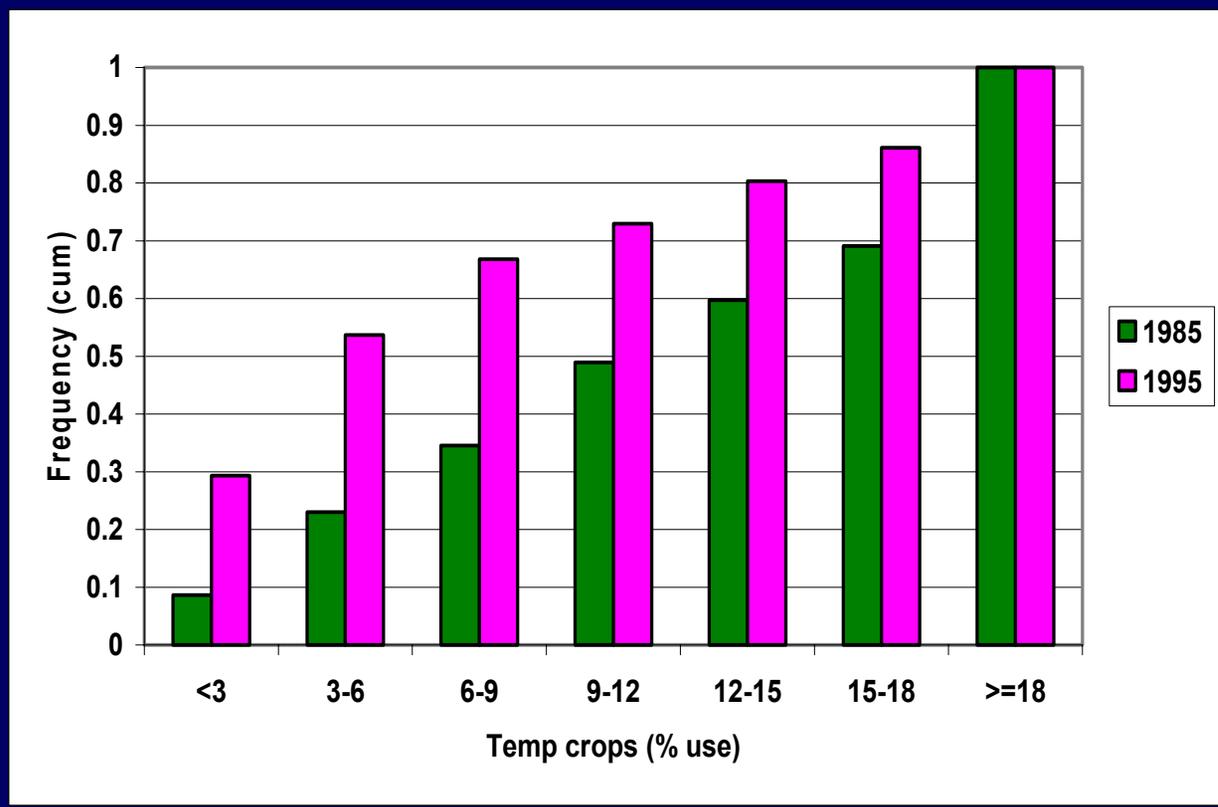
Apparent pasture management and reformation in some regions (Mattos & Uhl 1994, Arima & Uhl 1997)

Cattle densities (cumulative distributions)



Higher cattle densities occurred more frequently in 1995/96 than in 1985.
Pasture use intensification in more deforested areas.

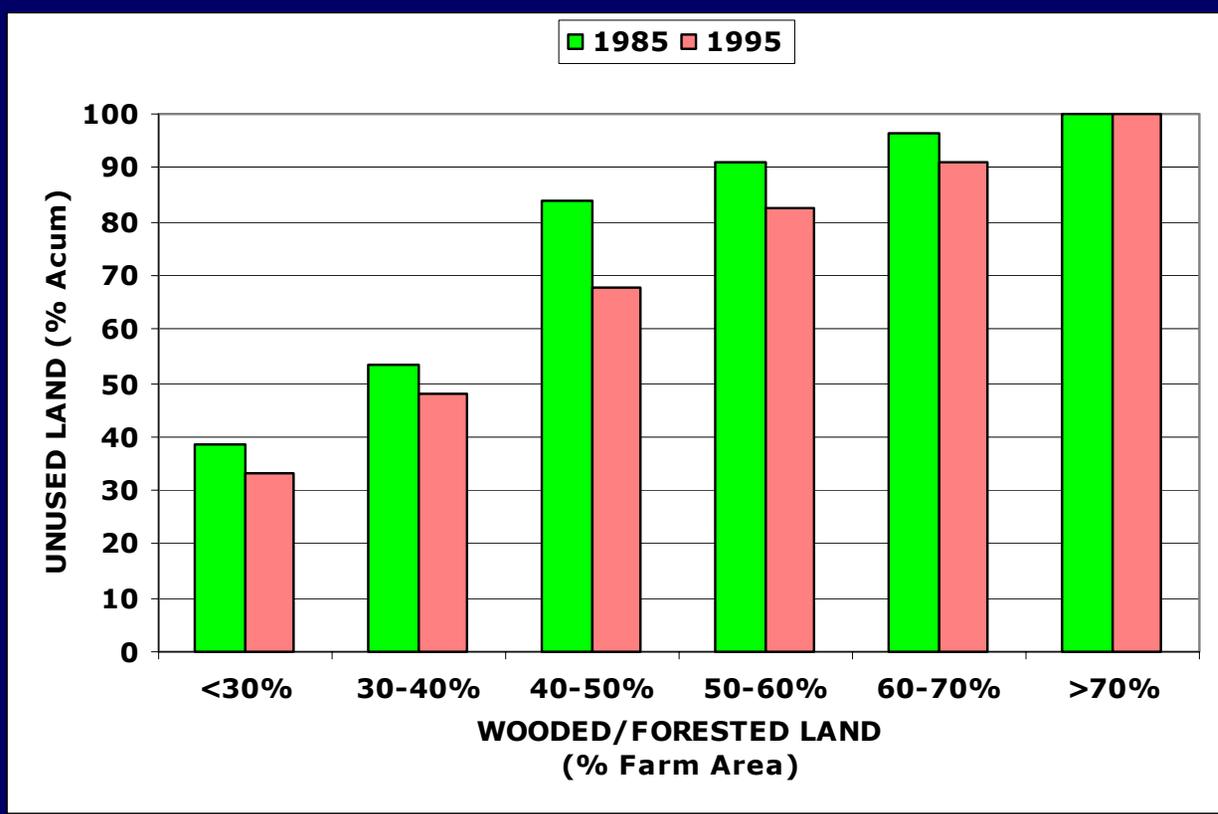
Temporary crops (cumulative distributions)



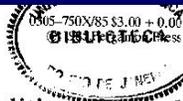
Crops represented larger fractions of land use in 1985 than in 1995/96

Coexists with specialized crop production in some areas (soy, maize, rice, oil palm etc)

Unused land (cumulative distributions)



Unused land lost importance in more deforested areas



Environment, Development and Politics: Capital Accumulation and the Livestock Sector in Eastern Amazonia

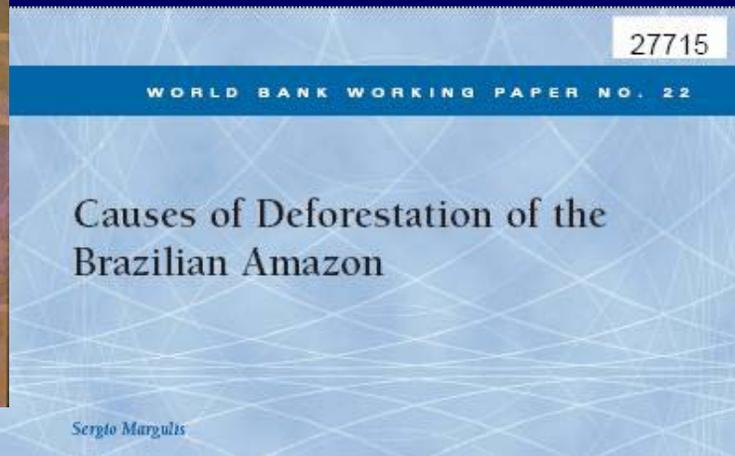
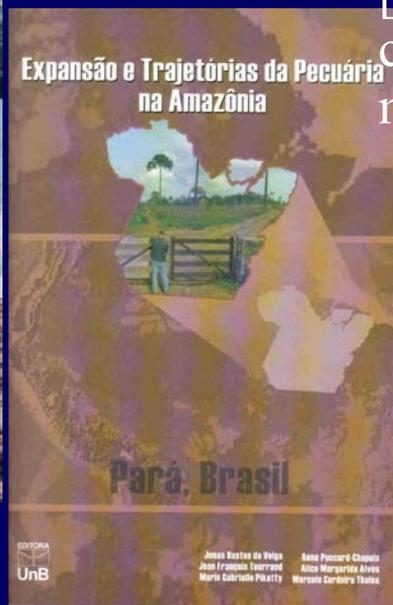
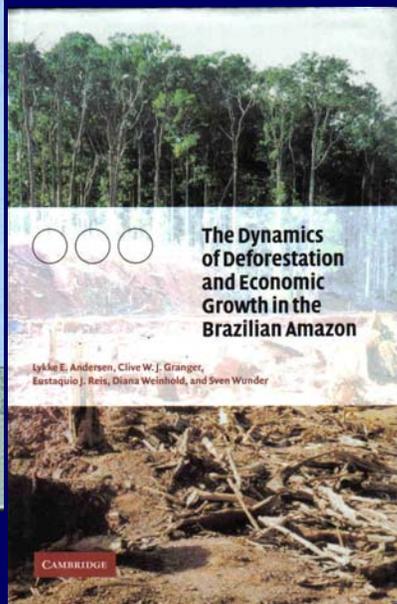
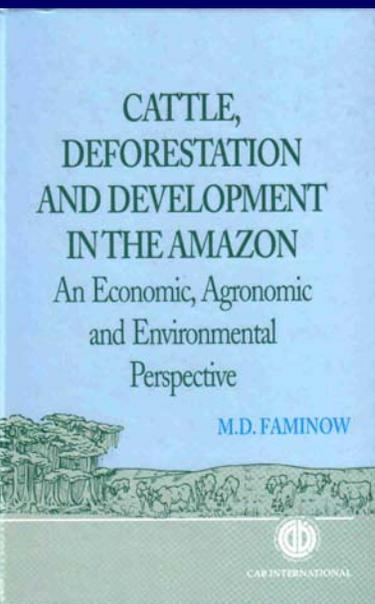
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Summary — Deforestation and environmental degradation are increasingly common themes in the literature on humid tropical rural development. This paper explores the frameworks used to analyze environmental questions in developing economies and how well these function in the particular case of livestock development in the Eastern Amazon Basin. The paper argues that, due to the peculiarities of the state subsidies available for ranching activities that spurred a frenzy of land speculation, the exchange rather than productive value of land became paramount. In such a context, cautious land management was irrelevant and serious environmental degradation was the result. The paper suggests that models of environmental degradation that focus only on the question of production cannot capture the environmental dynamics of speculative economies.

Changes in the frontier (in the perspective about the frontier ?)

Recent trends in cattle ranching and agriculture:

- Urban demand in place of subsidies or land speculation
- Intensification of [pasture] use
- Consolidation of market chains (local, regional, “export”); [increasing?] agric specialization; cattle & crops (soybean as the most important;)



Can we contribute to some
synthesis ?

The Amazonian Frontier

Concentration and intensification

- **90% of forest clearing within 100km from major roads**
- **Unused lands and fallow lost importance on average and in more deforested areas**
- **Crops lost importance to pasture on average and in more deforested areas, except in areas of specialization (soy but also some other)**
- **Cattle densities increased in more deforested areas**

What are the effects of pasture use intensification ?

What are the effects of specialized (technified?) agriculture ?

What are the roles of secondary succession ?

What are the spatial patterns of land use changes ?

How these changes will evolve over the long time ?

How short term and long term changes will affect the frontier ?



Large-scale Biosphere-Atmosphere Experiment in the Amazon

Two main research questions:

- ★ How Amazonia functions currently as a regional entity with respect to the natural cycles of water, energy, aerosols, carbon, nutrient and trace-gases?**
- ★ How will changes in land use and climate affect the biological, chemical and physical functioning of Amazonia, including its sustainability and influence on global climate?**

Four main research LUCC questions:

- 1. Rates and mechanisms of forest conversion and relative importance of land uses**
- 2. Patterns of forest conversion and land abandonment**
- 3. Selective logging**
- 4. Plausible scenarios of LUCC**

A few more questions ?

What are the consequences of concentration and intensification :

(Have concentration and intensification patterns contributed to :)

- **Has the moving frontier stopped ?**
(Concentration & intensification did not exclude diffusion,
'Cattle growth due both deforestation and intensification', SM 2004)
- Are they avoiding/accelerating land degradation ?
- ~ improving/worsening local conditions of life ?
- ~ improving/worsening conditions elsewhere ?
- Have they stopped/reduced rural conflicts ?
- Have they consolidated/weakened institutions ?



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Few challenges for research



- Land use/land cover changes evolve just as much as the frontier
- Can science (like LBA and PPG7/S&T) promise answers ?
- Different perspectives of “sustainability” have to be understood to involve stakeholders
- How science can promise questions ?

