Linking climate change control and development policies: the Brazilian case

Presentation at the Conference on

Global Warming: Looking Beyond Kyoto

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Questions

- Potential for integrating climate policy into national development priorities in Brazil?
- Policies to halt deforestation?
- Potential of North-South technology transfers (CDM or FDI) to promote economic growth along a lower emission trajectory?
- Amendments in the Kyoto Protocol to provide incentives for Brazil to curb greenhouse gas emissions in a post 2012 commitment period?

Outline

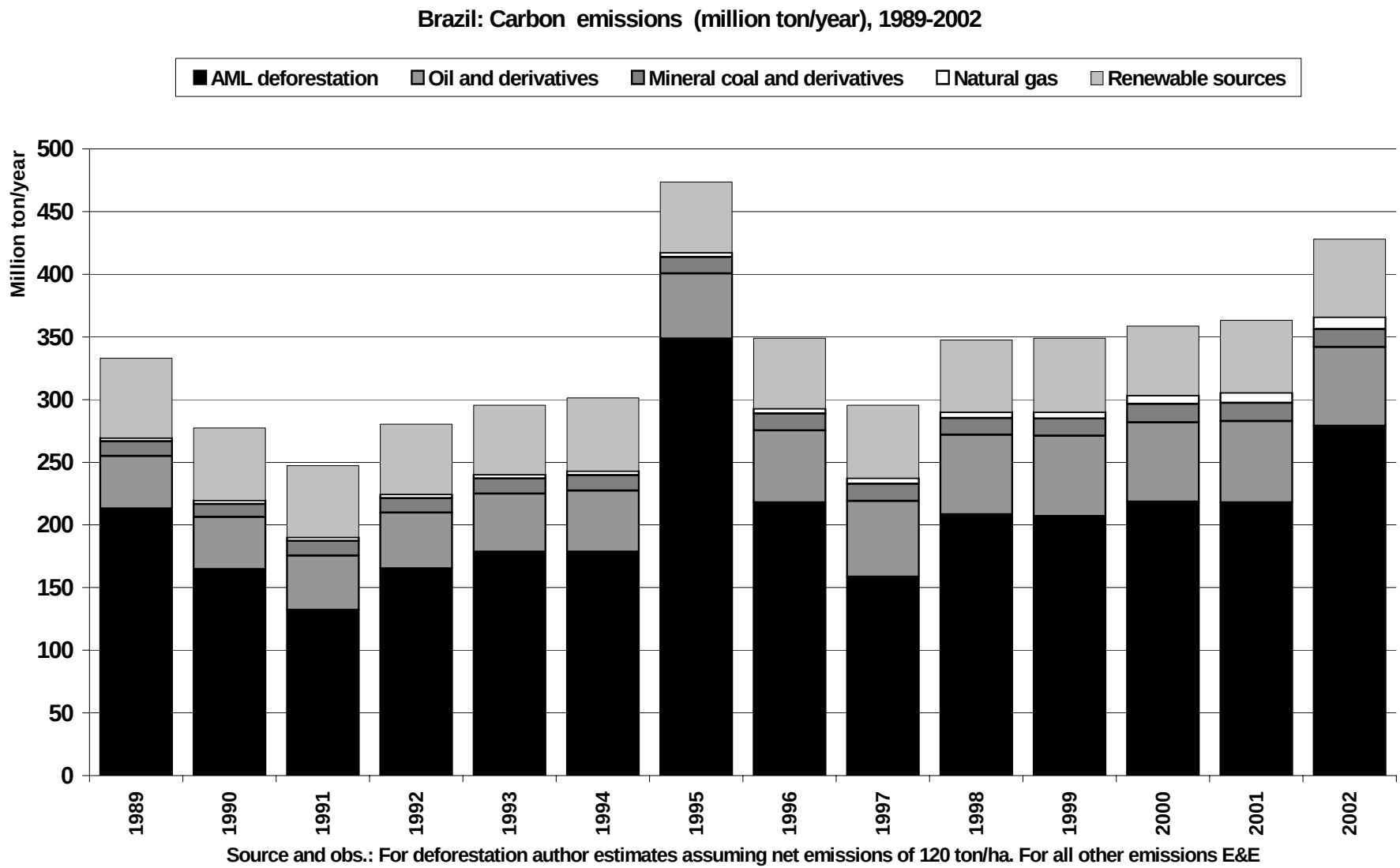
- Climate change control in Brazil
- Evidence on deforestation
- Drivers of deforestation
- Cost-benefit sketches
- Policies in the Post-Kyoto environment

Climate Change Control in Brazil

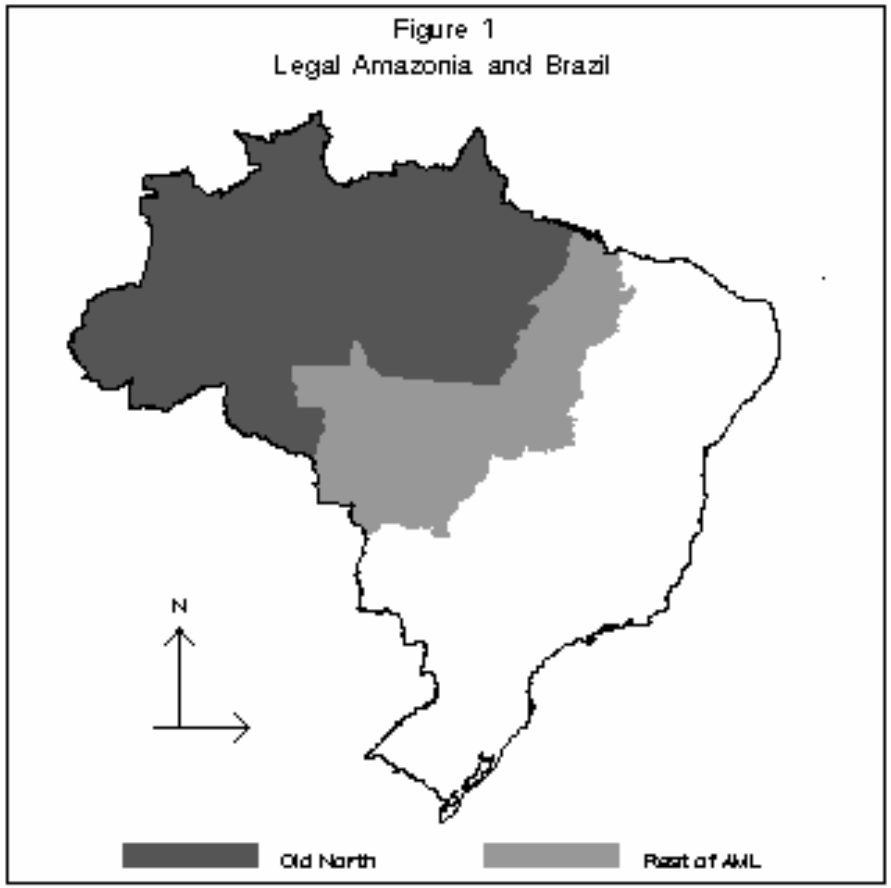
- Low environmental awareness:
  - Green Party not a significant player
  - Brown isuues dominate the agenda
- Institutional context:
  - Stakeholders: Foreign Relations, S&T and Environment Ministry, NGO, local population and agro-business
  - Sovereignity and security issues
- Climate convention activities
  - Brazilian proposal
  - Unintended benefits of energy policies: renewable
  - Inventory of GHG emissions: 0,5 ton C/capita but 0,15 kg/U/s$

Net emissions due to land use changes, 1988-94

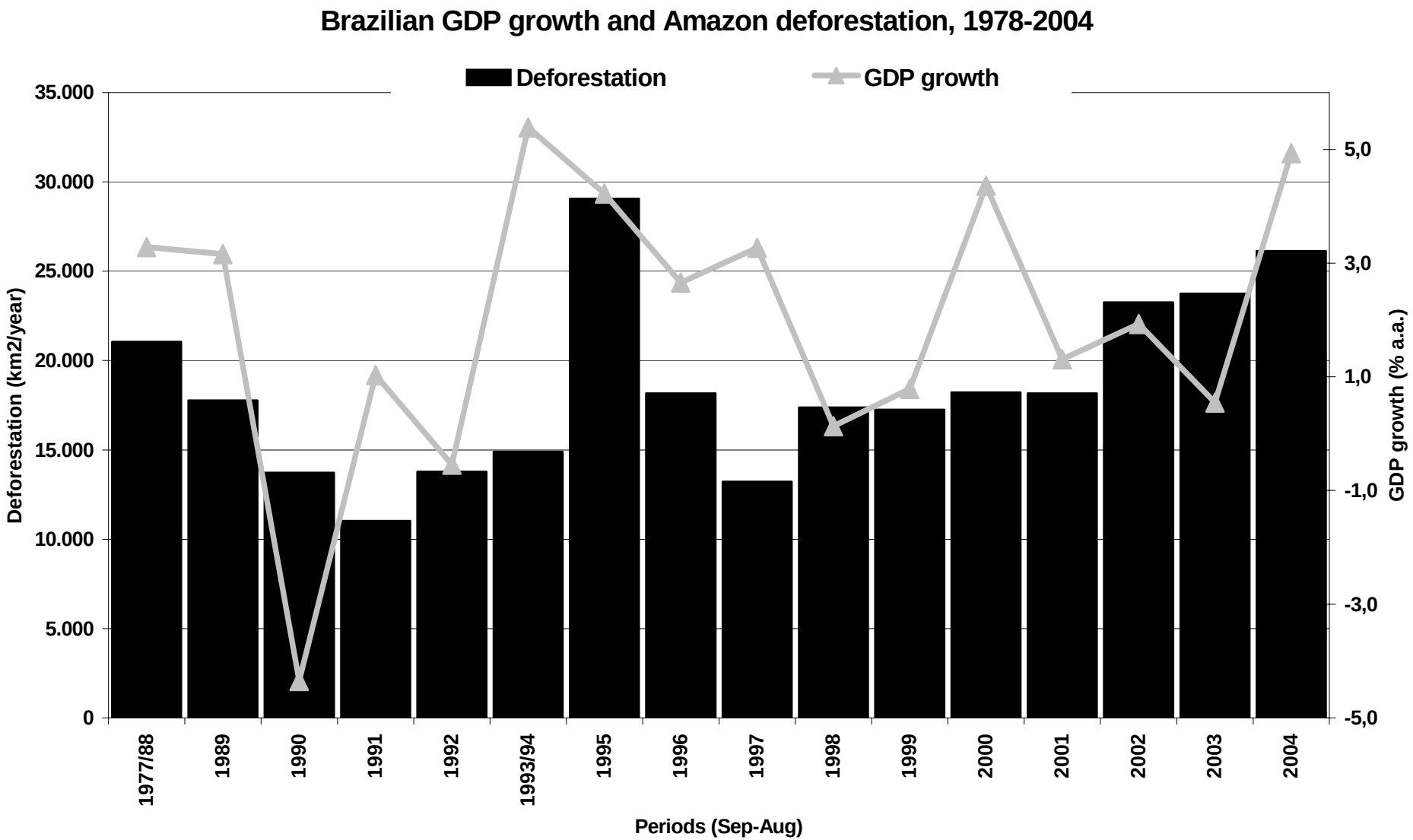
Bioma	Net emissions		
	TgC/yr	TgCO2/yr	%
Amazonia	116,9	428,6	59
Cerrado	51,5	188,7	26
Atlantic forest	11,3	41,3	6
Arid areas	10	36,5	5
Pantanal	7,5	27,4	4
Total	197,1	722,5	100

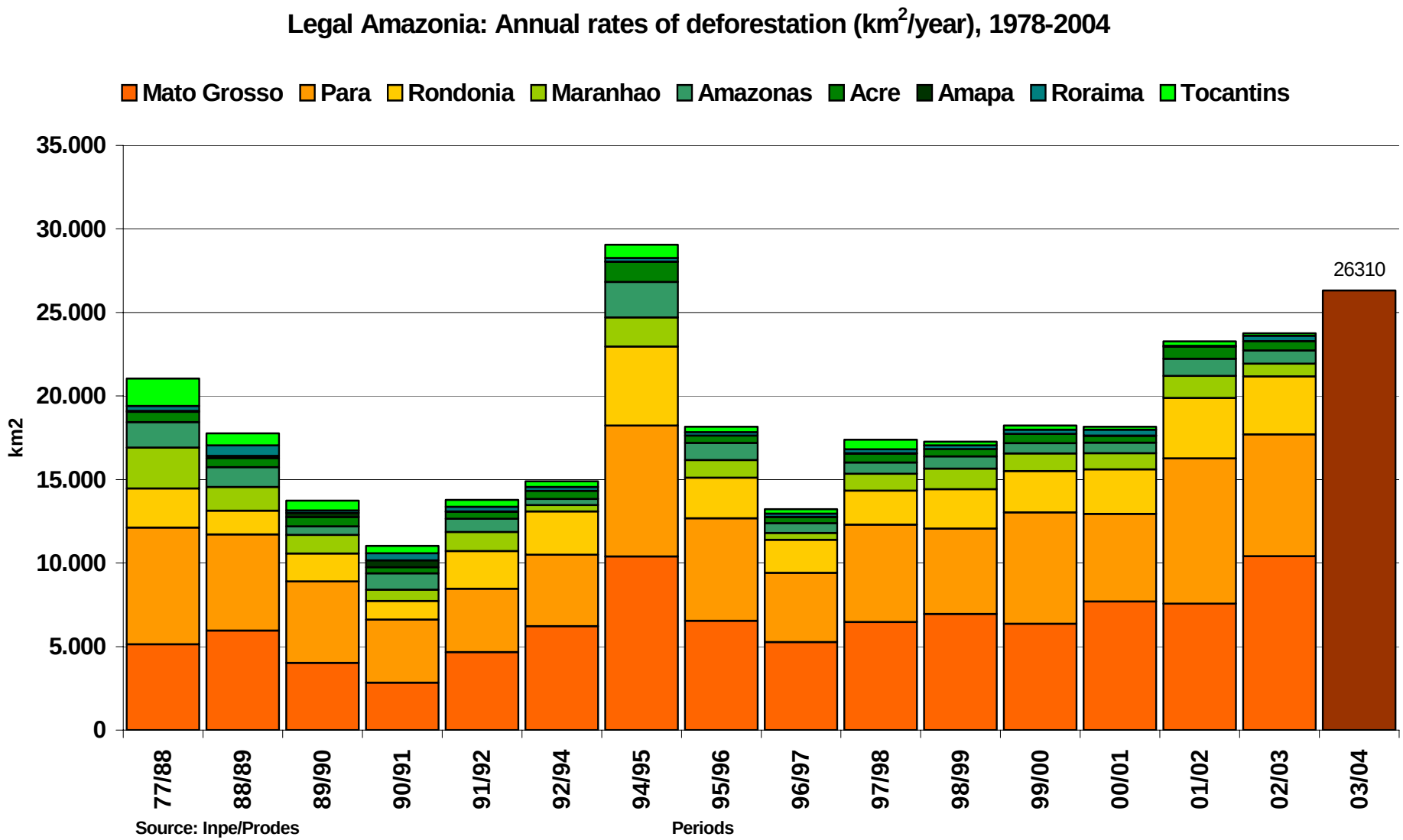

Brazil: Carbon emissions (million ton/year), 1989-2002
AML deforestation
Oil and derivatives
Mineral coal and derivatives
Natural gas
Renewable sources
Million ton/year
500
450
400
350
300
250
200
150
100
50
0
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
Source and obs.: For deforestation author estimates assuming net emissions of 120 ton/ha. For all other emissions E&E

Evidence on deforestation: Legal Amazônia (AML)



- Regional planning area:
  - 8 States + parts of 2 others
- 5 million km$^{2:}$ north 16°S and west 44°W
  - 70% of forests
  - 15% of savannas
  - 6% campinarana
  - 5% transitional vegetation
    4% other
- Cumulative deforestation:
  - 1978 – 3.0% of geog. area
  - 2004 – 13.9% of geog. area


Brazilian GDP growth and Amazon deforestation, 1978-2004
Deforestation
GDP growth
35.000
30.000
25.000
20.000
15.000
10.000
5.000
0
Deforestation (km2/year)
5,0
3,0
1,0
-1,0
-3,0
-5,0
GDP growth (% a.a.)
1977/88
1989
1990
1991
1992
1993/94
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
Periods (Sep-Aug)


Legal Amazonia: Annual rates of deforestation (km2/year), 1978-2004
Mato Grosso
Para
Rondonia
Maranhao
Amazonas
Acre
Amapa
Roraima
Tocantins
35.000
30.000
25.000
20.000
15.000
10.000
5.000
0
km2
26310
77/88
88/89
89/90
90/91
91/92
92/94
94/95
95/96
96/97
97/98
98/99
99/00
00/01
01/02
02/03
03/04
Source: Inpe/Prodes
Periods

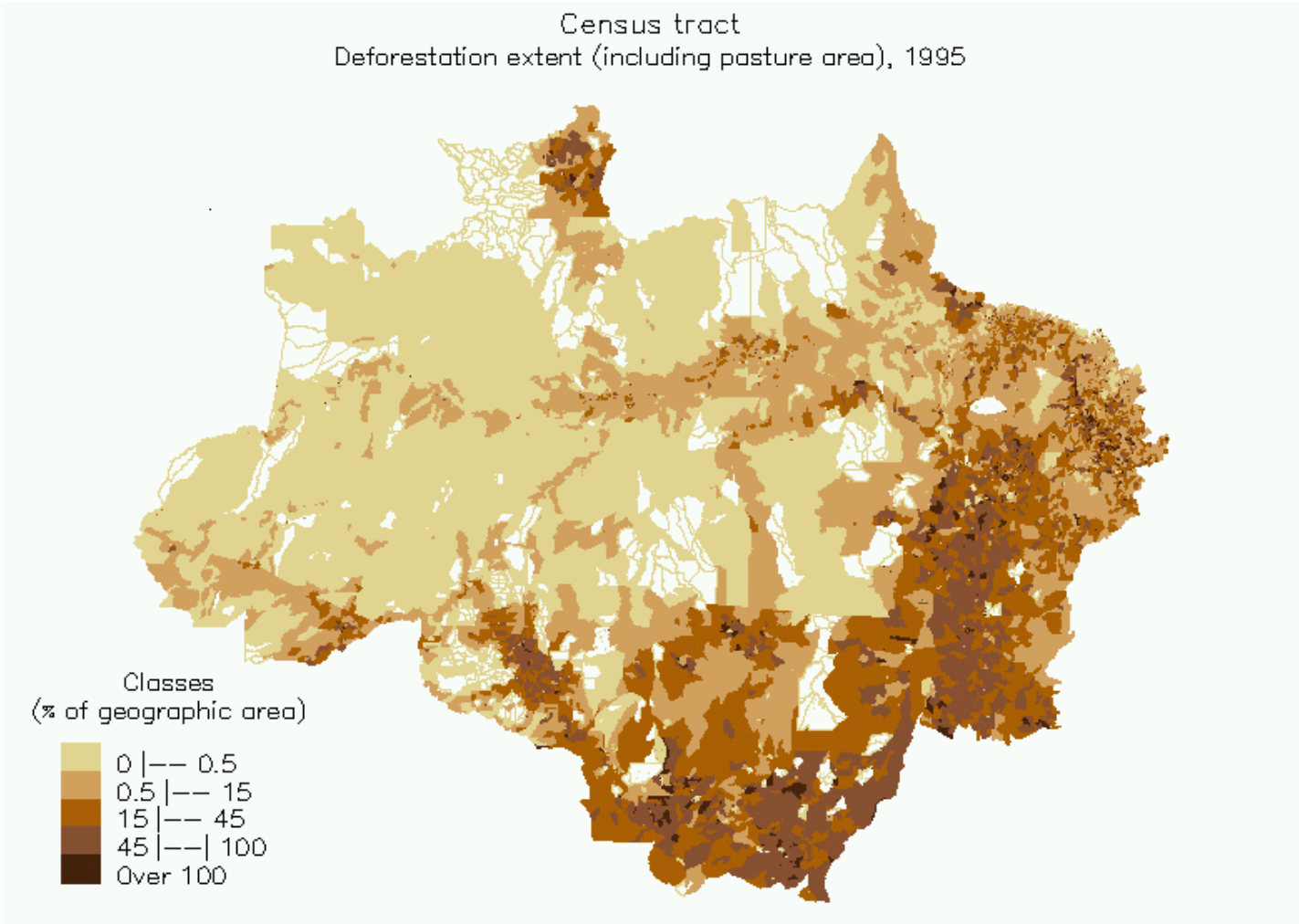
Land Uses in Amazonia, (% of area) 1975-95

Uses/Year	1975	1985	1995
Deforested	4.0	7.7	9.5
•Crop	0.6	1.2	1.1
•Planted pasture	1.4	3.8	6.6
•Fallow + Unused	2.0	2.7	1.8
Non-deforested	96.0	92.3	90.5
•Private forest	4.5	3.7	3.5
•Natural pasture	7.0	10.3	10.6
•Public and protected	84.5	77.3	76.3

Census tract

Percent of geographic area in agricultural establishments, 1995

Deforestation extent,1995
(including natural pasture)
IBGE-95



Roots of the deforestation problem

- Market failure
  - Natural resource abundance ➔ open access
  - Property rights not well defined ➔ predatory competition
  - Externalities ➔ ecological functions
- Institution failures
  - Lack of government institutions
  - High costs of monitoring and fiscalization

Drivers of deforestation

- Profits derived from productive activities -- logging, cattle ranching and commercial crops (soybean) -- drives deforestation;
- Land price speculation play a role in remote areas with costly access to markets;
- Government incentives and subsidies were important in the 70s not anymore; but federal transfers still make a significant contribution to regional (urban) income
- Accessibility to markets (transport cost) and geo-ecological conditions (topology and rainfall) are crucial determinants of profitability and deforestation

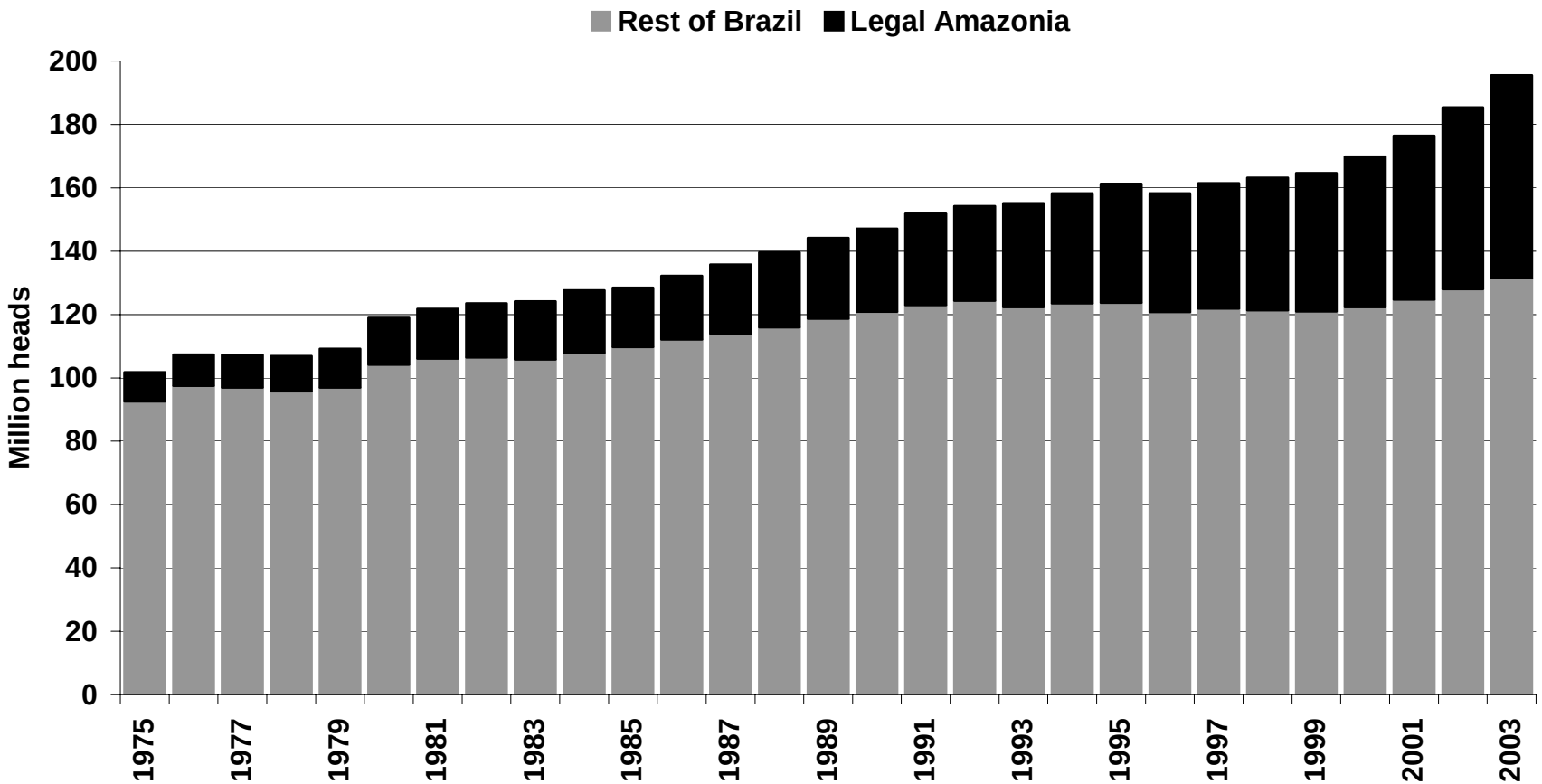
Prototypical spatio-temporal pattern of deforestation

- Squatter doing shifting cultivation and loggers are leading agents of (small scale) deforestation in wild areas
- Cattle ranchers and large scale deforestation come in the second stage of frontier settlement
- Commercial crops penetrate in the third stage replacing pasture area with relatively small impact on deforestation in consolidated areas

Technology

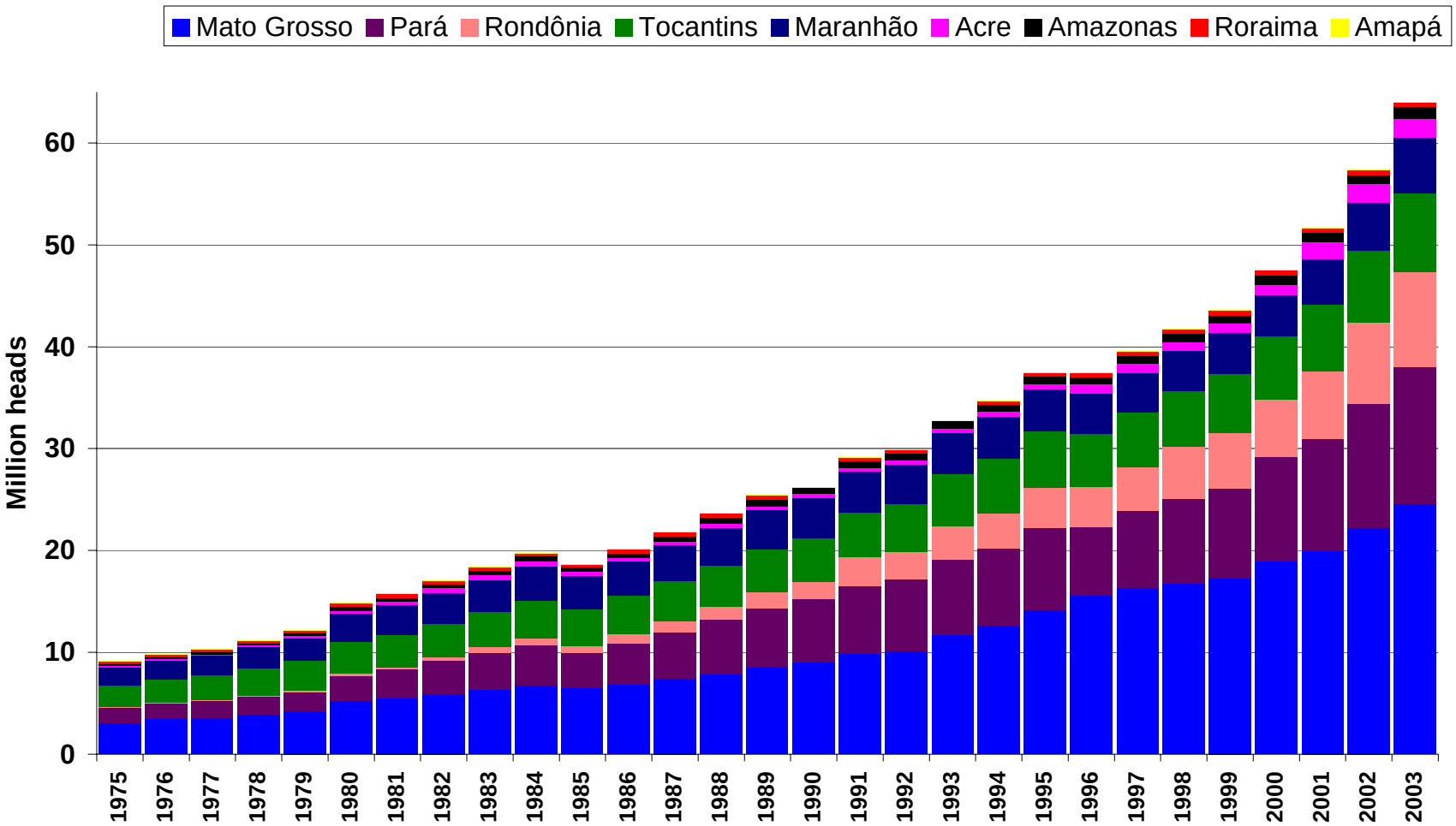
- Selective logging is important source of finance for initial investment
- Slash and burn technique is a rational response to the relative scarcity of labor and capital in the early stages of settlements
- Cattle raising with extensive land use is a rational product/technology choice given the low prices of land and thus becomes the most important source of deforestation
- Intensification requires adequate infrastructure (roads) and adequate topology
- Geo-ecological (rainfall) barries to commercial crops (soybean)

Cattle herd in Legal Amazonia and in the rest of Brazil, 1975-2003 (million heads)



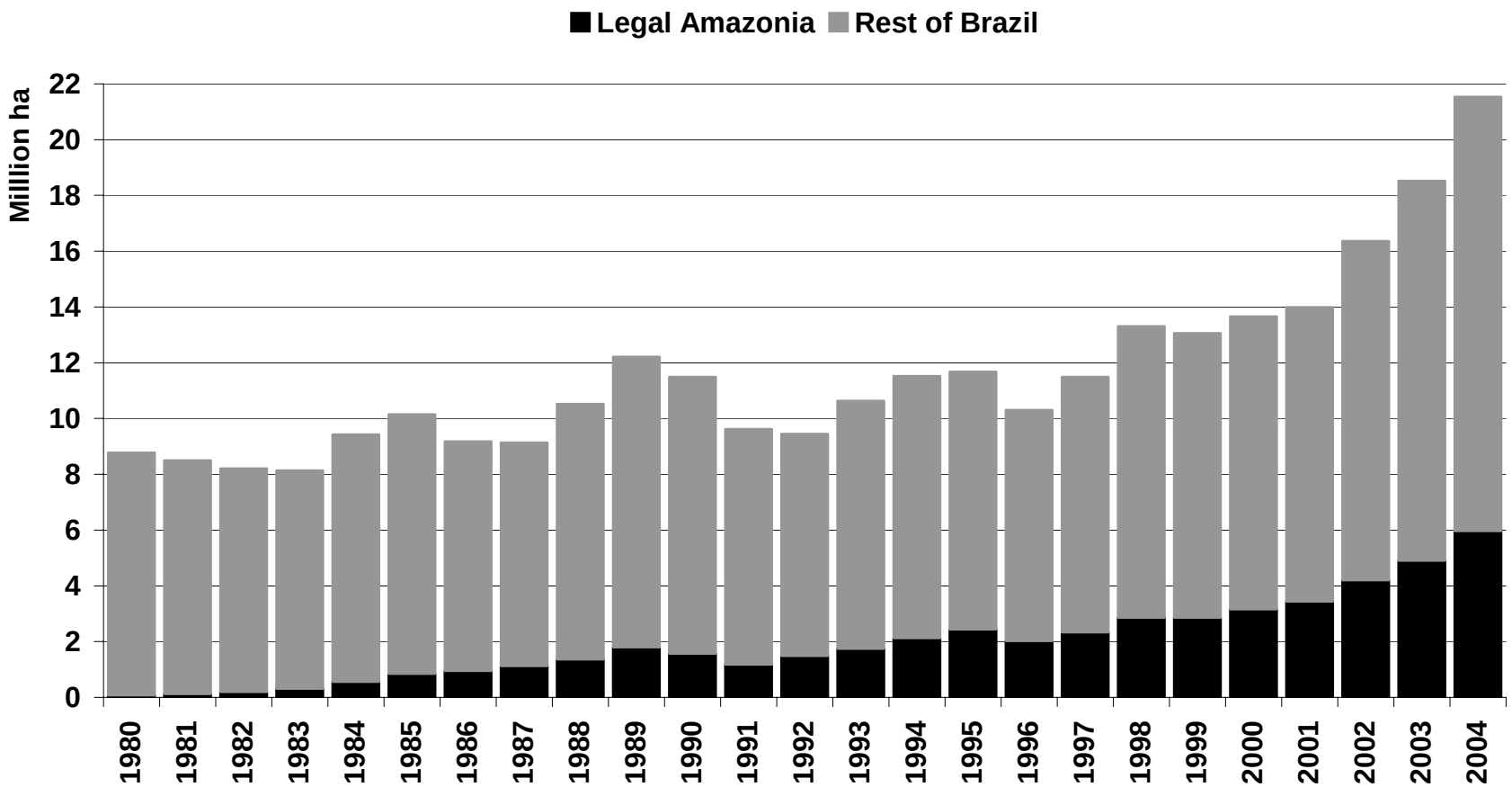
Fonte: IBGE - PPM

Legal Amazonia: Cattle herd by State, 1977-2003



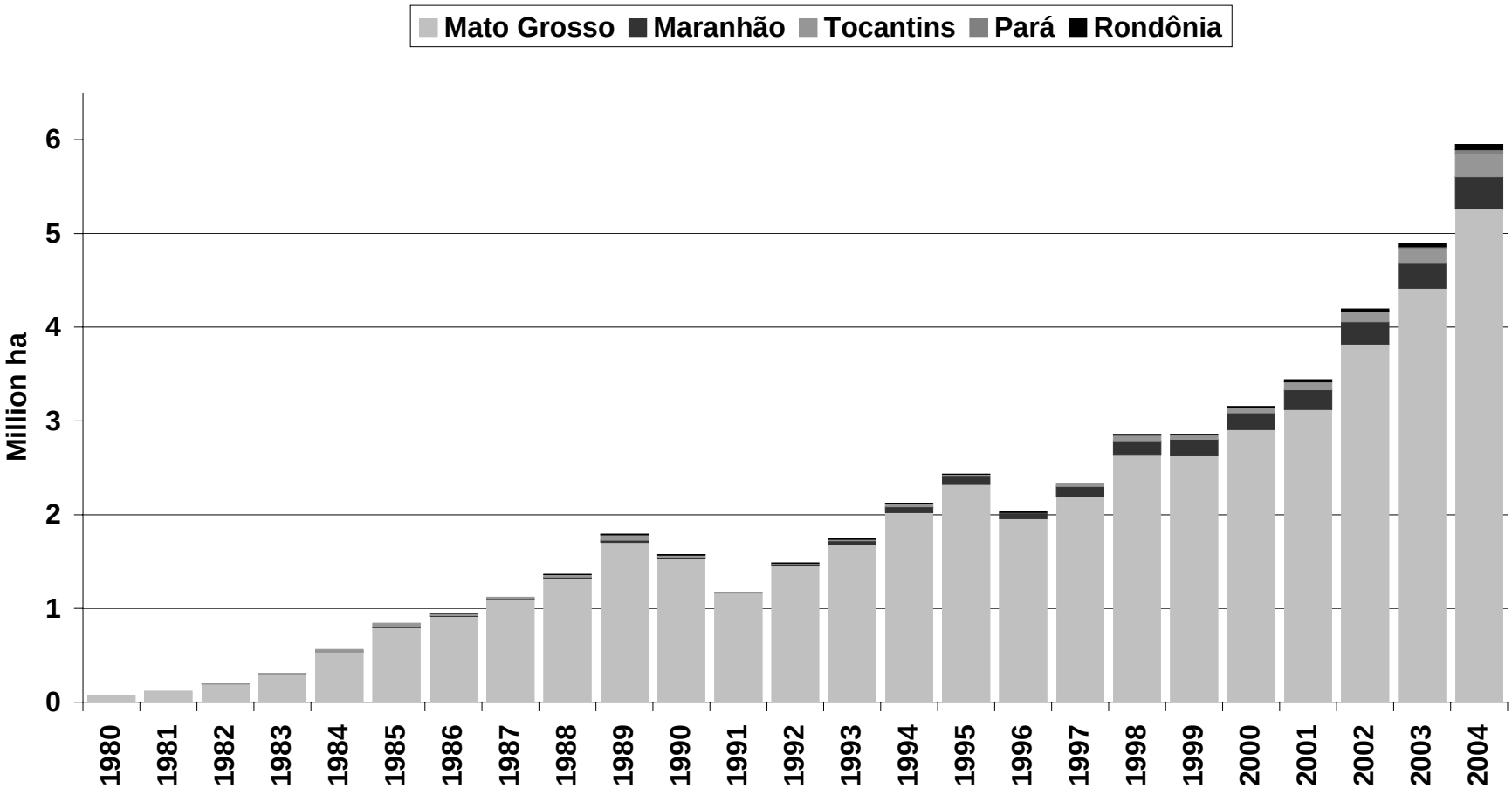
Fonte: IBGE - PPM

Soybean cropped area in Legal Amazonia and in the rest of Brazil, 1980-2004 (million ha)



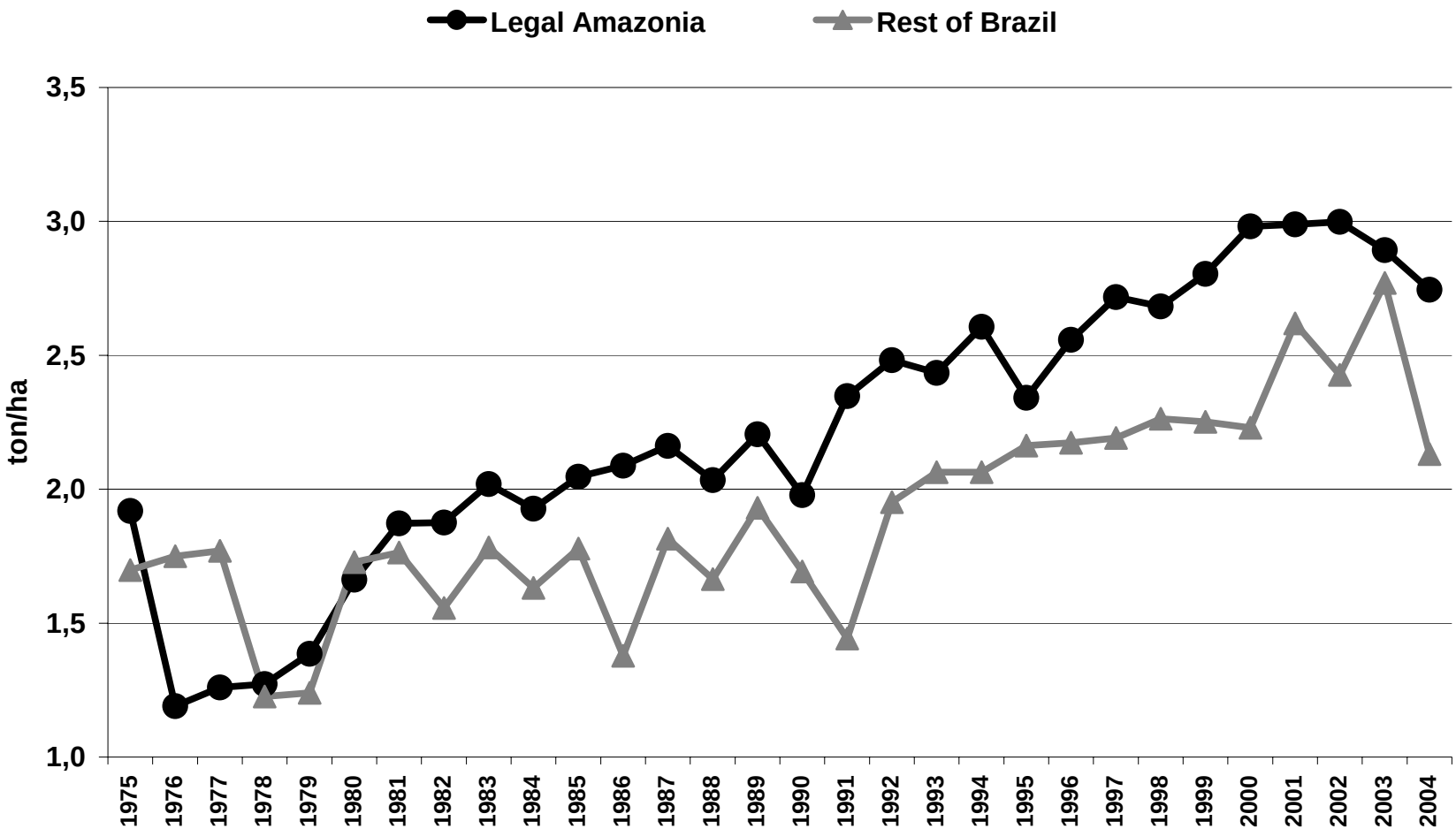
Source: IBGE - PAM

Legal Amazonia: Soybean cropped area by states, 1980-2004



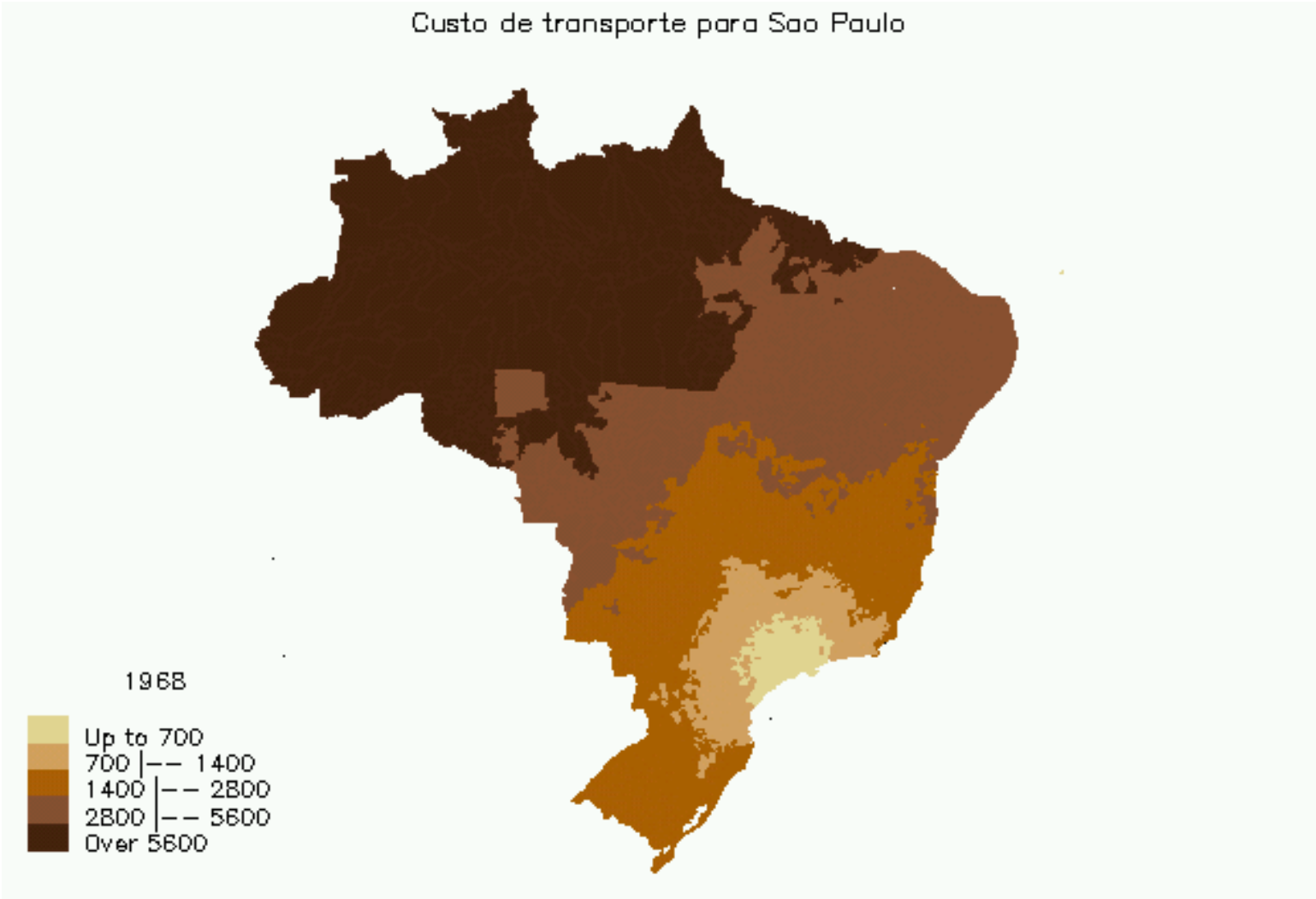
Fonte: IBGE - PAM

Soybean yield in Legal Amazonia and in the rest of Brazil, 1975-2004 (ton/ha)

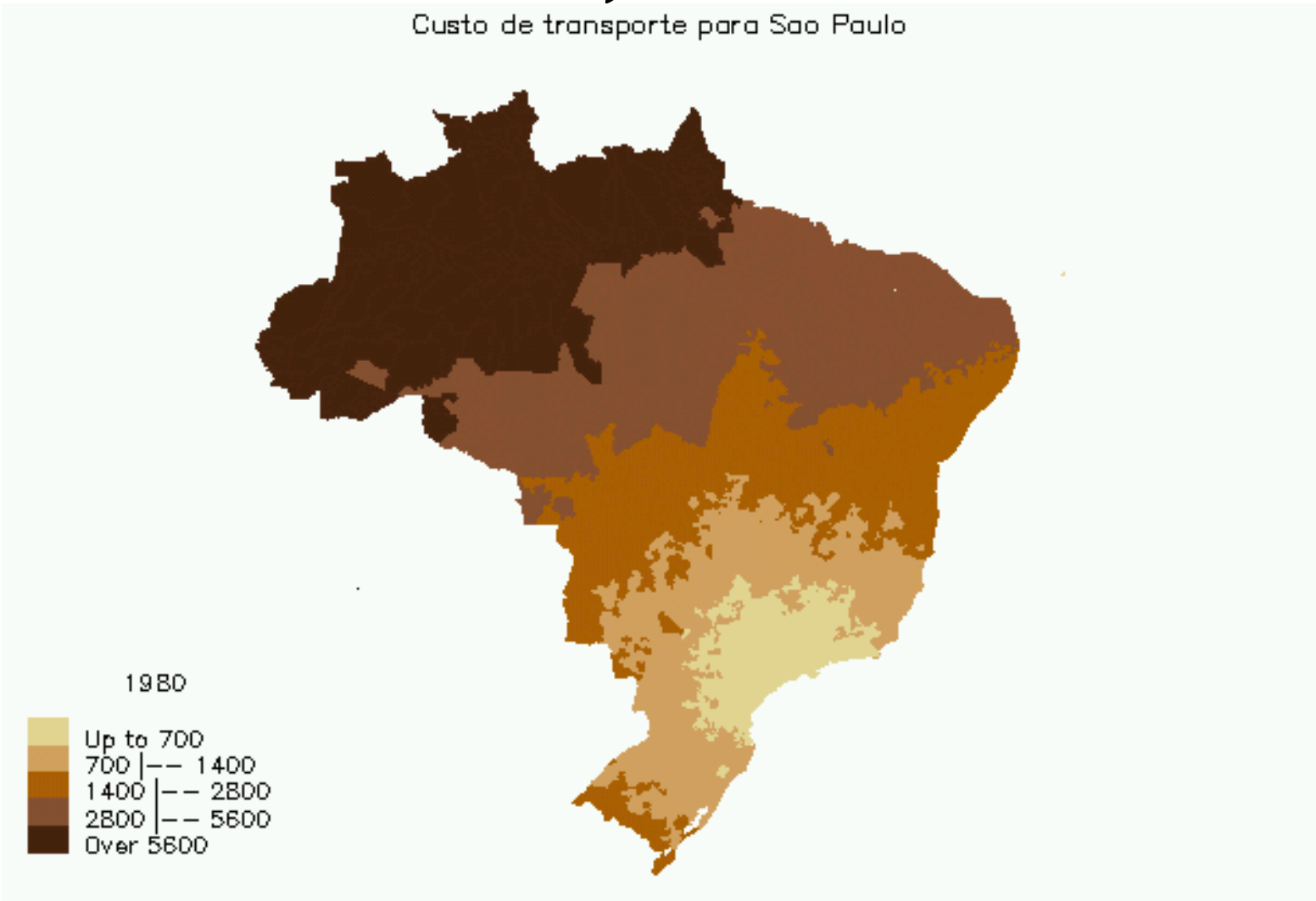


Fonte: IBGE - PAM

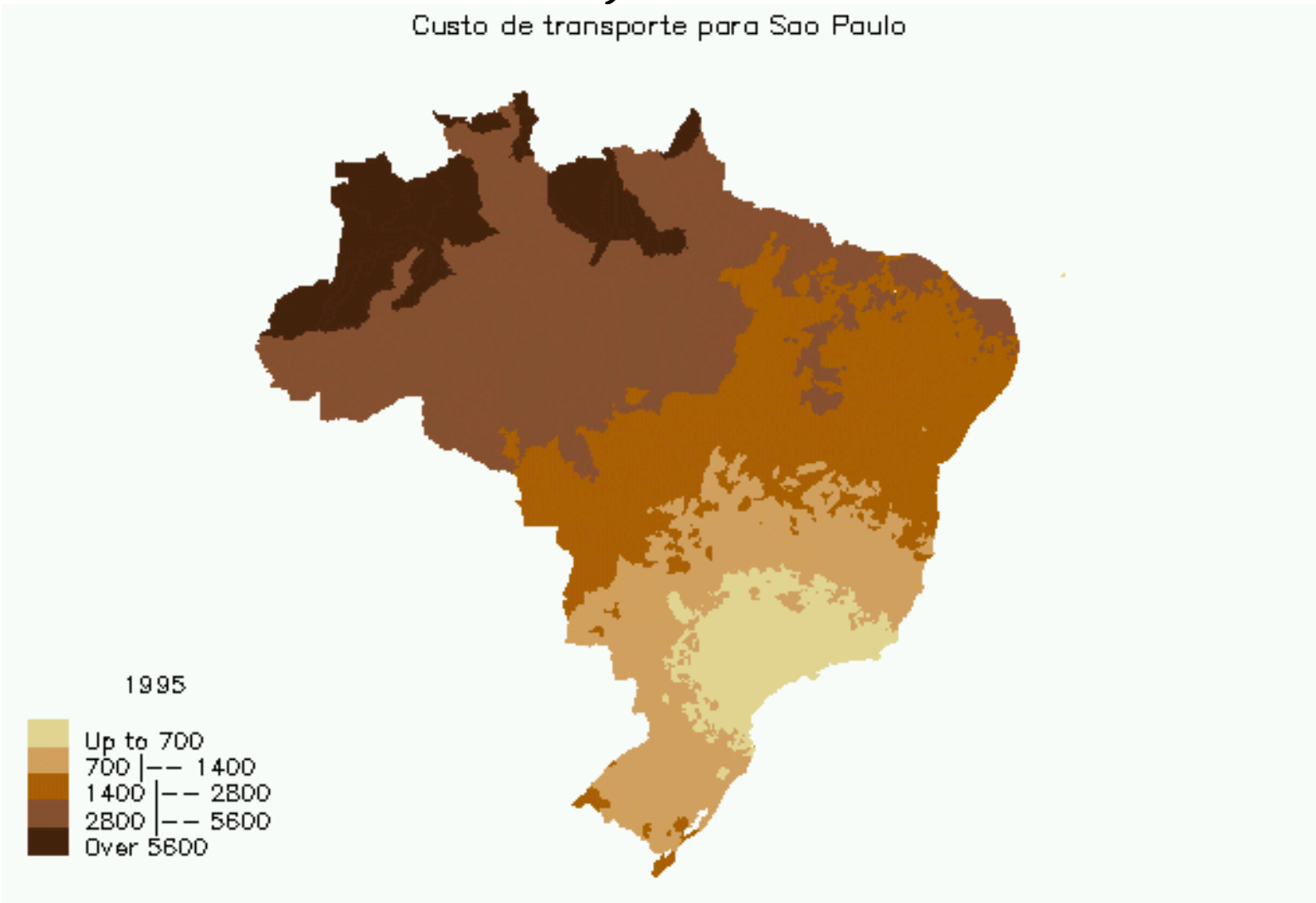
Transport costs ($/ton) to São Paulo, 1968



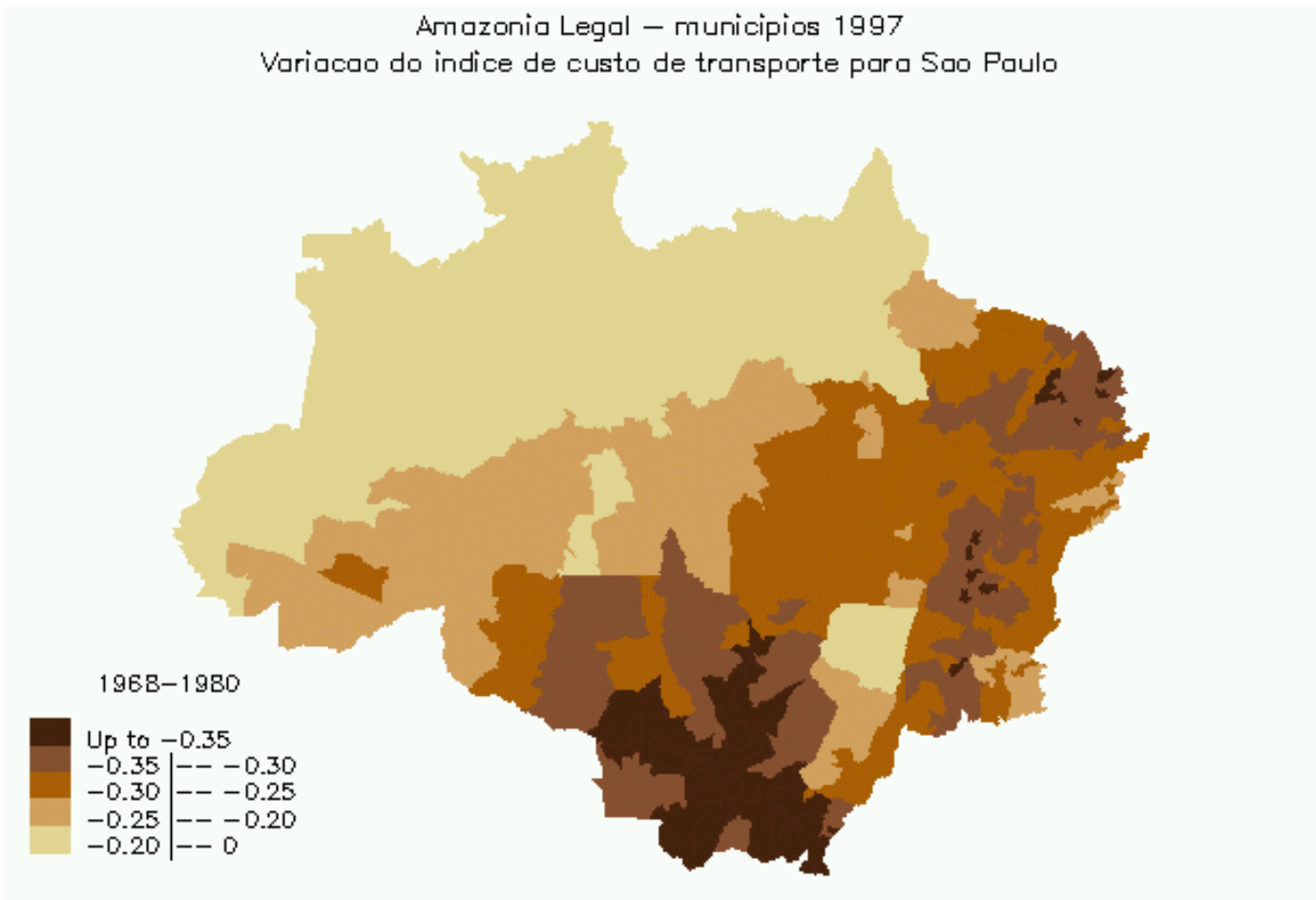
Transport costs ($/ton) to São Paulo, 1980



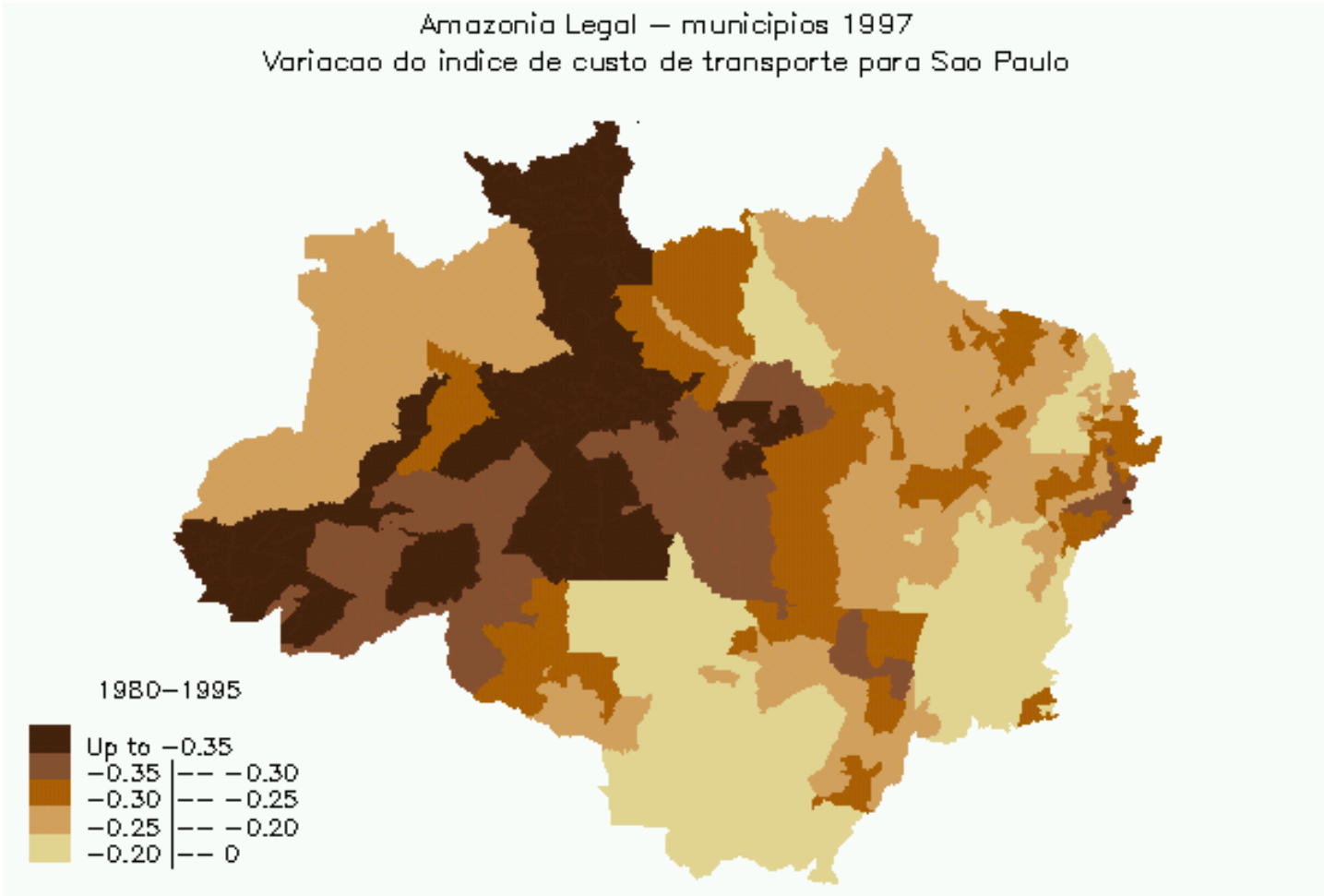
Transport costs ($/ton) to São Paulo, 1995



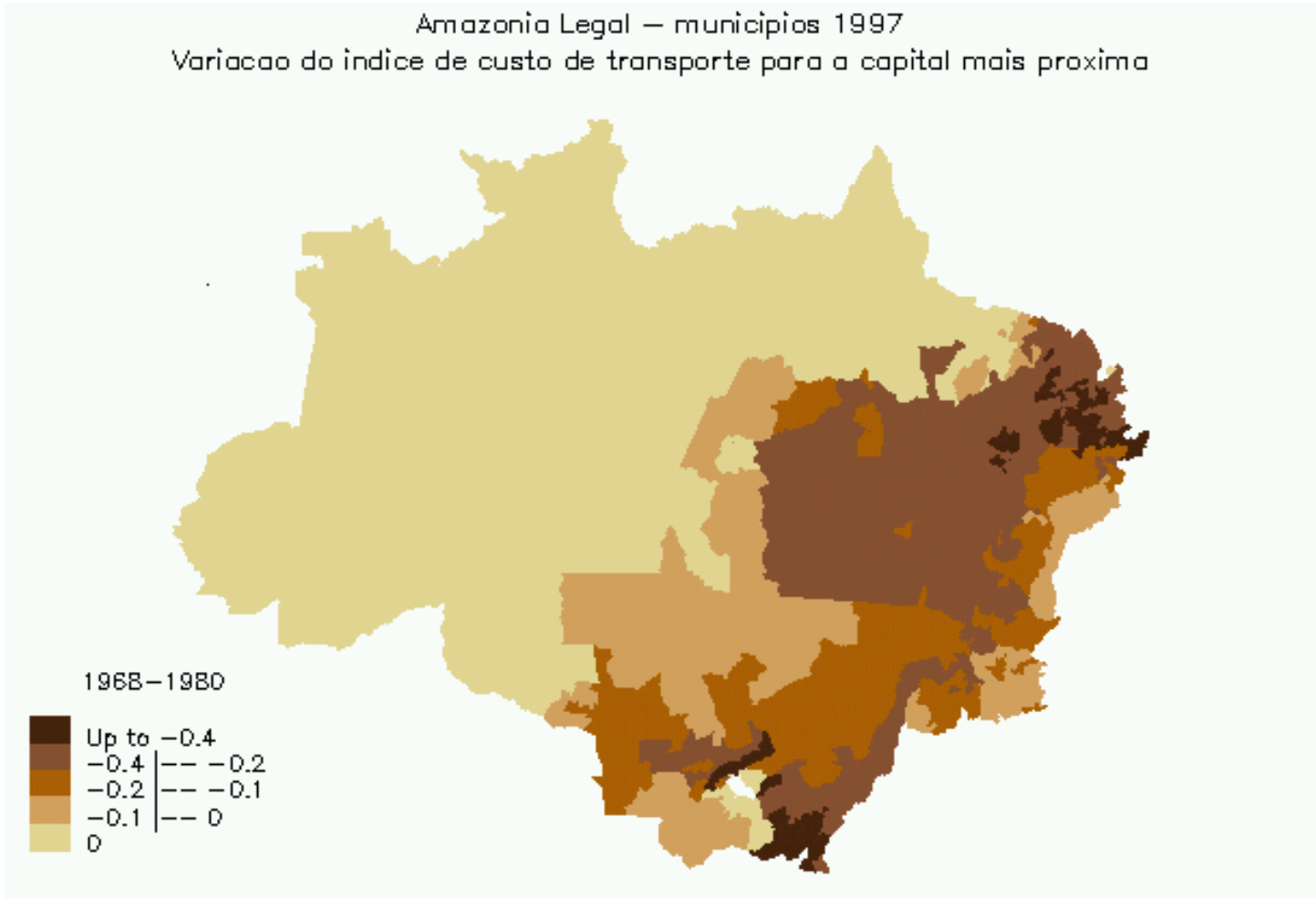
Reduction in transport cost to national markets (São Paulo), 1968-80



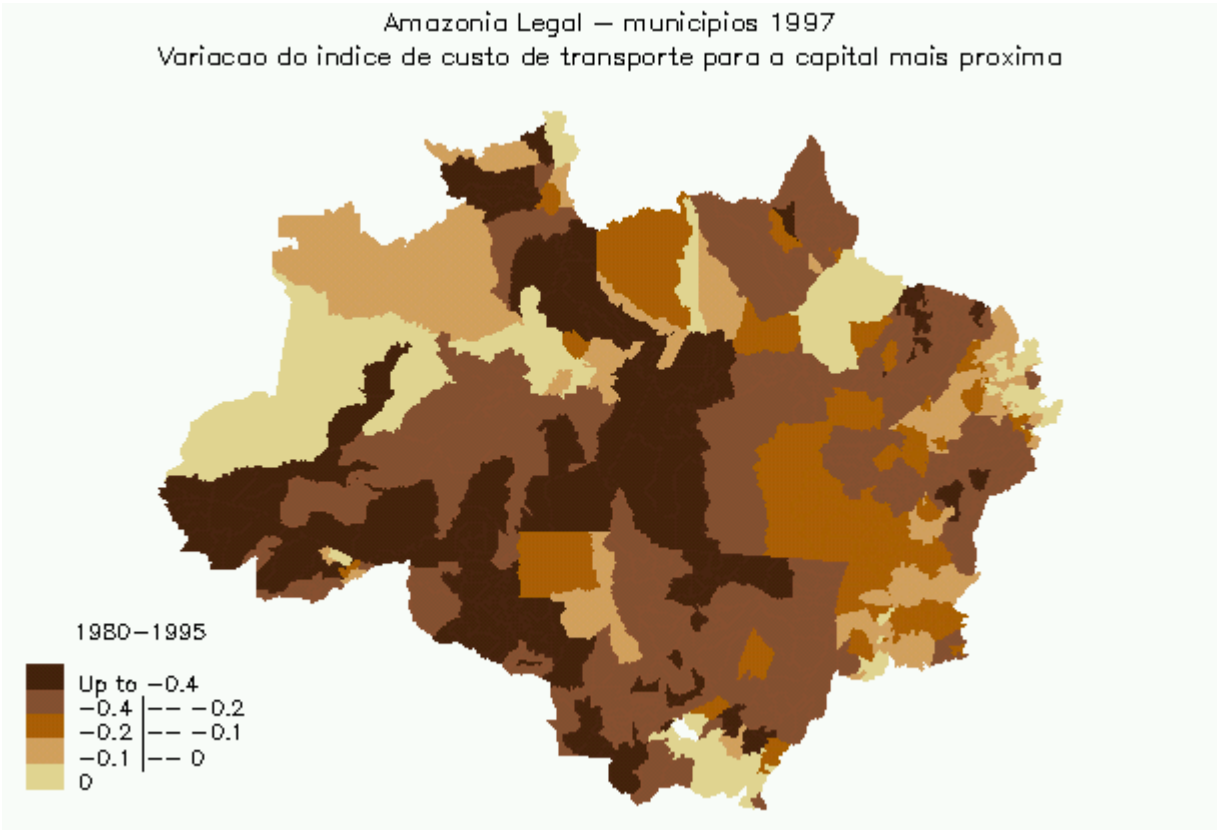
Reduction in transport cost to national markets (São Paulo), 1980-95



Reduction in transport cost to local markets (State capital), 1968-80



Reduction in transport cost to local markets (State capital), 1980-95



Cost benefits sketches: roads

- Soybean trucked to markets (800 miles) in very poor road conditions ➔ 2 x US costs (Fuller et al, McVey)
- Paving of roads is a hot policy issue
- Mechanical extrpaolations Laurance et. al ➔ catastrophic results; 35-50% of Amazonia deforested
- Econometric models Andersen et al. Pfaff et al. ➔ more reasonable impacts ➔ roads lead to more intensive cultivation
- The impact of land use intensification (both for logging and cattle ranching) on deforestation depends on the importance of local and national markets as destination of output (elasticity of demand)

Cost and benefit sketches: cattle raising

- Early settlers capitalize gains in land appropriation (land price speculation)
- Large (capitalized) cattle ranchers appropriate most of the gains of forest conversion:
  - rates of return in cattle ranching are potentially high (circa 10% p.a.)
- Deforestation + small scale cattle ranching important mechanism of social mobility ➔ extensive land use technologies
- No ecological/precipitation constraint ➔ penetrates the rain forest
- Economic/environmental sustainability of cattle ranching is an open issue
- Margulis 2002, Faminow, Andersen et al.

Cost and benefit sketches: soybean

- The role of Embrapa agricultural research crucial
- Large scale mechanized technology ➔ income concentration but does not generate frontier proletarians
- Agrobusiness activities ➔ urban employment
- Strong precipitation restrictions ➔ does not penetrate the dense rain forest
- Comes in a later stage of settlement ➔ mechanization requires no trunks and roots

Total Economic Value (GDP) of deforested areas in Legal Amazonia from 1985-95 in US$ de 1995/ha (Andersen et al 2002)

Net present value of	Discount rates		
	2% a.a.	6% a.a.	12% a.a.
•Rural GDP	1..657	553	276
•Total GDP	2.406	802	401
Total Economic Value	3635	1.418	481
•Private benefits	1.425	475	237
•Local public benefits	590	163	74
•Global public benefits	1620	790	170

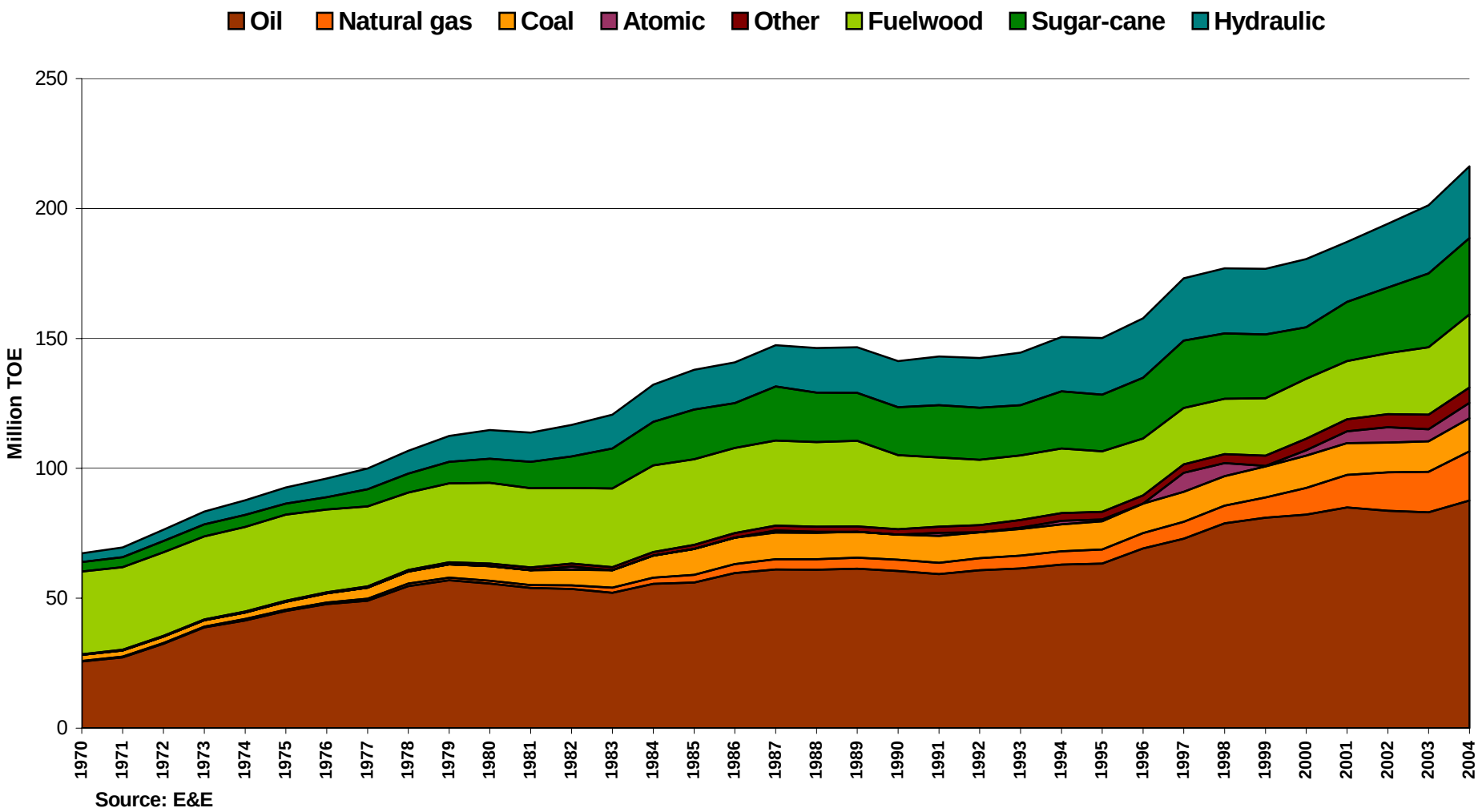
Policy issues in the Post-Kyoto environment

- Need of international compensation
- Avoided deforestation
  - Project x national level
  - Non-permanence issue
  - Sovereignity
  - Leakages
- Externality problems
- Transfer of technology

Policy issues in the Post-Kyoto environment

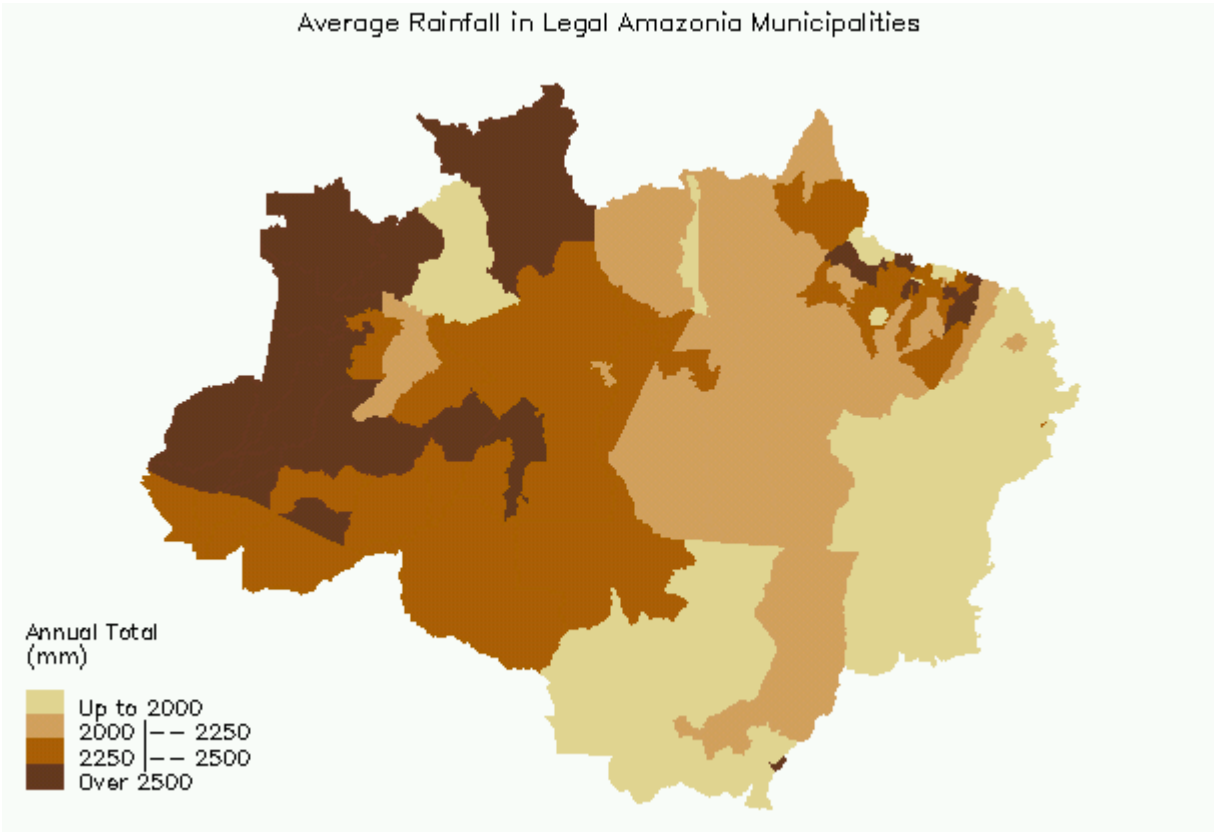
- The reduction of federal government transfer (fiscal responsibility) will indirectly induce lower deforestation through increased taxation of economic activity
  - Taxation of land at municipal level could play some role
  - Transfer linked to deforestation performance
- Effective regulation of land use (forest concession and reserves) important instrument, in particular to halt deforestation in some critical environmental areas (rainforest, biodiversity niches etc.)

Brazil: Sources of energy supply (million of TOE), 1970-2004



Source: E&E

Rainfall


Average Rainfall in Legal Amazonia Municipalities
Annual Total
(mm)
Up to 2000
2000 -- 2250
2250 -- 2500
Over 2500