

*LAND USE CHANGE IN BRAZIL:  
INTEGRATING ECOLOGY, ECONOMICS AND POLICY*

*Drivers of Land Use Change*

*Marcellus Caldas*

*Harvard University*

*January - 2003*

# FACTS

- ✓ The Brazilian Amazon comprises an area of near 5 million squared kilometers (70% are continuous forest) ;
- ✓ It contains approximately 50% of the known biodiversity in the planet ;
- ✓ Due to its vast unclaimed territory, it has attracted migrants from others regions, searching for agricultural land ;
- ✓ It remains a frontier region, mainly due to the long distance from main centers;
- ✓ Almost 85% of its original forest cover is still intact;
- ✓ Since the beginning of the sixties, the Brazilian Government made several attempts for development;
- ✓ In order to integrate the region to the rest of the country, a series of highways were constructed, such as: the Tranzamazonica Highway, the Cuiaba - Santarem Highway and the Belem - Brasilia Highway.

Figure 4

Extension of Paved Roads in the Brazilian Amazon: 1979/99

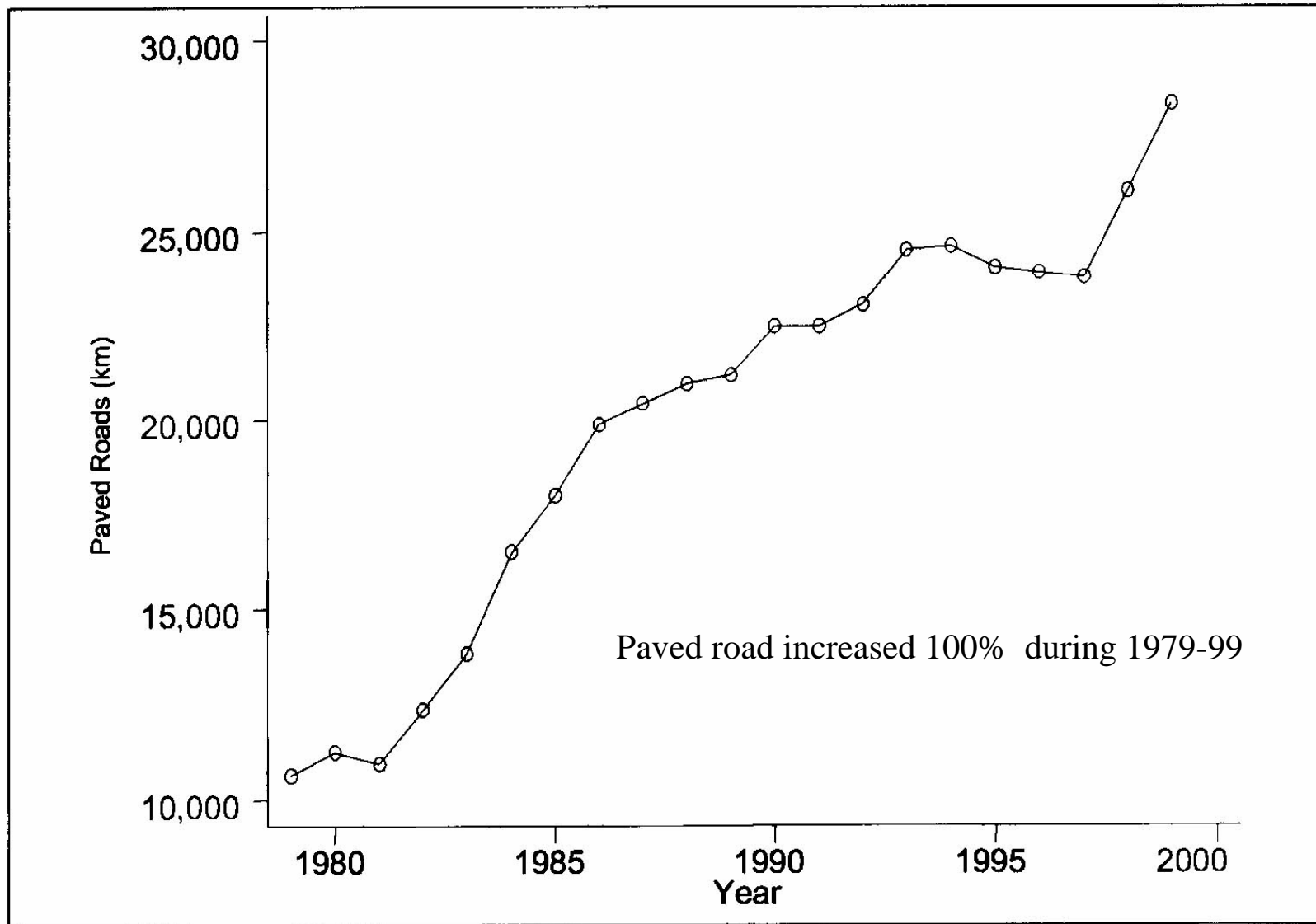
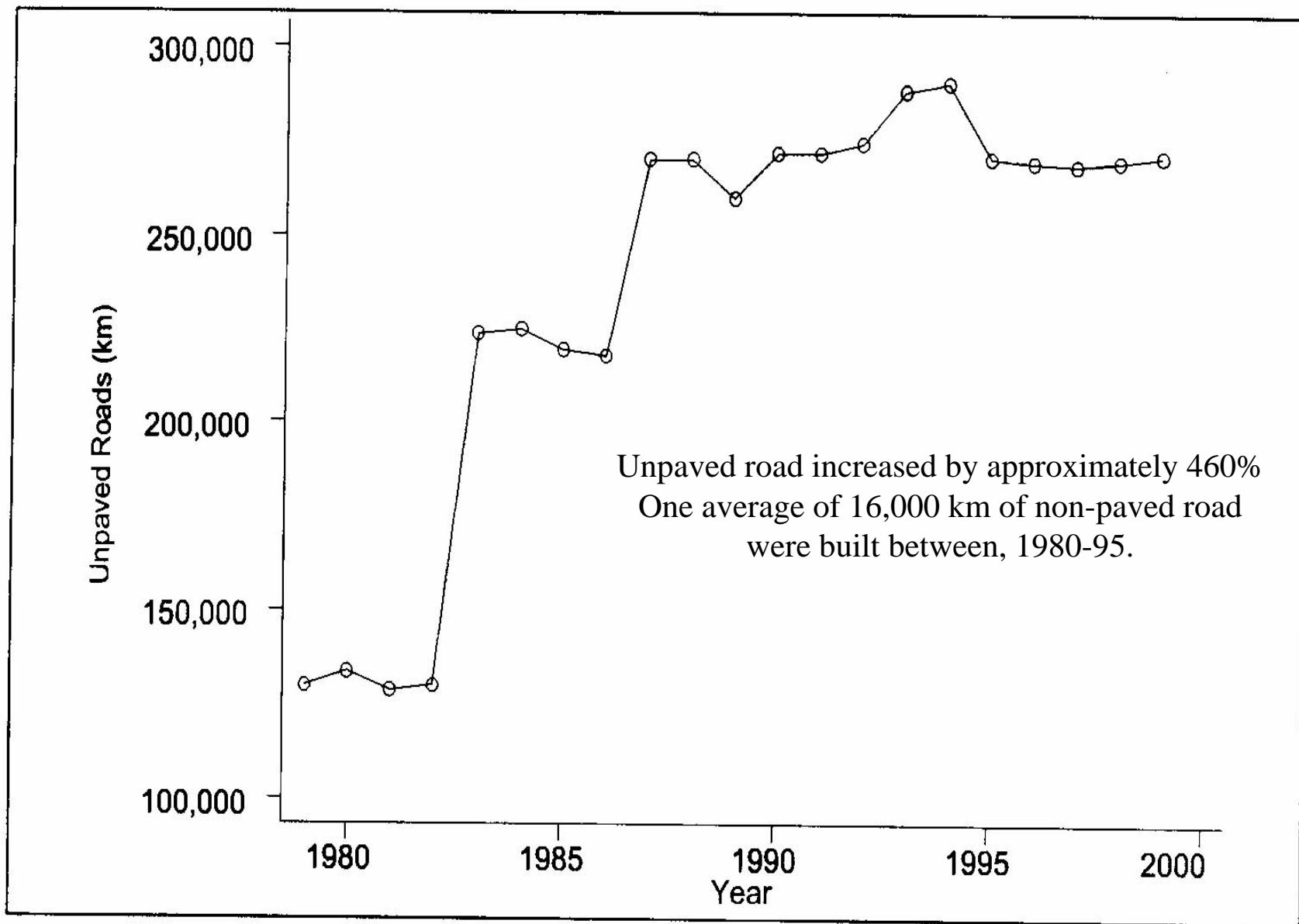



Figure 5

Extension of Unpaved Roads in the Brazilian Amazon: 1979/99





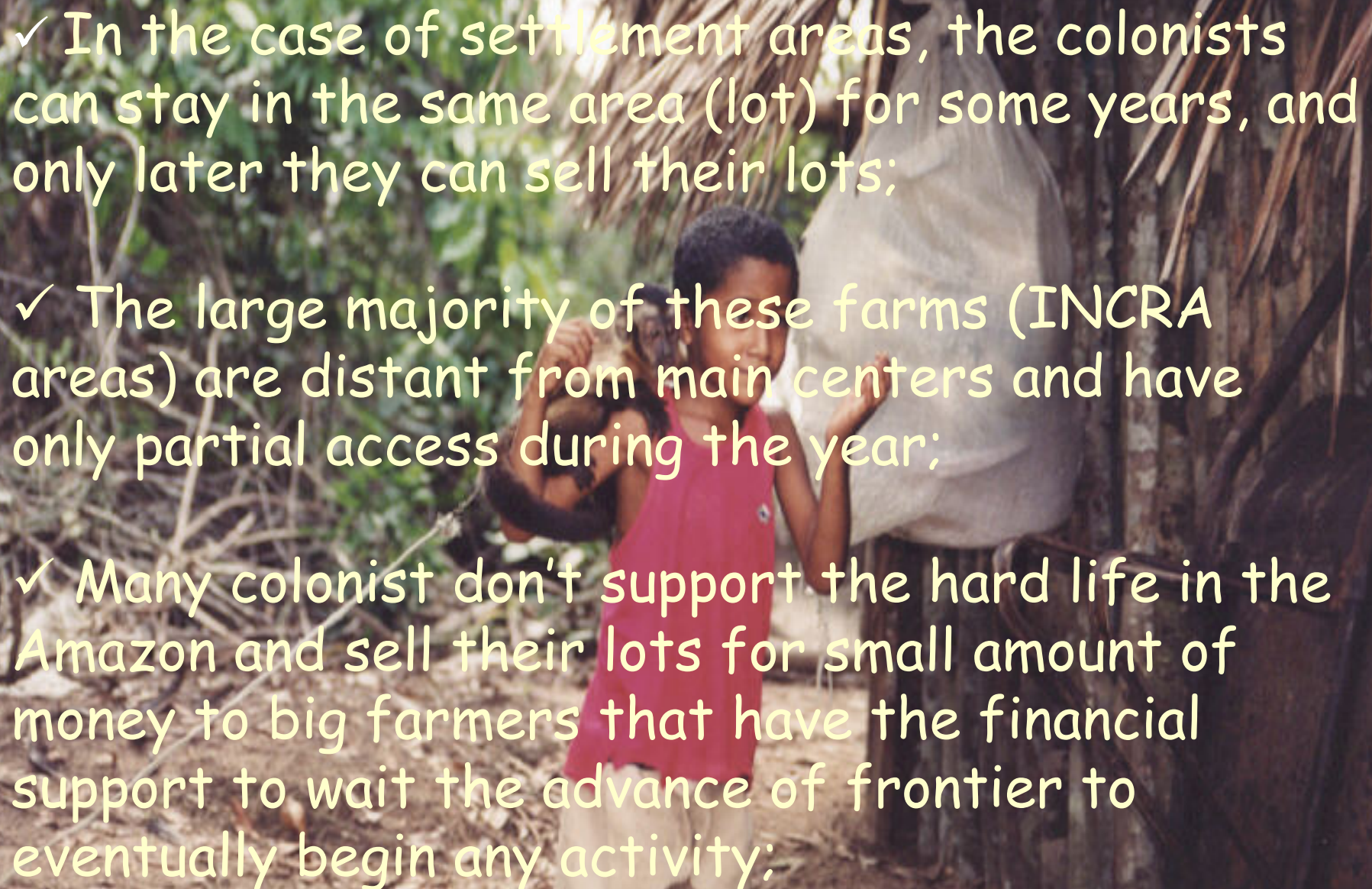


✓ Large amount of subsidized credit and fiscal incentives were given for agriculture and cattle ranching activities;

✓ The title of the land were given proportionally to the deforested area. Since cattle ranching has initial low investments, cattle ranching became the best way to get land in the 60's and 70's;

- ✓ Additionally to road construction, subsidized credit and fiscal incentives, numerous settlement projects were undertaken in regions near the new highways;
- ✓ In the past, migration policies were very important, but today, the process of opening new areas depend initially of an "inter-relationship" between two main agents: loggers and landless workers;
- ✓ The landless workers are the agents with less opportunity cost;
- ✓ The loggers need the scarce labor force in distant region where the timber is abundant, the land is free and there isn't any kind of enforcement;
- ✓ The landless workers are attracted, sometimes with the promise of settlement (private or public);



- 
- A young child with dark skin and hair, wearing a bright red tank top and light-colored pants, is walking towards the camera. They are carrying a small, dark-colored monkey on their back. The child is standing in front of a rustic structure with a thatched roof made of dried palm fronds. A large white sack is hanging from the structure. The background is filled with lush green foliage, suggesting a rural or forested area. The text is overlaid on the image in a yellow, sans-serif font.
- ✓ In the case of settlement areas, the colonists can stay in the same area (lot) for some years, and only later they can sell their lots;
  - ✓ The large majority of these farms (INCRA areas) are distant from main centers and have only partial access during the year;
  - ✓ Many colonist don't support the hard life in the Amazon and sell their lots for small amount of money to big farmers that have the financial support to wait the advance of frontier to eventually begin any activity;



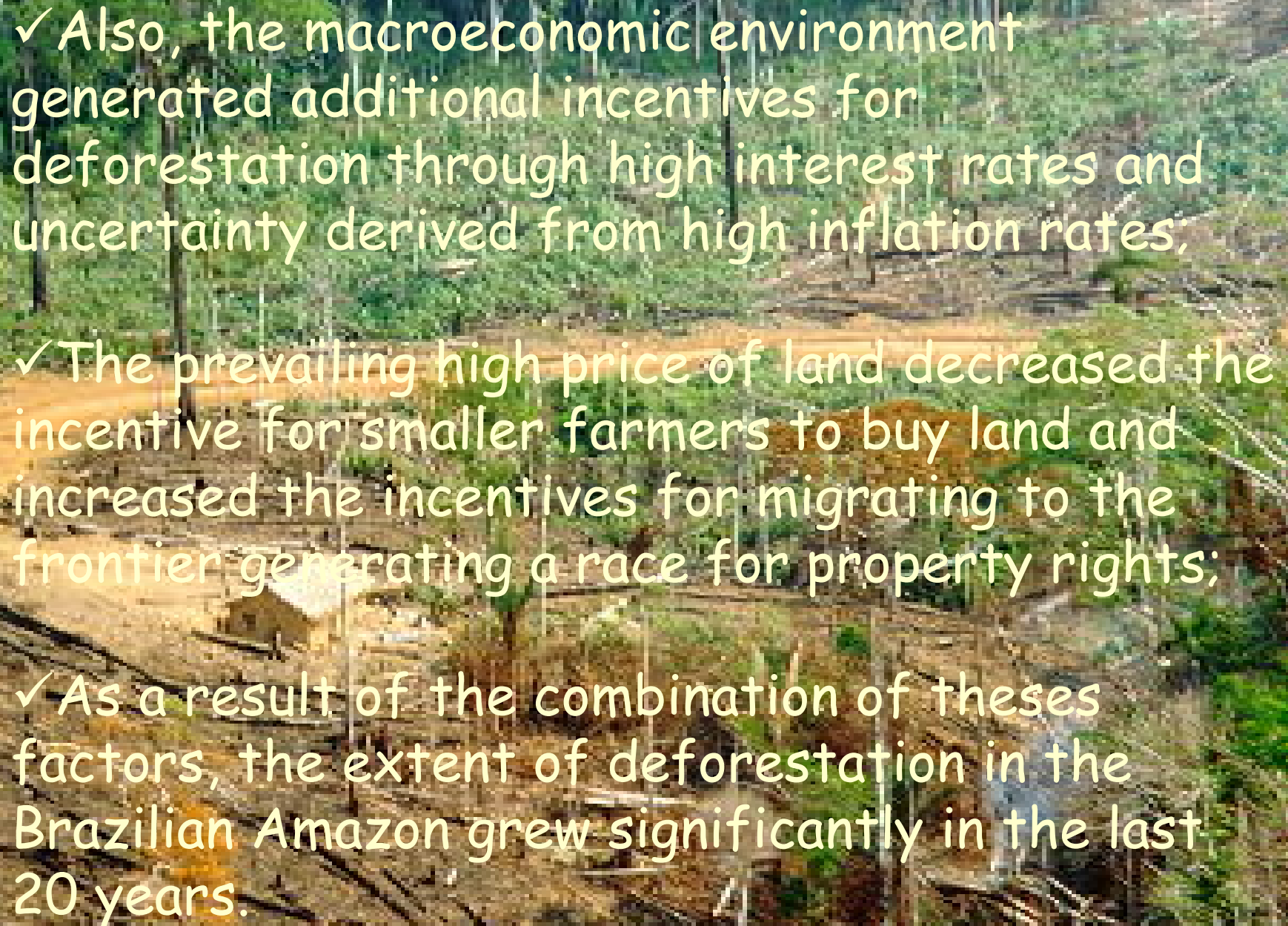
- 
- ✓ Also, the macroeconomic environment generated additional incentives for deforestation through high interest rates and uncertainty derived from high inflation rates;
  - ✓ The prevailing high price of land decreased the incentive for smaller farmers to buy land and increased the incentives for migrating to the frontier generating a race for property rights;
  - ✓ As a result of the combination of these factors, the extent of deforestation in the Brazilian Amazon grew significantly in the last 20 years.

Table 1

## The Extension of Deforestation in the Brazilian Amazon: 1978, 1988 and 1998

States	(Km <sup>2</sup> )				
	1978	1988	1998	% Growth in Deforested Area 1978/88	% Growth in Deforested Area 1988/98
Acre	2,500	8,900	14,714	256.0	65.3
Amapá	200	800	1,962	300.0	145.3
Amazonas	1,700	19,700	28,866	1,058.8	46.5
Maranhão	63,900	90,800	100,590	42.1	10.8
Mato Grosso	20,000	71,500	131,808	257.5	84.3
Pará	56,400	131,500	188,372	133.2	43.2
Rondônia	4,200	30,000	53,275	614.3	77.6
Roraima	100	2,700	5,791	2,600.0	114.5
Tocantins	3,200	21,600	26,404	575.0	22.2
Total	154,178	379,488	553,780	146.1	45.9

Source: INPE (2000).

174,000 km<sup>2</sup> of forest was cleared between 88/98

<sup>7</sup> These estimates are based on INPE (2000) subtracting the estimated cleared area in 1998 from the estimated cleared area in 1978.

Table 2

## Land Use in the Brazilian Amazon: 1985 and 1996 (Area in km<sup>2</sup>)

Land Use	1985	1996
Perennial Crops	10,183.27	10,788.24
Annual Crops	79,735.44	70,604.42
Planted Forest	3,031.78	5,800.30
Planted Pasture	298,423.46	477,273.20
Fallow Land	43,517.64	29,030.27
Productive Land not Used	114,754.61	74,275.44
Total Cleared Area	1,378,194.56	1,524,032.00

Source: IBGE agriculture census 1985 and 1995. The Brazilian Amazon considered here includes the state of Maranhão and the state of Goiás.

Planted pasture increased 60% in 10 years from 298,000km<sup>2</sup> to 470,000 km<sup>2</sup>

# WHAT DRIVES TROPICAL DEFORESTATION ?

- ✓ Various hypotheses have produced rich arguments:

## PROXIMATE CAUSES

Human activities or immediate actions at local levels;

## UNDERLYING CAUSES

Social processes, such as human population dynamics or agricultural policies

# What Drives Tropical Deforestation?

Proximate Causes

## Infrastructure

- ✓ Markets (e.g. sawmills)
- ✓ Settlements
- ✓ Public Service (e.g. electrical grids)
- ✓ Private Company (e.g. Hydropower)
- ✓ Transport (e.g. roads)

## Agricultural Expansion

- ✓ Cultivation (e.g. Smallholders)
- ✓ Cattle Ranching
- ✓ Colonization Projects

## Wood Extraction

- ✓ Commercial
- ✓ Fuelwood
- ✓ Charcoal Production

## Others Factors

- ✓ Pre-disposing Environment Factors (e.g. land characteristics)
- ✓ Biophysical Drivers (e.g. fire)
- ✓ Social Trigger Events (e.g. economic shocks)

## Demographic Factors

- ✓ Natural Increment (e.g. fertility)
- ✓ Migration
- ✓ Population Density
- ✓ Life Cycle Features

## Economic factors

- ✓ Market Growth
- ✓ Economic Structures
- ✓ Urbanization
- ✓ Industrialization
- ✓ Special Variables (e.g. price increases)

## Technological Factors

## Policy & Institutional Factors

## Cultural factors

Underlying Causes

(Geist & Lambim, 2001)

# Some controversial issues

- ✓ It is difficult to assess what constitutes inappropriate deforestation [defining it is ultimately a political decision].
- ✓ Determining the relative contribution that different agents make to deforestation is controversial. [due to lack of reliable information and because interactions among agents make difficult to analytically separate their effects].
- ✓ There is evidence to argue that part of deforestation is inappropriate and that it has negative externalities for society. Further, it tends to grow increasingly over time.
- ✓ In theory, defining inappropriate deforestation [agents and geographic areas] should help to identify the targets of policy designed to reduce both its rates and magnitude.

# Solutions that become drivers

- ✓ It is reasonable to assume that anything that makes converting forest to other land-use more profitable will accelerate the process of forest clearing.
- ✓ Thus, some solutions that would hypothetically reduce deforestation can all work in the opposite sense.

Among them:

- 1) Improving agricultural technology
- 2) Providing secure land tenure rights
- 3) Giving farmers better access to credit
- 4) Improving farmers access to markets

- ✓ Solutions that increase the profitability of agricultural land-uses may either favor long-term investment in forest clearing and help farmers to get access to the credit to finance it, or reduce the incentive to clear land.

# Conventional wisdom

- ✓ Conventional wisdom has often depicted a lose-lose scenario where the forest suffered as result of high economic inefficiency which led to an acute social inequity.
- ✓ Some policy reforms that attempted to correct policy failures contributed to further deforestation. Often these policies neither reduced deforestation nor achieved the desired social objectives.
- ✓ Over the past two decades the impact of government intervention in land use has decreased: explanations of the causes of deforestation are moving from policy-led to market-driven approaches.
- ✓ The manner in which the causes and agents of deforestation are conceptualized will greatly influence the solutions that may be suggested to reduce inappropriate forest clearing.



# The win-lose scenarios

- ✓ It is difficult to conceive win-win solutions, and contrary to what is generally accepted, the history of deforestation is more often a story of win-lose.
- ✓ Three situations supporting such argument are:
  - 1) The agricultural and livestock activities that replaced forests are more profitable, and might be more sustainable than previously believed;
  - 2) Clearing forest helped many small farmers to improve their livelihoods and well-being;
  - 3) Many so-called sustainable alternatives [i.e. NTFP] turned out to be less profitable than originally hoped.
- ✓ Hence, controlling deforestation will generally involve a trade-off between economics and the environment. Yet, the economic gains from agricultural land-uses are not equally distributed among different agents and regions.

# What can be done?

- ✓ Reinforcing the rights of agents who practice systems that are more compatible with the long-term conservation of forest cover, or in the cases in which the social and economic benefits compensate for the forest loss.
- ✓ Stimulating forest management as an attractive long-term option [e.g., through consolidating a national forest system and promoting forest management in private lands, both individual and collective].
- ✓ Paying countries and individual landowners to conserve forest [someone has to give the people that want to clear forests a real incentive not to do so]. Protected areas are not always the best way to protect forest.
- ✓ The government should undertake ecological-economic zoning, in order to identify and protect biodiversity. Such zoning should reflect the current state of knowledge and technical know-how, and be undertaken with input from local stakeholders.