GEOGRAPHY

More people, fewer trees

Minas Gerais researchers develop index to identify Amazon Forest areas prone to deforestation

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If federal government technicians and administrations indeed decide to fight deforestation, in keeping with the President of the Republic's announcement in late September at the United Nations General Assembly, they may question which areas should be considered priority, given that they have limited personnel and Brazil is so big. A potential area of priority are the towns in the south of the state of Pará, along the Cuiabá–Santarém highway. This is not a random choice, but the result of applying a mechanism that detects environmental transformations, the Index of Socioeconomic Dimensions (ISD) prepared by geographers from the Federal University of Minas Gerais (UFMG).

This index associates social and economic factors such as education, health, employment, urban development and the economy with the transformation of an area. The faster the growth of a municipality and its economy, the more precarious the living conditions tend to be, the stronger the migration, the higher the ISD and the greater the risk of environmental damage. In other words: more people in pursuit of employment or better jobs but fewer trees standing.

Areas with high population growth and high ISD could warrant more attention, since they are potentially areas of deforestation . This is the case of the town of Aripuanã, state of Mato Grosso, the towns near Santarém, state of Pará, the towns north of the city of Manaus, state of Amazonas, and along the Amazon River, beside the strip along the Porto Velho–Manaus highway.

Equatorial nature, **oil on canvas by Joseph Leone Righini**

Upon developing this index, Ricardo Garcia, Britaldo Soares-Filho and Diana Sawyer realized that the Amazon region is subject to the demands of many different social groups – a territory. Deforestation therefore has become a social phenomenon and acquired its own characteristics, according to local needs. "The main cause of deforestation in the south of Pará is the expansion of livestock, while in the state of Amapá deforestation is driven by the development of cities", Garcia exemplified.
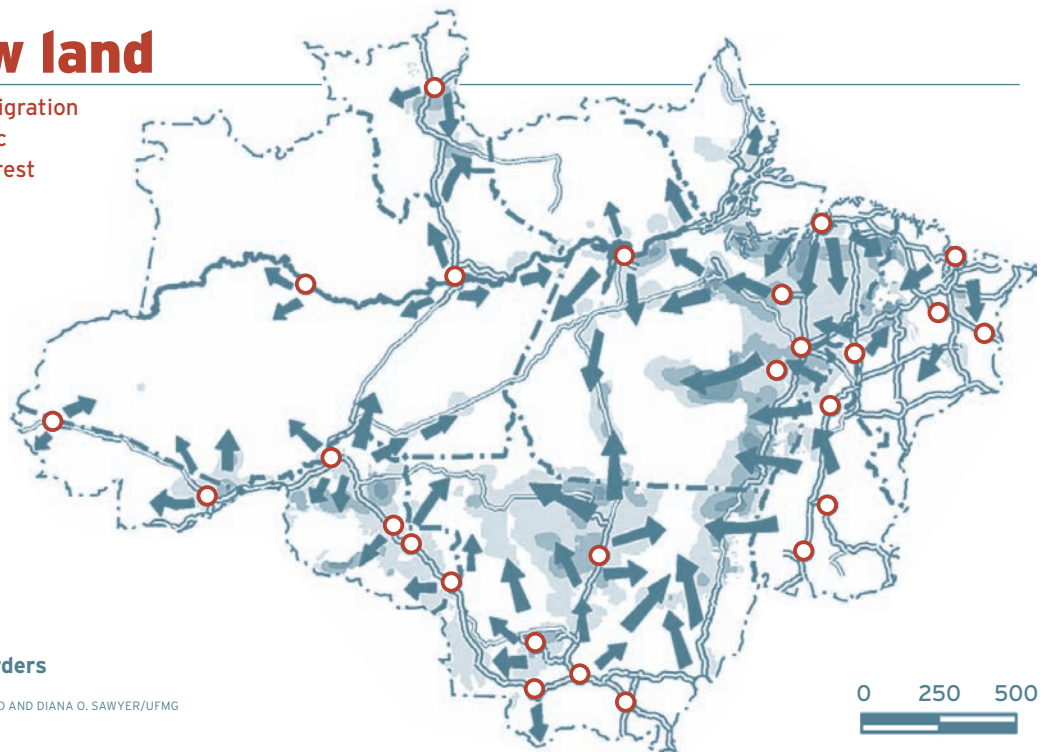
The progress of livestock farming is one of the key explanations for deforestation, since the beginning of the occupation of the Amazon Forest, which occurred at least two centuries ago. On a bigger scale, when each state is analyzed separately, as is the case in this study, migration appears to be a stronger reason for the disappearance of natural vegetation. According to Garcia, "migration accounts for a large proportion of deforestation, as it precedes the expansion of crop and livestock farming. People migrate to places where they hope to find work."

Between 1995 and 2000, some fifty thousand people left Belém, the capital of Pará; this illustrates how other states capitals in the North of Brazil experienced a population growth. Manaus, for instance, saw an inflow of forty thousand inhabitants between 1995 and 2000, who, added to the city's previous population of 1.4 million inhabitants, significantly contributed to the transformation of the natural landscape within the urban perimeter. According to this study, the greater the population, the greater the impact on the environment.

Route to new land

Urban expansion, population migration and the Index of Socioeconomic Dimensions help predict the forest areas likely to disappear

Deforestation density

- ■ High
- ■ Medium
- ■ Low

- ➤ Deforestation fronts
- ○ Regional centers
- ═ Paved roads
- ═ Access roads
- – ∙ – National and state borders

0   250   500

This reasoning explains why important urban centers in the Amazon region (generally the capital cities, which the authors of this study have dubbed "macro-centers") have the highest ISD and very little forest. The nine macro-centers (São Luís, Cuiabá, Porto Velho, Rio Branco, Manaus, Boa Vista, Belém, Macapá and Palmas) are the hubs of a network of 792 municipalities, also regulated by 29 regional centers and 48 micro-centers, respectively defined in accordance with their area of influence.

Given that the economy of a macro-center is more dynamic, they often represent focal points of deforestation. "The expansion of crop and livestock farming arises from and depends on metropolitan areas that provide manpower, equipment, slaughterhouses and a consumer market; it spreads thanks to roads and waterways", explained Garcia. "The southern tip of Pará is a good example of how urban centers are promoting deforestation."

Detailed in an article published in the *Ecological Indicators* journal, the ISD takes into account five variables from economic and population censuses. Four of them are directly related to de-forestation: the greater the indicator, the higher the risk of deforestation. The first variable is the population concentration and dynamics, which includes the total number of inhabitants, the density and the growth rate. The second variable is economic development, which takes into account the municipality's gross income and currency in circulation. The third variable is agricultural infrastructure, which is assessed by agricultural revenue, farmed areas and the number of tractors and trucks, for example. The fourth variable is agricultural and timber production, i.e., the total area of agribusiness and timber producing properties.

Only the fifth variable of the index represents a factor capable of restraining forest disappearance: social development, quantified by indicators such as the population's level of education, the number of doctors and public health-care centers, houses with running water, and streets with lighting. The rationale is quite simple: the greater the level of comfort and the better the infrastructure, the less likely it is that residents of a given city will move to other areas.

This index also explains why forests become farms or pasturelands. According to figures published by the Institute for Space Research (INPE), the state of Mato Grosso accounted for 48% of the 26 thousand kilometers of deforested areas in the past few years. Its towns have the highest ISD index in the entire region.

Meanwhile, there is no indication that the ISD will be adopted quickly in Brasília, but this study has been of use for other research. It was used as basis for dividing the Amazon Forest into social and economic regions, as part of a larger study published by the journal *Nature* in March 2006. This study showed that by 2050 half of this forest may disappear, giving rise to farms, pastures and cities, indicating the need for adjustments in the environmental policy. The forest preservation areas alone may not be sufficient to sustain the forest and the rainfall in the southeast's major cities. ∎

> Scientific article

GARCIA, R.A. et. al. Socioeconomic dimensions, migration, and deforestation: An integrated model of territorial organization for the Brazilian Amazon **Ecological Indicators**. v. 7, n. 3, p. 719-730, jul. 2007