

# Study of the evolution of deforestation patterns in the Brazilian Amazonia

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**Abstract.** *Patterns of deforestation are caused by the way which different actors use the land provoking its change. Recent works identify deforestation patterns in settlements projects in the Brazilian Amazonia in a static way, in other words, they do not identify them as a pattern evolves along the time. This work has as objective to study the evolution of deforestation patterns in the Amazonia. The deforestation patterns were analyzed in a sequence of images in different periods. This study will aid the specialist understand as a pattern evolves in the Amazonian landscape and that actions can be taken for the representation of that evolution.*

## 1. Introduction

The search for deforestation patterns has been constant due to the need of monitoring of the risk areas, which it would be more efficient if it was possible to indicate starting from certain behavior, as it would be the progress of the deforestation in certain region. A way of to detect and to monitor the change patterns in the biodiversity provoked by human actions is the use of remote sensing. The monitoring of the forest and land use and land cover changes needs temporary analyses and they usually use satellite images or aerial pictures [Lambin and Geist 2003].

In the Amazonia, the main processes of alteration of the land cover are linked to agricultural producers and their different strategies for land use [Becker, 1997]. Escada (2003) defines a typology of land use and land cover patterns for the Center-north area of Rondônia in the Amazonia. This typology constitutes a synthesis of the main processes associated to the different categories of rural properties established in the region and to the different occupation forms. Different actors involved in the change of the land use (small farmers, farmers, cattle breeders) can be distinguished by their different patterns of land use [Lambin and Geist 2003].

Silva (2005) treats the problem of detection of change patterns in the land use starting from the typology of land use and land cover patterns through methods for extraction of semantic information in satellite images using techniques of image mining. One of the results is a structural classifier that it uses the specialists' knowledge to determine the patterns that characterize the study region and, to leave of that knowledge, it generates "ecological" and geometric criteria capable to detect patterns land use change in Amazonia region [Silva 2005]. The limitation of this work is that the determination of the pattern is accomplished statically for a specific date. Each pattern represents a new object for period of time that is characterized as a new occupation, in other words, the

increment of a deforested area. In this way, the evolution, in terms of area of the deforestation in the Amazonia can be verified, however, that approach clue of side a significant part of the information of each deforestation that is the previous history, essential for the study of the evolution of the patterns of land use change in each region.

The objective of this work is to study the evolution deforestation patterns to identify the model that define the evolution of the objects that represent the deforestation patterns in the Amazonia, specifically in the Projects of Settlements in Rondônia. Starting from satellite images TM/LANDSAT originating from of the project PRODES (Estimate of Amazon Gross Deforestation Project) [INPE 2003], we identified and studied the objects that represent the deforestation patterns that will aid the specialist to understand as the deforestation patterns evolves in the Amazonia.

In what follows, we presented the study of deforestation patterns in the Amazonia in section 2 and in the section 3 we presented the conclusions.









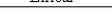
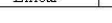
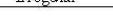
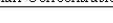
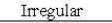
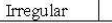
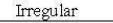
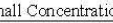




## **2. Study of evolution of deforestation patterns in the Amazonia**

With the objective of to detect the dynamics of the spatial deforestation patterns and to associate them to different actors and processes, three elementary structures were recognized in the analysis of the data of deforestation: irregular, linear e geometric [Siva 2005]. Starting from the typology of land use and land cover patterns, the characteristics of those patterns were defined as linear with spatial distribution to the therefore of the highway, with variable extension of deforestation, tends as land use the hand of family work, subsistence agriculture; irregular with close spatial distribution to main roads and population nuclei, with extension of smaller deforestation than 50ha, tends as land use the hand of family work, subsistence agriculture; and geometric with close space distribution to highways and population nuclei, with extension of larger deforestation than 50ha, tends as land use of the cattle breeding for medium and big farmers.

The evolution of deforestation was evaluated in the series of temporal images TM/Landsat 5 (231/66 and 231/67, from 1985 to 2000, with resolution of 30m), in *Vale do Anari*, classified by the structural classifier. We studied the spatial relationship (touch, inside of) among the objects that represent the patterns in different periods of time (t). The objective of the study was the cases that indicate to flow when two areas deforested in different periods represent the same area and they should be united, and when they should be maintained in separate for they indicate not concentration. The group of the studied patterns is presented in the Table 1.

What noticed in that study is that depending on the context the union represents the deforestation evolution of object however in certain cases the union of two objects is not correct, because it does not represent its evolution. Cut objects for highway do not represent the same area. Another found situation is that in settlements projects the lots are distributed along the highway and the deforestation of a lot begins starting from the highway for the bottoms of the lot. Deforestations along the highway belong to different lots, in other words, they are different objects. In that way it is fundamental for study that the object with typology *highway* is defined in the initial period of evaluation.

**Table 1. Study of the evolution of the deforestation patterns.**

Pattern 1 (t1)	Pattern 2 (t2)	Generated Pattern	Meaning
			
Linear	Linear	Linear	Highway
			
Linear	Linear	Irregular	Small Concentration
			
Irregular	Irregular	Irregular	Small Concentration
			
Irregular	Irregular	Geometric	Large Concentration
			
Geometric	Indifferent	Geometric	Large Concentration

The study takes into account the analysis done in relation to classification of the patterns, the union in different periods and the result of that union. It also takes into account the spatial distribution of the objects in relation to highway to define two objects that touch each other they should really be united or maintained in separate.

#### 4. Conclusions

This paper proposes a study, to aid the specialist in the analysis of the evolution of the deforestation patterns in the Brazilian Amazonia. The initial model generated needs to be perfected for the search of the best representation of the reality. To leave of this study we intended to extend the structural classifier creating a computer solution with the objective of to maintain and to present the history of objects that represent the deforestation patterns.

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