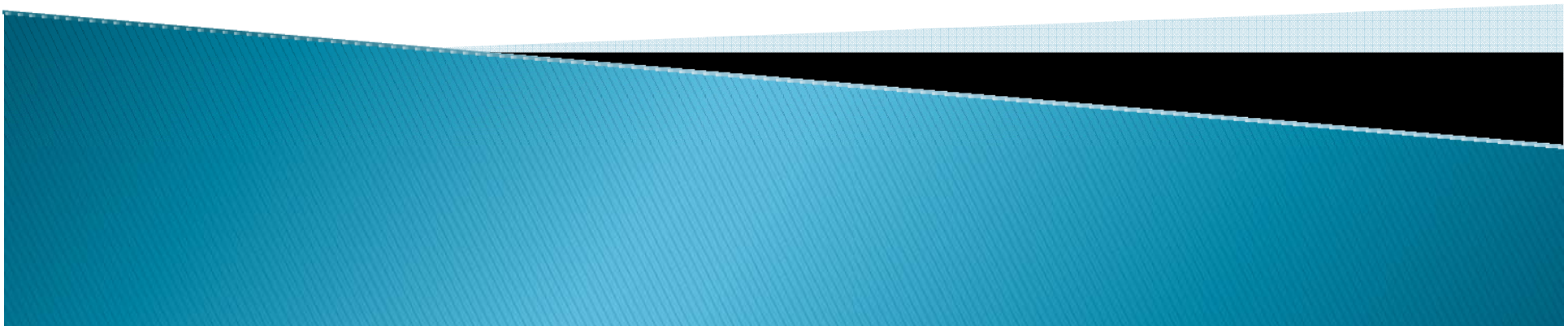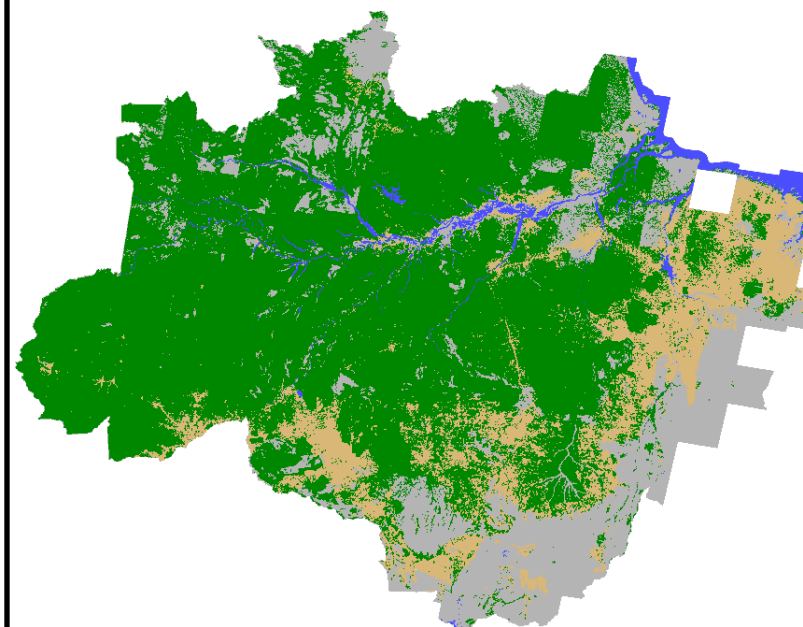# Characterization of human occupation trajectories: Patterns in the Amazon through Data Mining

Leila Fonseca, Isabel Escada,
Érika Saito, Thales Korting

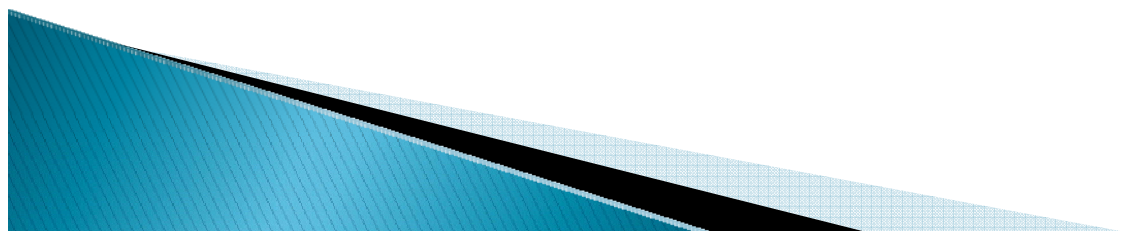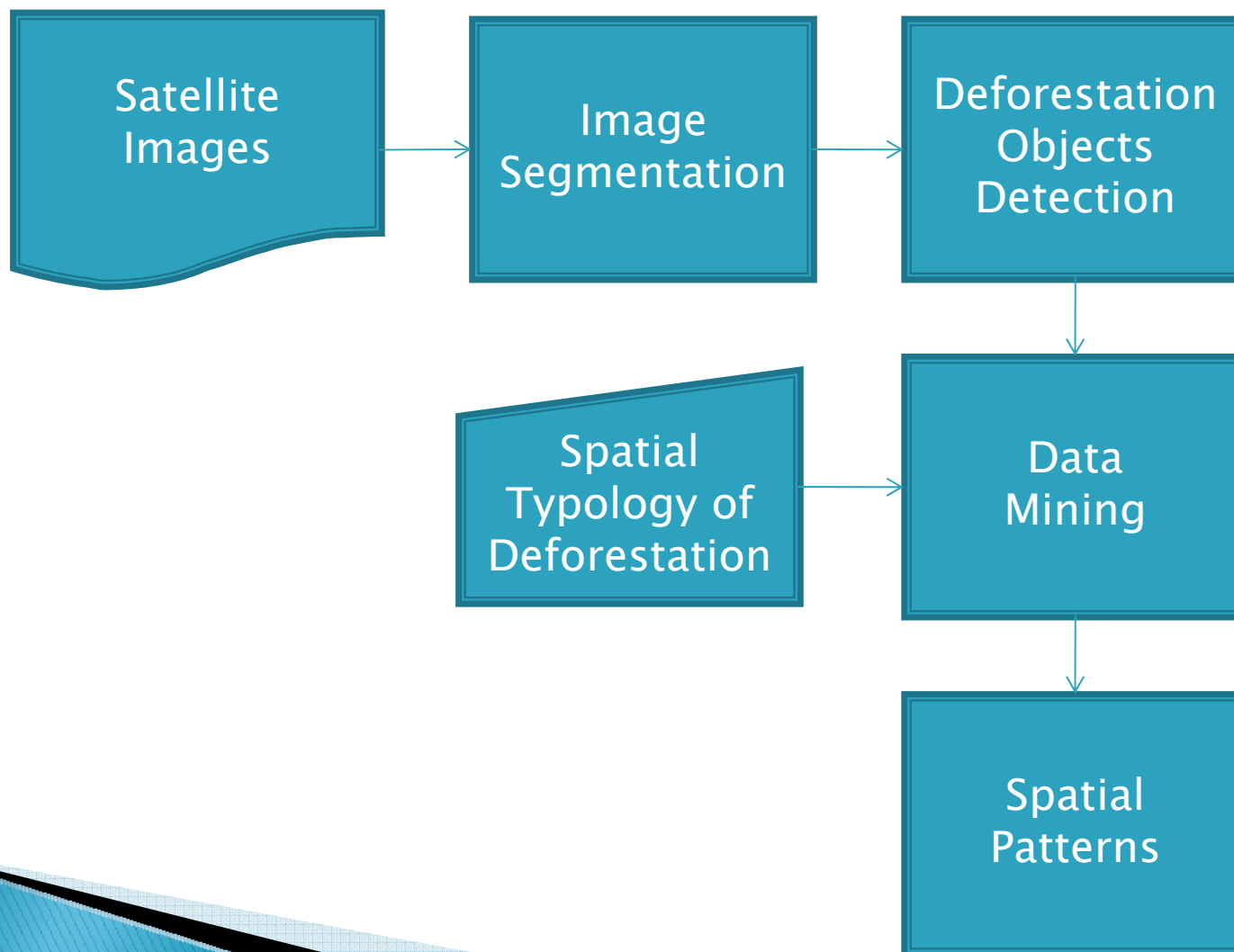ABCC WORKSHOP – Perth, Australia – August 23–25, 2011

Working hypothesis

The Brazilian Amazon has different institutional arrangements that influence the spatial and temporal patterns of deforestation

Objectives

- Identify and analyze patterns of deforestation
- Associate deforestation to human activities
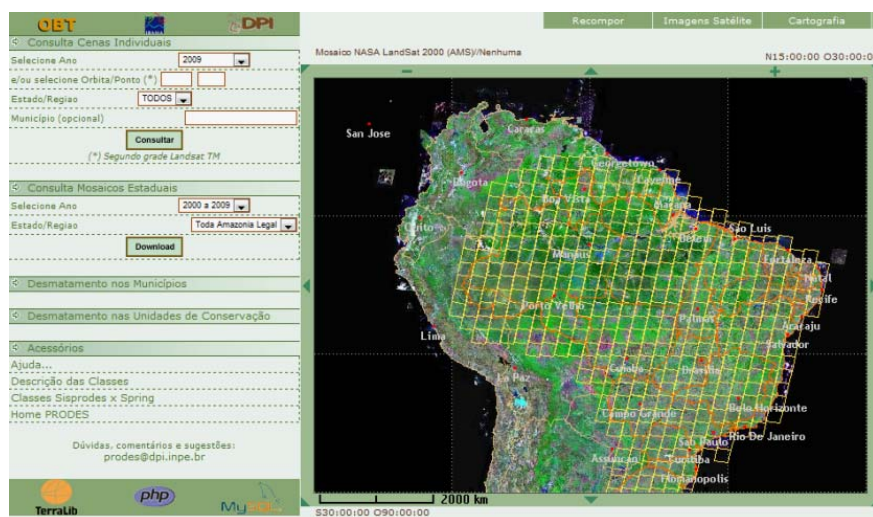- Detect trajectories of land occupation

Fonte: Ciência Hoje
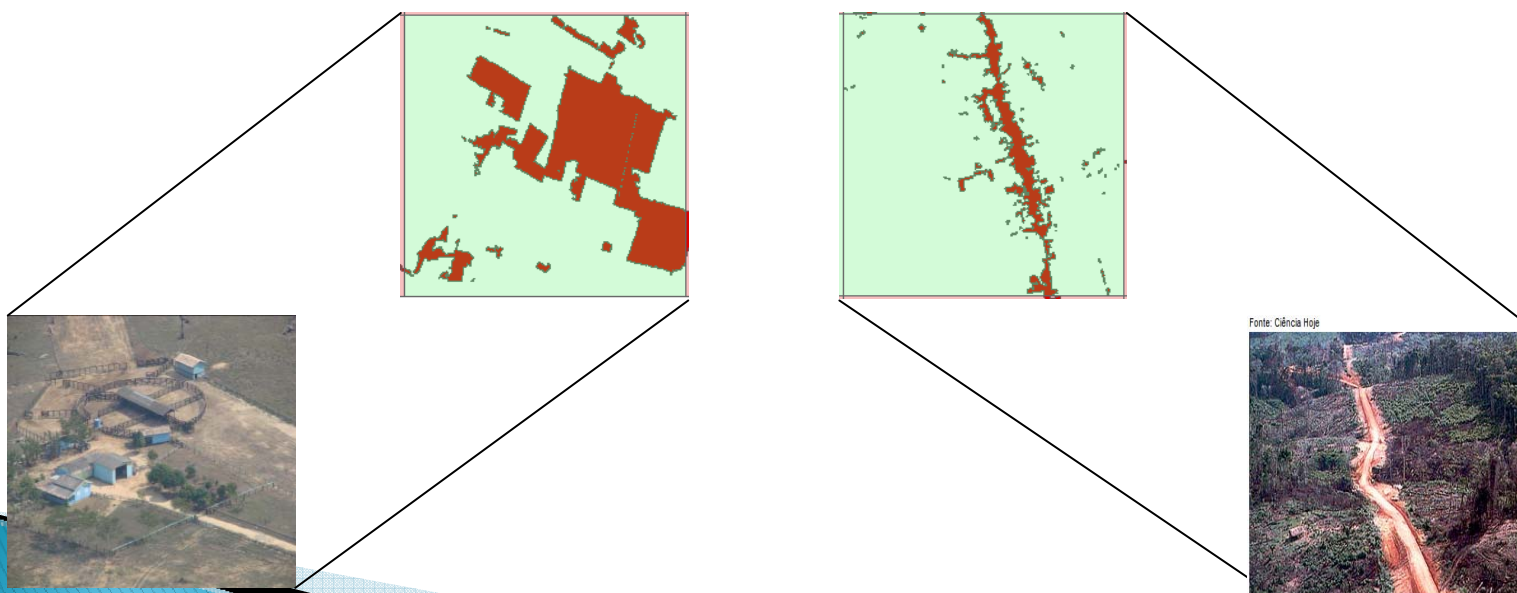
How to detect deforestation patterns?

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┌─────────────────┐      ┌─────────────────┐      ┌─────────────────┐
│    Satellite    │ ───▶ │      Image      │ ───▶ │  Deforestation  │
│     Images      │      │  Segmentation   │      │     Objects     │
│                 │      │                 │      │    Detection    │
└─────────────────┘      └─────────────────┘      └─────────────────┘
                                                           │
                                                           ▼
┌─────────────────┐                               ┌─────────────────┐
│     Spatial     │ ───────────────────────────▶  │                 │
│   Typology of   │                               │      Data       │
│  Deforestation  │                               │     Mining      │
└─────────────────┘                               └─────────────────┘
                                                           │
                                                           ▼
                                                  ┌─────────────────┐
                                                  │     Spatial     │
                                                  │    Patterns     │
                                                  └─────────────────┘
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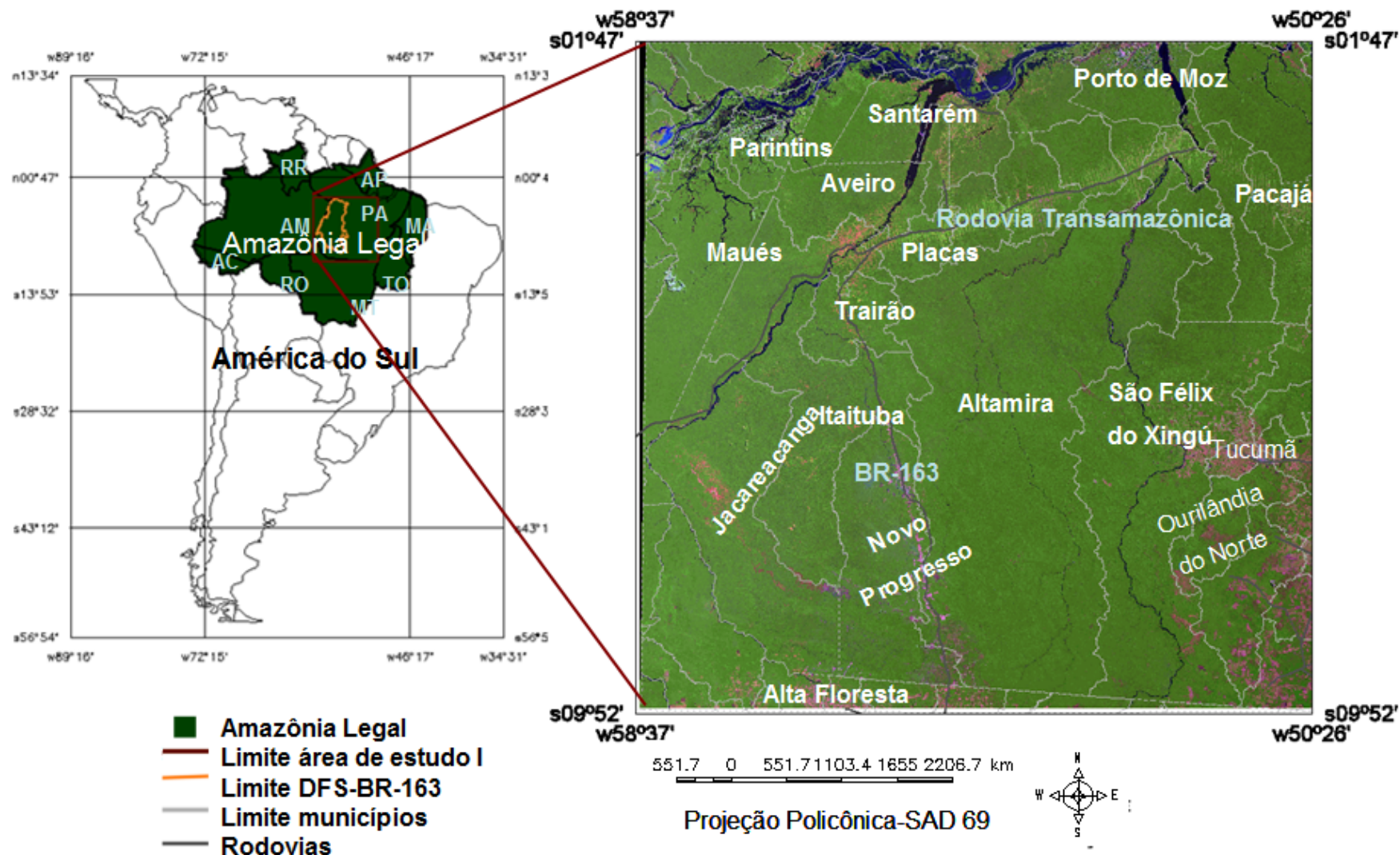
PRODES – input data

- Amazon monitoring using satellite imagery
- Annual rates of deforestation
- www.obt.inpe.br/**prodes**

Study Case

Methodology – GeoDMA

GeoDMA – Geographical Data Mining Analyst

Free and open source system developed in C++ devoted to data mining analysis with geographical data. It is a plugin for TerraView GIS
http://www.dpi.inpe.br/geodma

(KORTING et al., 2008)

Create cell layer

Extract Landscape Ecology Metrics

Deforestation patterns

Deforestation

Forest

Geometric	Corridor	Fishbone
Diffuse	Fragmented	Island
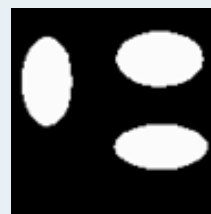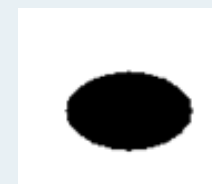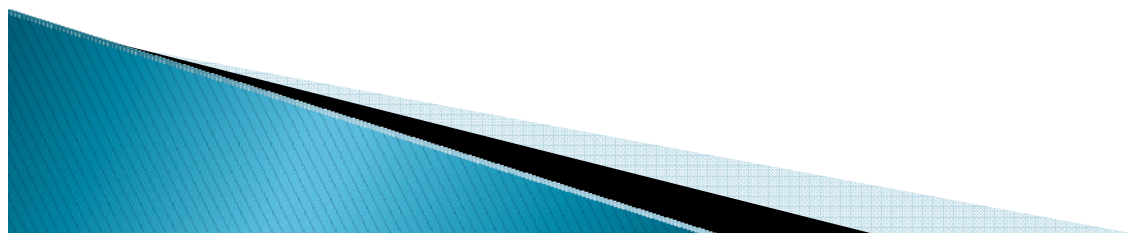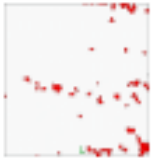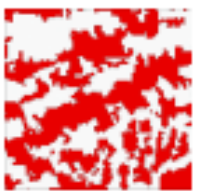
Human Occupation Patterns Typology – Deforestation Patches

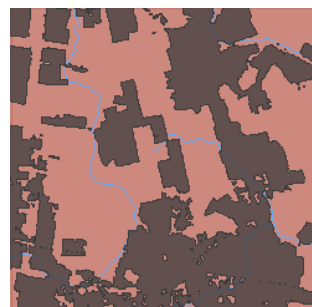|	Pattern	Patern Description (1:100.000)	Semantic
	Diffuse	• Small and isolated patches • Low to medium density • Uniform distribution	• Beginning or non intensive occupation process • Non planned occupation • Small farms or household family • Occupations along rivers
	Linear	• Linear patches like corridors • Low density • Unidirectional	• Beginning of the occupation process • Non planned occupation • Occupation along roads • Small farmers
	Large Geometric	• Large and medium isolated patches Geometric patches • Low to medium density	• Beginning or intermediary stage of the occupation process • Medium and large farms
	Multidirectional	• Medium and Small patches • Several shapes (irregular, geometric and linear) • Medium to high density patches • Multidirectional	• Occupation expansion. • Non planned occupation • Land concentration • Medium and small farms
	Consolidated	• Large compact and continuous deforestation patches. • Small Forest remnants • Low density of forest pacthes	• Advanced occupation stage • Land Concentration • Small, Medium and Large farms • Fragmentation • Consolidated Occupation
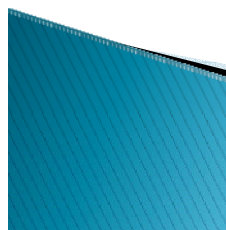
Trajectory of land change
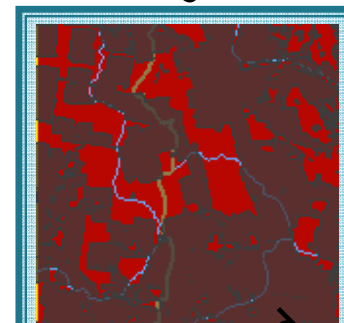

geometric   geometric   consolidated   consolidated   consolidated deforestation
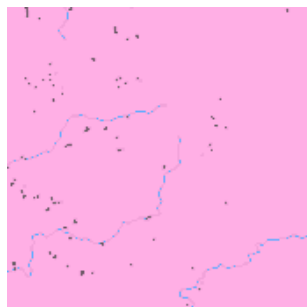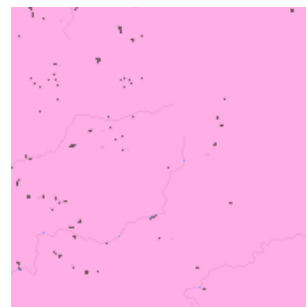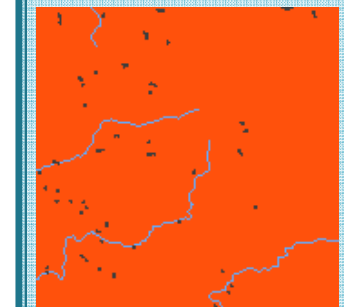
forest   forest   diffuse   diffuse   expanded deforestation

1997   2000   2003   2006
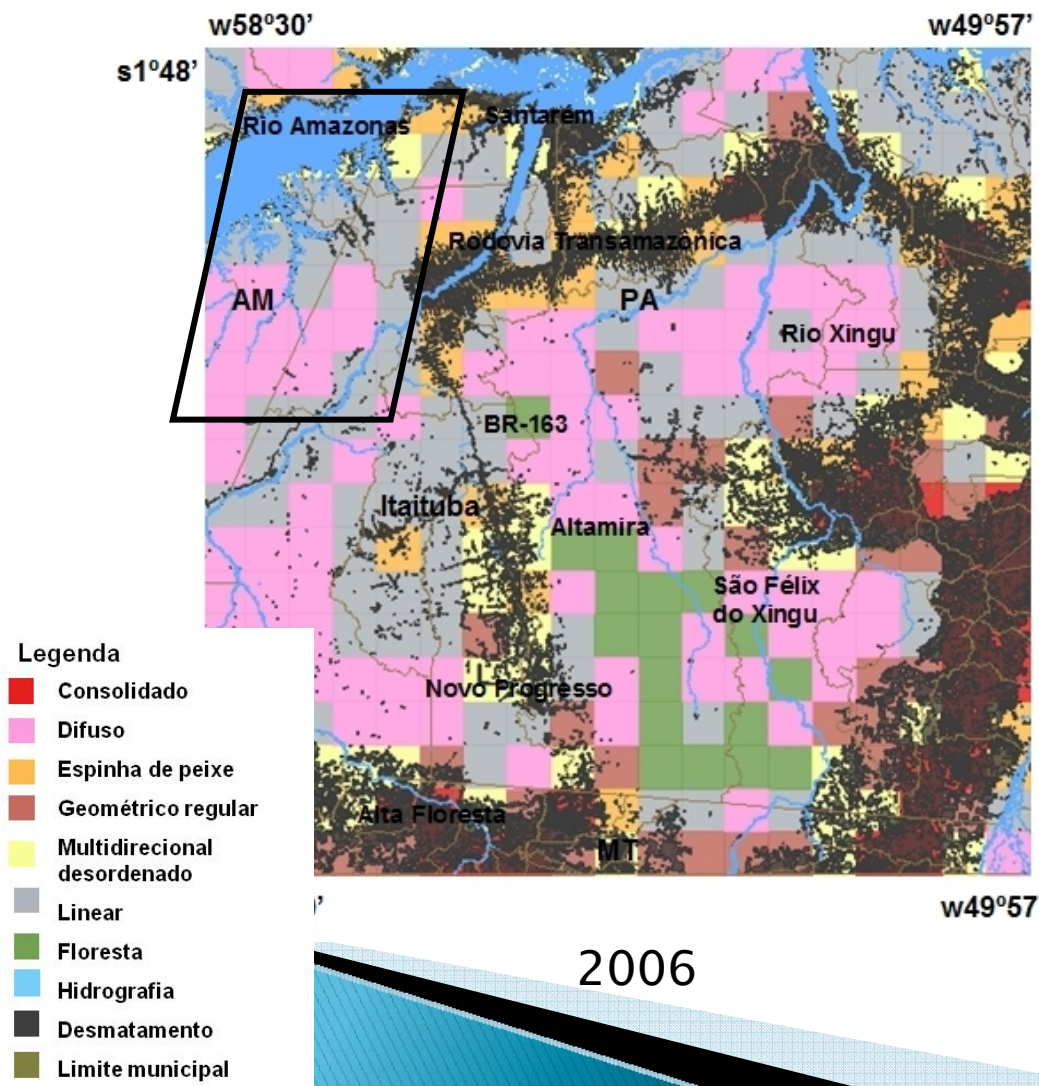
Mapping trajectories of change

Map of land use patterns

Trajectories of change

2006

Legenda
- Consolidado
- Difuso
- Espinha de peixe
- Geométrico regular
- Multidirecional desordenado
- Linear
- Floresta
- Hidrografia
- Desmatamento
- Limite municipal

Legenda
- Expansão
- Sem mudança
- Consolidação
- Floresta
- Hidrografia
- Limite Estadual
- Rodovias
- Limite municipal

Projeção Policônica
Datum SAD69
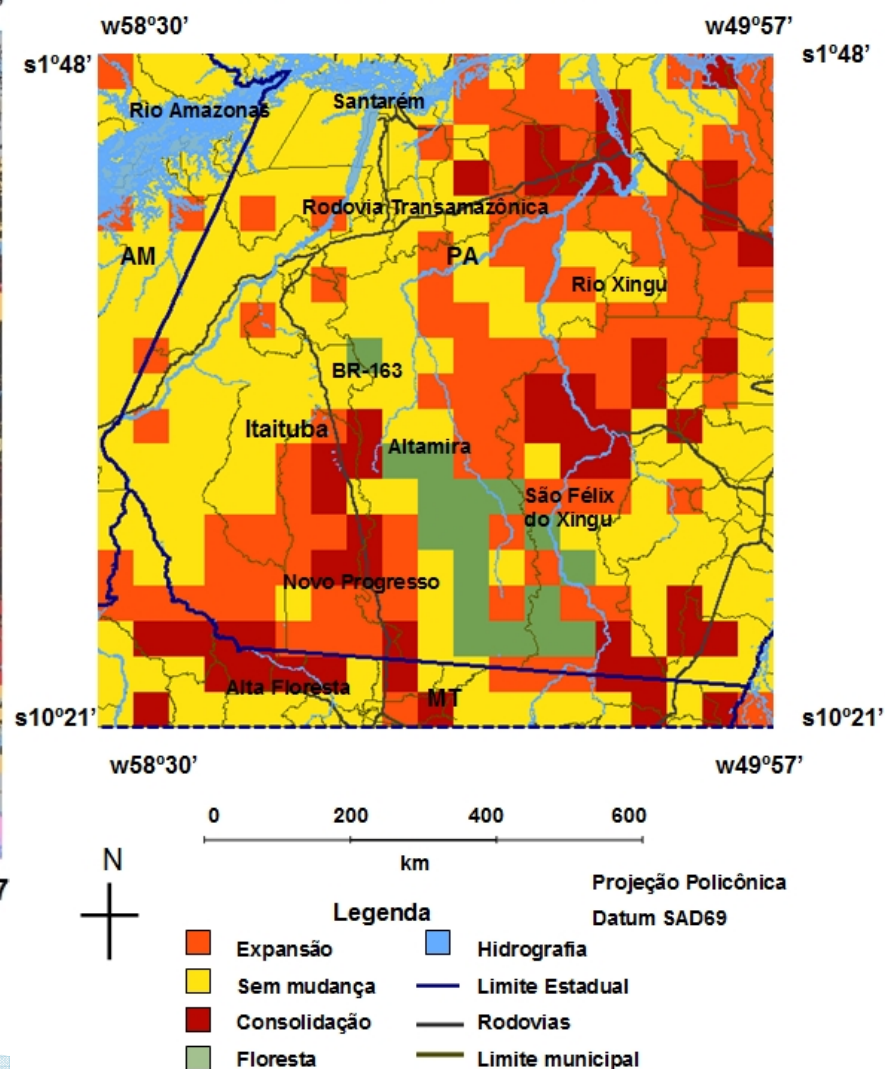
Research under development

- Develop tools to detect changes automatically
- Apply data mining to classify land use changes

Zoom: 1d 5d 1m 3m 6m 1y Max   ● EVI2 original: 0,388 ● EVI2 filtrada: 0,394 | 17/12/2009

THE GLOBAL FARM

With its plentiful sun, water and land, Brazil is quickly surpassing other countries in food production and exports. But can it continue to make agricultural gains without destroying the Amazon?

Brazil is the world's current largest experiment on land change and its effects: will it also happen elsewhere? Today's questions about Brazil could be tomorrow's questions for other countries

THE GLOBAL FARM

With its plentiful sun, water and land, Brazil is quickly surpassing other countries in food production and exports. But can it continue to make agricultural gains without destroying the Amazon?

Thank you!

For questions, please contact the authors:

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erika@dpi.inpe.br
tkorting@dpi.inpe.br