Workshop in Spatial Analysis in Anthropology: Introduction

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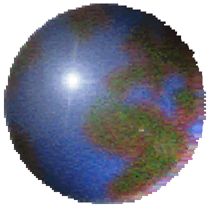
The Challenge: Place as an analytical component of social and environmental processes



Time and history are well-established anthropological dimensions

“Place” or spatial location is treated as an externality, rarely explicitly and accurately accounted for in data sets

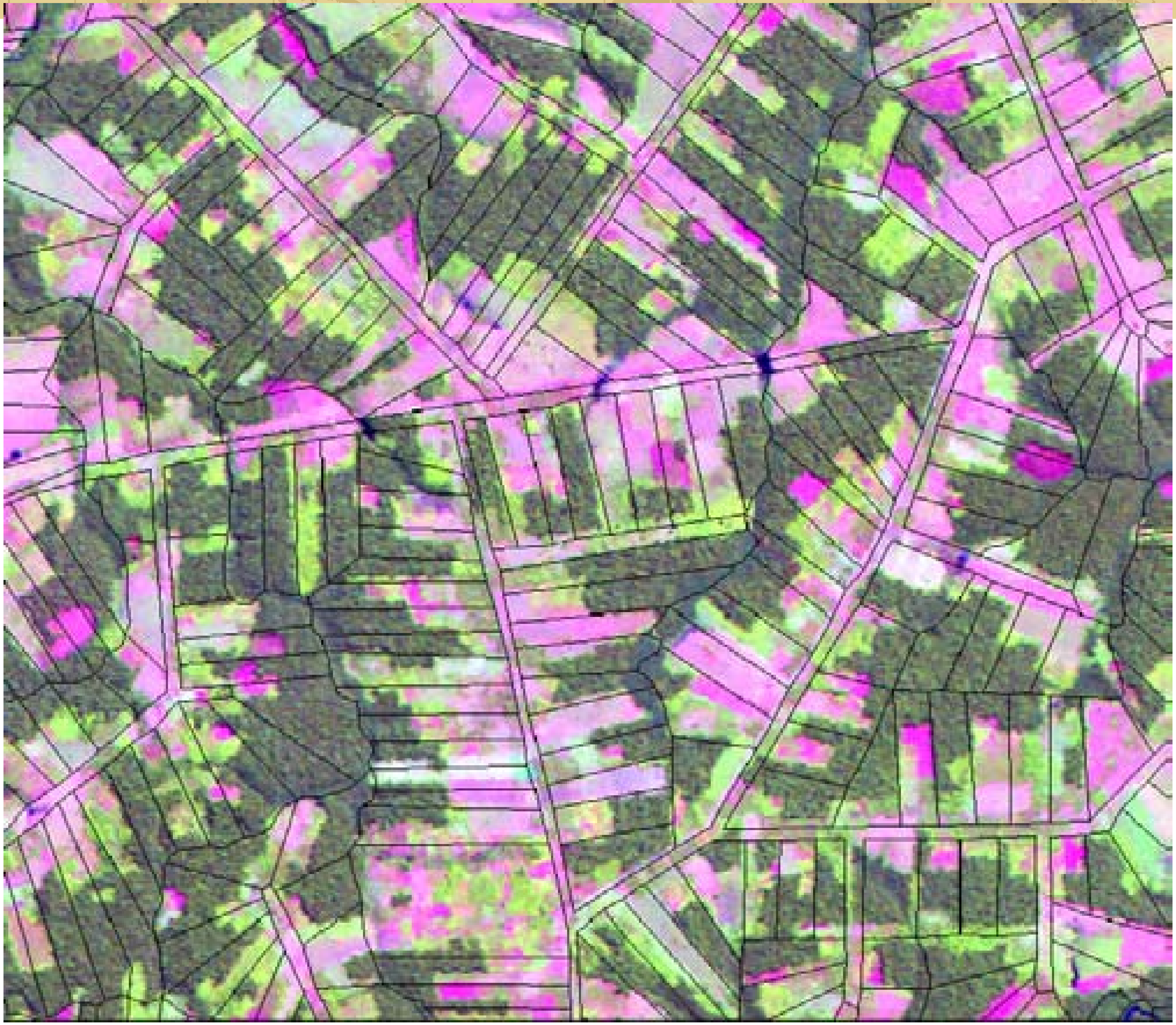
Further exacerbated by tendency to make location of study area less than clear due to tendency to hide the real name of the village

But in a sea of forest, for example, it does matter where human action is located

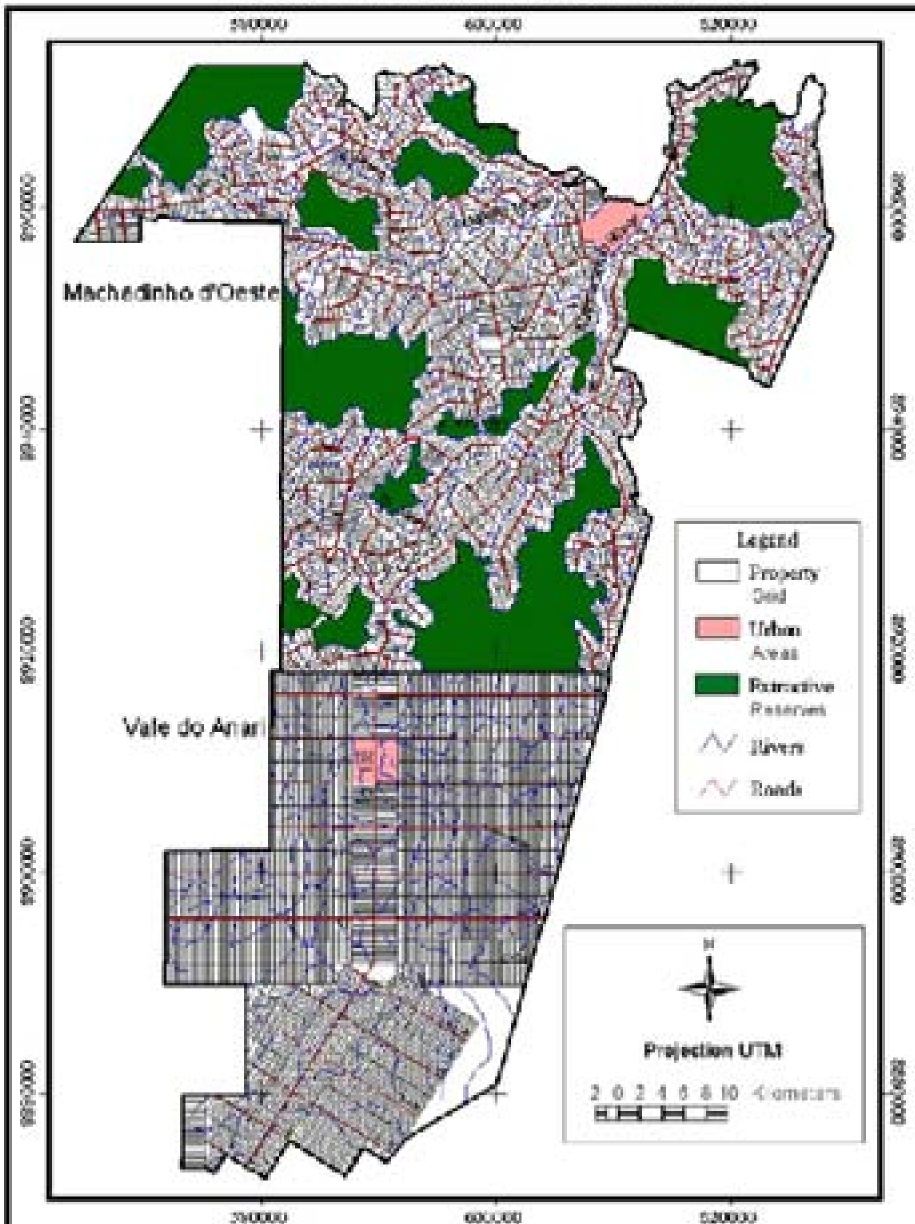
Forest Canopy

Cleared Forest

Machadinho, RO (1980-)



Machadinho d'Oeste and Vale do Anari, RO
Property Grids, Roads, Rivers, and Reserves



Social Science Infrastructure

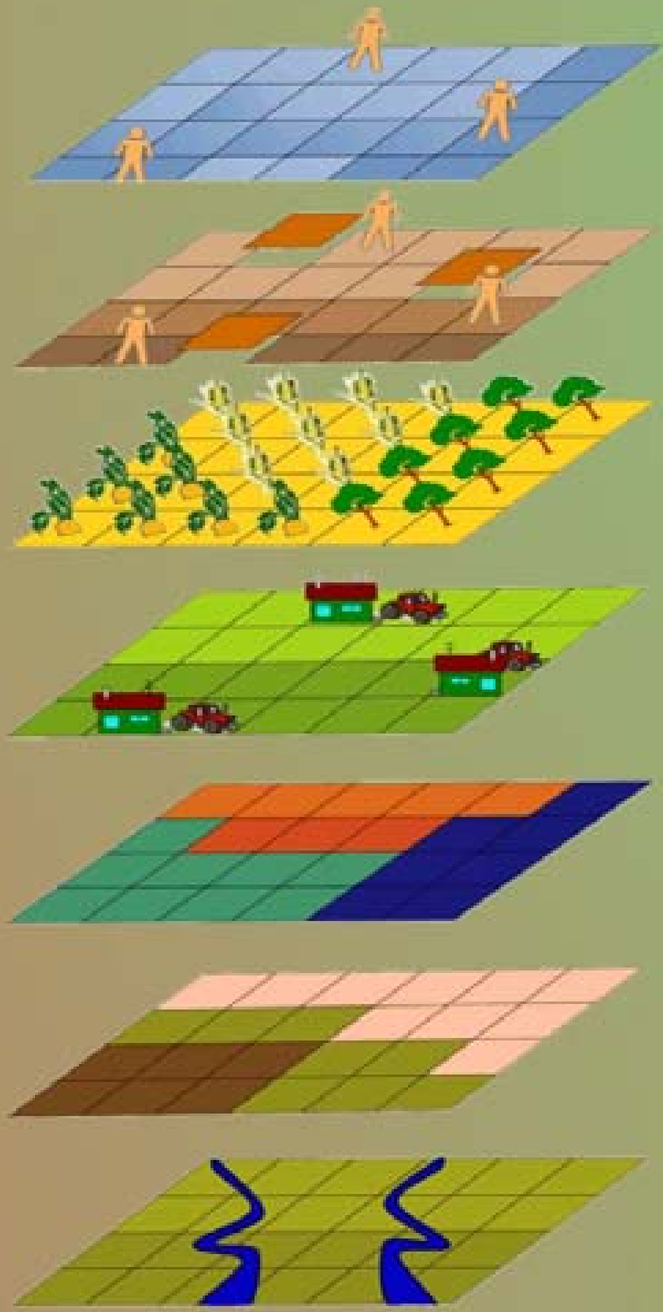
- The Hubble Telescope for the social sciences
- Redefining infrastructure
  - shared resources for research
  - data, tools, training, education, human resources, linkages
  - The Center for Spatially Explicit Social Science, CSISS, at UC, Santa Barbara

CSISS

- Space as an integrating mechanism in social science
  - integrating data - GIS
  - integrating processes
  - integrating disciplines
  - Serving the needs of the social sciences in developing spatially explicit approaches
- csiss.org

General principles: 1. Integration

- Linking data through common location
  - the layer cake



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Human Actors/Communication Networks

Land and Water Markets

Land Use and Land Cover

Farmsteads

Ownership

Soil Quality

Water Flow

SPATIAL DATA LAYERS

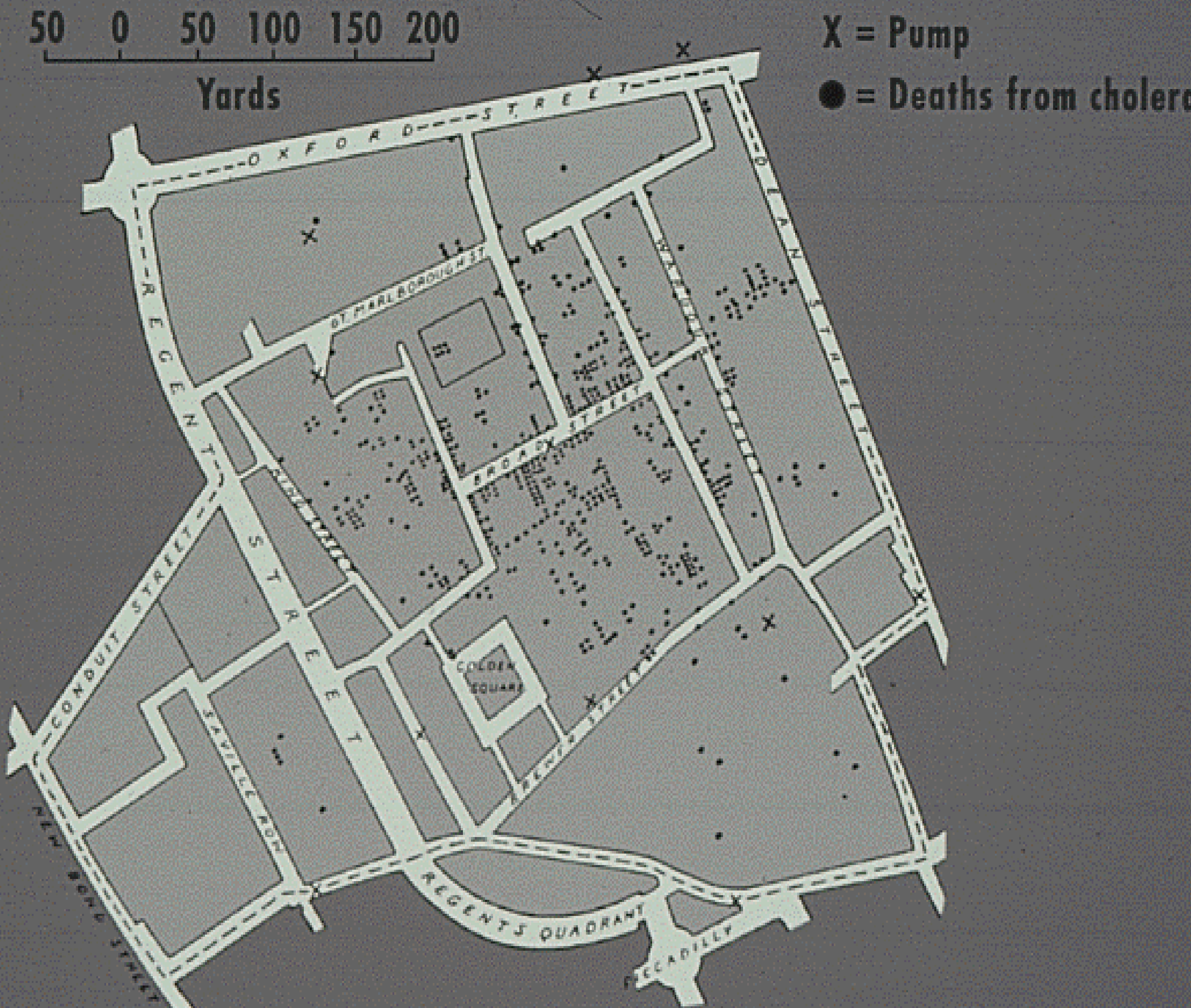
General principles: 1. Integration

- Linking processes across disciplines
  - spatially explicit processes
  - e.g. economic and social processes interact at common locations
  - Team-based research, with participation of natural and social scientists

Field Team 2001

2. Spatial analysis

- Social data collected in cross-section
  - longitudinal data are difficult to construct
- Cross-sectional perspectives are rich in context
  - can never confirm process
  - though they can perhaps falsify
  - useful source of hypotheses, insights



The Snow Map of Cholera Incidence in the Area of Broad Street, London, in 1854.
The contaminated water pump is located at the center of the map, just to the right of the D in BROAD STREET.

3. Spatially explicit theory

- If results are affected by moving objects in space (invariance test)
- If location is included in representation of the system as coordinates
- If spatial concepts such as location or distance appear directly in algebraic expressions or behavioral rules
- If the spatial forms of inputs and outputs differ, i.e. the landscape is modified by the process

Spatially explicit theory

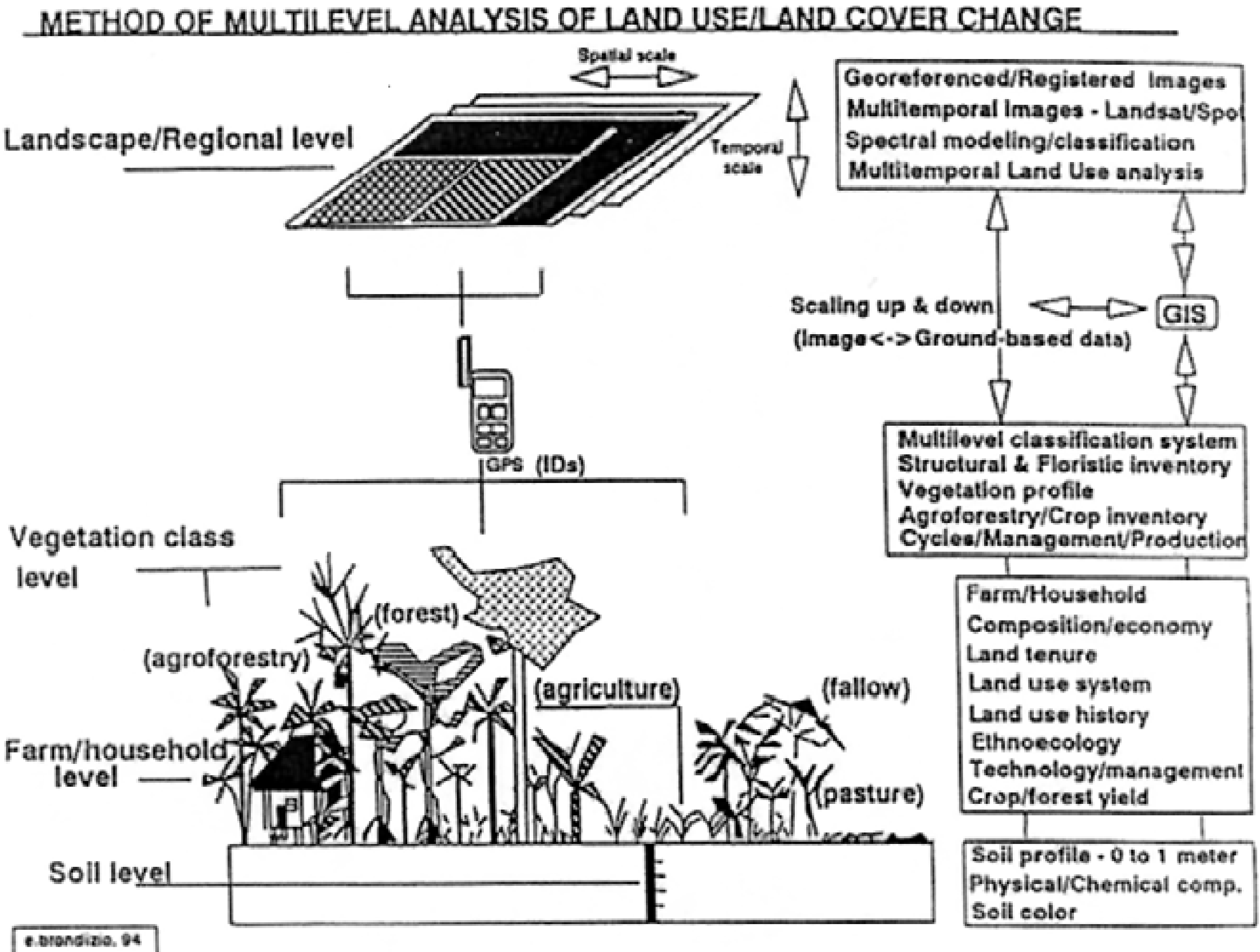
- A strong reason to be spatially explicit is that the output of our analyses have important consequences for real locations, such as conservation areas for biodiversity
- Geographic Information Systems (GIS) are powerful tools in defining inputs, analysis and outputs of spatially explicit information
- Need to be more dynamic and less descriptive e.g. agent-based and cellular automata models

Spatially explicit theory

- An important challenge is how to spatially represent variation: as continuous variables or as discrete variables
- And if the latter, at what scale should it be represented?
- Most commonly, a model will combine some discrete variables (e.g. types of agents) with continuous variables (e.g. population density, temperature or soil gradients)

The Earth's surface

- Uncontrolled variance
- There is no average place
- Results depend explicitly on bounds
- Places as samples
- Opportunity to rethink how we sample in anthropology


METHOD OF MULTILEVEL ANALYSIS OF LAND USE/LAND COVER CHANGE
Spatial scale
Temporal scale
Landscape/Regional level
Georeferenced/Registered Images
Multitemporal Images - Landsat/Spot
Spectral modeling/classification
Multitemporal Land Use analysis
Scaling up & down
(Image<->Ground-based data)
GIS
GPS (IDs)
Multilevel classification system
Structural & Floristic inventory
Vegetation profile
Agroforestry/Crop inventory
Cycles/Management/Production
Vegetation class level
(forest)
(agroforestry)
(agriculture)
(fallow)
(pasture)
Farm/household level
Farm/Household
Composition/economy
Land tenure
Land use system
Land use history
Ethnoecology
Technology/management
Crop/forest yield
Soil level
Soil profile - 0 to 1 meter
Physical/Chemical comp.
Soil color
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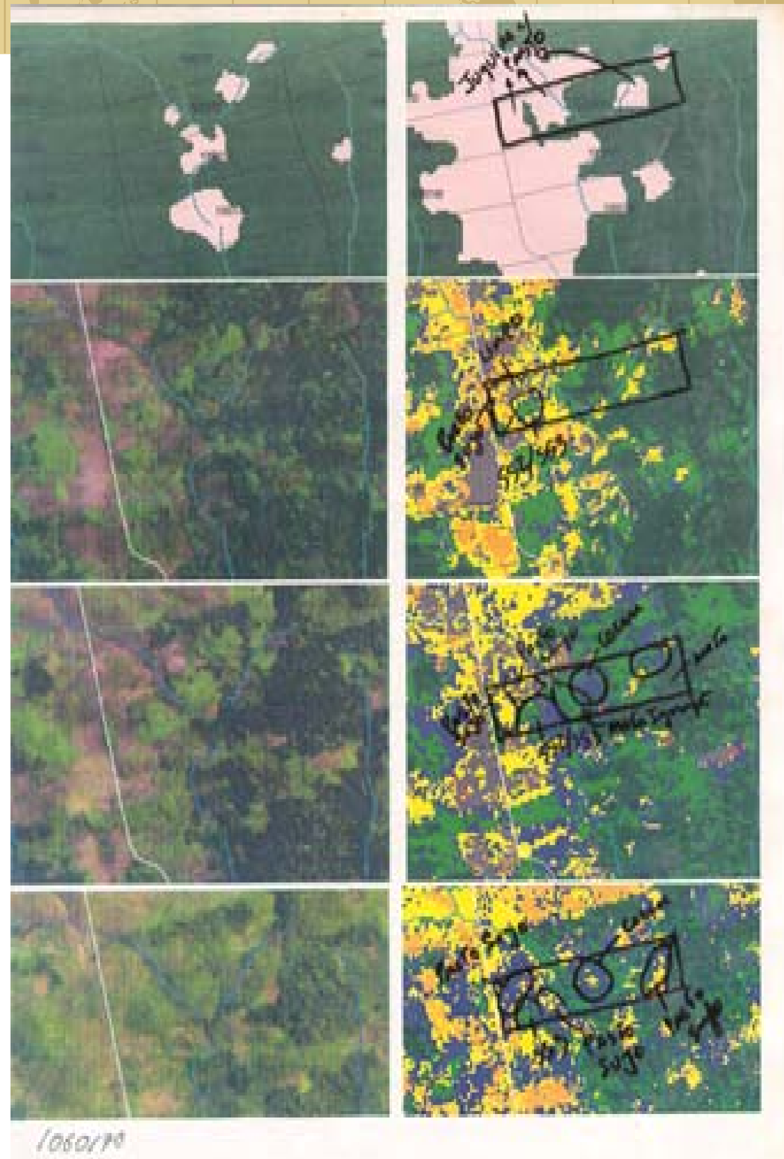
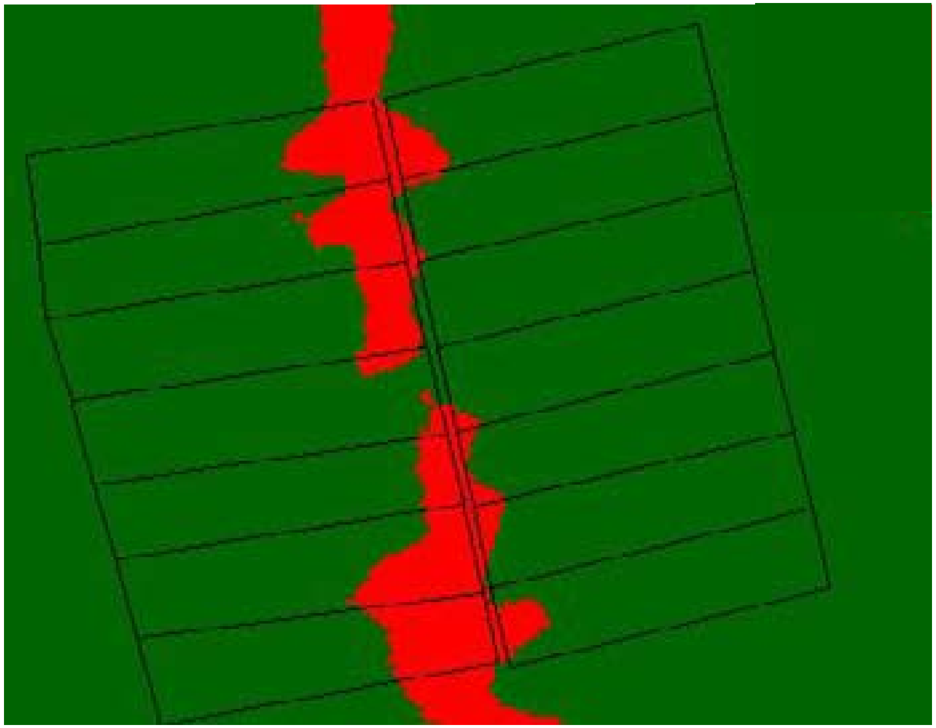
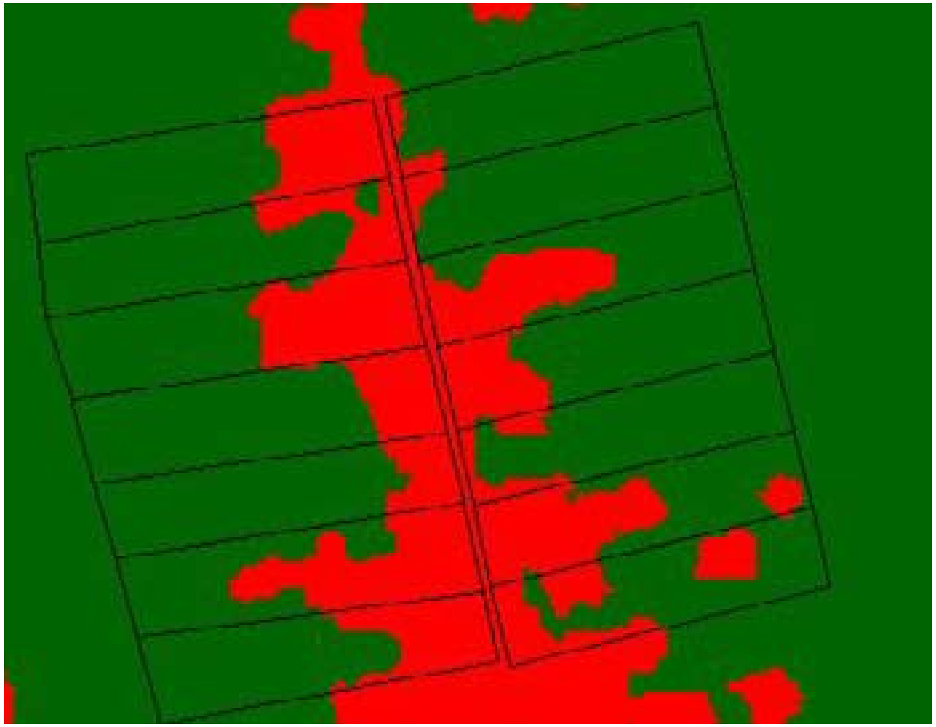
MAQUINORTE LTDA



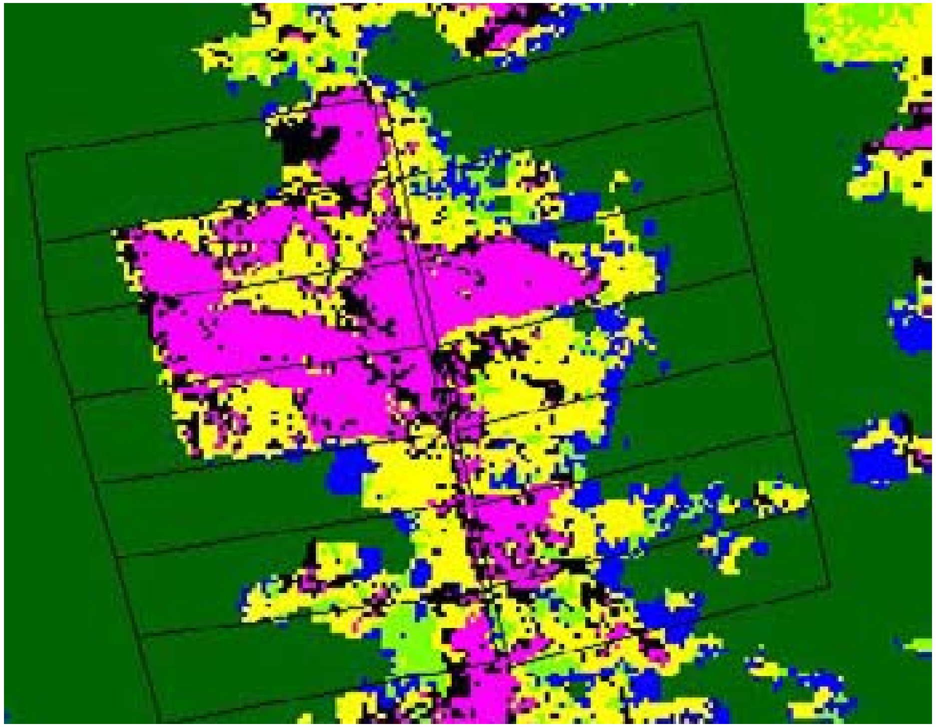
1973



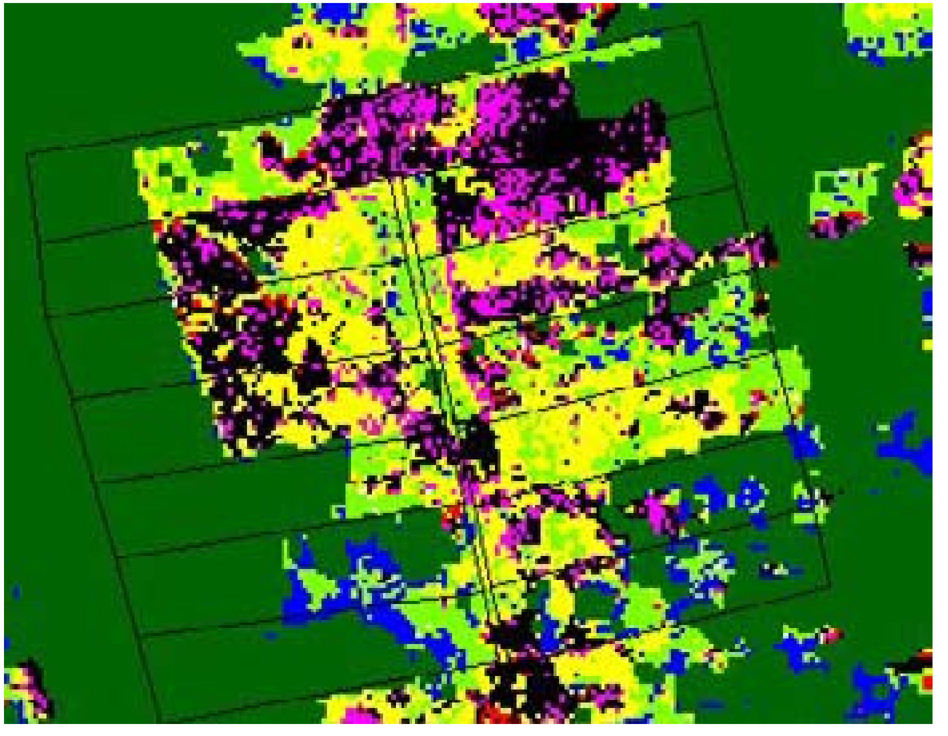
1978



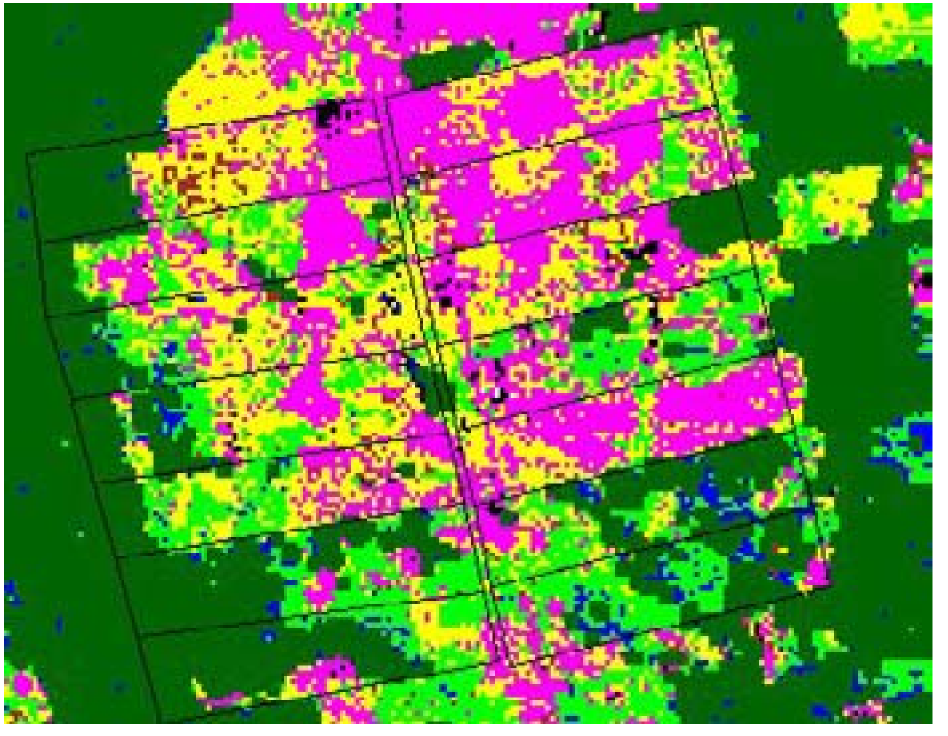
1985



1991



1996



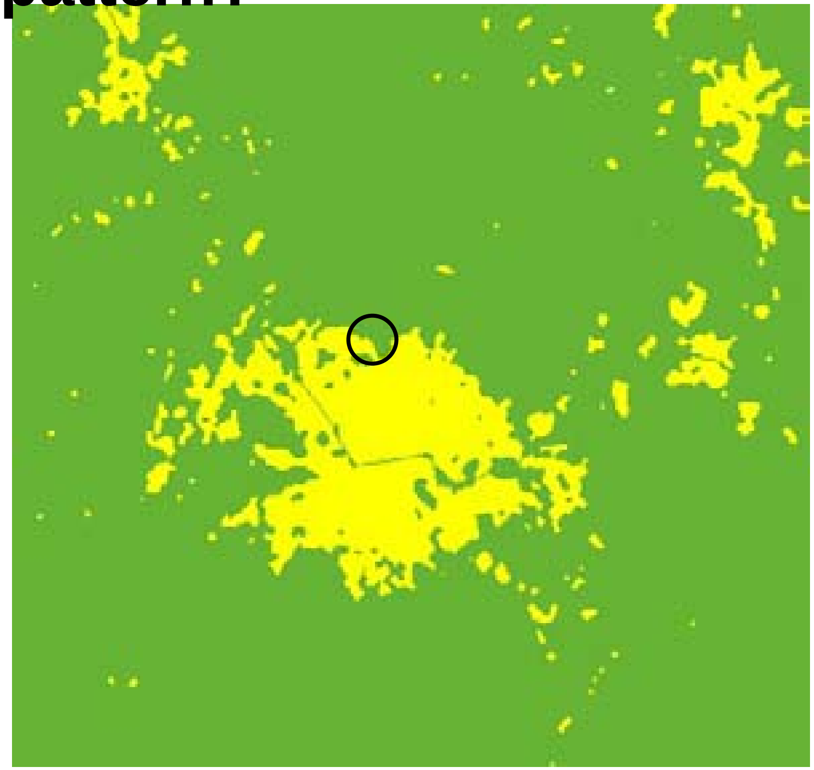
Example

Comparing two indigenous communities (neighbors) with the same land use system (long-fallow swidden agriculture)

<u>Site</u>:	**Vaupes, Colombia**
<u>Key variables</u>:	**Soil and land cover type**
	Distance and access
<u>Spatial indicators</u>:	**Area measures,**
	Number, type, size, density of patches
	Distance measures

Vaupes, Indigenous Communities, Long-Fallow Manioc Agriculture

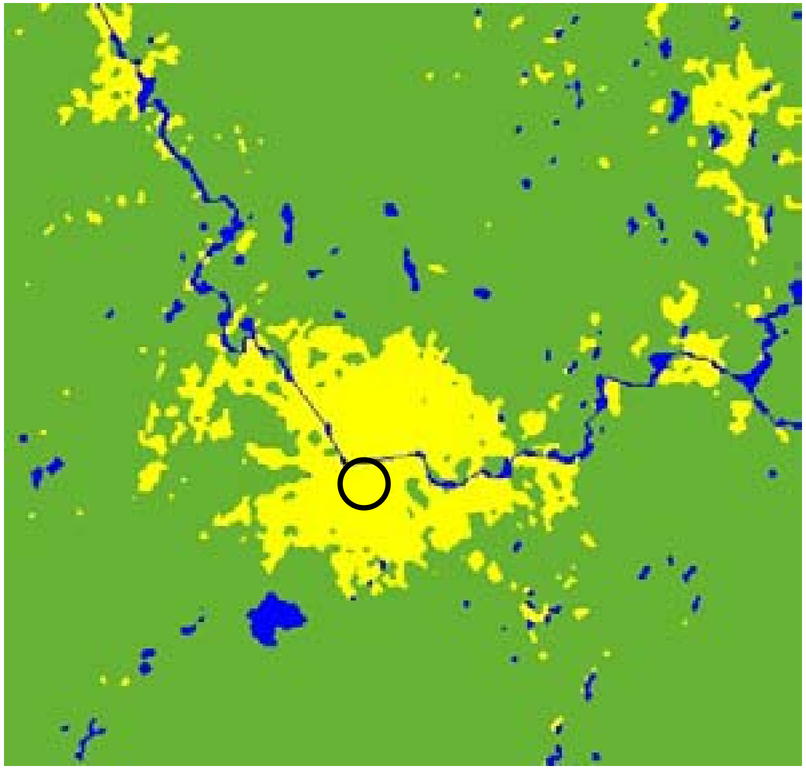
What explains differences in landscape configuration across two similar land use systems and settlement pattern?

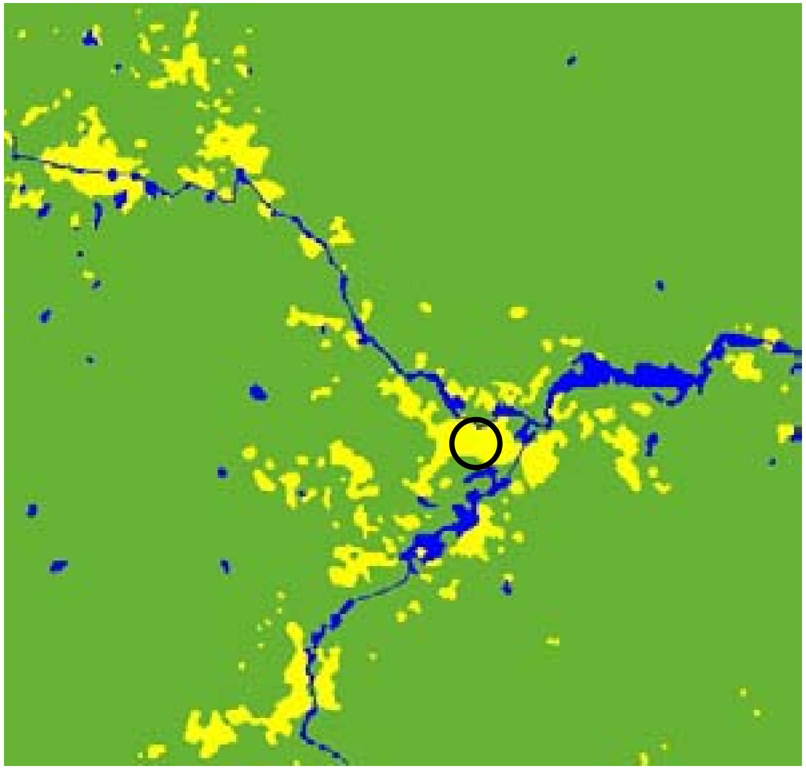


Concentric

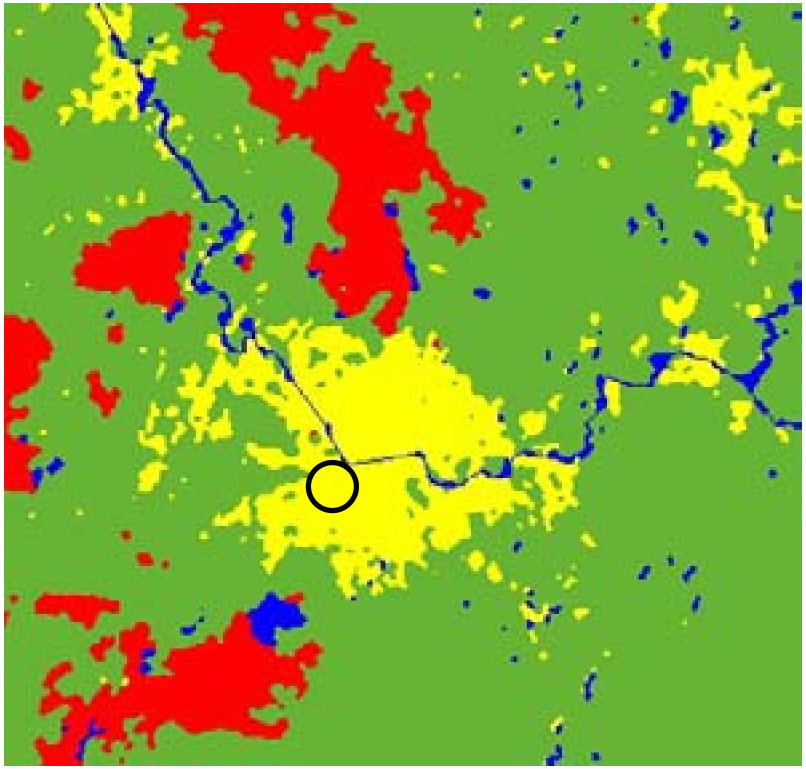
Dendritic

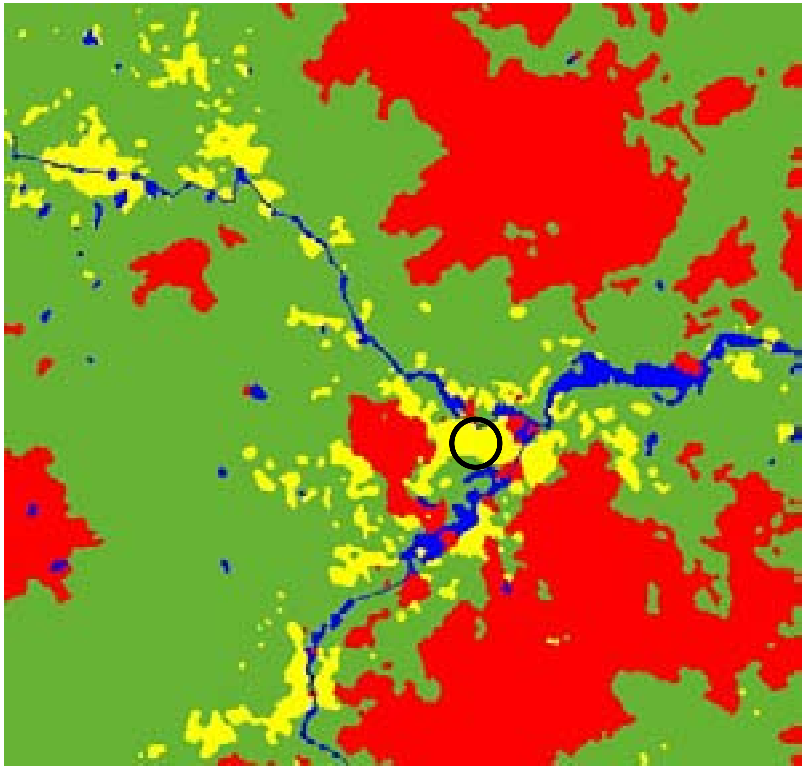
River *Access* as a Biophysical Opportunity

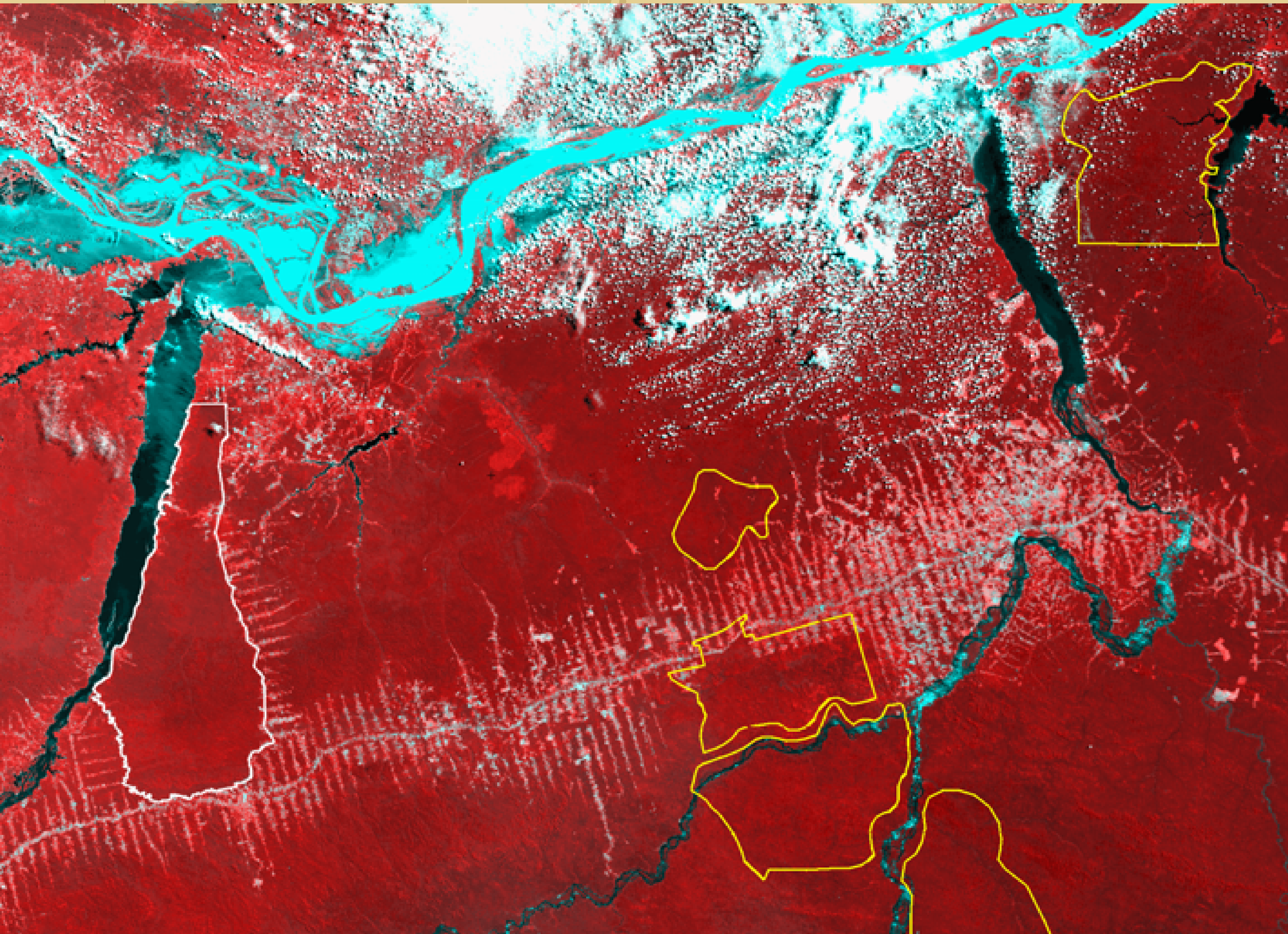




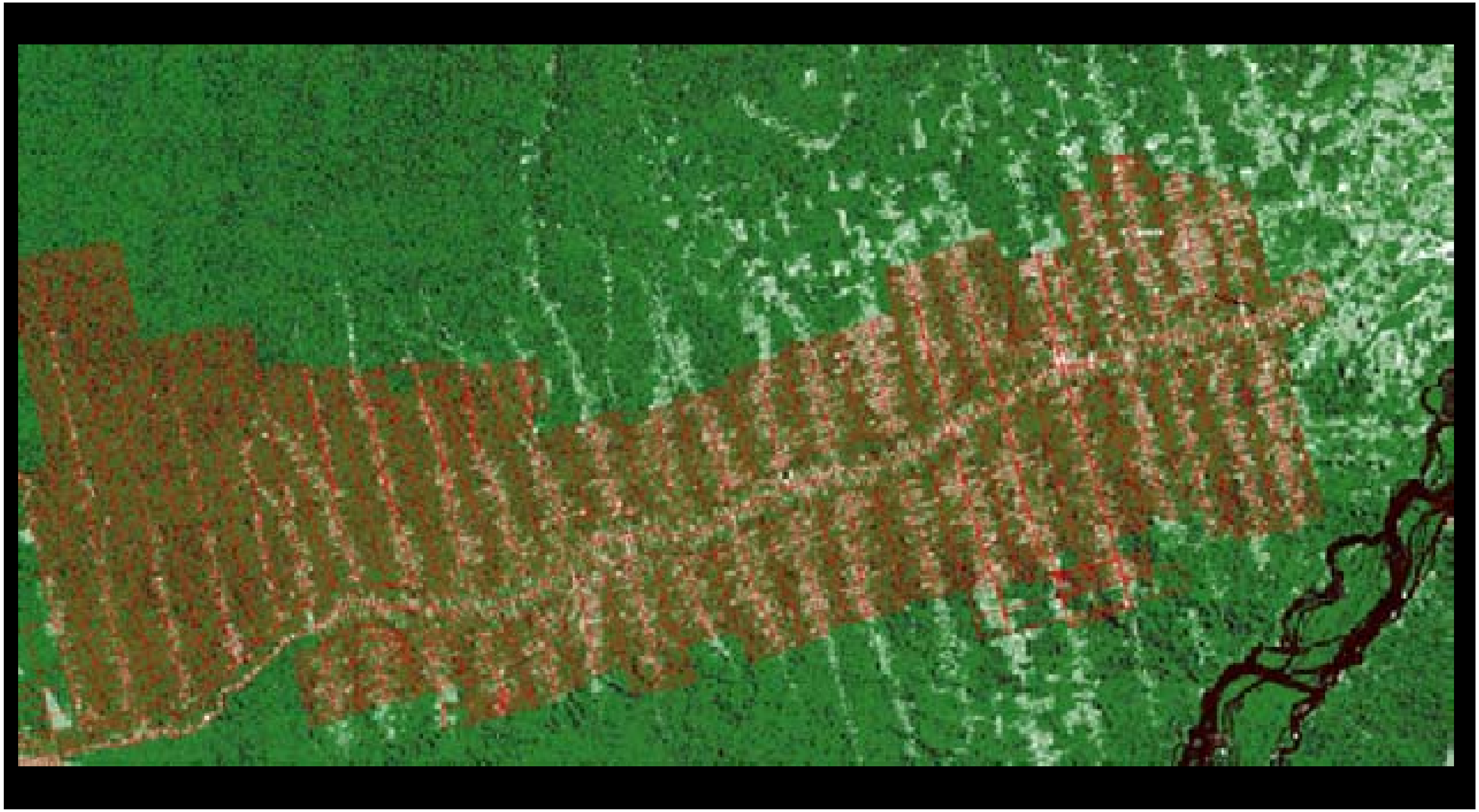
Land <u>Cover</u> and <u>Soil Type</u> as a Biophysical Constraint



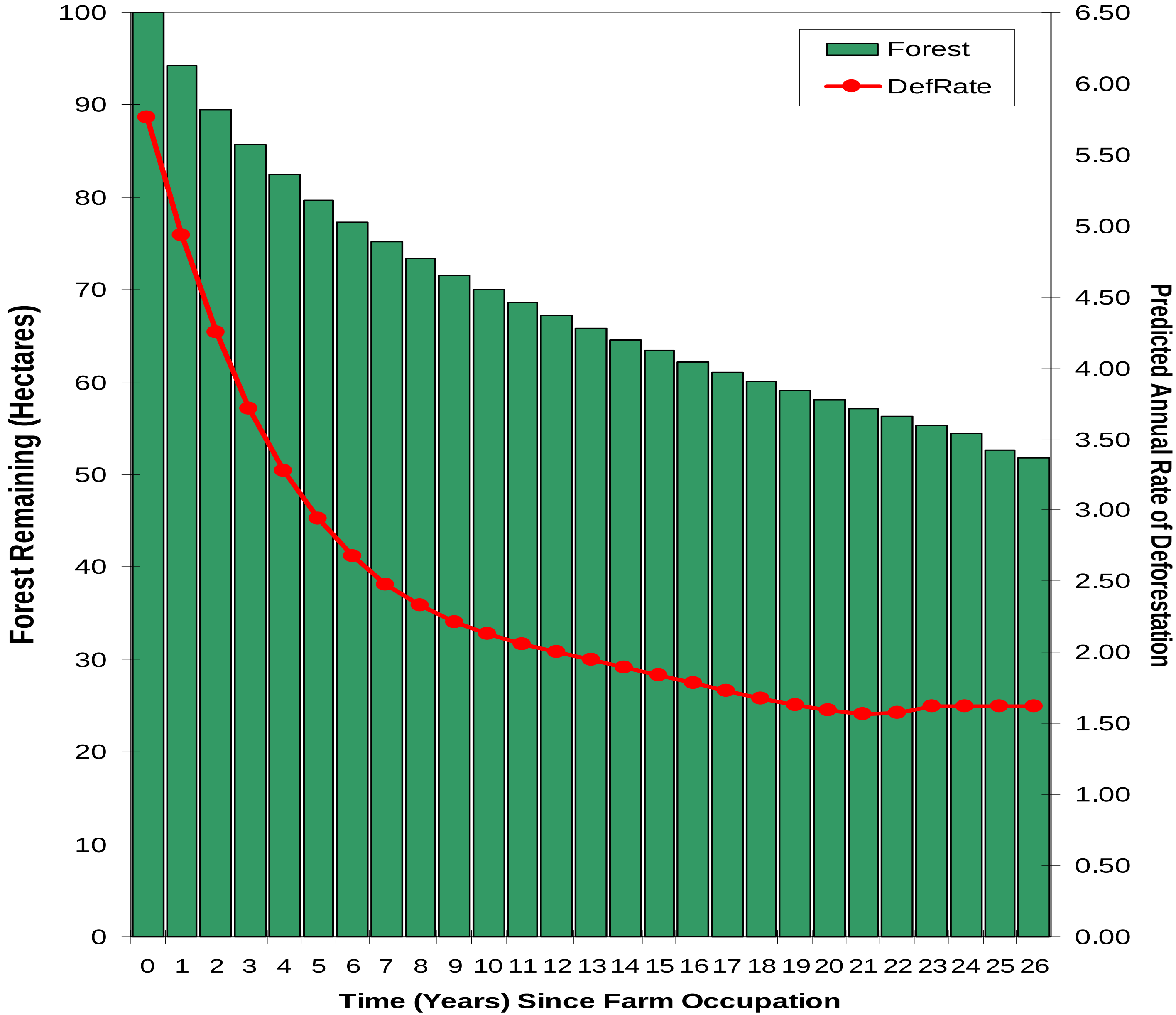




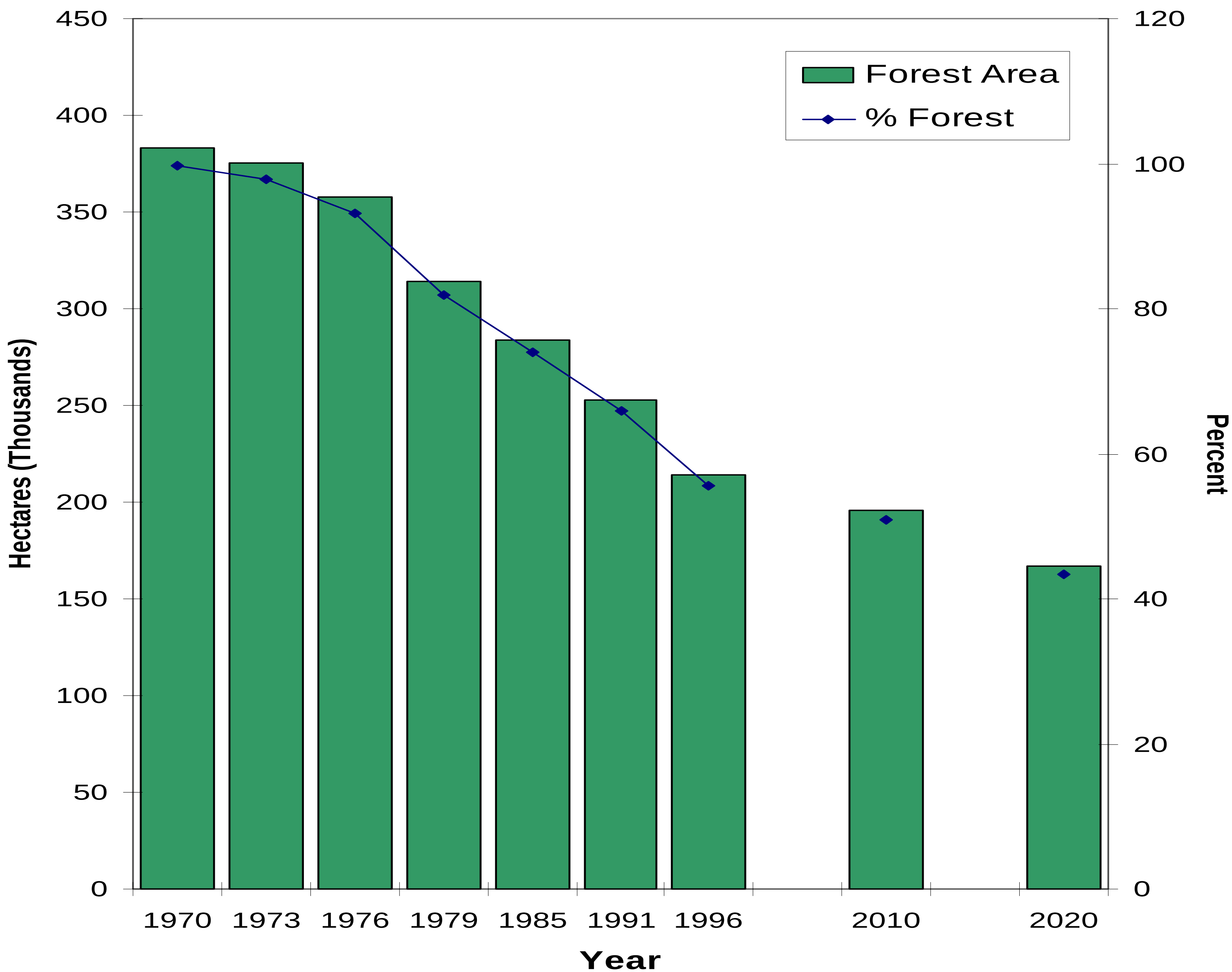
Integrating Land Cover Data with Parcel Boundaries

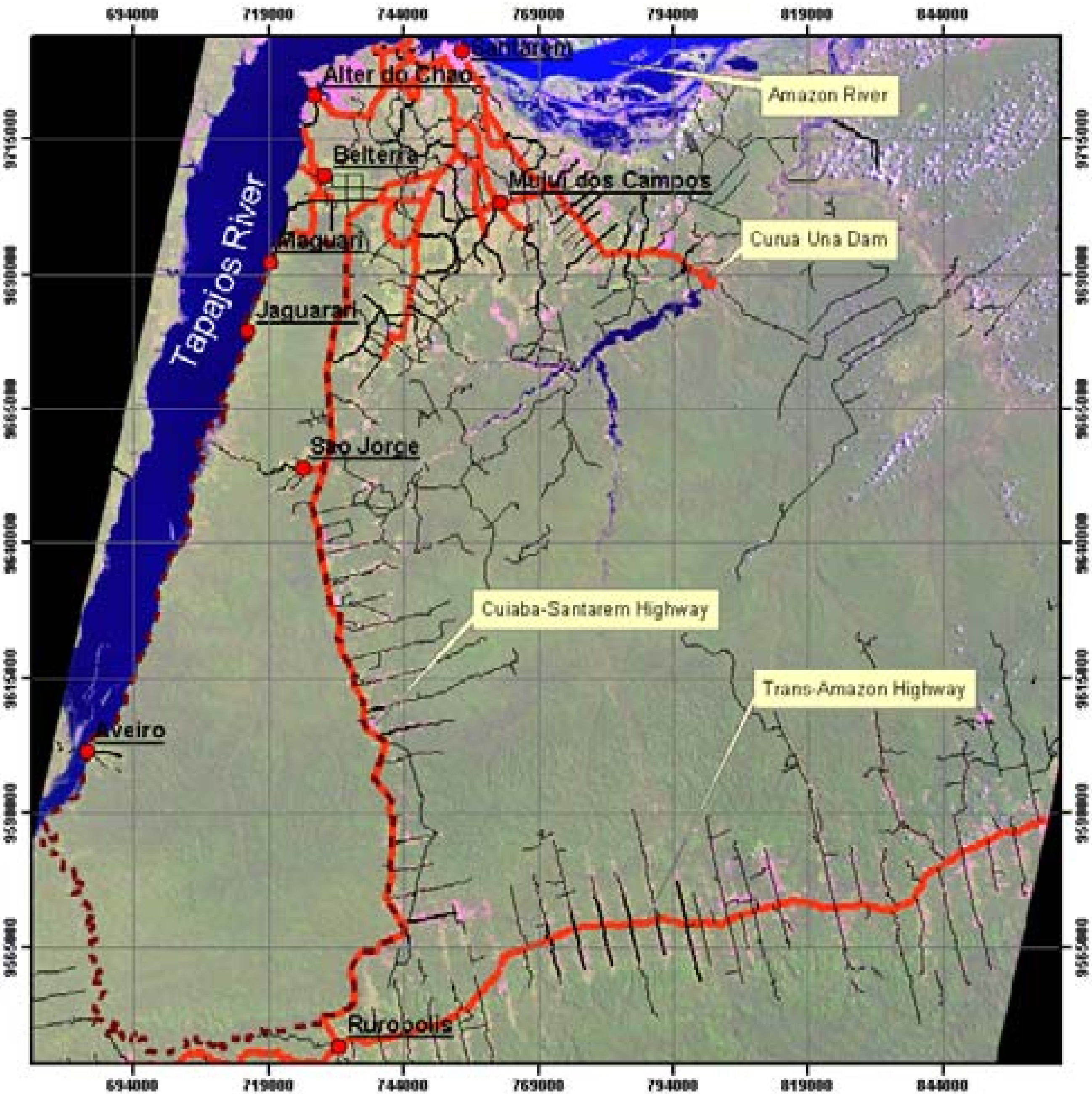


Predicted Deforestation Over Time (Farm Level)



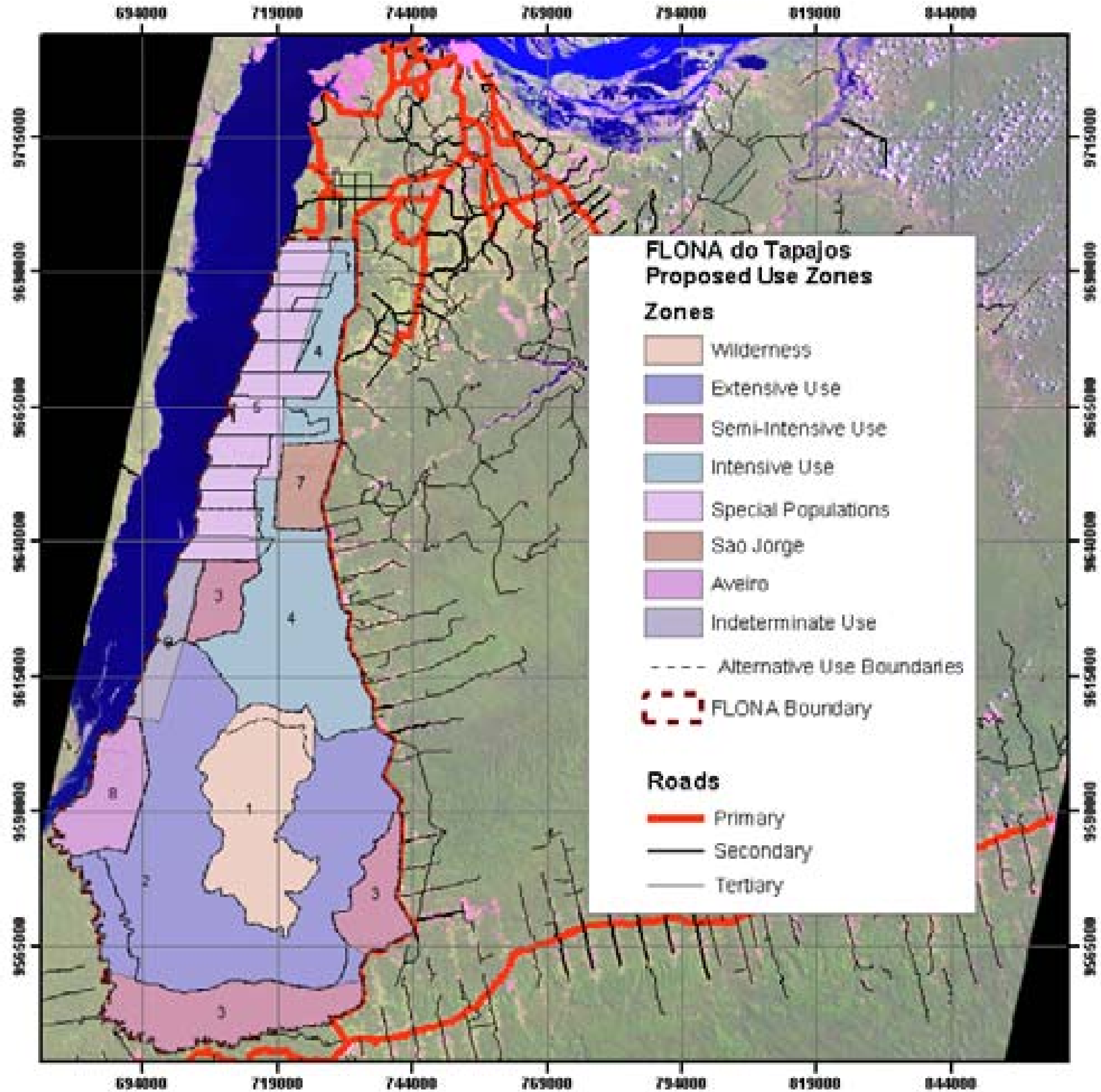
Forest in Study Area - Observed, 1970-96 & Predicted for 2010 & 2020 Based on Farm Level Projection

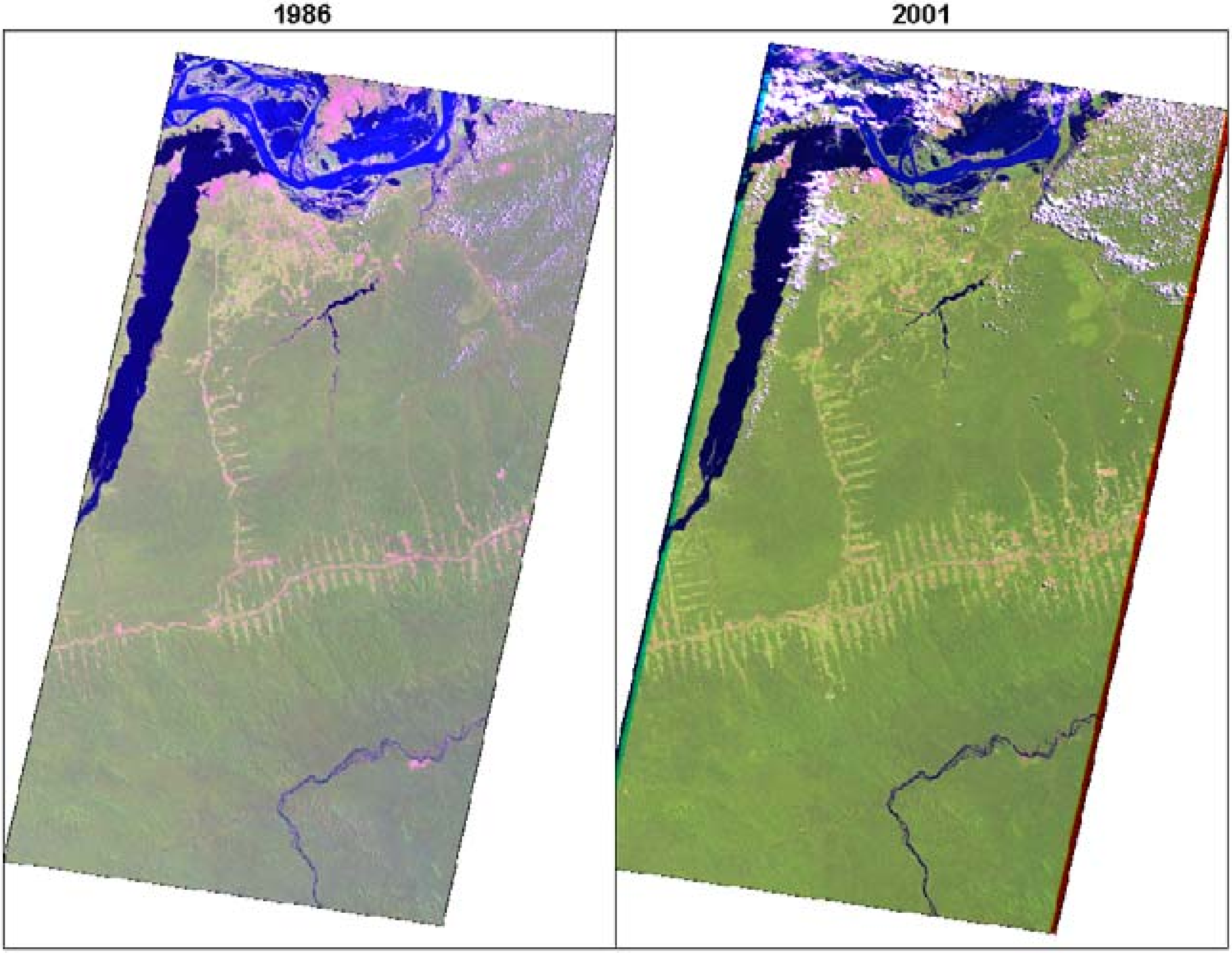




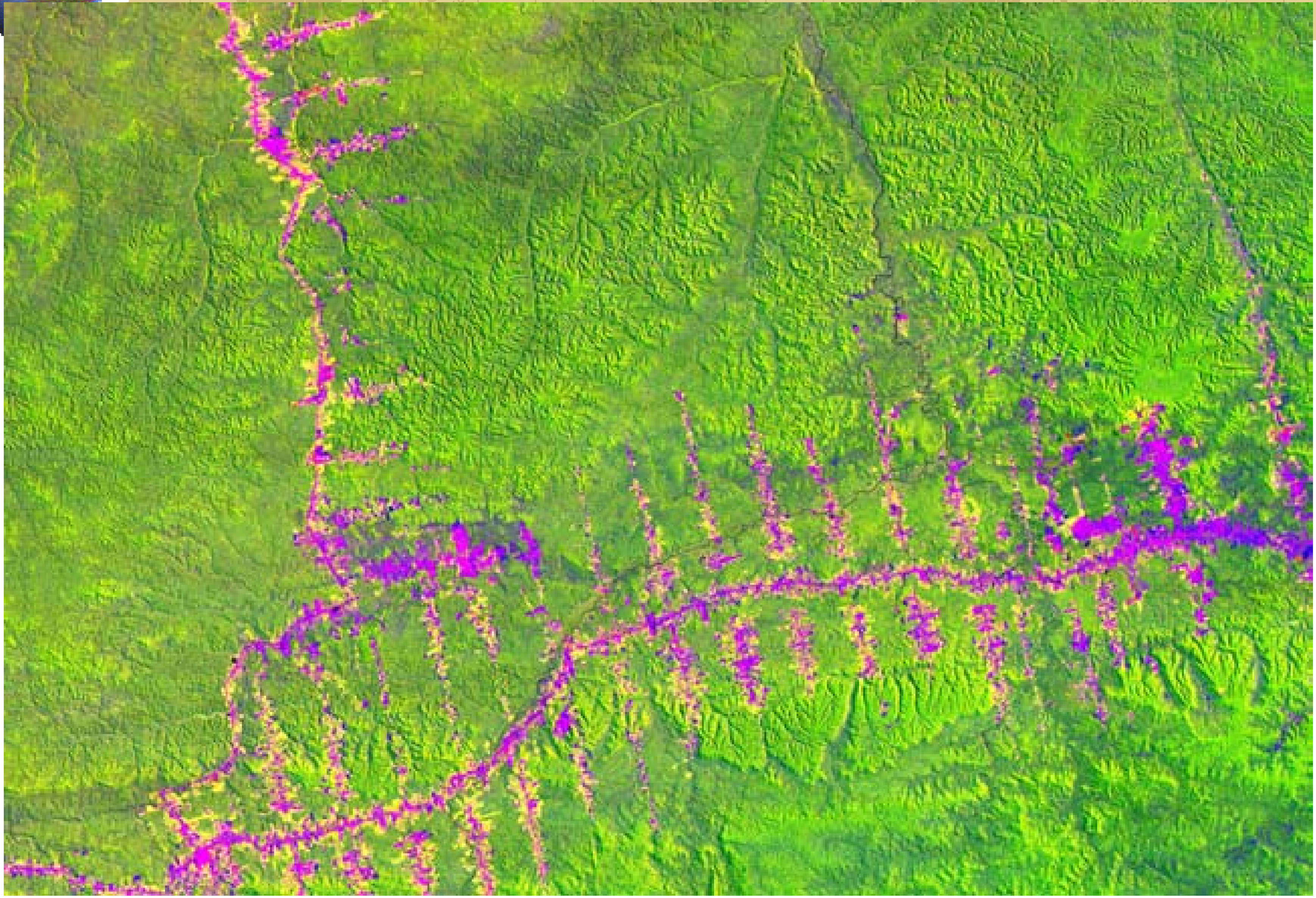
1986 Landsat TM Image Mosaic for the FLONA/Santarem Region of Para State, in the Brazilian Amazon

Bands 5 (red), 4 (green), 3 (blue)

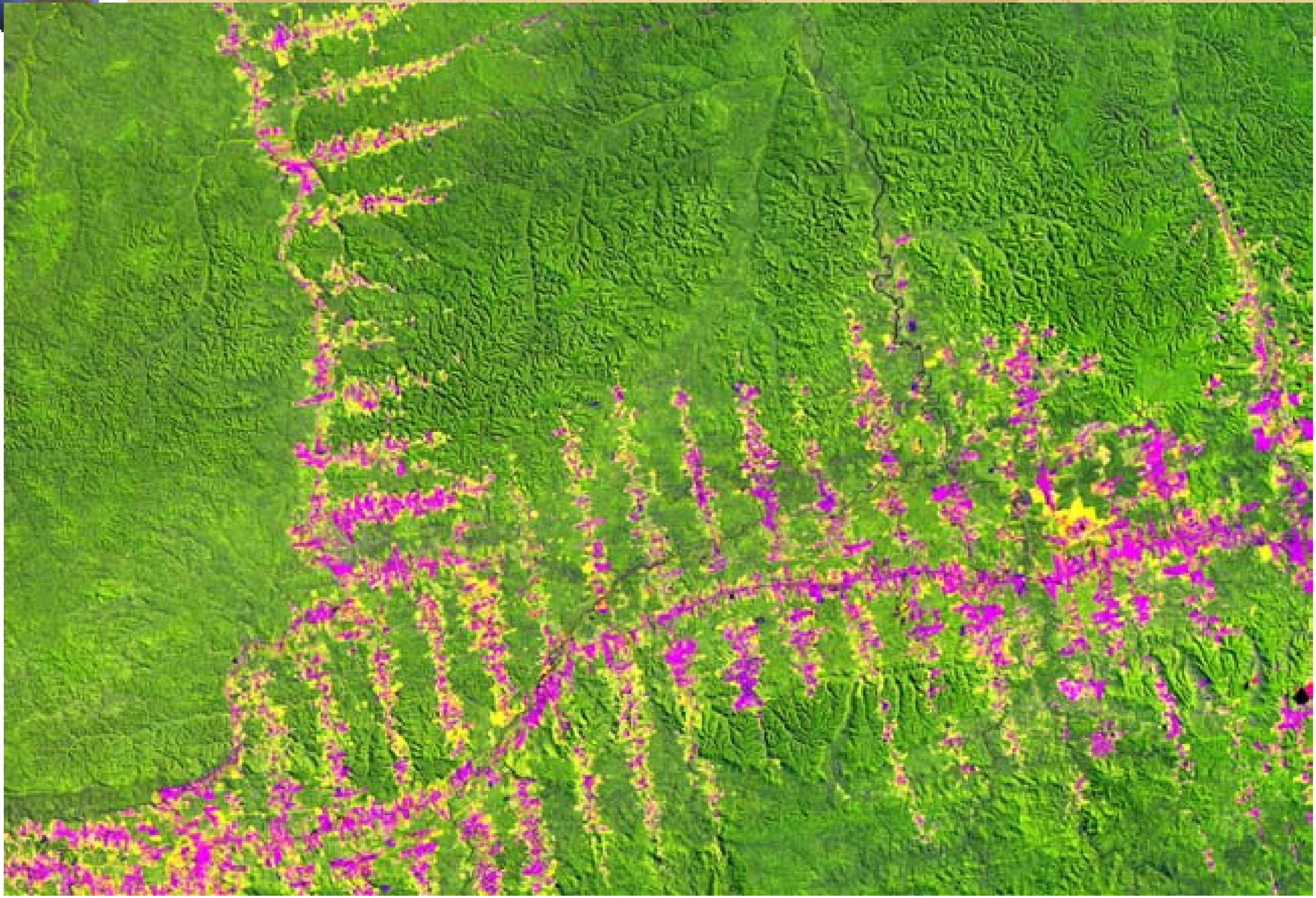

FLONA do Tapajos
Proposed Use Zones
Zones
Wilderness
Extensive Use
Semi-Intensive Use
Intensive Use
Special Populations
São Jorge
Aveiro
Indeterminate Use
Alternative Use Boundaries
FLONA Boundary
Roads
Primary
Secondary
Tertiary
694000
719000
744000
769000
794000
819000
844000


1986
2001

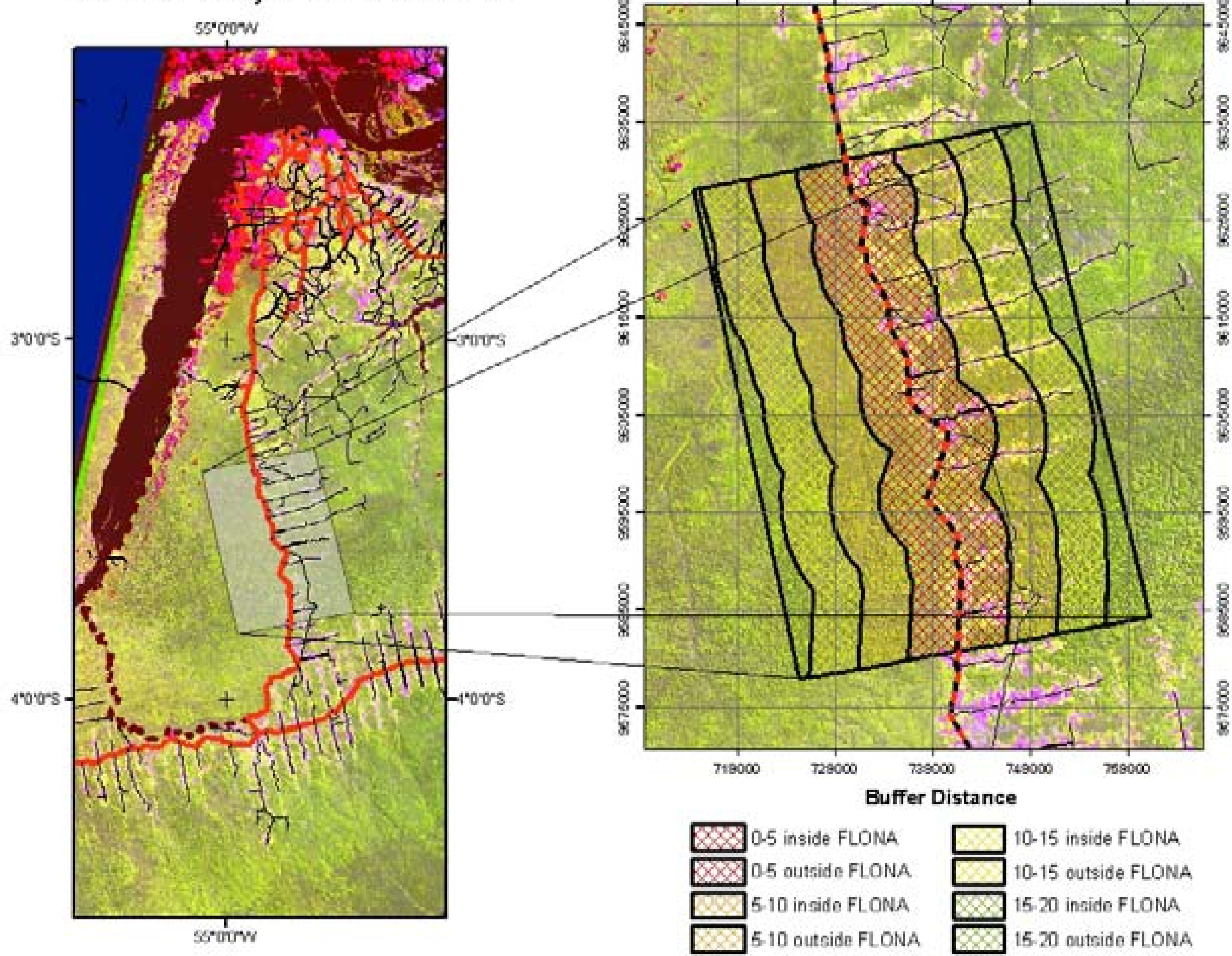
1986



2001

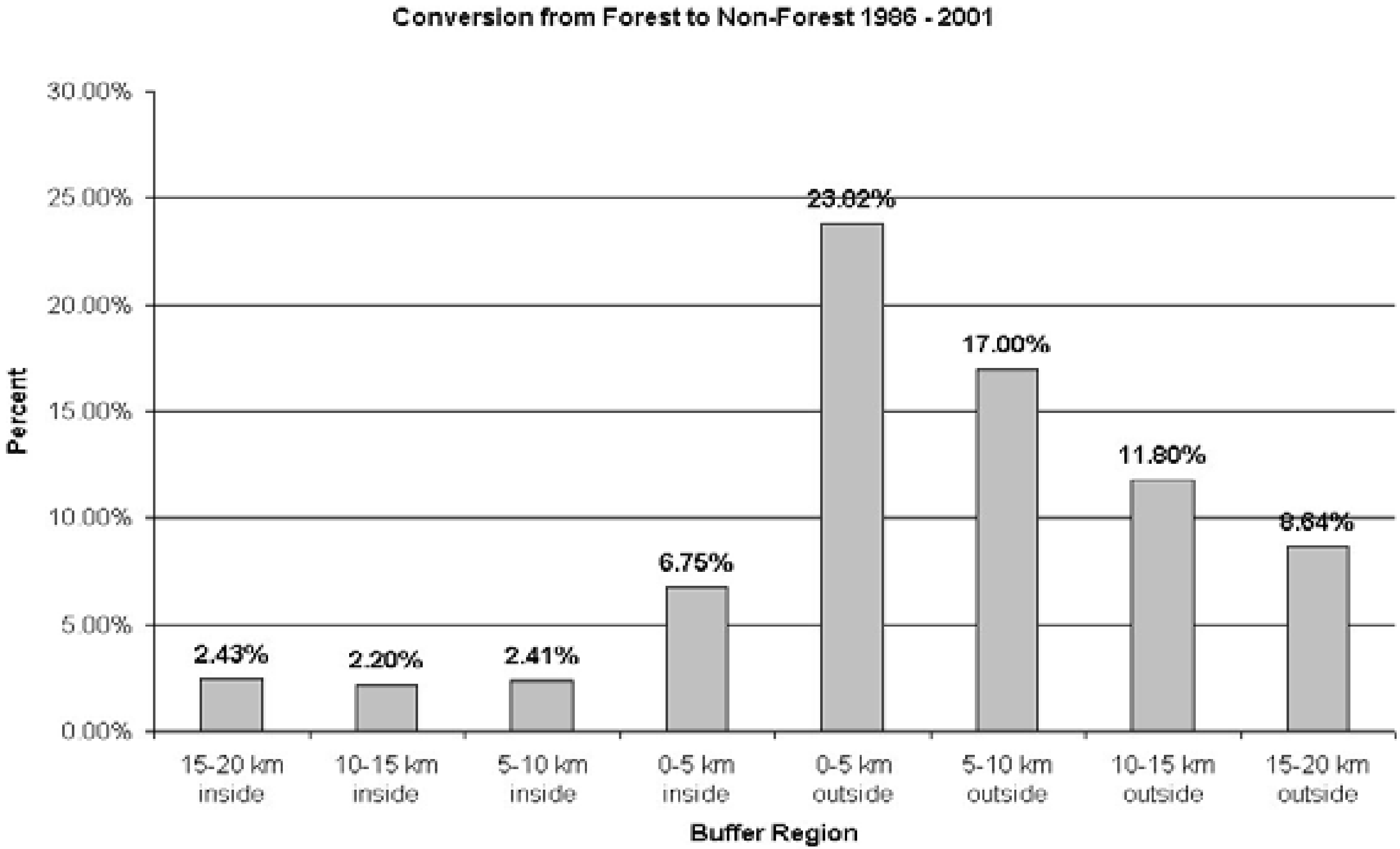


FLONA do Tapajos Study Region and LULCC Sub-Study Area with 5km Buffers



2001 ETM+ Mosaic Principal Components 1(red), 2(green), 3(blue) - Histogram Equalized

Produced by Bruce W. Boucek, October, 2002


Conversion from Forest to Non-Forest 1986 - 2001
Percent
30.00%
25.00%
20.00%
15.00%
10.00%
5.00%
0.00%
2.43%
2.20%
2.41%
6.75%
23.82%
17.00%
11.80%
8.64%
15-20 km inside
10-15 km inside
5-10 km inside
0-5 km inside
0-5 km outside
5-10 km outside
10-15 km outside
15-20 km outside
Buffer Region

Knowledge and policy

- Policy requires the projection of general knowledge in spatial context
  - the implications of this process in this location
  - alternative futures visualized under local circumstances
- GIS combines the general (processes, models, algorithms) with the specific (database of local details)