9th INTECOL INTERNATIONAL WETLANDS CONFERENCE

Deforestation Evolution in the Amazon Floodplain

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Floodplain forest

Fishery production

Aquatic system biodiversity

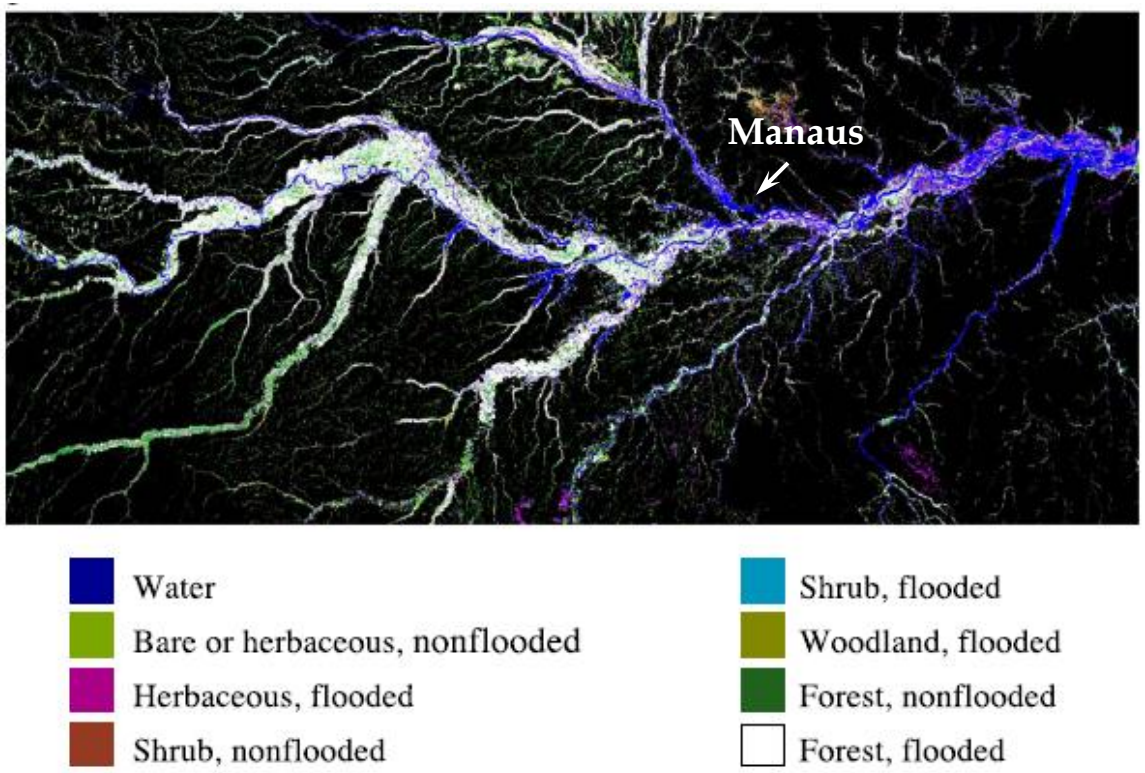
Water quality

Riparian population health

Water circulation

Differences in vegetation cover

Vegetation map of the Amazon Floodplain (1996)



Mapping of wetlands vegetation and inundation at high-water stage (May – June 1996). Source: Hess et all. (2003)

HESS, L. L.; MELACK, J. M.; NOVO, E. M. L. M.; BARBOSA, C. C.; GASTIL, M. Dual-season mapping of wetland inundation and vegetation. **Remote Sensing of Environment**, v. 87, p. 404 - 428, 2003.

Differences in vegetation cover

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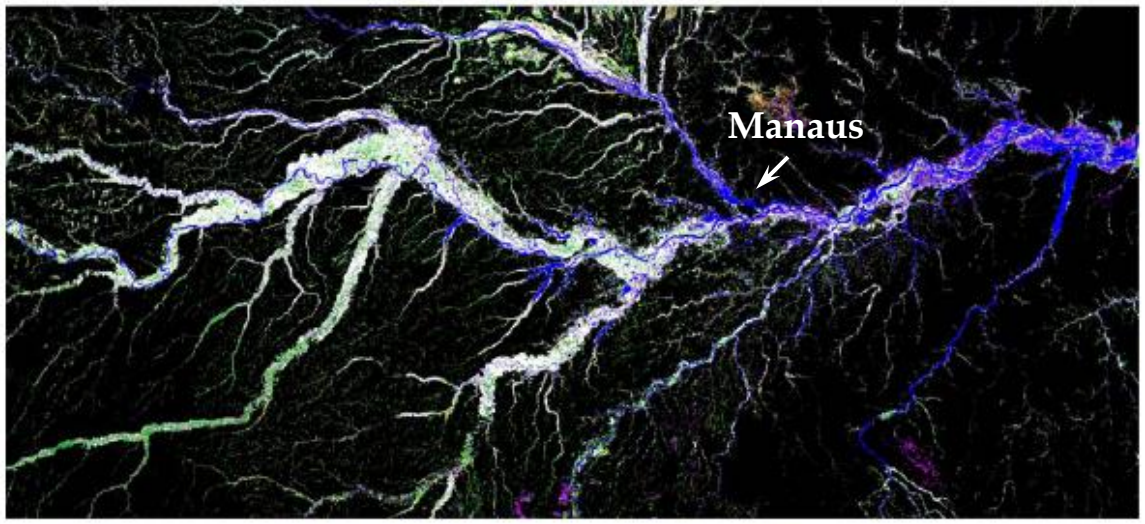


Natural factors x Human activity

Geographic location
Geomorphology

Agriculture
Cattle ranching
Logging

First stage: hypothesis and objective

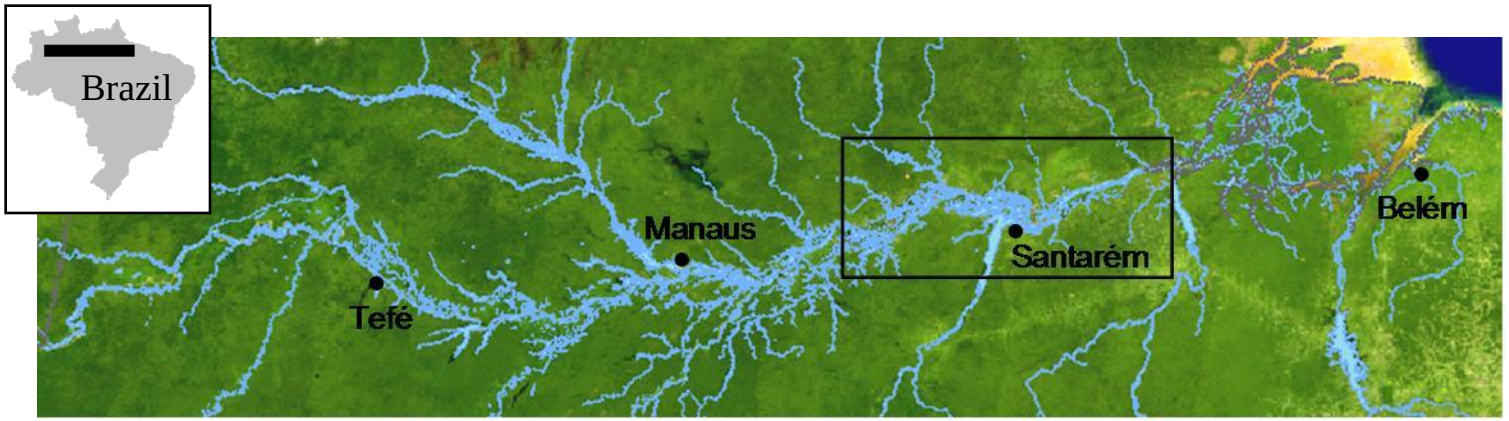
Hypothesis:

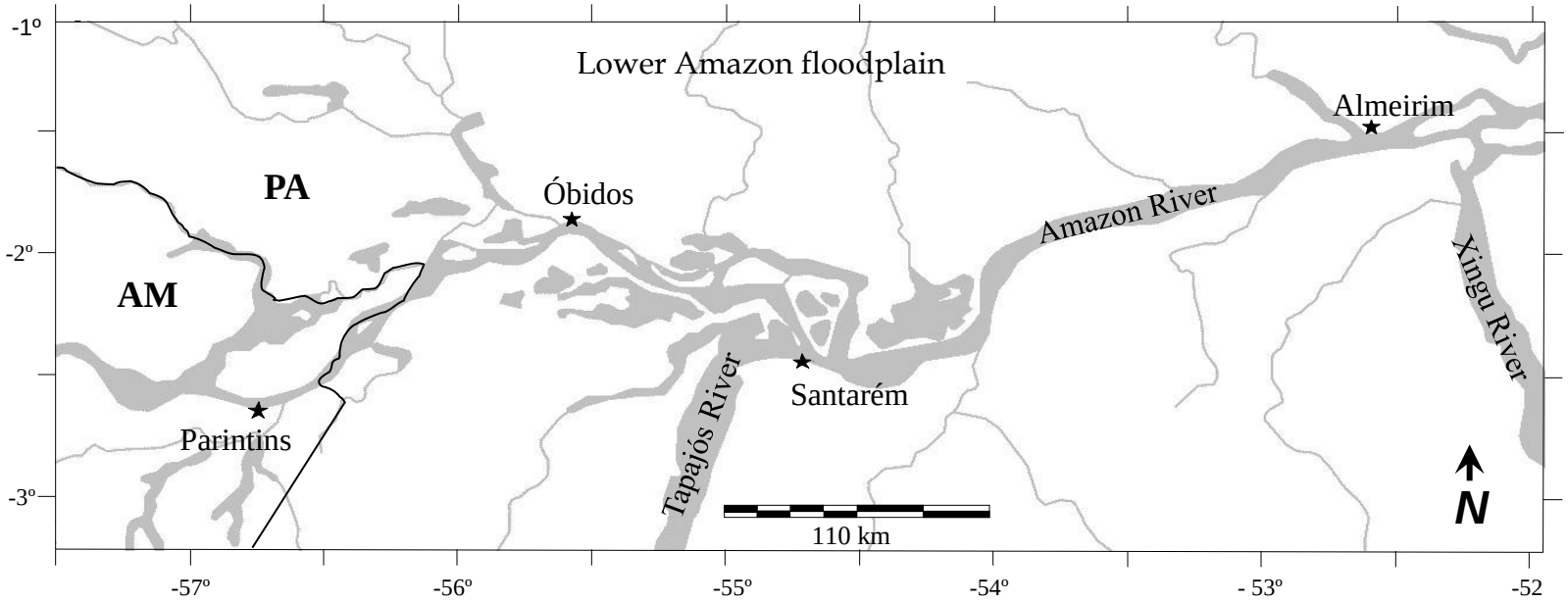
The difference in floodplain vegetation cover pattern between the regions upstream and downstream of Manaus is a result of human activities.

Objective:

Assess the existence and extent of deforestation in the Lower Amazon floodplain (downstream of Manaus), between the late 1970s and 2008.

Study Area


Brazil
Manaus
Santarém
Belém
Tefé

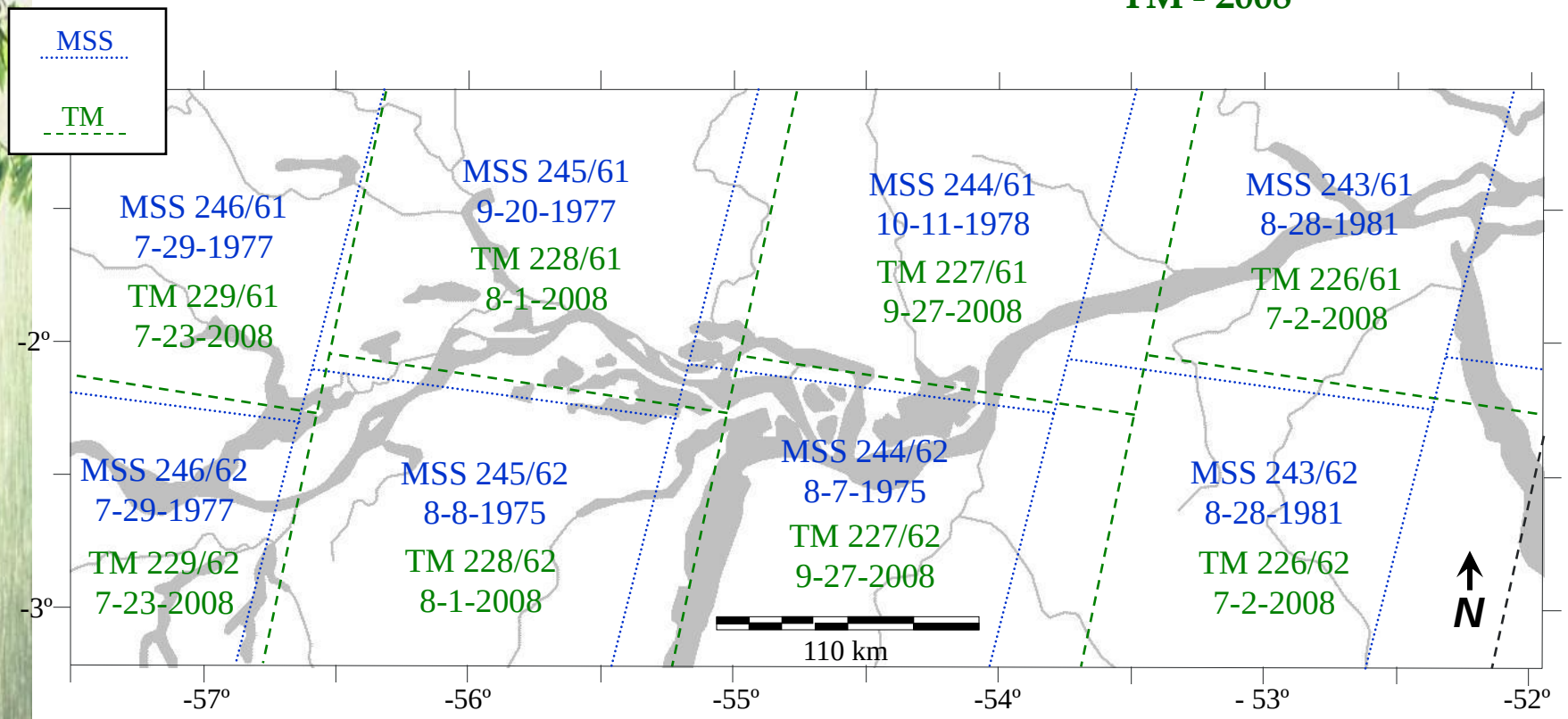

Lower Amazon floodplain
Almeirim
PA
Óbidos
AM
Amazon River
Xingu River
Parintins
Santarém
Tapajós River
110 km
N
-1º
-2º
-3º
-57º
-56º
-55º
-54º
- 53º
-52

Data and methods

Remote sensing data

MSS – Late 1970s

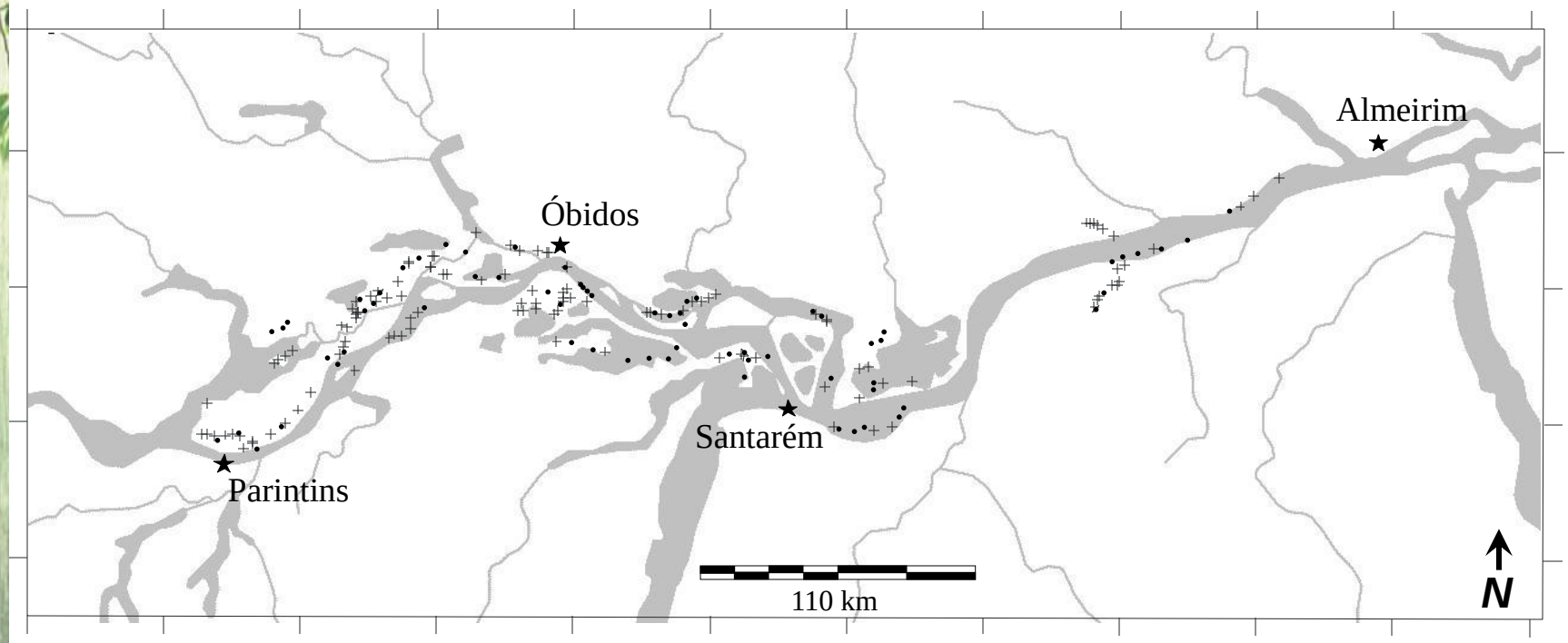
TM - 2008



Data and methods

Field data

Campaigns: high-water (June 2009) / receding-water (Sept. 2009)



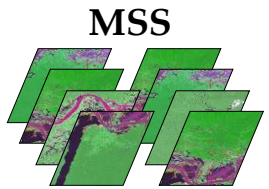
⊞ Botanical observations **= 68**

⊡ Community Interviews **= 117**

185

GPS Photos **= 2 023**

Data and methods



Preprocessing

MSS and TM mosaics

Multidate Segmentation

Nearest Neighbor Classification

Training data
- 17 field points
- ~ 30 GPS photos

1970s
Vegetation Maps
2008

Accuracy assessment

Field Data
- 168 field points

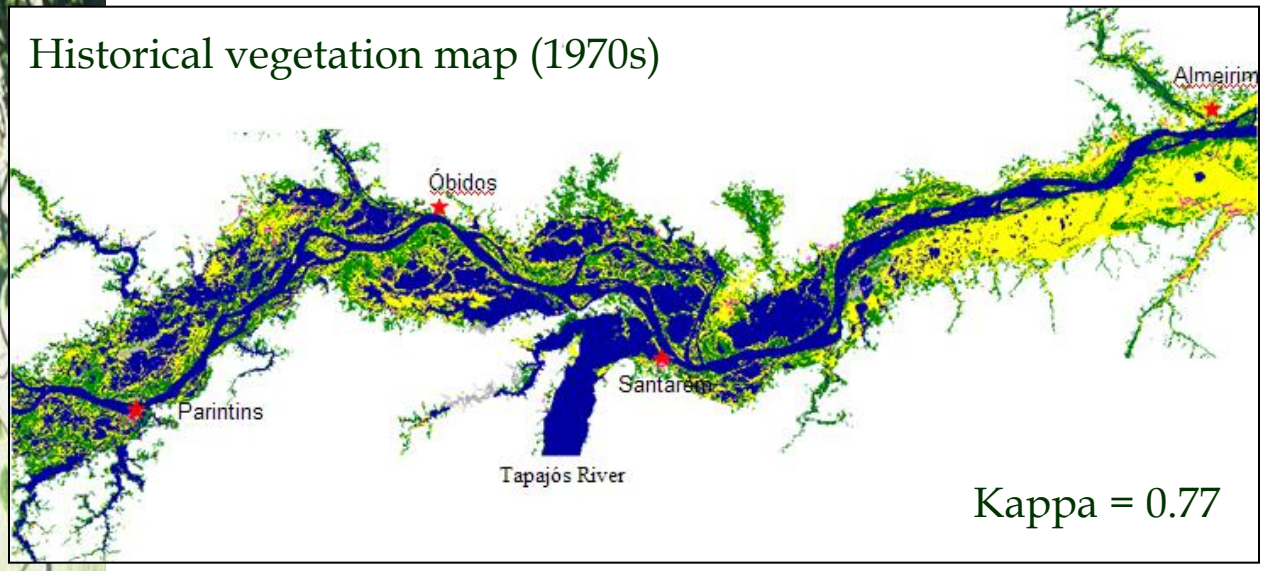
Vegetation maps integration

Deforestation Map

Object-oriented analyze

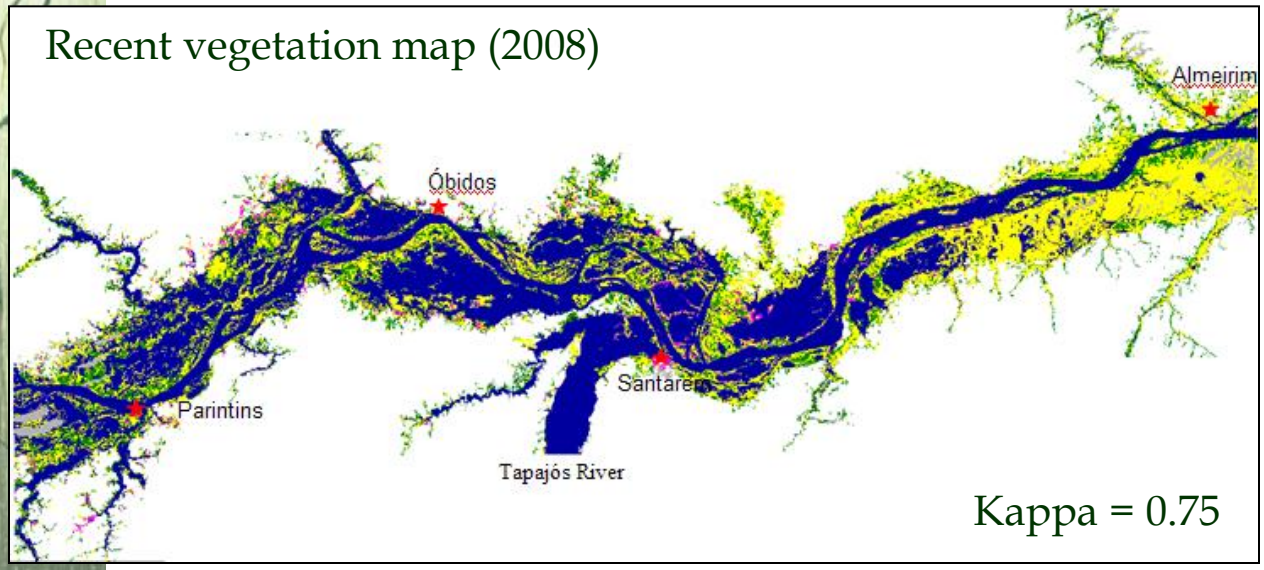
Results

Historical vegetation map (1970s)



Kappa = 0.77

Recent vegetation map (2008)

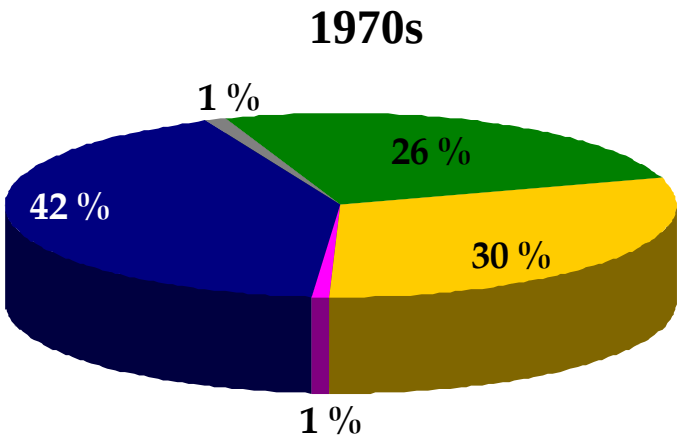


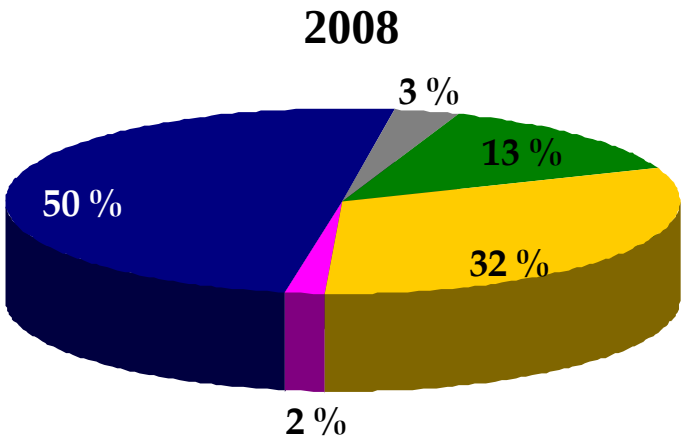
Kappa = 0.75

LEGEND

- Floodplain forest
- Non-forest vegetation
- Bare soil
- Water surface
- Cloud
- Mainland mask

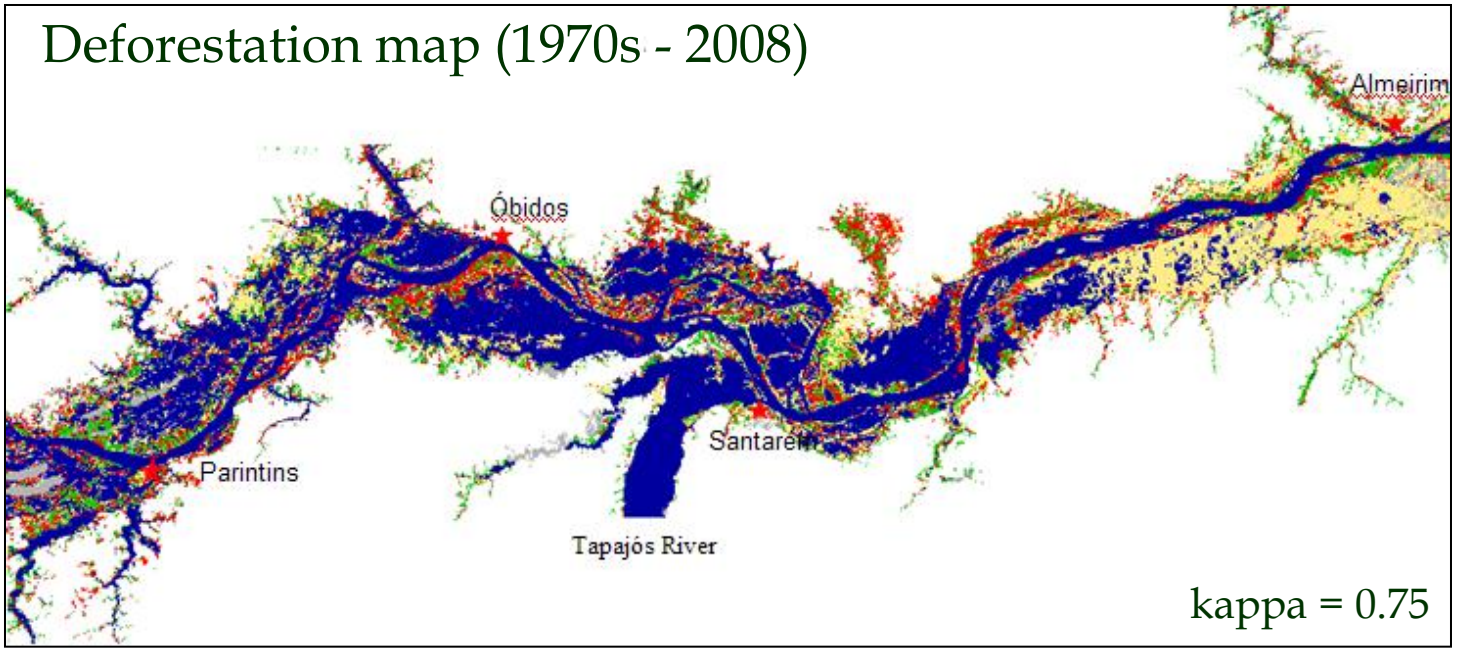
Results

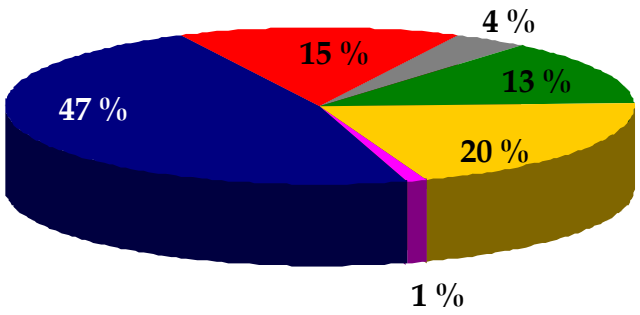




	Classes	Area (km^2) 1970s	2008
	Floodplain forest	7795	4073
	Non-forest vegetation	9096	9548
	Bare soil	248	600
	Water surface	12691	15032
	Cloud	309	887
	Total area	30140	

Results





	Classes	km²	% (- water)
	Deforestation	4336	27
	Floodplain forest	3992	25
	Non-forest veg.	6040	38
	Bare soil	372	2
	Water surface	14227	-
	Cloud	1173	7
	Total area	30140	100

Conclusions

1. About half of the Lower Amazon floodplain was still covered by forest in the late 1970s. Deforestation reduced this to about a quarter of the land area by 2008, but the process was already in course well before the 1970s.

The major phase in the expansion of agriculture was between 1950 and 1975.

2. The most affected areas were concentrated in the central portion of the Lower Amazon (Óbidos, Santarém, Alenquer and Monte Alegre).

Together with field information, these results suggest that floodplain deforestation was mainly due to agriculture and livestock activities.

3. The results support the hypothesis that the differences in floodplain vegetation cover patterns upstream and downstream from the city of Manaus are, to a large degree, a consequence of anthropogenic factors.

However, a more complete characterization of the floodplain cover changes is needed, especially where agriculture and livestock activities play an important economic role.

In order to accomplish this task, larger time series data (7-8 dates), covering other locations of the Amazon floodplain forest are being integrated into this research for further analysis.

Second stage: hypothesis and objective

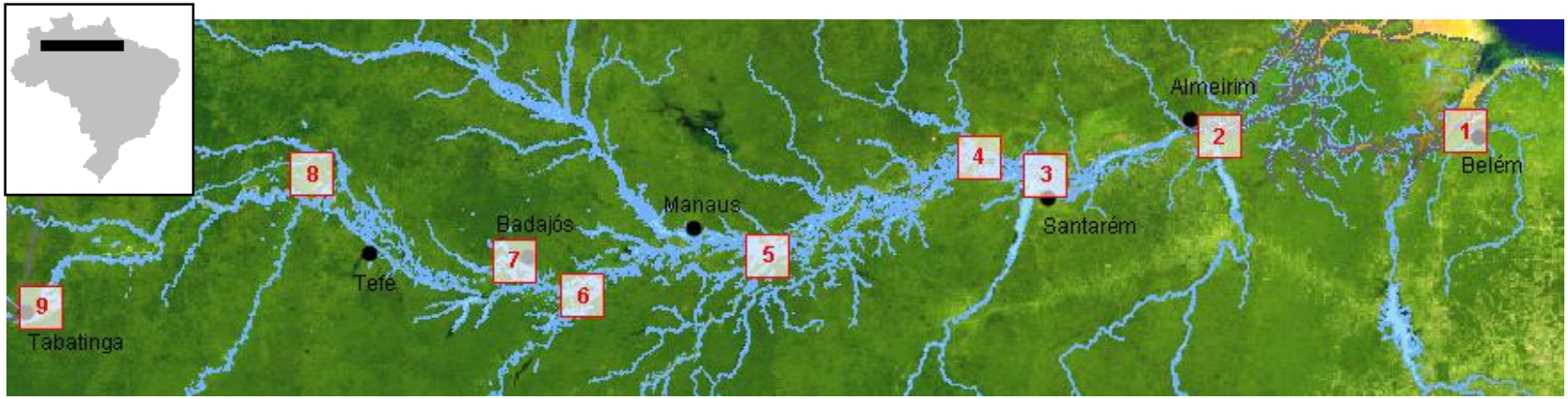
Hypothesis:

The process of forest cover change in the Amazon floodplain is not continuous in space and time, as it is subject to the successive economic cycles and occupation history of each region.

Objective:

Access the spatial and temporal patterns of forest cover changes in different regions along the Amazon floodplain using multi-temporal Landsat image classifications.

Study Area



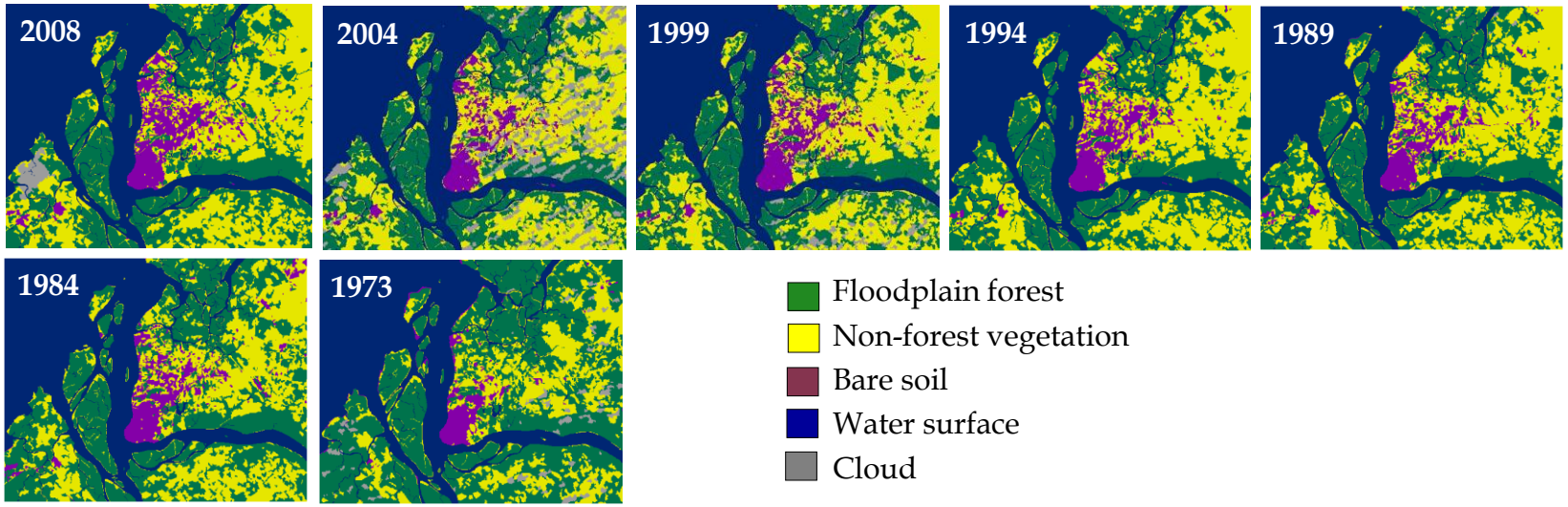
1. **Belém**
2. **Xingu**
3. **Santarém**
4. **Óbidos**
5. **Madeira**
6. **RDS Piagaçu**
7. **Badajós**
8. **RDS Mamirauá**
9. **Tabatinga**

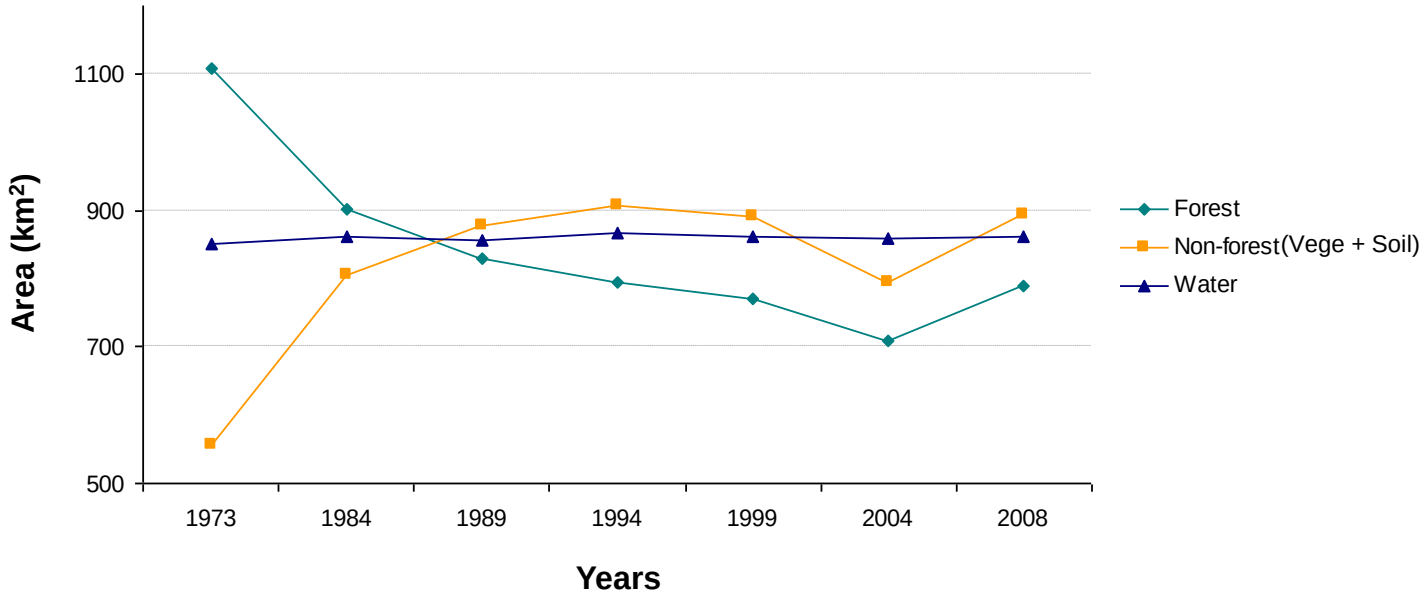
Same methodology

Landsat time series

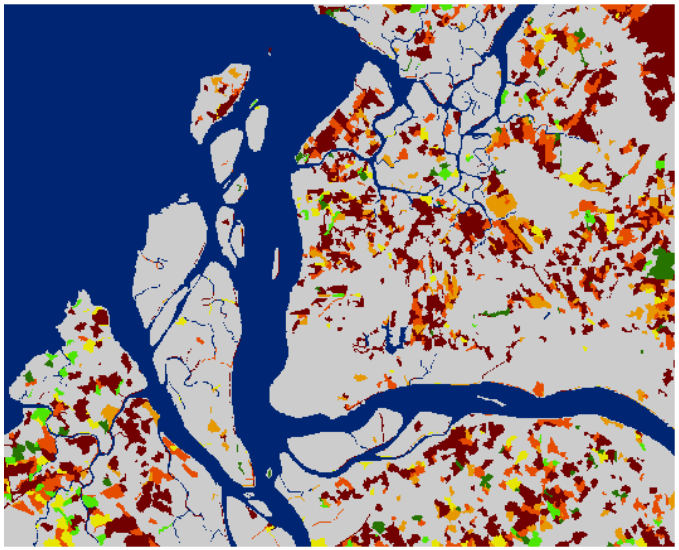
Each 5 years since 1973

Preliminary results: Belém

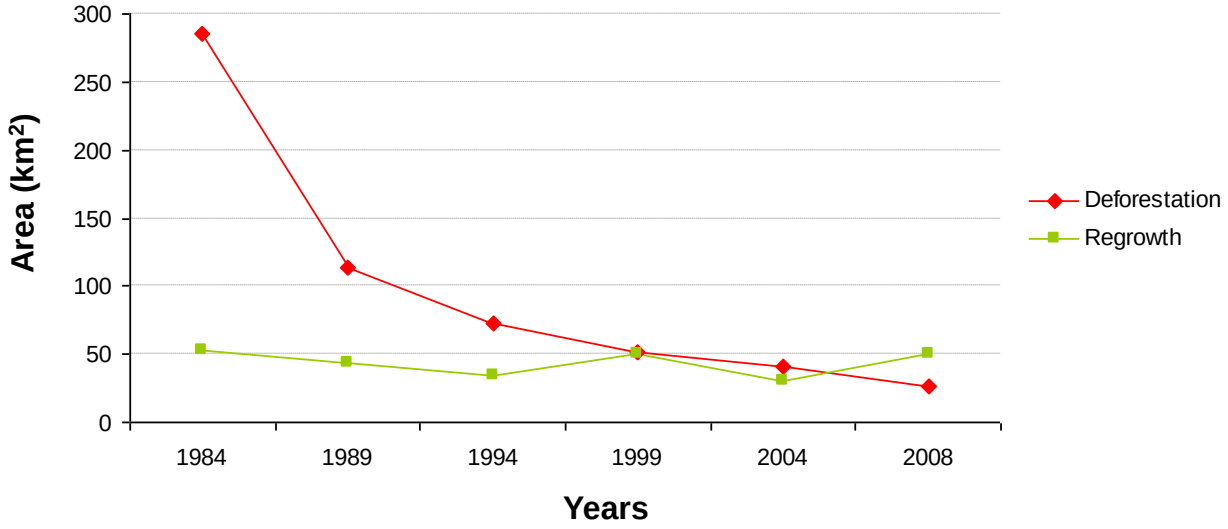




Preliminary results: Belém



- Deforestation (1984)
- Deforestation (1989)
- Deforestation (1994)
- Deforestation (1999)
- Deforestation (2004)
- Deforestation (2008)
- Water surface (1973 - 2008)
- Others



Next Steps

- Mapping the other areas
- Evaluate landscape evolution (landscape metrics)
- Integration with floristic information (inventories)
- Integration with social information (interviews)

How different patterns of forest cover change affect the integrity of forest ecosystems and the provision of ecosystems goods and services to the local communities?

Thank you