The use of ALOS imagery to investigate the carbon dynamics of the Amazon river system

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Science Team meeting #16 – Phase 3 Kick-off
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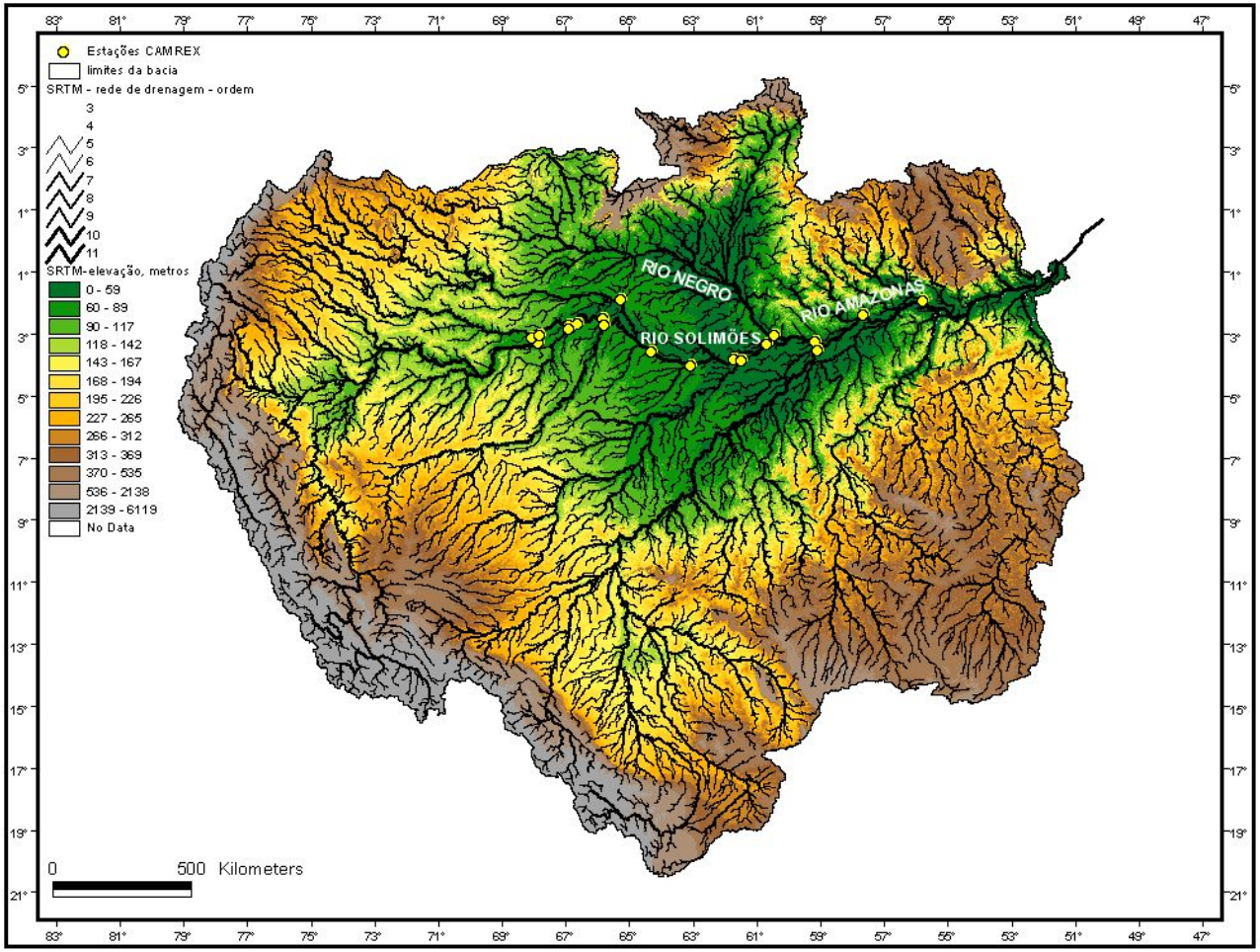
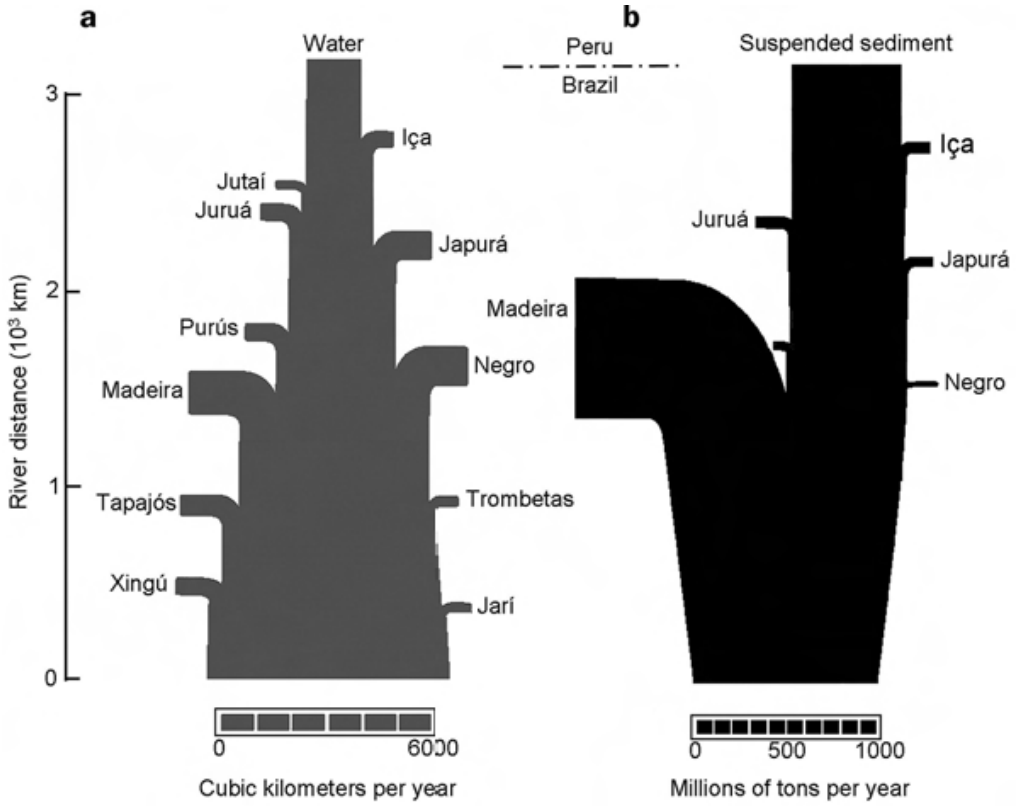
Amazon basin



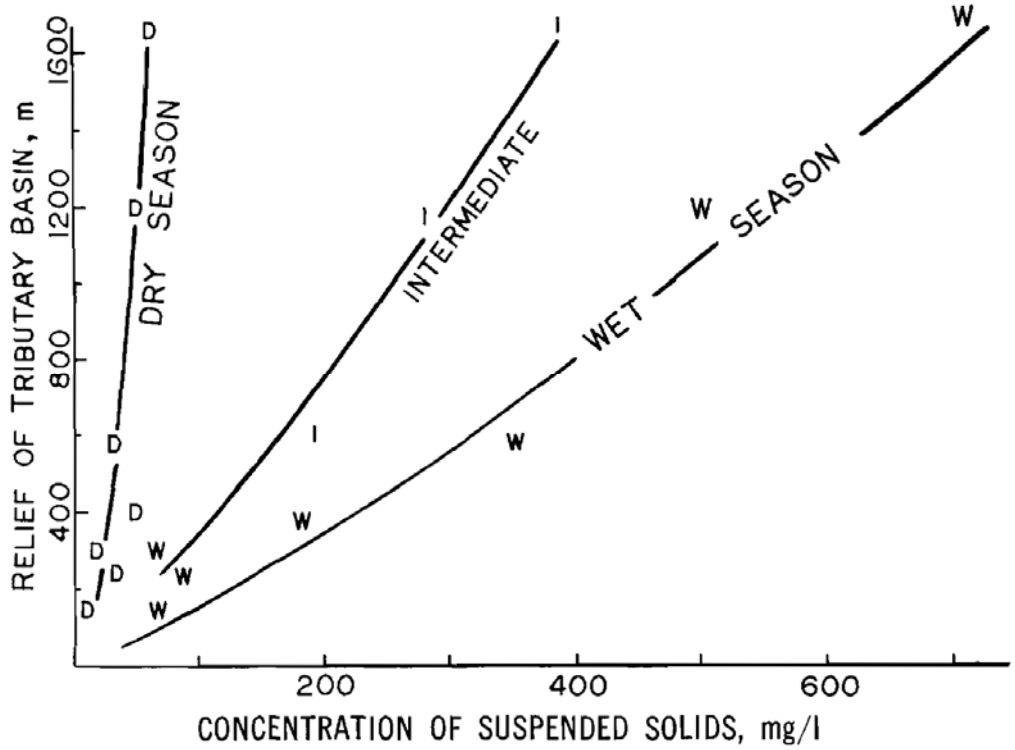
Role of the Amazon River System in the Regional and Global Carbon Cycle

- Outstanding questions:
  - What controls export of organic carbon from the drainage basin?
    1. Particulate Organic Carbon (POC)
    2. Dissolved Organic Carbon (DOC)
  - Does LUCF affect these processes?
  - Are fluvial wetlands a net sink or souce of CO_2 to the atmosphere

The source of POC – Soil erosion and transport

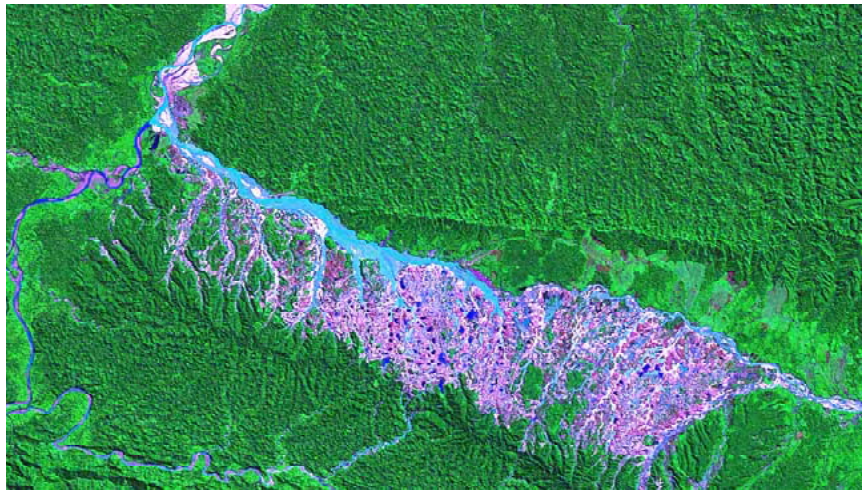


The effect of relief on natural erosion rates

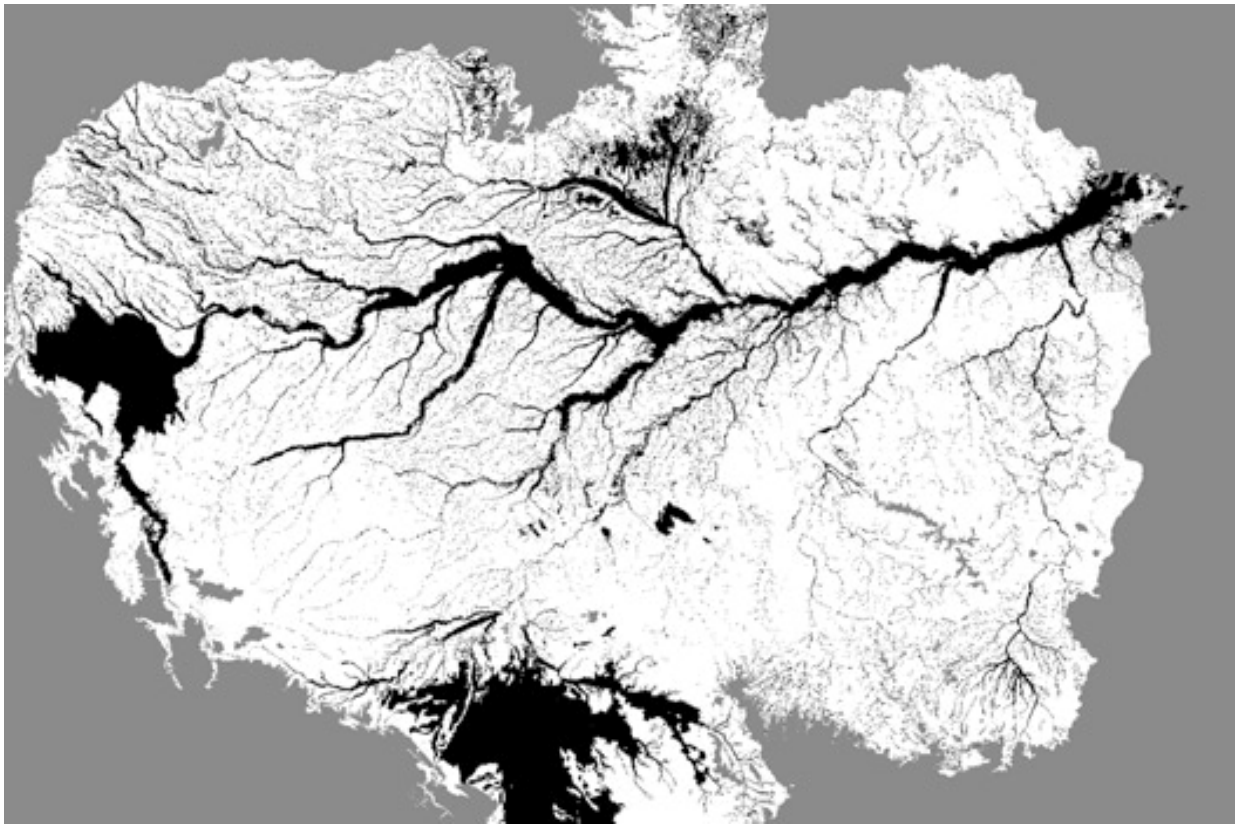


Effects of recente LUC

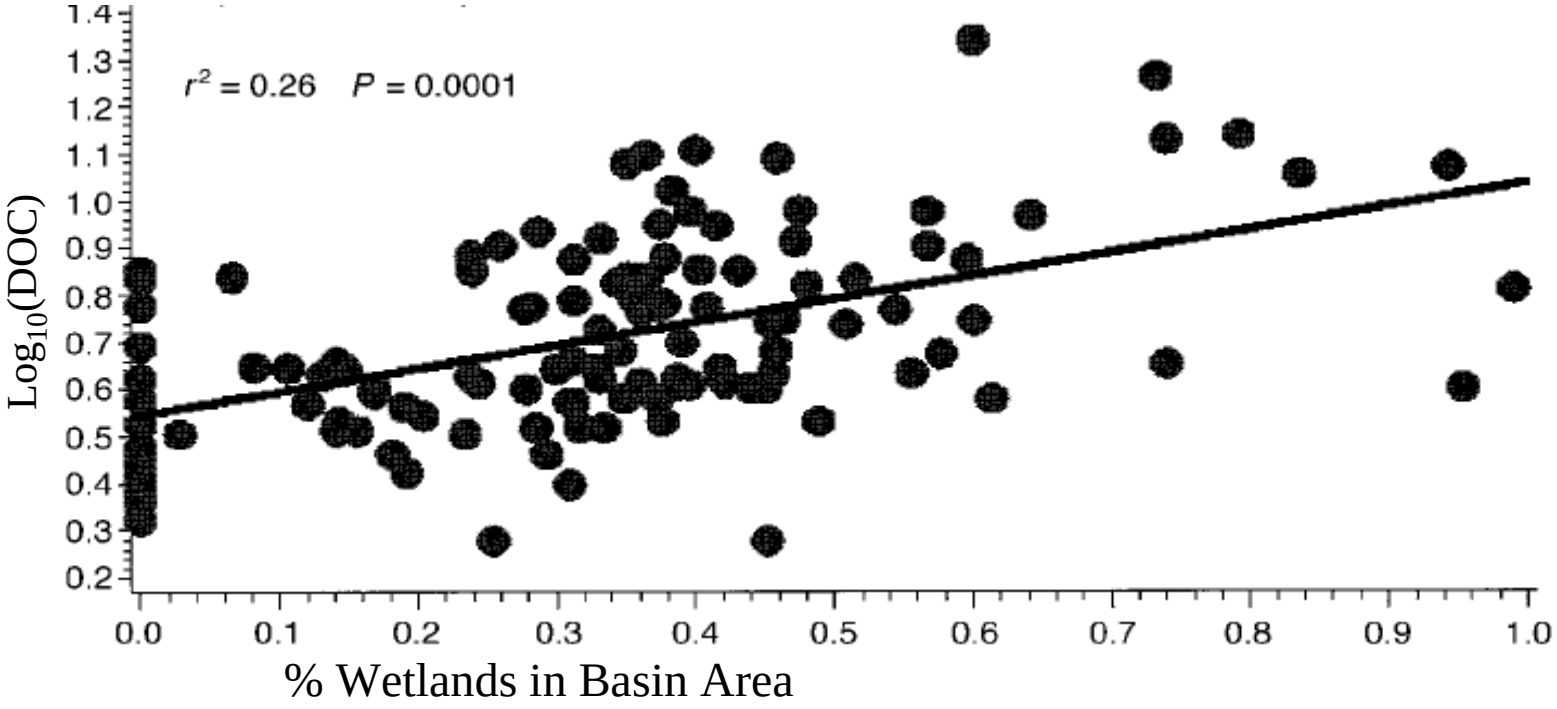
LUC and erosion in the Peru



The source of DOC – wetland?



Influence of wetland density on DOC levels in Wisconsin rivers



Fonte : Gergel et al 1999

Carbon dynamics in wetlands

- High regional emissions of CO_2 and CH_4
- Complete carbon balance needed to understand signficance
  - Need improved estimates of emissions
  - Regional estimates of aquatic blant biomass and primary production
    - Wetland forests
    - Aquatic macrophytes
    - Algae

Project objectives

Use ALOS imagery and field measurements to:

1) investigate the role of relief, deforestation and seasonal flooding in inter-fluvial and alluvial wetlands in the export and dynamics of DOC and POC in the Amazon river system,

2) estimate the carbon balance along a 100km reach of the central Amazon floodplain and

3) use the latter results and classified regional ALOS mosaics to estimate the carbon balance of alluvial wetlands across the entire Amazon basin.

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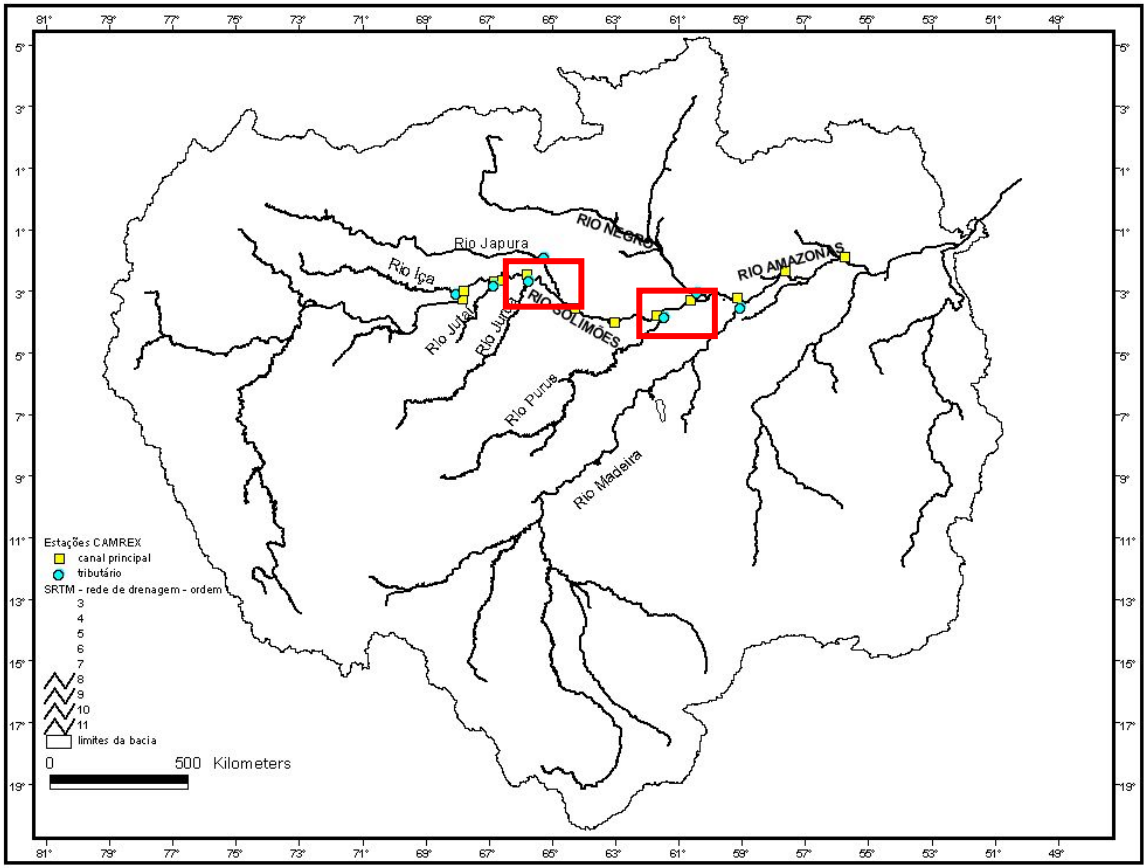
River sampling points



Methods evolving the use of ALOS data

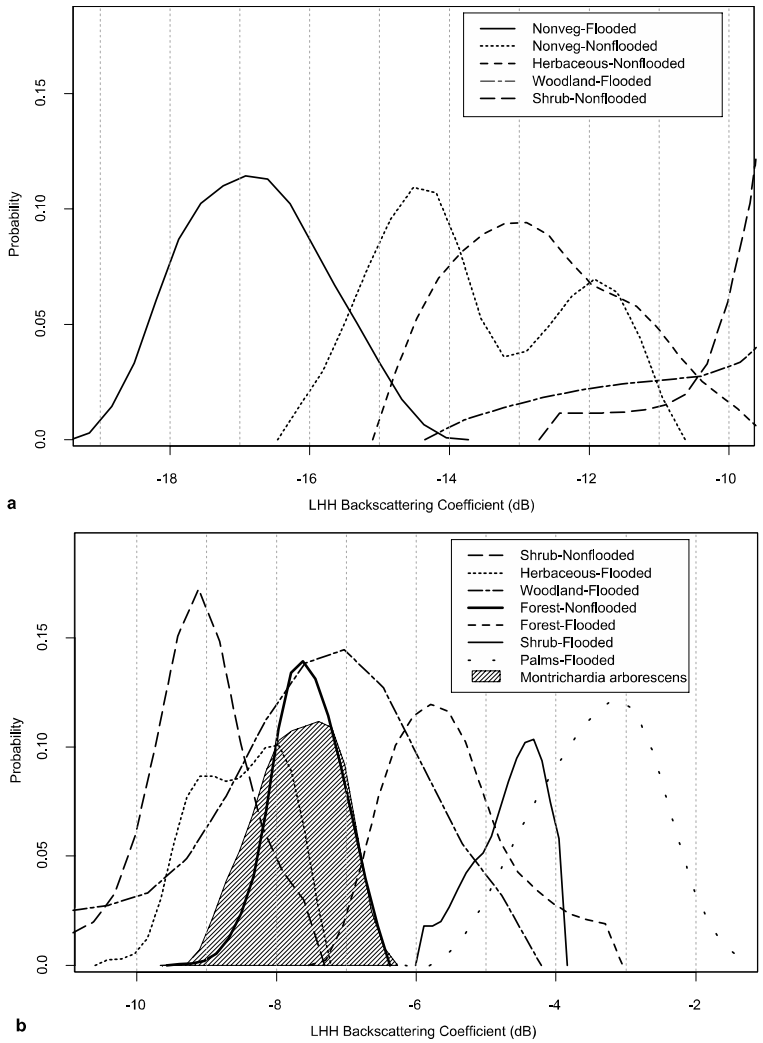
- Classifications
- Spacial and temporal interpolation of field measurements

Wetland classification methodology

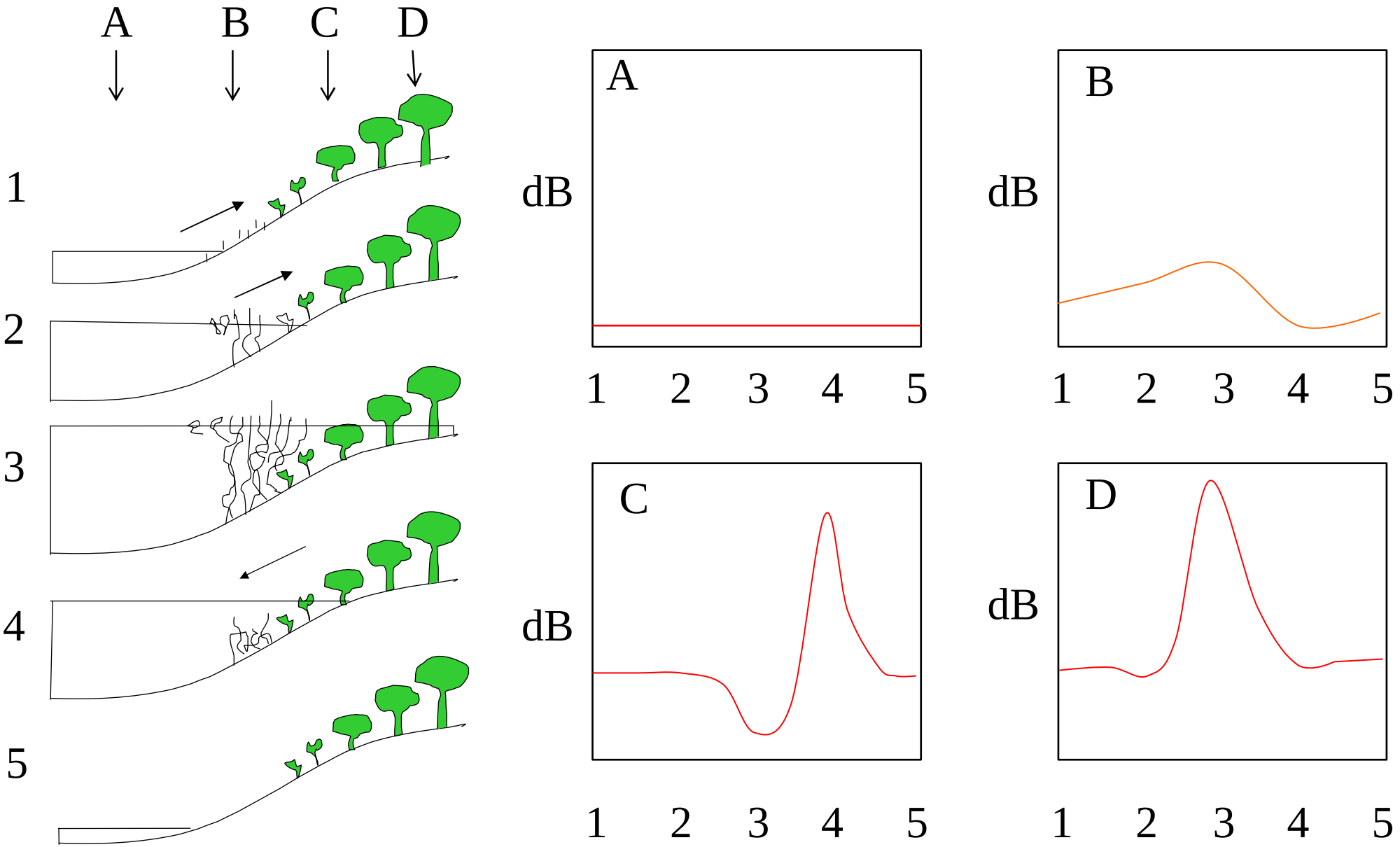
- **Classification types**
  - **Habitats types**
  - **Inundation state**

- **Aproaches**
  - **Static thesholds**
  - **Dynamic decision models**

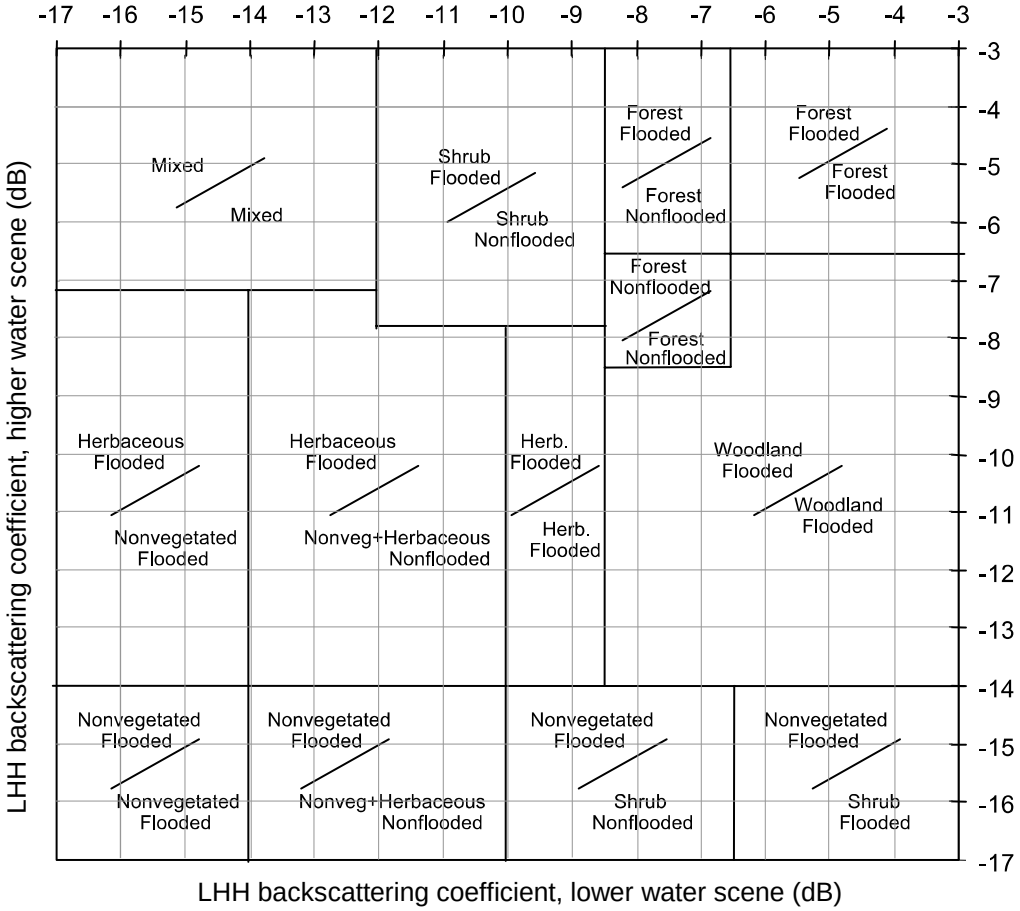
Problems with static threshold aproach

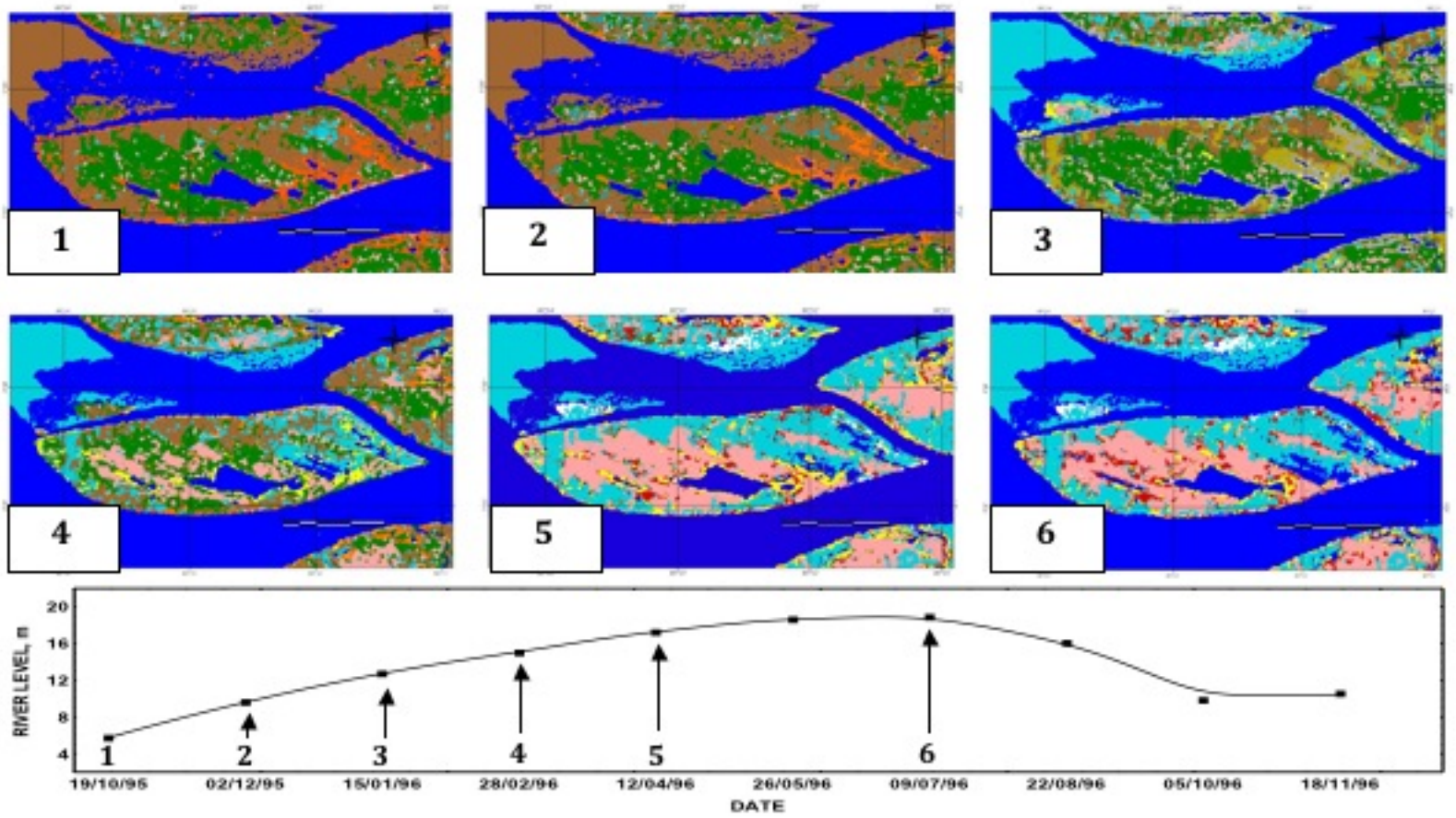


Redrawn from Hess et al 2003


A
B
C
D
1
2
3
4
5
dB
A
B
C
D
1 2 3 4 5

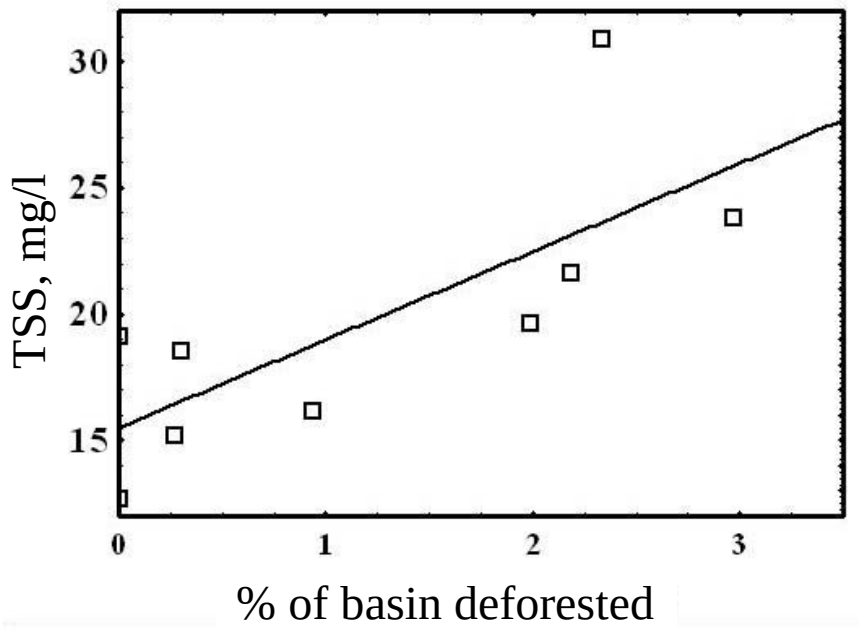
Decision Matrix Approach (modified from Hess et al. 2003)



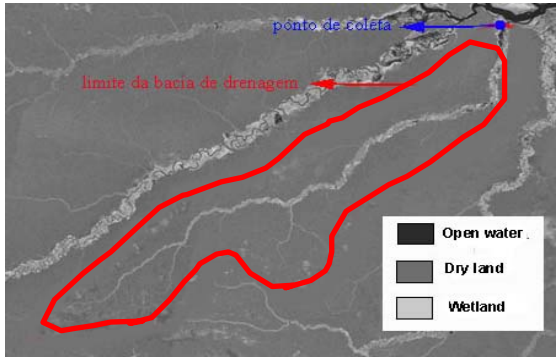


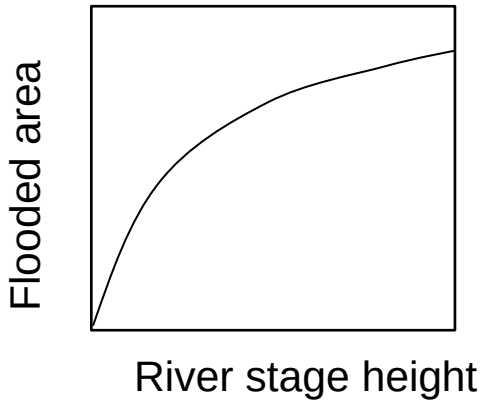
Supervised classification of habitats on Muratu Island (Central Amazon floodplain) at six different phases of the Amazon River flood cycle, derived from the sequential analysis of a temporal series of JERS-1 L-band SAR images. Numbers indicate sequential phases of the annual flood cycle. Habitats classes include:
■ - open water, ■ - dry shrubs and grasses, ■ - flooded shrubs and grasses, ■ - dry forest, ■ - moderately flooded forest, ■ - severely flooded forest, □ - submerged forest, ■ - dry deforested area, ■ - flooded deforested area.

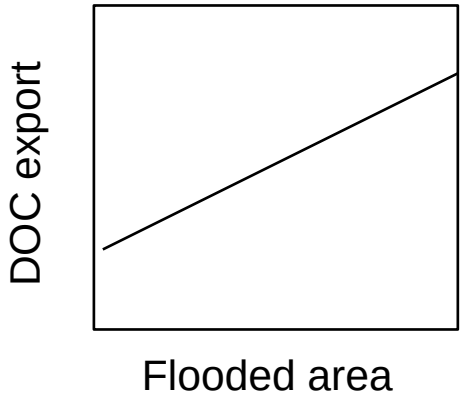
Forest/Non-Forest classification and application

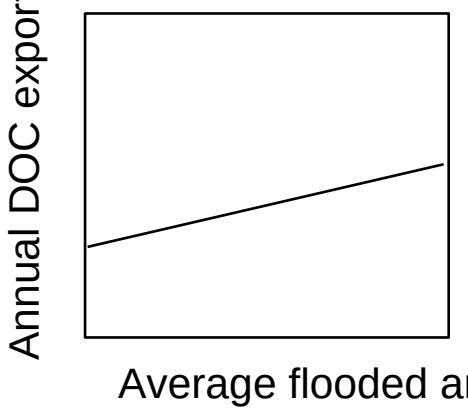


Interpolation and application of flooding data



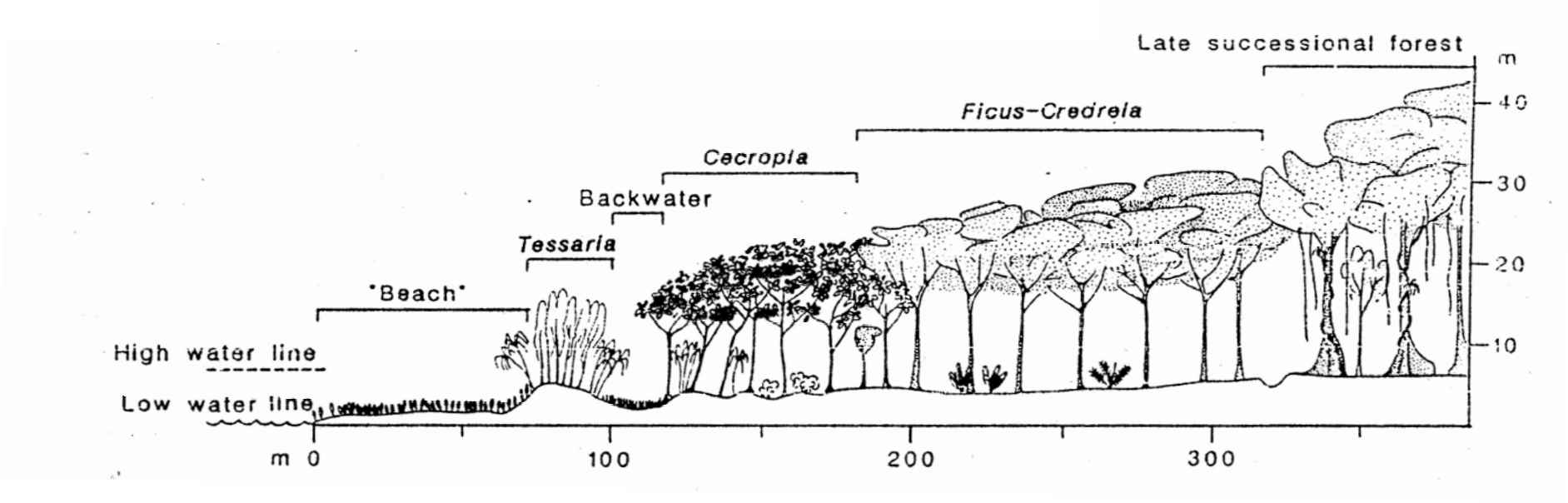




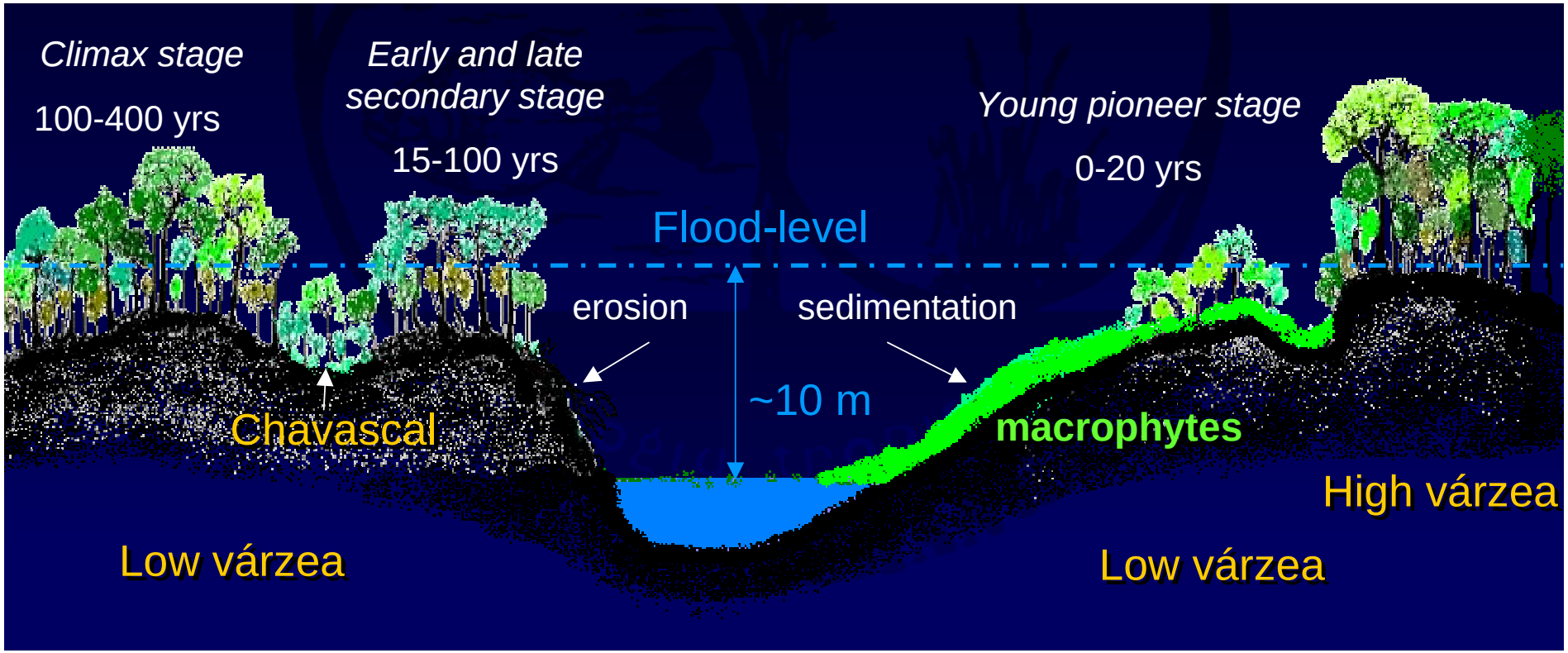


Estimation of forest biomass and production

Dealing with spatial variability

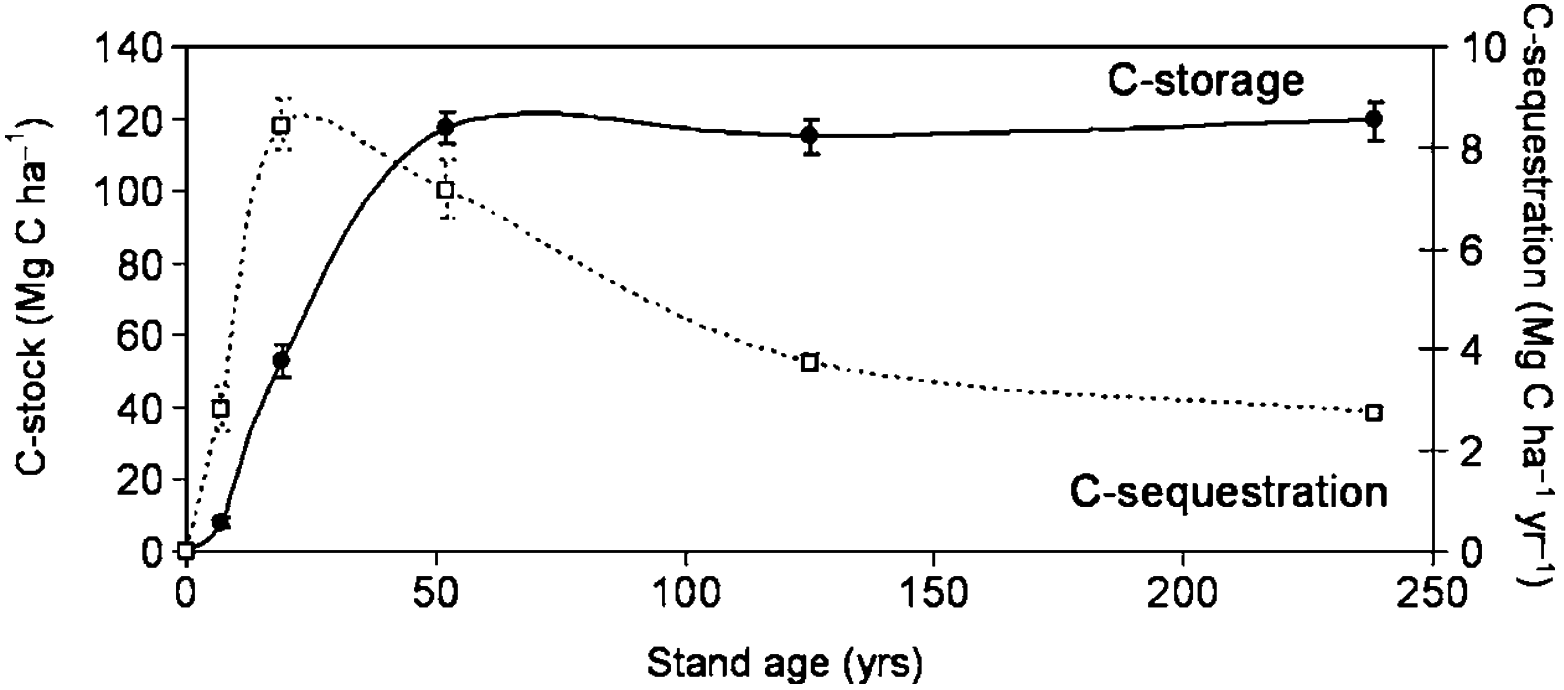


A complex mosaic of successional states



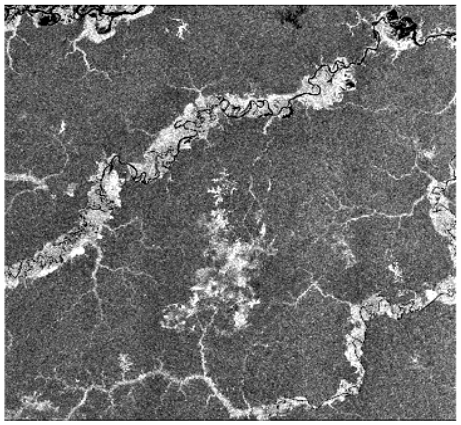
(modified from Schoengart et al 2004)

Effects of stand age on biomass and net production

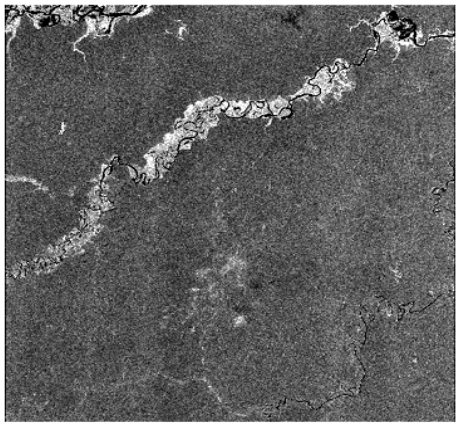


Redrawn from Schoengart et al 2010

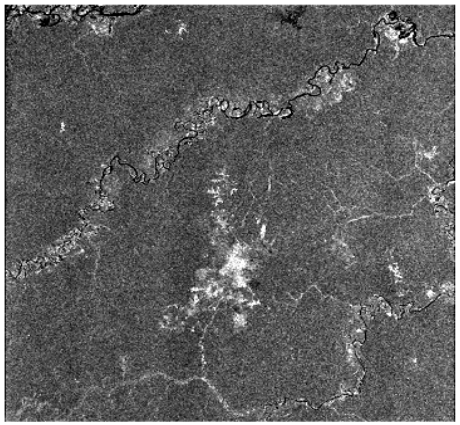
Using flood period as a surrogate of topography and stand age
Developing flood period maps from ALOS imagery



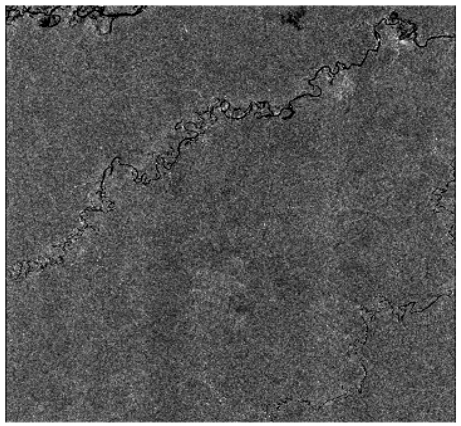
A



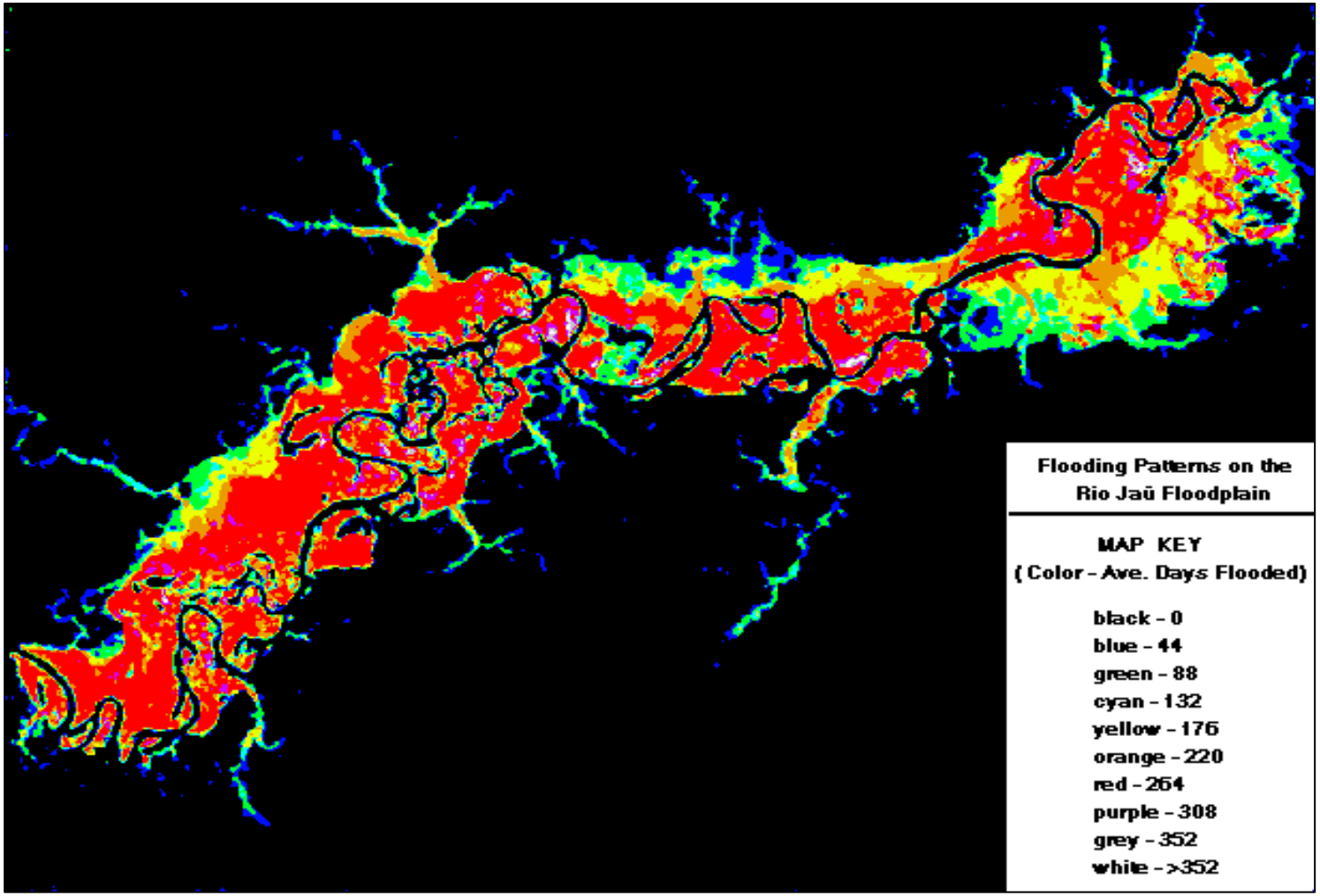
B



C



D


Flooding Patterns on the
Rio Jaú Floodplain
MAP KEY
(Color - Ave. Days Flooded)
black - 0
blue - 44
green - 88
cyan - 132
yellow - 176
orange - 220
red - 264
purple - 308
grey - 352
white - >352

Project Milestones

- Major cruises for regional field collections and measurments (july 2011, november 2011, march 2012, july 2012, september 2012 and janeiro 2013
- Local field collections and measurements (monthly excursons from november 2011 – december 2012)
- Image classification (depends on mosaic delivery dates, projected completion mid 2012)

Support to JAXA's global forest mapping effort

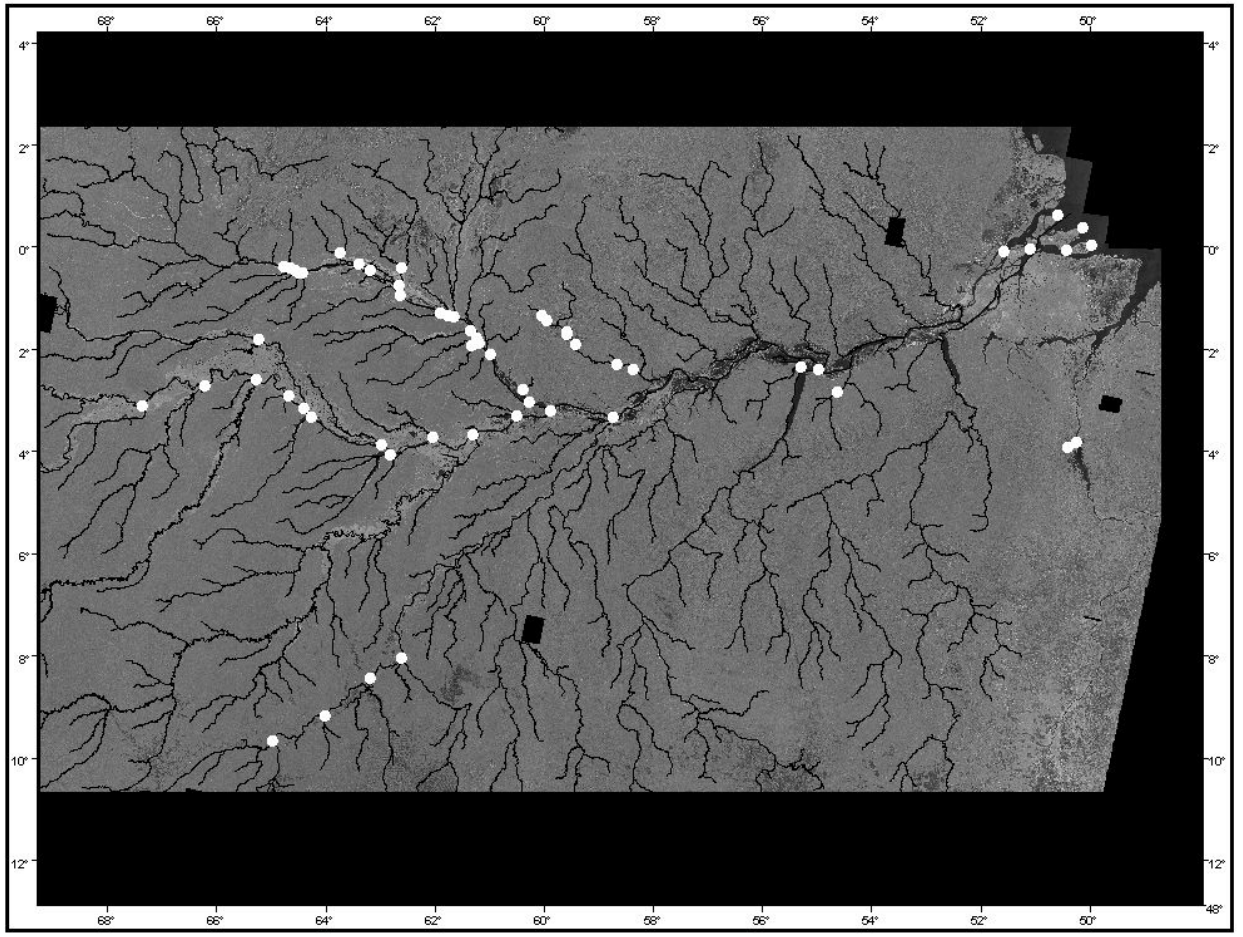
by providing :

1)Geocoding points,

2)Wetland forest biomass estimates and

3)field validation of wetland habitat classifications along 2000km of the central Amazon floodplain and along the Madeira and Negro rivers.

Geocoding points locations



Deliverables (delivery date)

- Multi-temporal regional scansar mosaics – classified for wetland type and flooding status (depends on /JAXA/JPL mosaic delivery date, projected late 2012) JPL products?

- Analyses of DOC anf POC dynamics linked to ALOS and SRTM derived inundation patterns and relief patterns (manuscript by late 2012)

- ALOS assisted carbon balance for floodplain study site (manuscript by mid 2013)

- ALOS interpolated carbon balance for alluvial wetlands in the Amazon Basin (manuscript by early 2014)

Deliverables (delivery date)

- Geocoding points – late 2011
- Forsest biomass estimates – late 2013
- Validation data for wetland classifications – early 2012

Colaborators

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