Amazon-influenced mangroves
The changing forests


IVth Scientific Meeting of the ORE-HYBAM - Lima (Peru) 6-9 September 2011.
1. EVIDENCES OF IMPACTS ON FOREST ECOSYSTEMS?

2. ECOLOGICAL KNOWLEDGE FOR A BETTER UNDERSTANDING OF RIVER FLUXES?

**AMAZON SEDIMENT DISCHARGE (OBIDOS): +20%**

Fig. 8. Annual Amazon River discharge and sediment discharge between 1996 and 2007 at Óbidos.
LEARNING FROM FORESTS DYNAMICS

Forest dynamics is the expression of an equilibrium between endogenous growth processes of forest trees and exogenous constraints exerted by the environment $\leftrightarrow$ history of forest characteristics.

**External limits**
- forest boundaries
- forest extents

**Internal characteristics**
- species composition
- structural parameters
- functioning parameters

**Learning on physical processes from Amazonian forest seems to be difficult:** A mosaic of forest biomes $\leftrightarrow$ a mosaic of watersheds $\leftrightarrow$ A mosaic of human ways of living.

**But Amazonian mangroves has advantages:** A very specific salt-tolerant ecosystem (few species) $\leftrightarrow$ the final mud deposit areas $\leftrightarrow$ ~pristine coasts. However, oceanic processes must be understood.
AMAZON MUD-INFLUENCED COASTS

Mud bank alongshore migration

Area of influence of Amazon sediments dispersal

French Guiana

Amapá

AMAZON RIVER

Para
MUD BANKS = NEW SUBSTRATE FOR NEW MANGROVE

Anthony et al. 2008 (CSR)
Proisy et al. 2009 (CSR)

~ 40 km long x 5 km wide

AGBiomass ~ 0 tDM/ha
OPPORTUNISTIC COLONIZATION
over thousands of hectares in one year

AGB ~ 1 tDM/ha
3-4 YEARS LATER (same place)

AGB ~ 90 tDM/ha
ELSEWHERE, IN A STABLE REGION

200 tDM/ha < AGB < 450 tDM/ha

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HIGH BIOMASS
= f(COASTAL STABILITY)

Ecological questions:
1. How to measure such high level biomass forest?
2. A link to mud deposits history?
MANGROVE DESTRUCTION AS A CONSEQUENCE OF EROSION PHASES (MUDBANK MIGRATION TO THE NW)

Anthony et al. 2011 (ESR)

AGB = 0 t DM/ha

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MANGROVE RENEWAL AS A CONSEQUENCE OF ACCRETION PHASES (MUDBANK MIGRATION TO THE NW)

AGB > 0 t DM/ha
THE PARA MANGROVES: +720 km² BETWEEN 1996 -2008


Figure 7- RADARSAT-1 and Landsat TM composite showing the coastal geomorphology and shallow water morphology. a = accretion and e = erosion.
THE AMAPA MANGROVES BETWEEN 1972-2008

- Region of very difficult access
- Changes are occurring over km²

Specific dynamics of mangrove islands
THE AMAPA MANGROVES ISLANDS ARE DIRECTLY IMPACTED BY SEDIMENT BUDGET
FRENCH GUIANA: THE 1950-2010 MANGROVE COASTLINE RECORDS

1950-2008, Aerial photographs, Landsat, Spot, Ikonos, ALOS images

© C. Proisy, French Guiana, 2010
FRENCH GUIANA: THE 1950-2010 MANGROVE COASTLINE RECORDS

SIGNAL ANALYSIS

SURINAM

BRAZIL
A REMOTE SENSING FRAMEWORK FOR ESTIMATING AG BIOMASS OF CHANGING TROPICAL FORESTS

Forest inventories+ big trees biomass

Coupling of ecological and physical models

Physical validation of AG biomass maps

From Proisy et al. 2000

From Proisy et al. 2007

From Proisy et al. 2011
COUPLING VARIABILITY OF AMAZON SEDIMENT DISCHARGE TO STUDIES OF MANGROVES DYNAMICS

- Mangrove grow during mud accretion
- Mangrove disappear during mud erosion

1. Various contexts from Pará to French Guiana coasts
2. Monitoring Amapá mangrove islands is of prime interests for HYBAM

MONITORING BIOMASS CHANGES IN FOREST ECOSYSTEMS FOR IMPROVING TEMPORAL ANALYSIS OF CHANGES IN RIVER PROCESSES

- A physical- and ecological-based modeling framework is required
- Ground-truth and database linking are indispensable
- Call for generalizing mangrove-implemented remote sensing methods to flooded forests (cf. mangrove islands): a study from Atlantic ocean to the Andes?
SOME TEAM REFERENCES DEALING WITH COASTAL DYNAMICS AND FOREST BIOMASS


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