



Multi-scale analyses of inundation and wetland vegetation dynamics: Applications to carbon fluxes

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Towards a Functional Characterization of Amazonian Wetlands

**Basinwide mapping of Amazonian wetlands using a
classification system suitable for multiple
applications:**

Biogeochemical and hydrologic modeling

Resource management and development planning

Classification approach

Three physical characteristics detectable using satellite remote sensing satisfy the key requirements :

Vegetation structure (non-vegetated, herbaceous, shrub, woodland, forest)

Inundation periodicity (flooded or non-flooded on a sequence of dates)

Water type (blackwater, whitewater, clearwater, mixed)

Remote Sensing Datasets

High-resolution basinwide and regional mosaics

SAR (JERS-1, Radarsat, Envisat) 100 m

Landsat TM 30 m

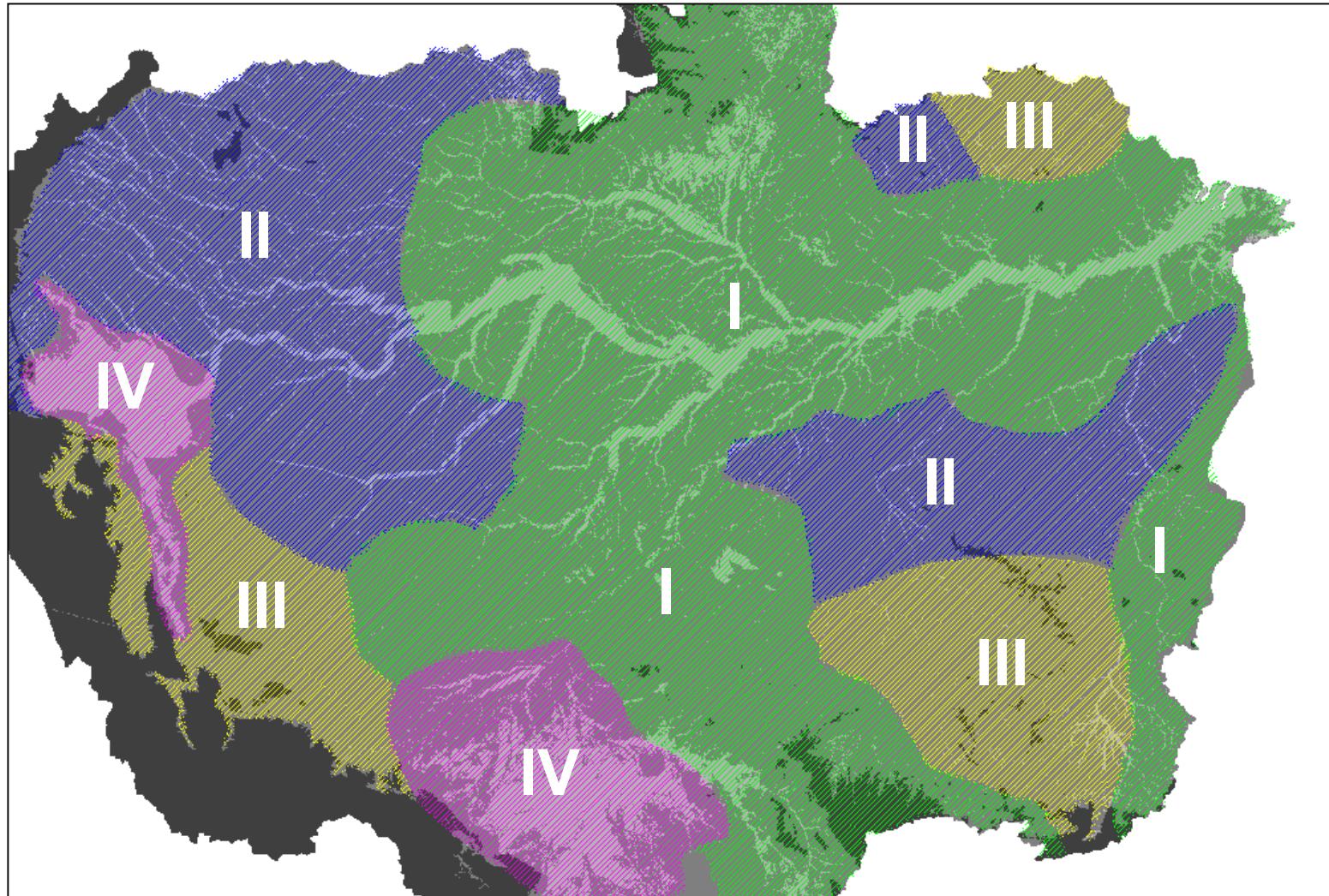
Shuttle Radar Topography Mapper 90 m

Low-resolution regional mosaics

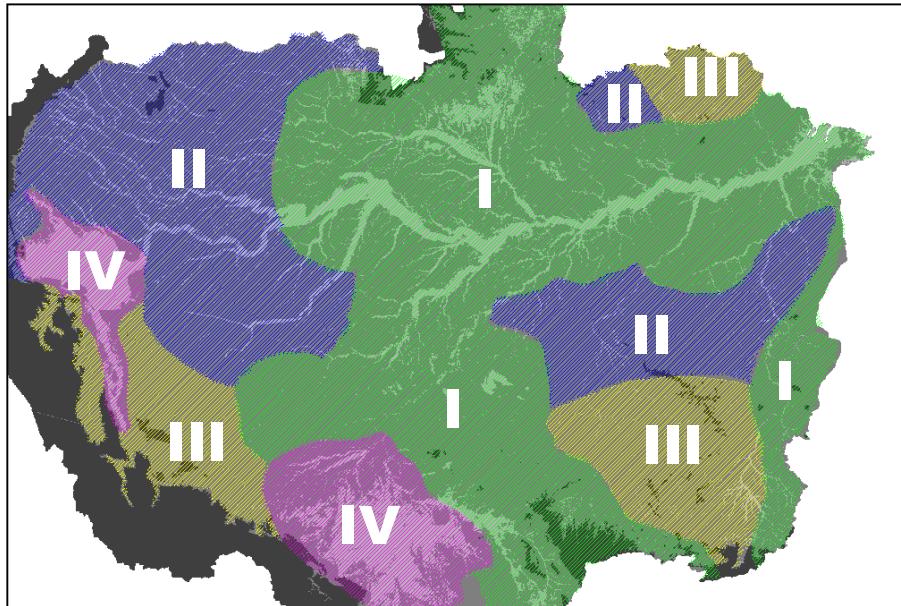
SMMR passive microwave 25 km

MODIS 250 m

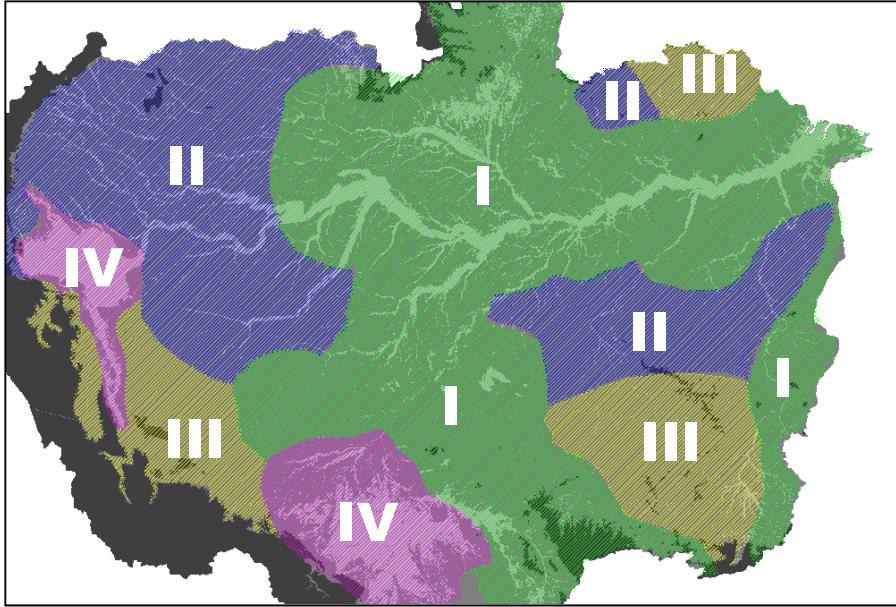
Wetlands Mapping: Thematic Accuracy Zones



Wetlands Mapping: Thematic Accuracy Zones (2)

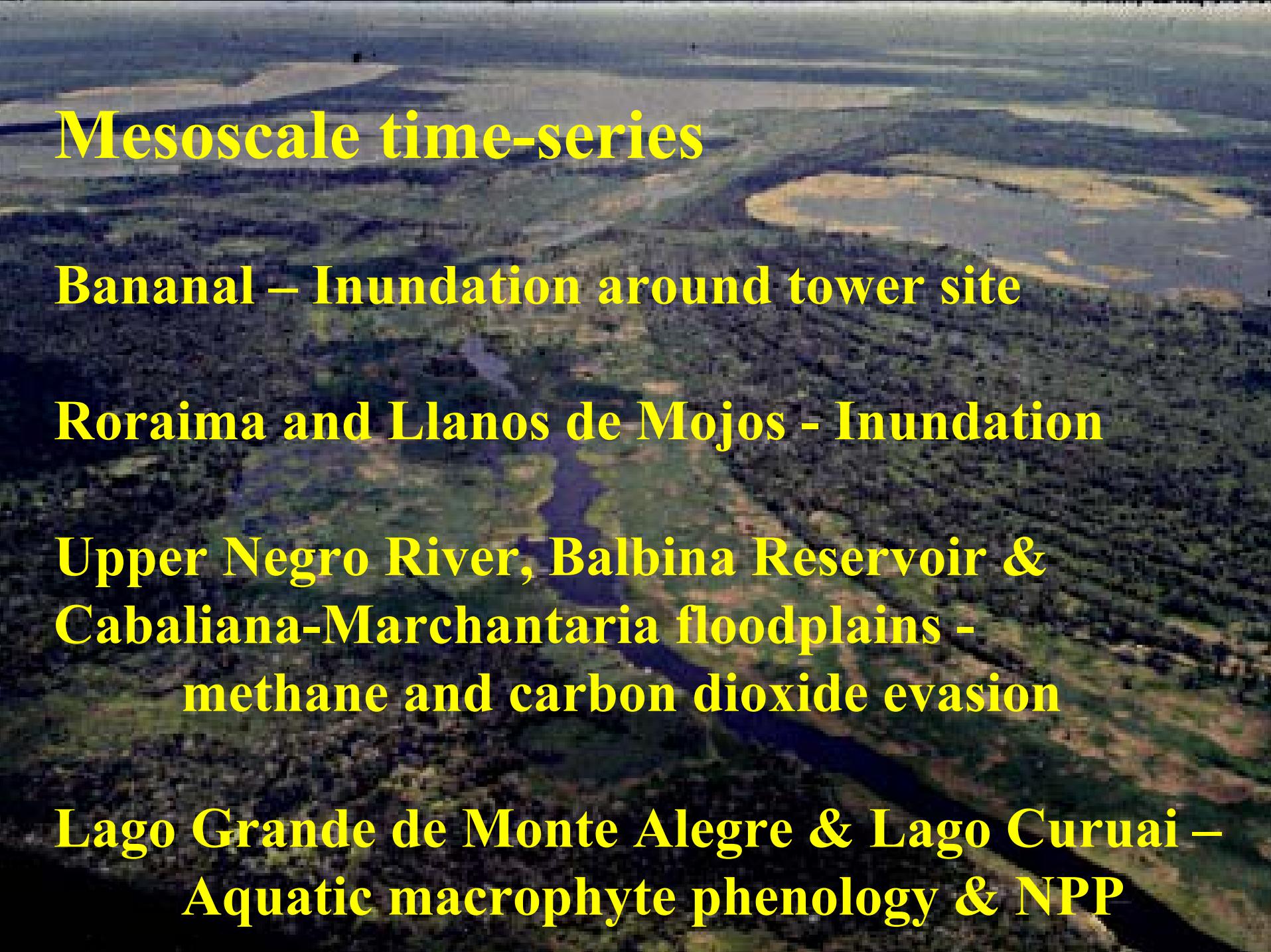


- For wetland vs. non-wetland mapping, primary validation dataset is 1999 videography (timed to high-water stage for central Amazon)
 - Zone 1 is a 500 km buffer centered along 1999 video flightlines
 - Within Zone 1, we assume video-based accuracy statistics are valid
- To what extent can these results be extended beyond Zone 1?



Wetlands Mapping: Thematic Accuracy Zones (3)

- Zone II: vegetation structure and flood timing are represented within video transects
- Zone III: flood timing not well represented within video transects
- Zone IV: neither vegetation nor flood timing well represented within video transects

The background image shows an aerial view of a flooded landscape. A dark blue river flows through the center, surrounded by large areas of water. The surrounding land is a mix of green and brown, indicating different types of vegetation or soil. In the distance, there are some small buildings and trees.

Mesoscale time-series

Bananal – Inundation around tower site

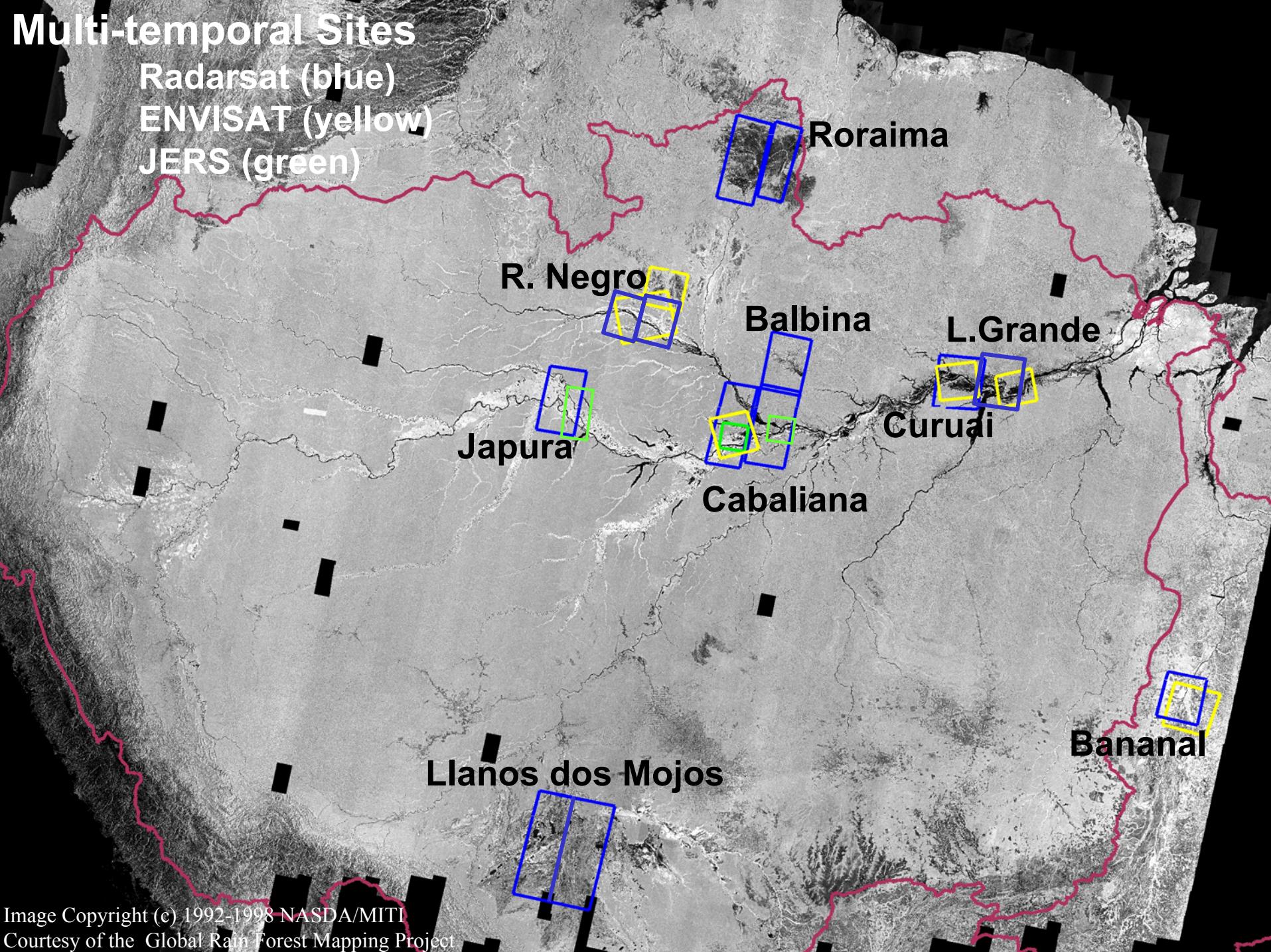
Roraima and Llanos de Mojos - Inundation

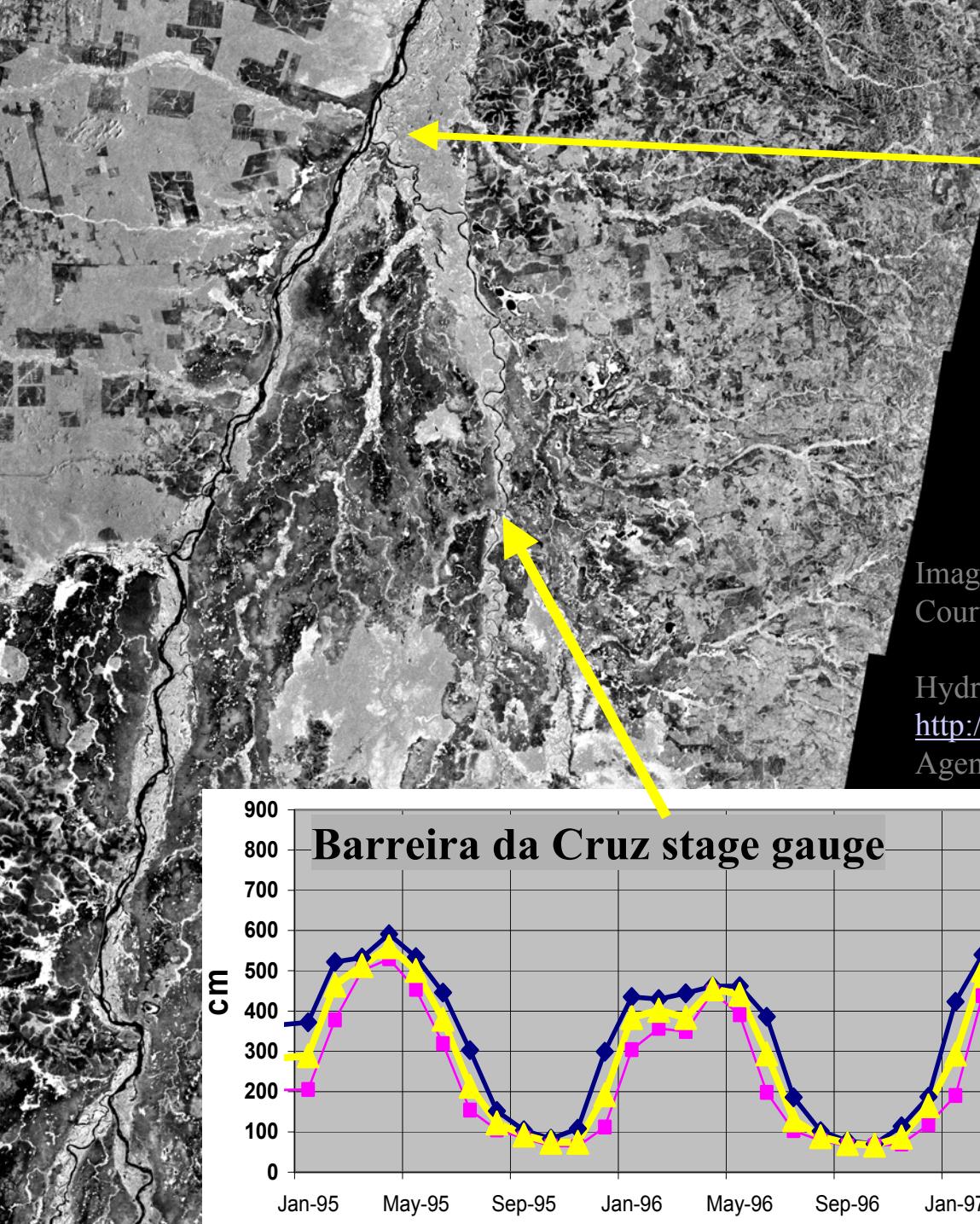
**Upper Negro River, Balbina Reservoir &
Cabaliana-Marchantaria floodplains -
methane and carbon dioxide evasion**

**Lago Grande de Monte Alegre & Lago Curuai –
Aquatic macrophyte phenology & NPP**

Multi-temporal Sites

Radarsat (blue)
ENVISAT (yellow)
JERS (green)



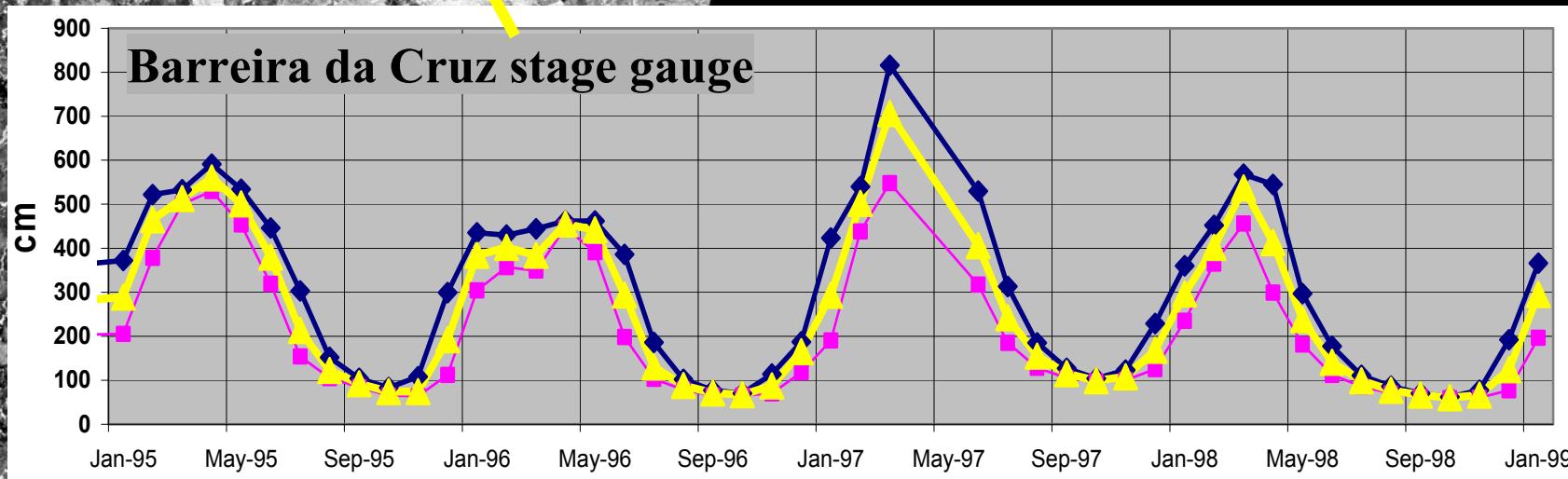


Bananal Tower Site

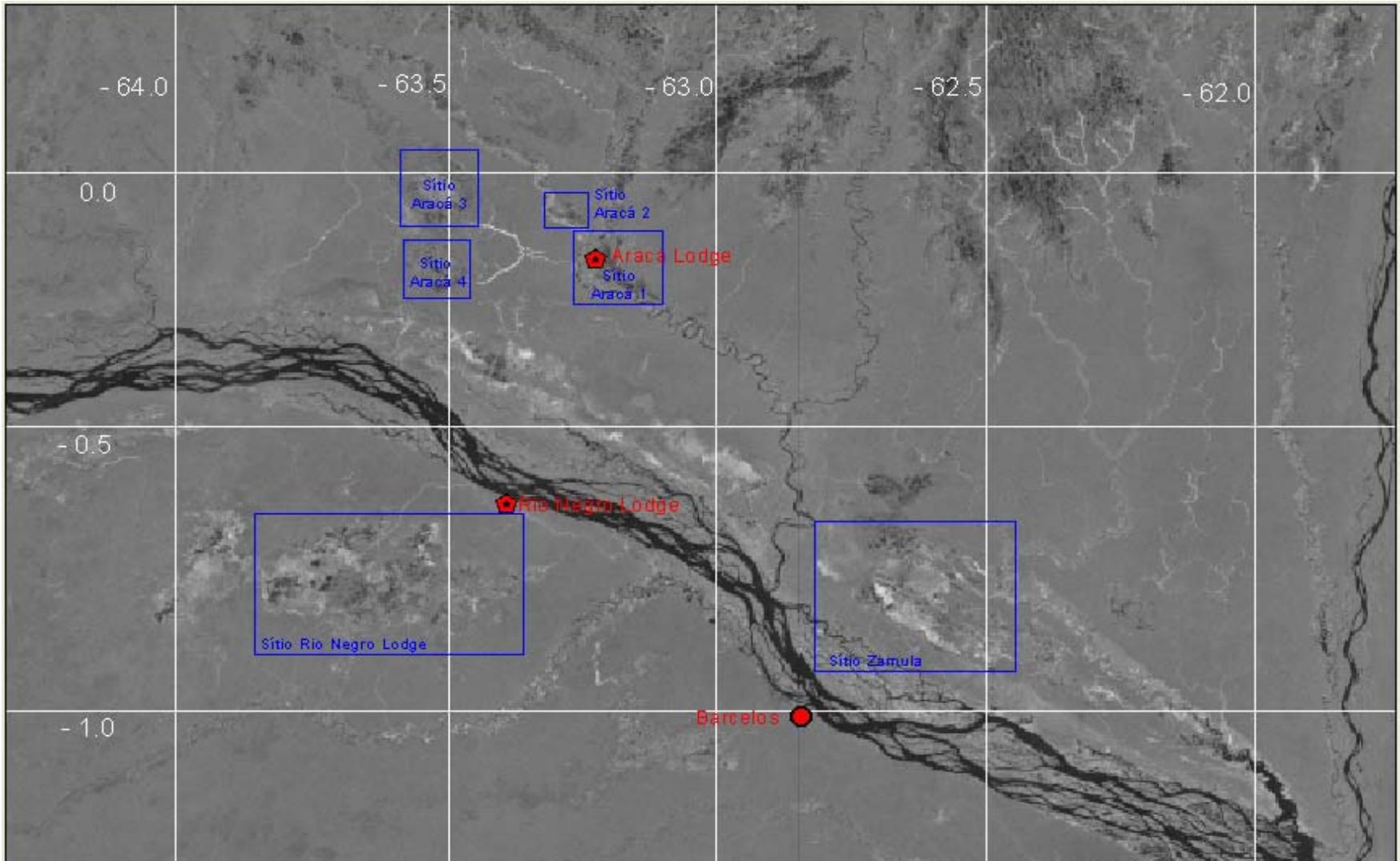
Radarsat data from
March 2003 to March 2004
and continuing

Image Copyright (c) 1992-1998 NASDA/MITI
Courtesy of the Global Rain Forest Mapping Project

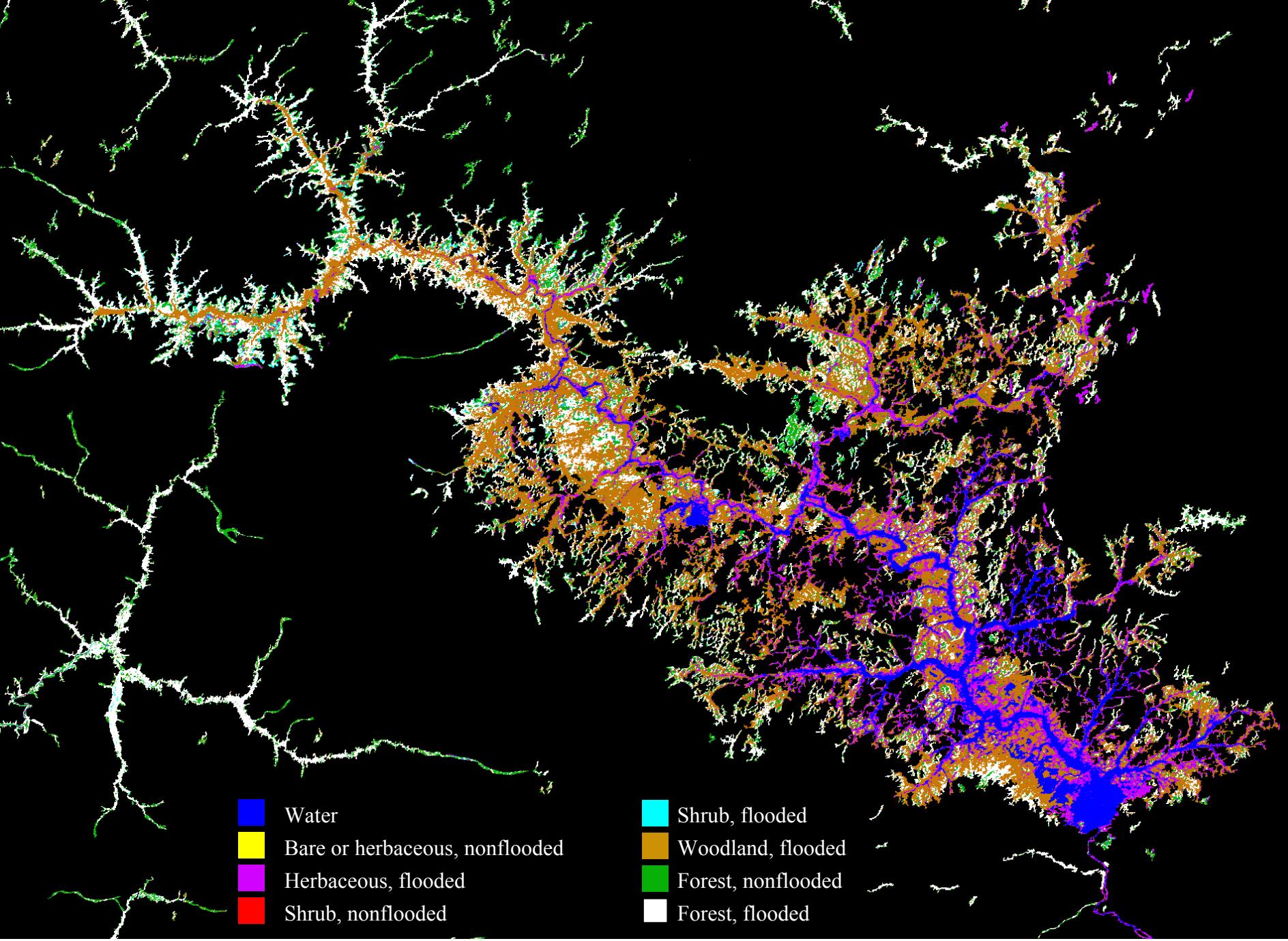
Hydrograph from
<http://hidroweb.ana.gov.br/HidroWeb/>
Agencia Nacional de Aguas (ANA)



Upper Rio Negro sites for methane and carbon dioxide evasion studies



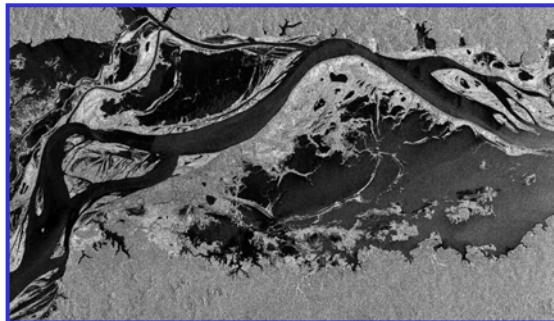
Radarsat coverage from Feb 2004 to Dec 2004



Balbina reservoir at high water

Spatio-temporal dynamics of macrophyte communities with multi-sensor data

Radarsat C-HH, Envisat ASAR C-HH/VV,
MODIS, Landsat TM



ASAR



Radarsat

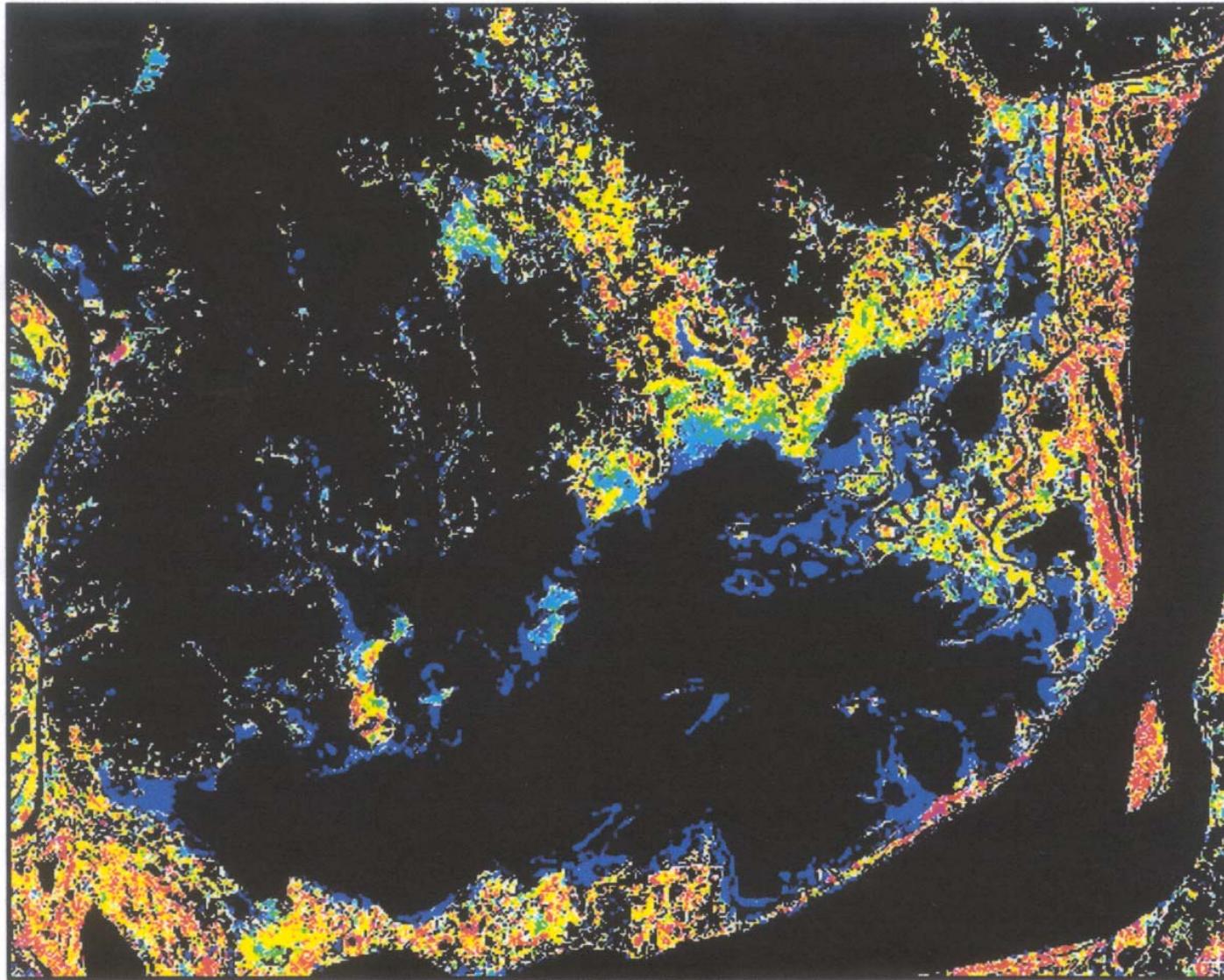


TM



MODIS

Net Primary Productivity of Floating Macrophytes

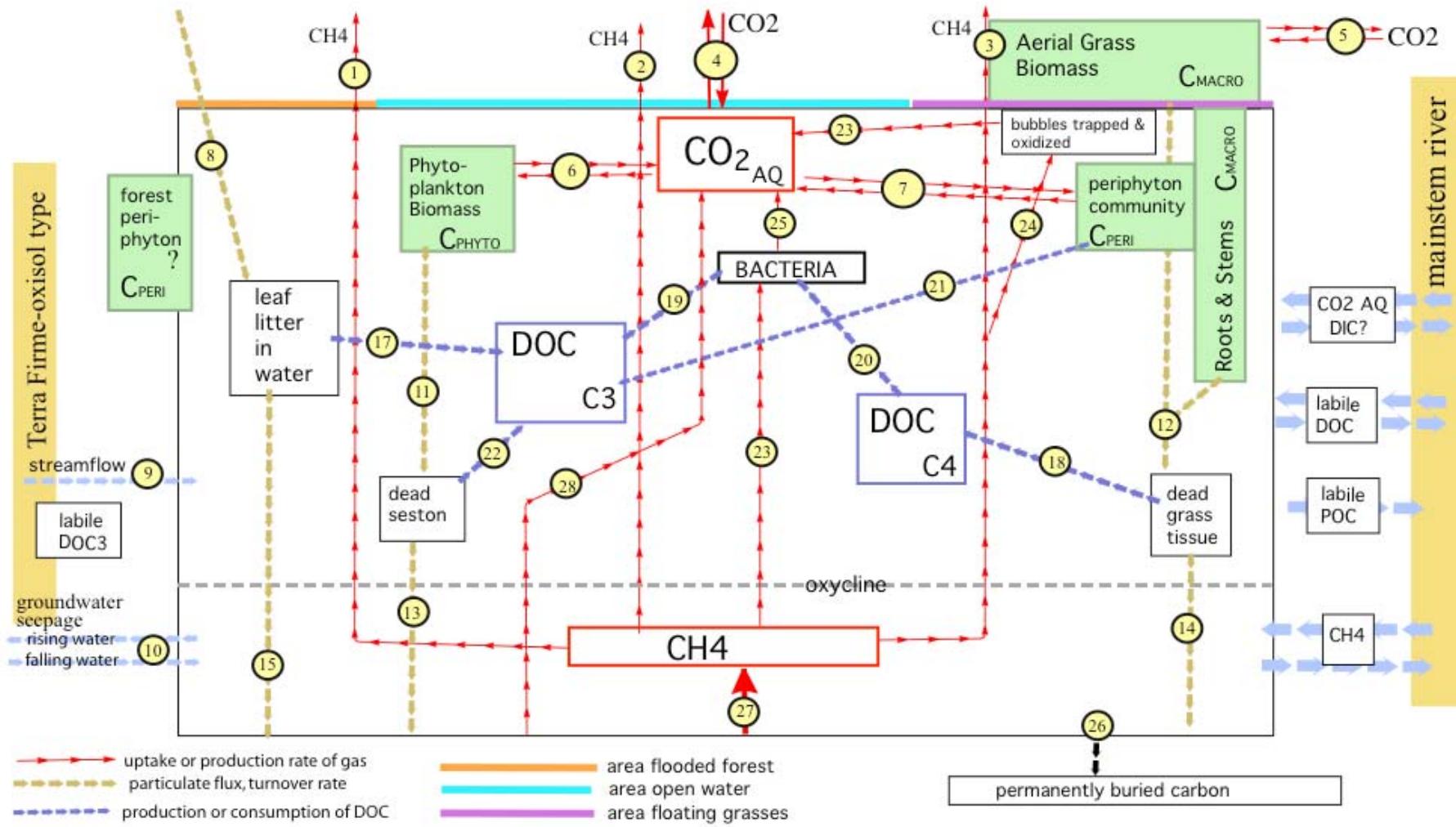


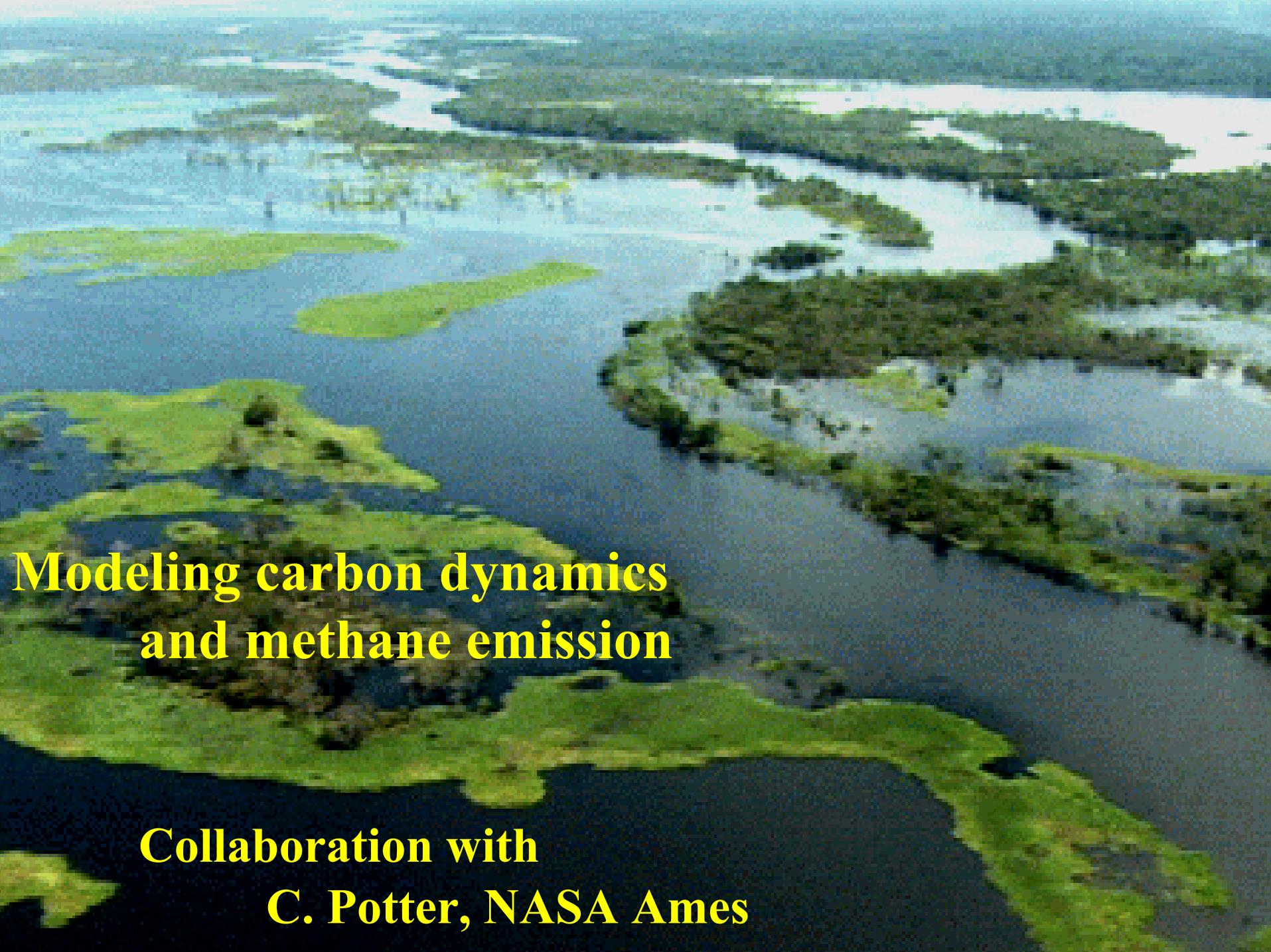
M. Costa 2000

An aerial photograph showing a vast, flooded landscape. A large river or lake dominates the scene, with numerous green, forested islands and peninsulas extending into the water. The surrounding terrain is also covered in dense green vegetation. In the top right corner, a portion of an airplane's wing and engine is visible, indicating the photo was taken from an aircraft.

Measurements of carbon dynamics in a floodplain lake

Carbon fluxes in Lago Calado





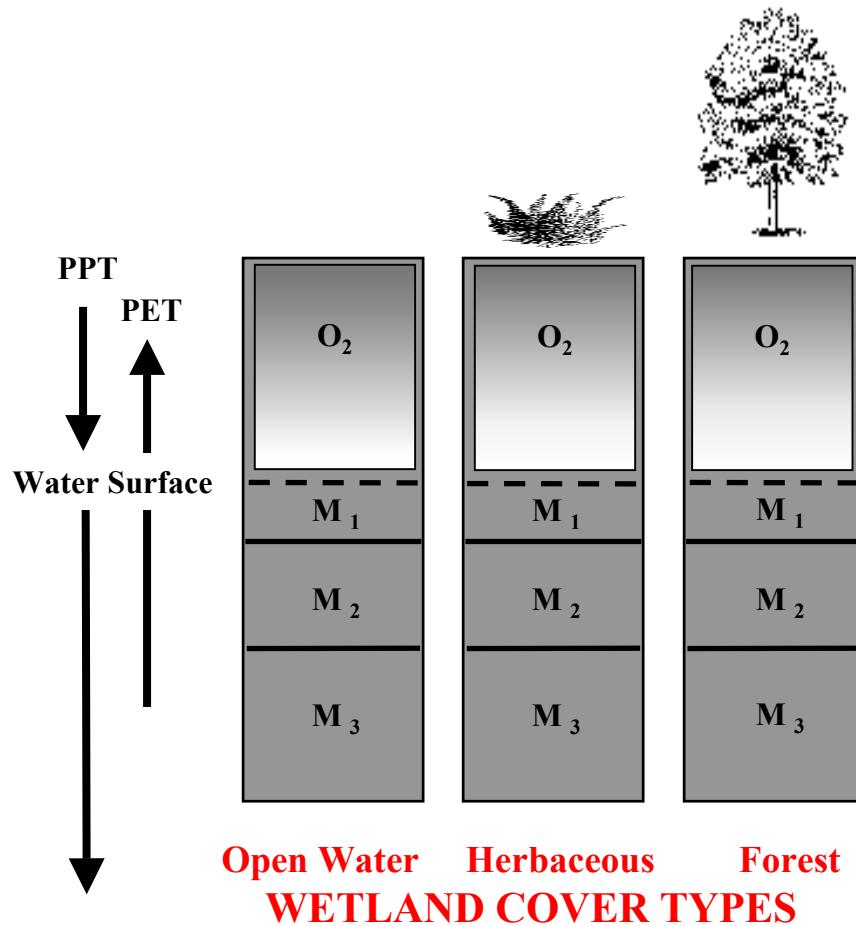
**Modeling carbon dynamics
and methane emission**

**Collaboration with
C. Potter, NASA Ames**

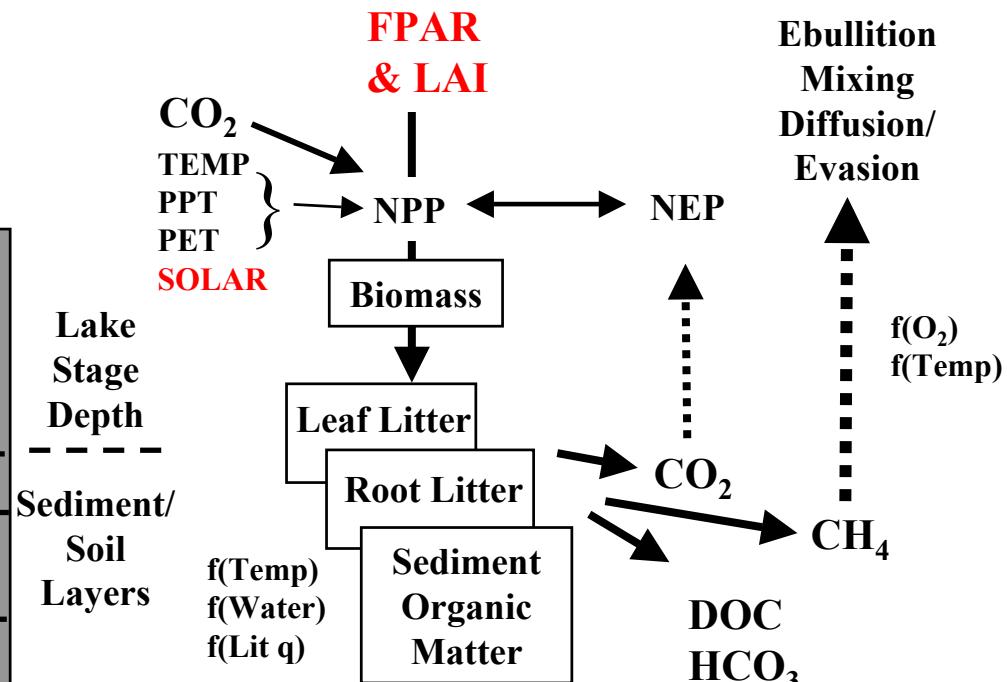
NASA-CASA Amazon Wetlands Model

Satellite Product Inputs

(a) Vegetation Cover and
Lake Water Level



(b) Plant Production and
Nutrient Mineralization



(c) Trace Gas Emissions

