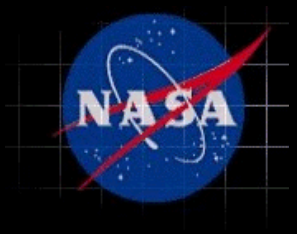
Tropical Deforestation and the Land-Water Interface

Linking land use and the integrity of freshwater ecosystems

Marcia Macedo

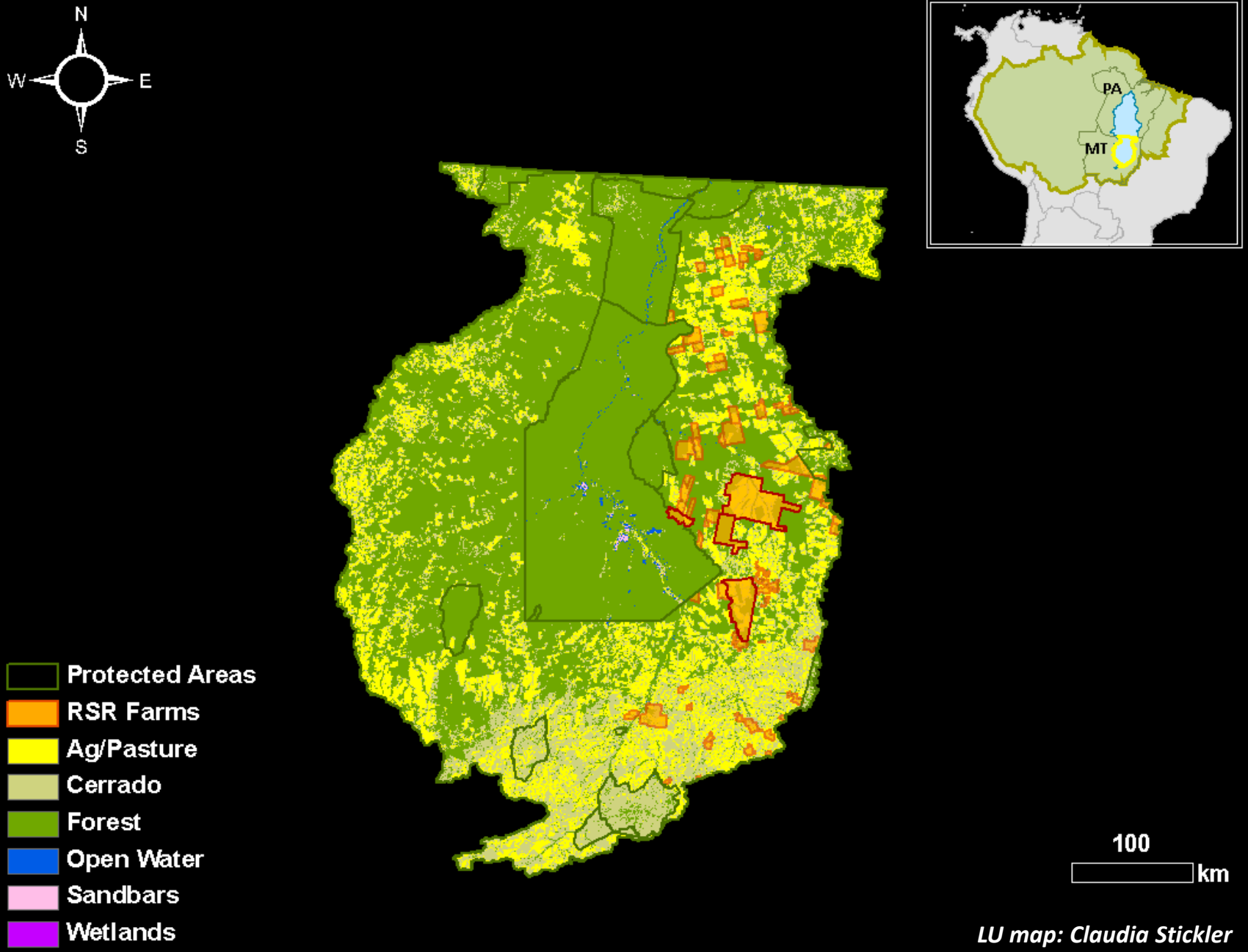
April 21, 2010



Research goal

To understand how land use change affects the connectivity of streams and explore the implications of these changes for the health of freshwater ecosystems

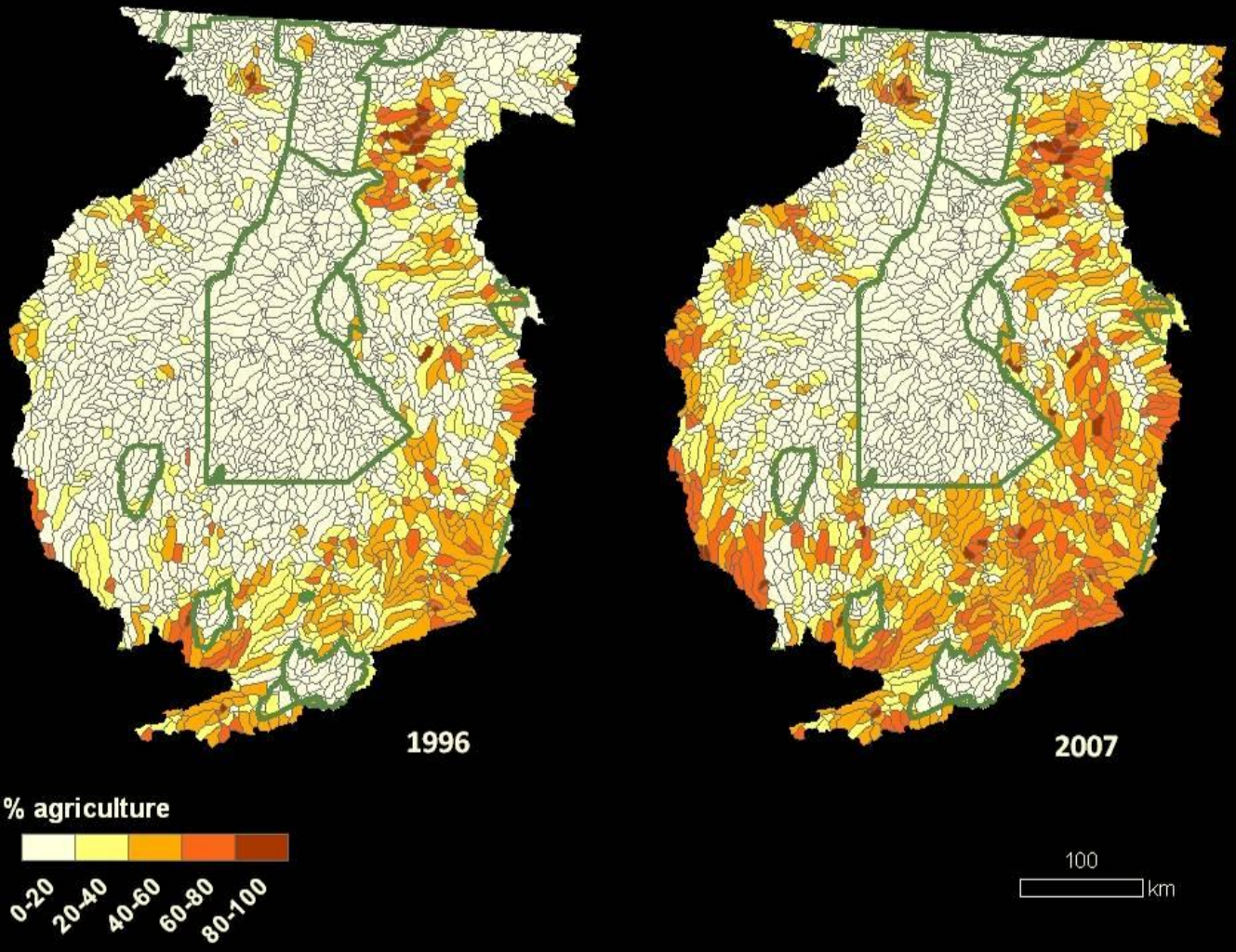




N
W
E
S
PA
MT
Protected Areas
RSR Farms
Ag/Pasture
Cerrado
Forest
Open Water
Sandbars
Wetlands
100
km
LU map: Claudia Stickler

Land use intensification

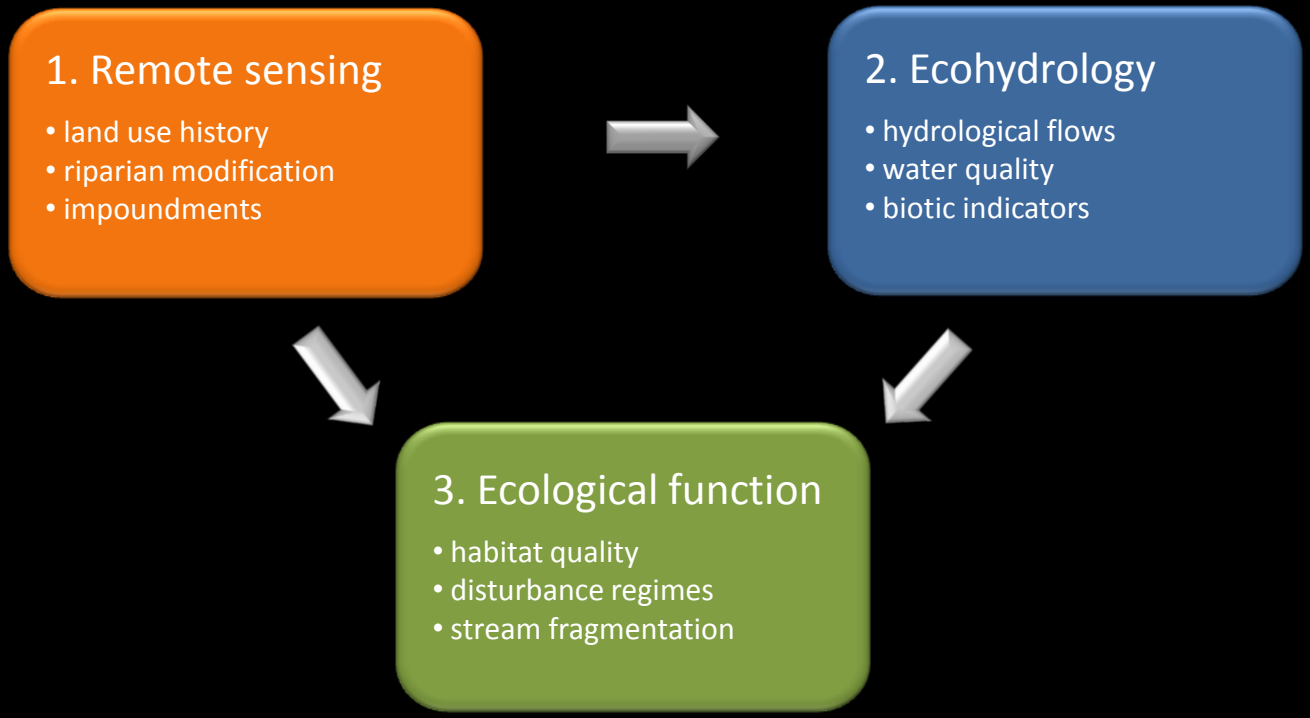
- deforestation
  - 6.3 M ha from 2000-2009 (INPE)
- drivers
  - industrial agriculture
  - cattle production
- land use practices
  - riparian forest removal
  - small dam installation

Catchment scale land use

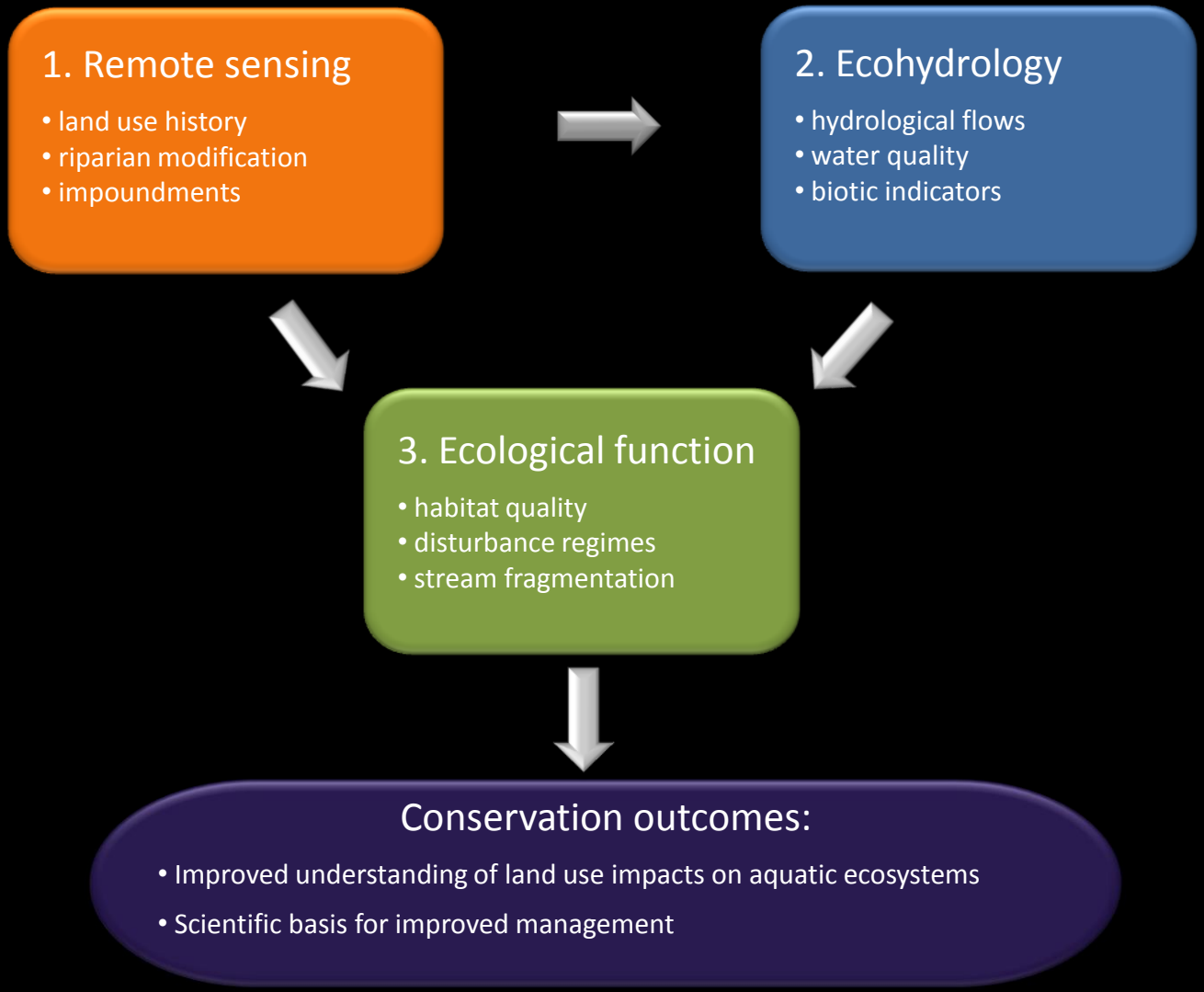


LU data: Claudia Stickler

Research framework

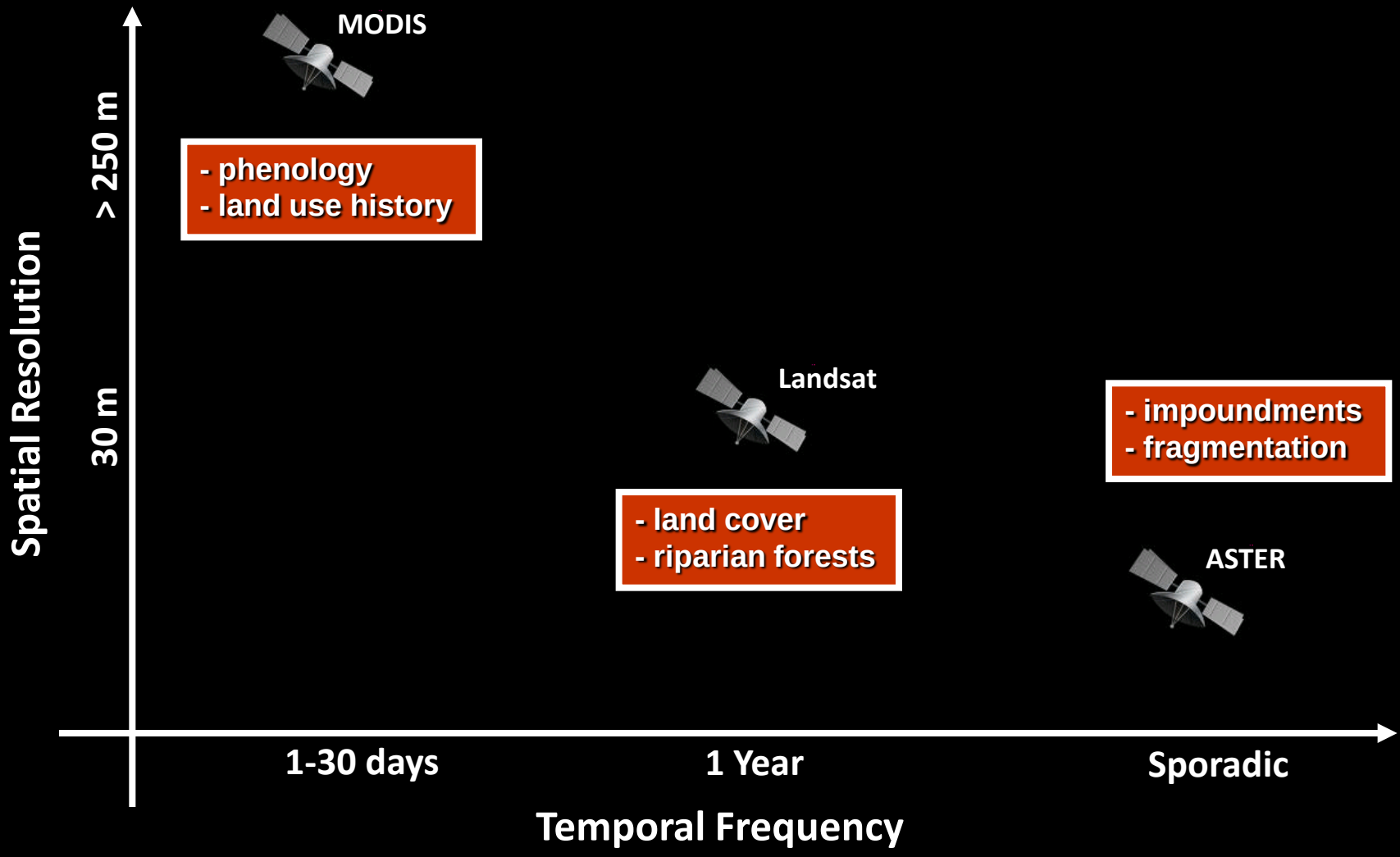


Research framework

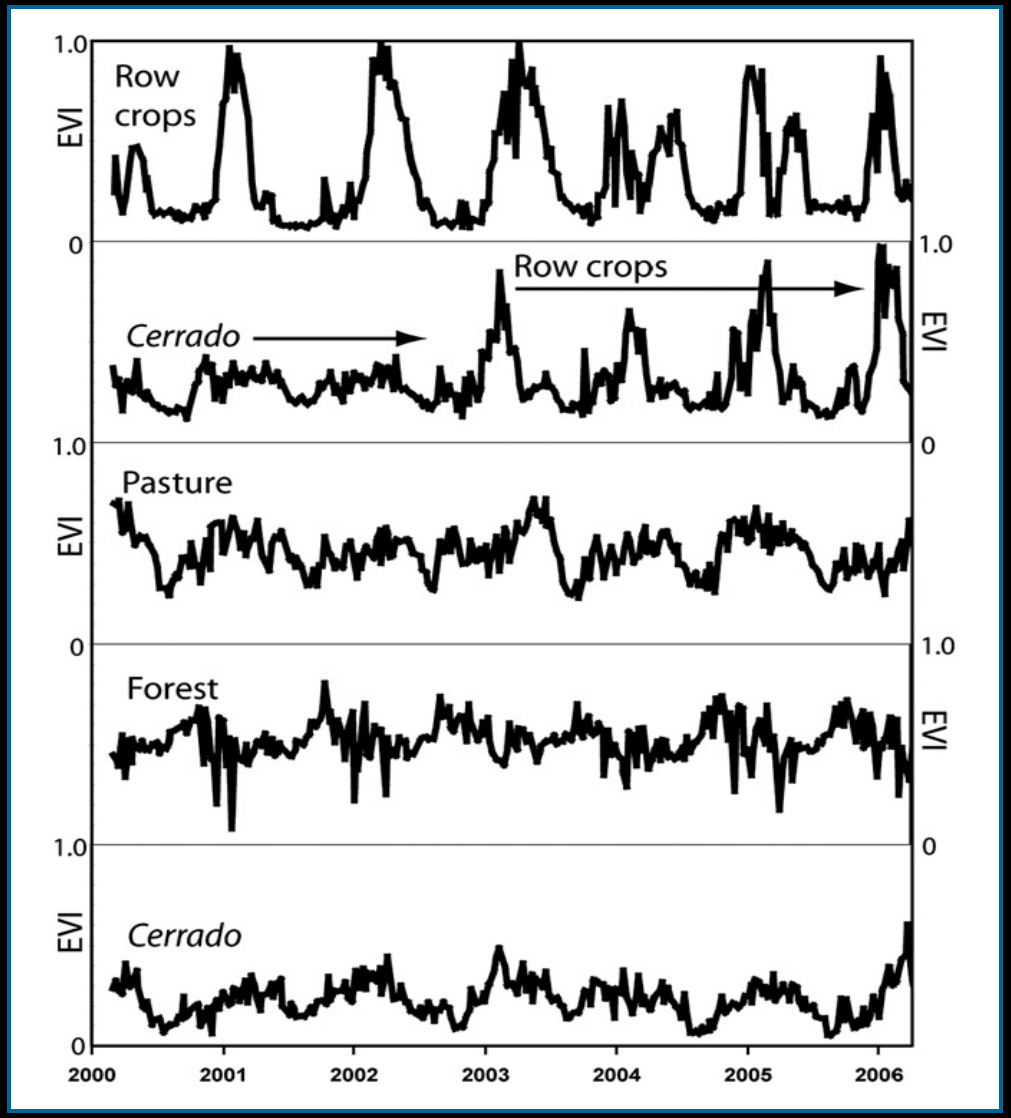



Remote sensing

Multiple scales

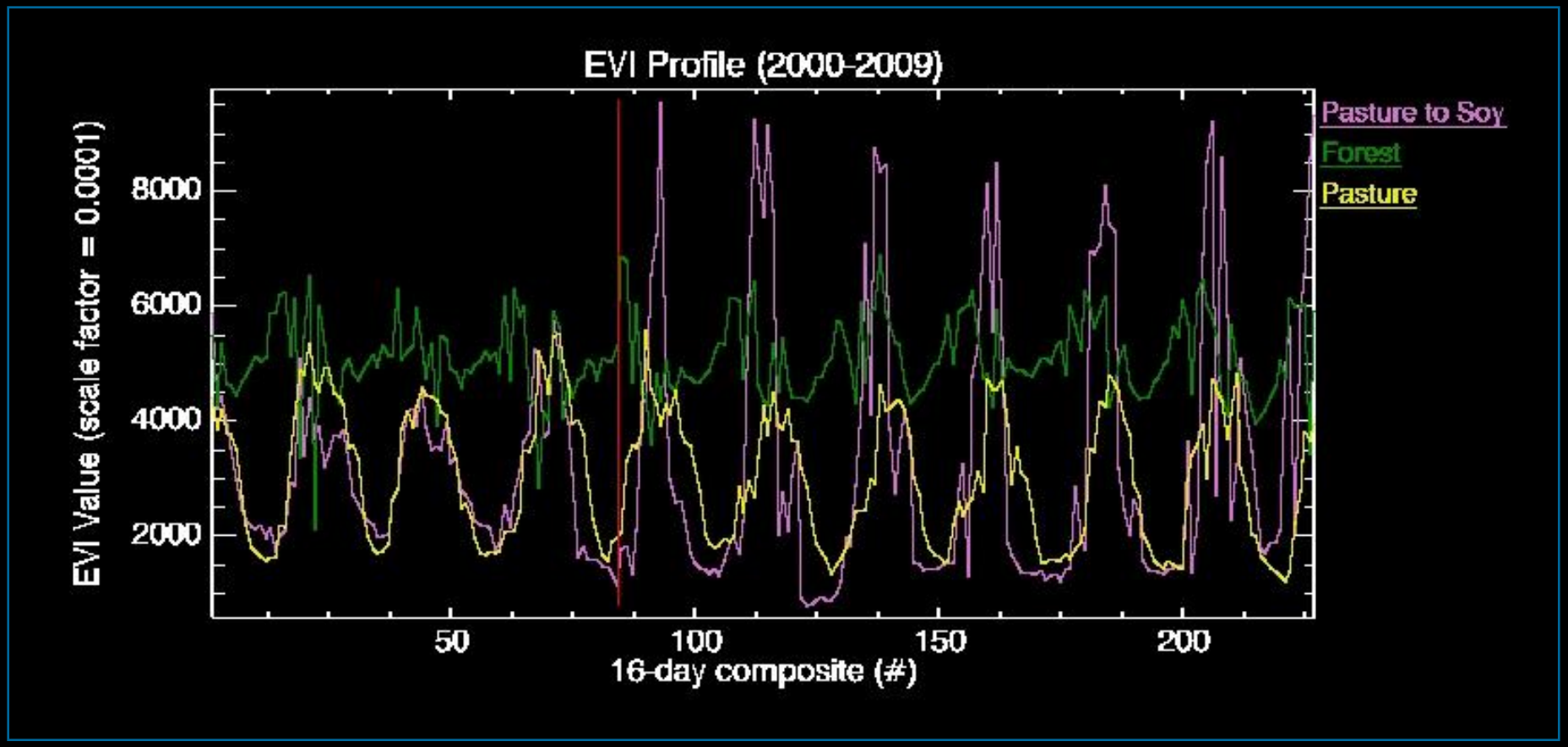


EVI time series

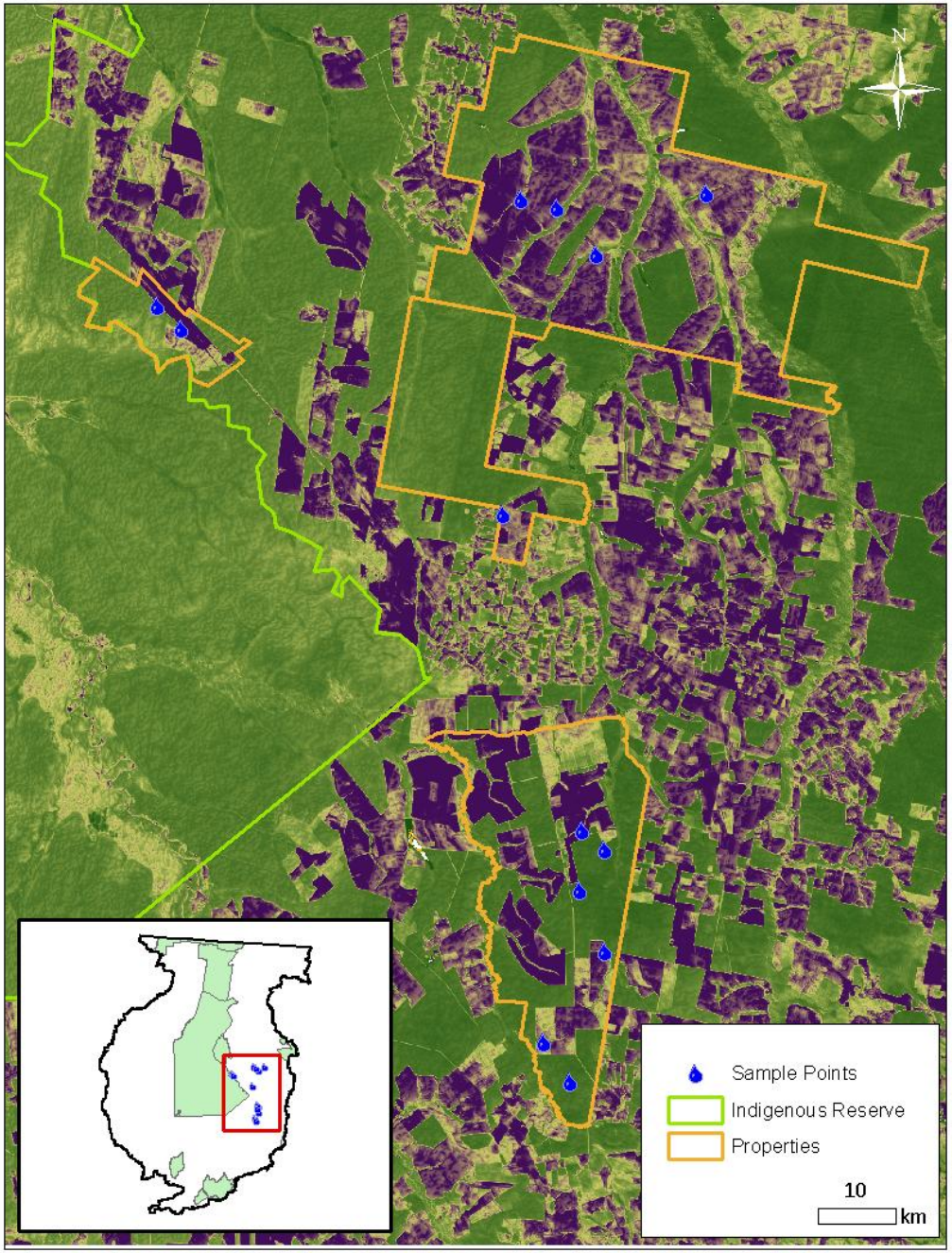


Galford et al., RSE 2008

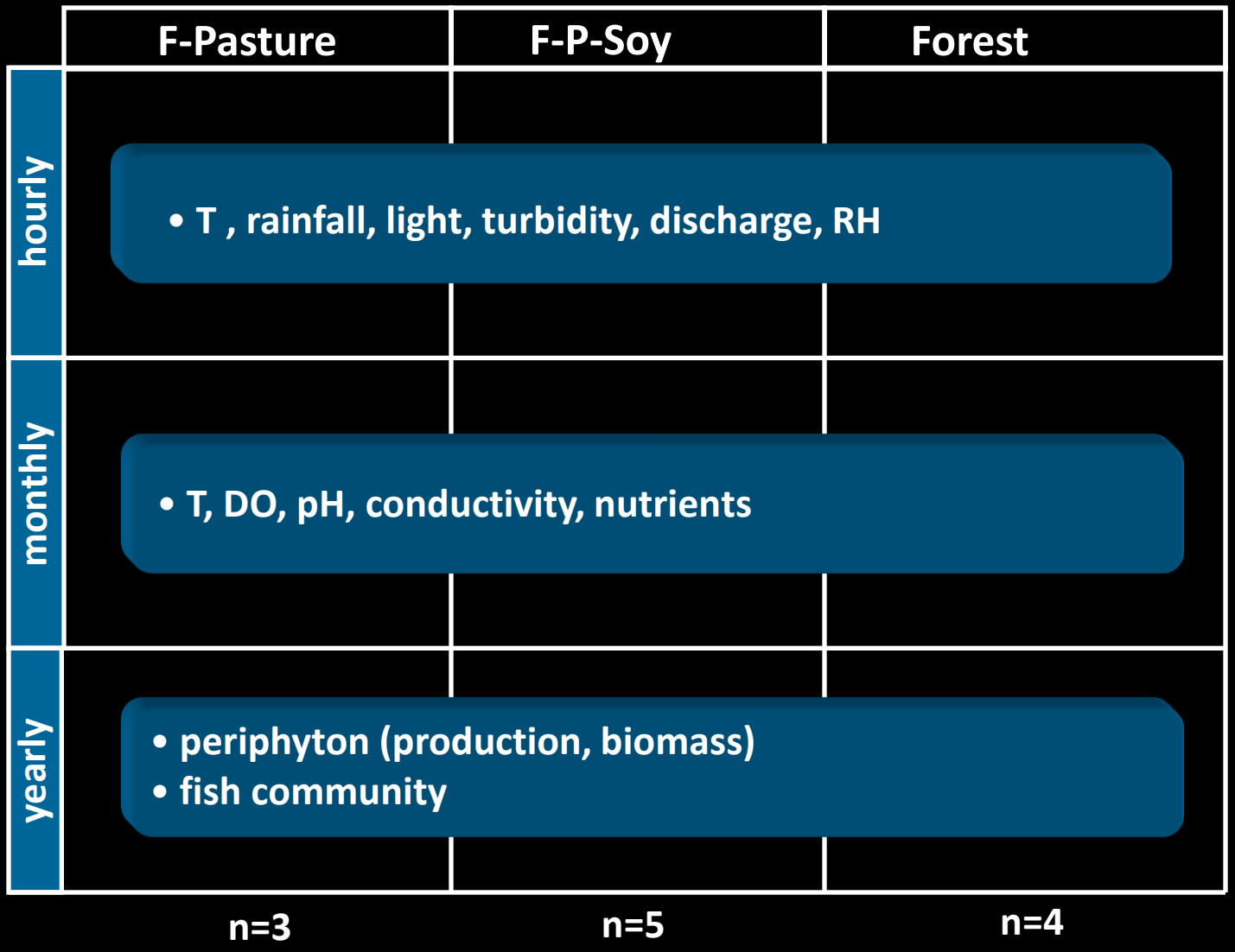
EVI time series



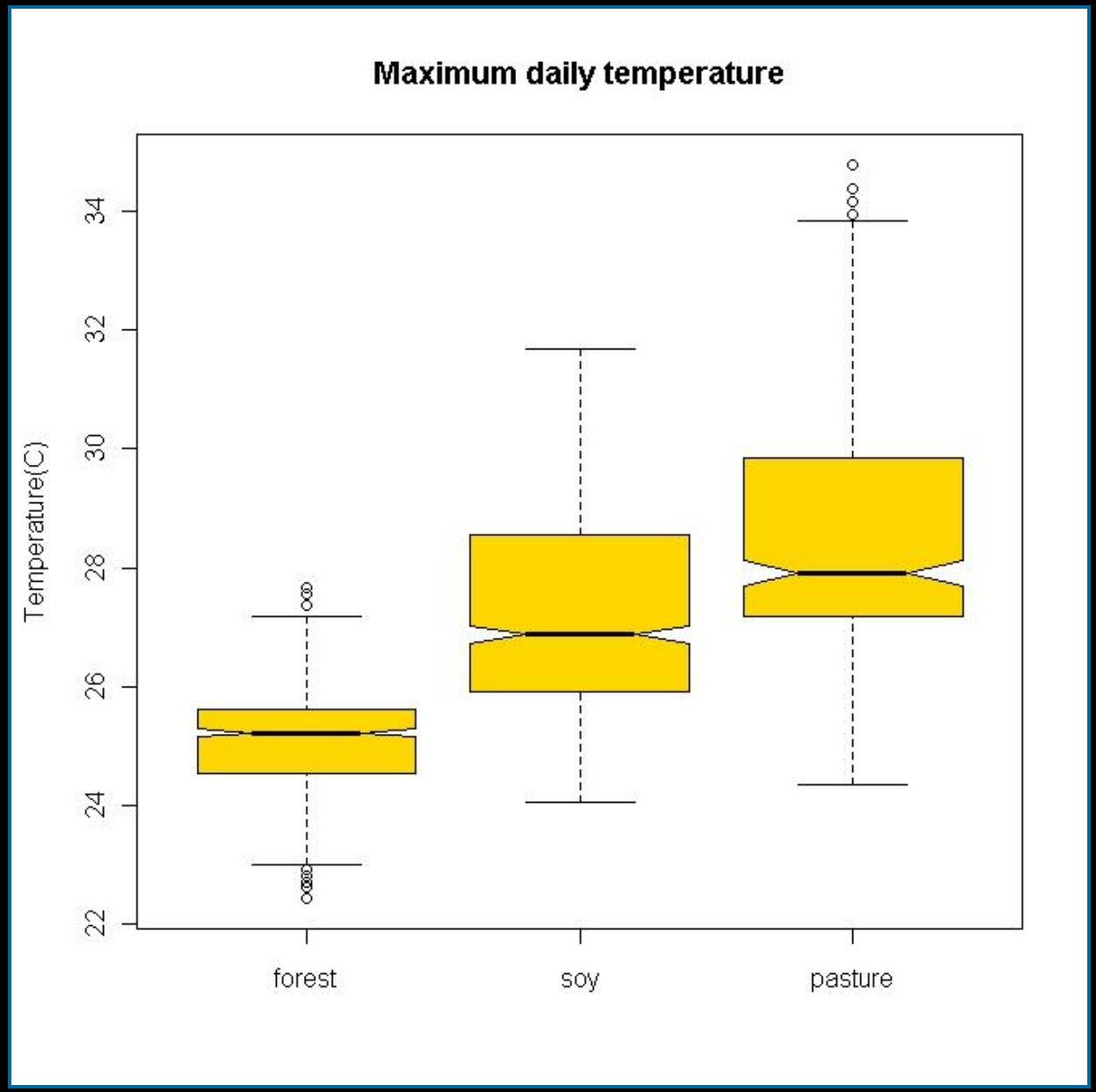

Ecohydrology

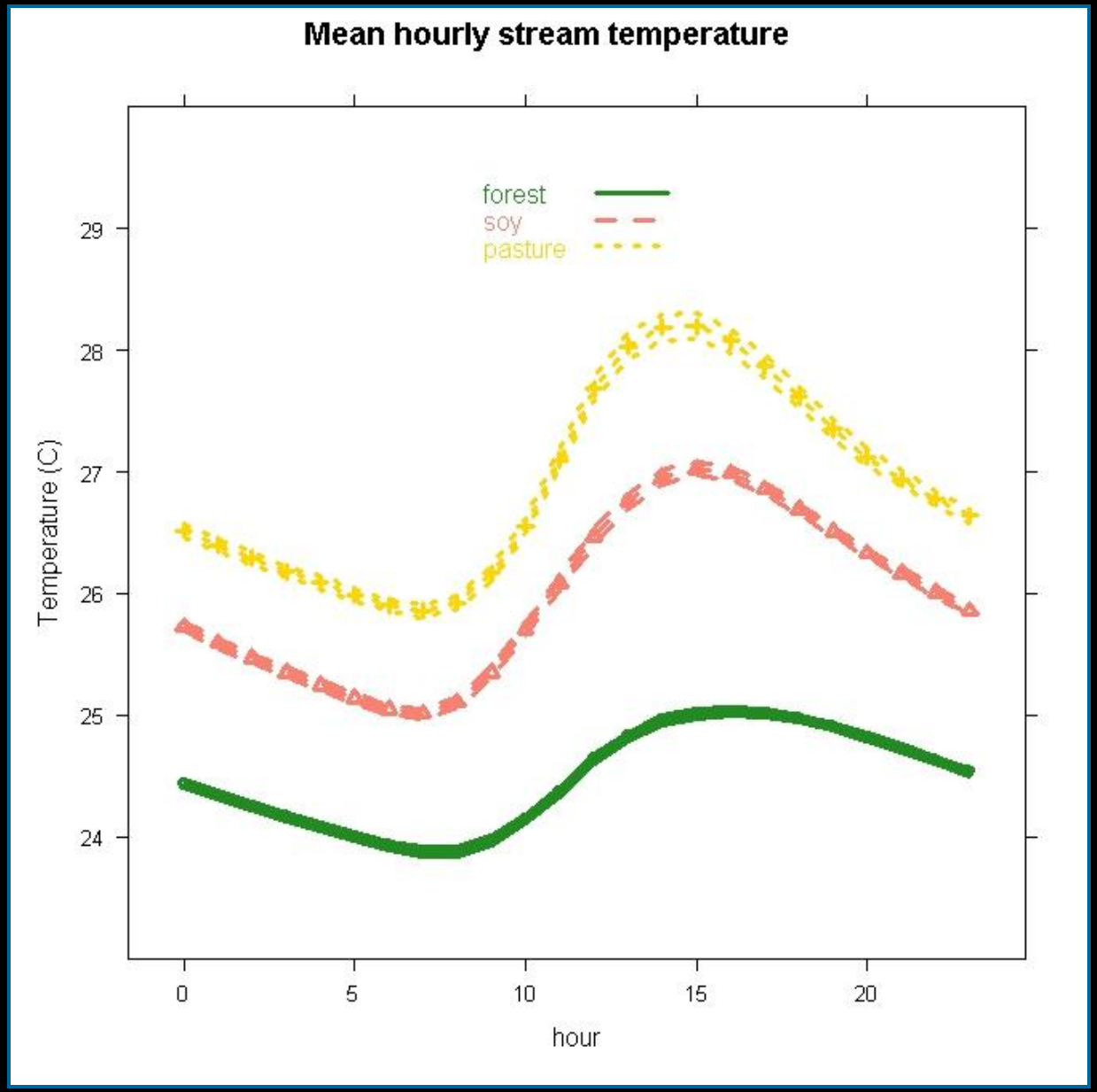

N
Sample Points
Indigenous Reserve
Properties
10
km

Water quality indicators




•primary production (chl-a)
•community composition
•nutrient limitation
•primary production (chl-a)
•light (lux)
•temperature (C)
•clarity (luxA/luxB)
•discharge (m³/s)


Maximum daily temperature
Temperature(C)
22
24
26
28
30
32
34
forest
soy
pasture


Mean hourly stream temperature
forest
soy
pasture
Temperature (C)
29
28
27
26
25
24
0
5
10
15
20
hour

Modeling stream temperature

Nepstad et al., 2007

Covariates

- light
- riparian cover
- discharge
- rainfall
- watershed area
- LU history
- impoundments
- air temperature


Ecological function

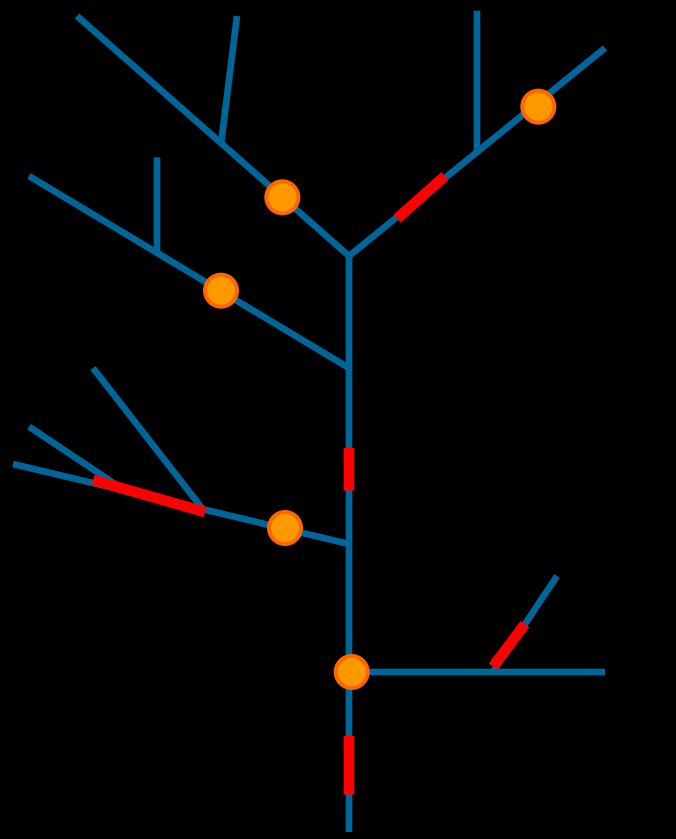
Hydrological connectivity

- fragmentation alters physical variables that determine basic ecological function
- impoundments and riparian forest removal change:
  - flow/sediment transport
  - light/temperature
  - nutrient regimes

Photo: Vania Neu, 2007

Extrapolating to landscape scale

- develop fragmentation indices
  - impoundments
  - riparian disturbance
  - landscape metrics
- infer impacts on biota
- prioritize management



Xingu in the news…

Belo Monte Dam May Operate at 40% of Capacity, Estado Says

-- O Estado de São Paulo, April 11 2010

Amazon Dam Project Pits Economic Benefit Against Protection of Indigenous Lands

-- The New York Times, April 18 2010

-- International Rivers

Avatar director James Cameron joins Amazon tribe's fight to halt giant dam

-- The Guardian, April 18 2010

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- Universidade Estadual do Mato Grosso, Dept. of Icthyology
- University of Maryland, Dept. of Geography
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Thank you
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