# Lost in the Bloody Amazon? (LBA)

Ecological Accomplishments of the Large Scale Biosphere-Atmosphere Experiment in Amazonia (LBA)

Eric A. Davidson
LBA-ECO Project Scientist

The Woods Hole Research Center

# Large Scale Biosphere-Atmosphere Experiment in Amazônia (LBA)

**LBA is an international, multi-disciplinary cooperative research program led by Brazil. NASA leads the U.S. participation in LBA, working in close partnership with the Brazilian leaders and scientists.**

**LBA research is focused on producing new knowledge about the:**

**•climatological, ecological, biogeochemical, and hydrological functions of Amazônia**

**•impact of land use change on these functions**

**•interactions between Amazônia and the Earth system**

**LBA is the largest cooperative international scientific project ever to study the interaction between tropical forests and the atmosphere.**


**The Amazon region of South America as viewed by MODIS on NASA's Terra satellite.**

# Mosaicked L-band synthetic aperture radar (SAR) imagery acquired by the Japanese Earth Resources Satellite-1

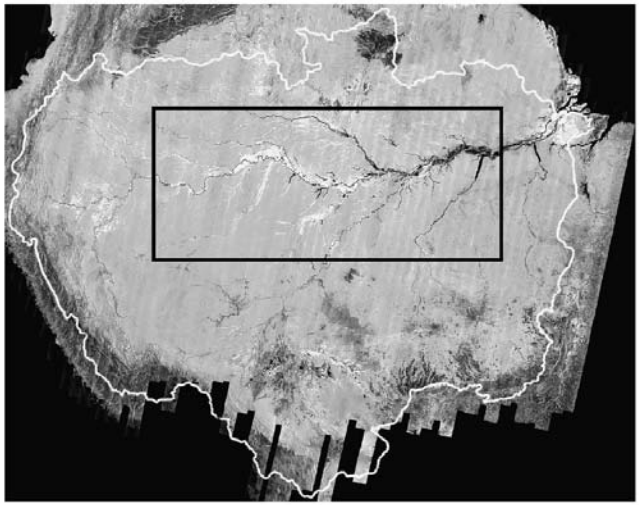


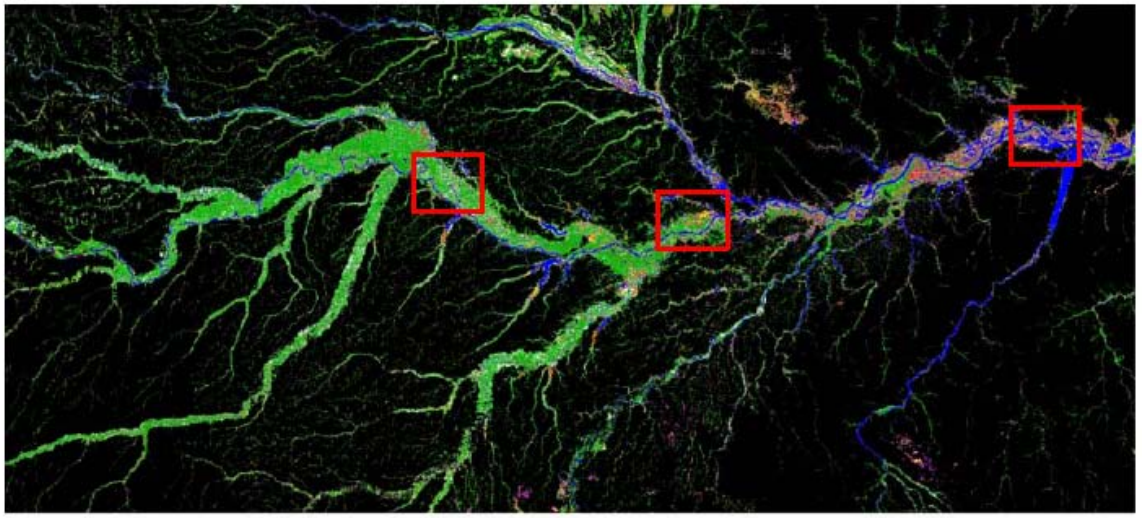
Fig. 1. Global Rain Forest Mapping Project radar mosaic showing central Amazon study quadrat (black) and boundary of the Amazon basin (white). The quadrat extends from 72°W, 0°N to 54°W, 8°S.

**Amazon Basin below 500m: wetlands 17%, uplands 83%**
**Hess et al. 2003**

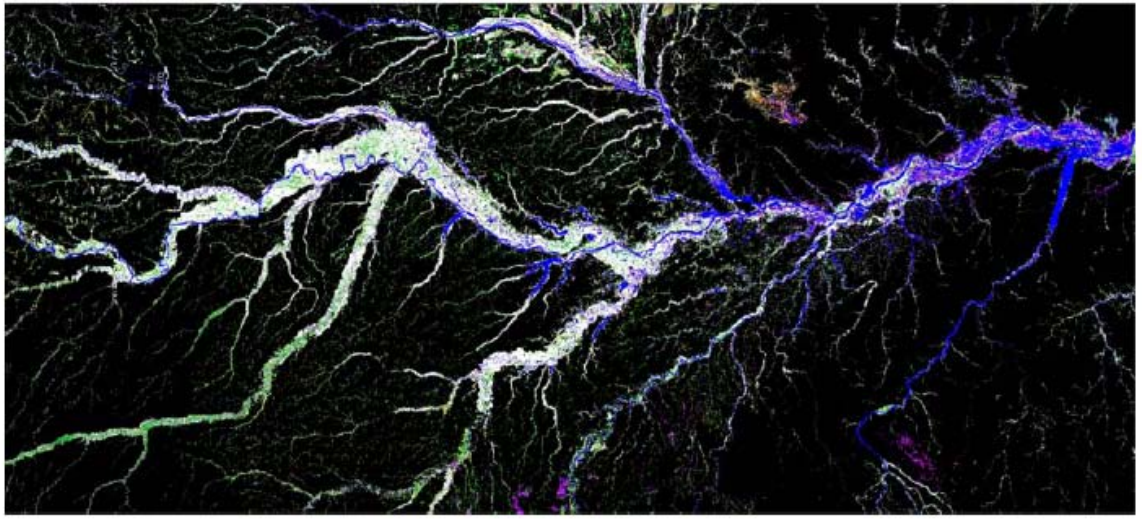
**Methane Emissions:**
**This 1.8 million km² quadrant: 7 Tg C $y^{-1}$**
**Extrapolated to basin below 500m: 22 Tg C $y^{-1}$**
**Melack et al. 2004**

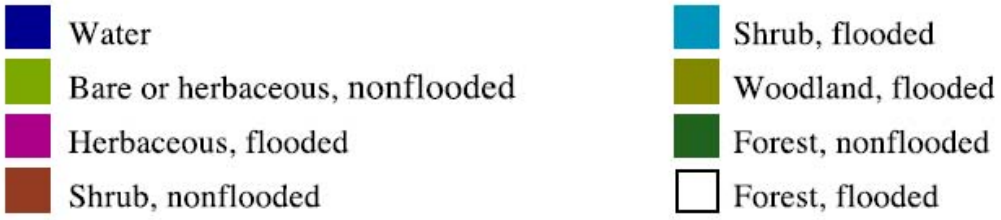
L.L. Hess et al. / Remote Sensing of Environment 87 (2003) 404–428

*a* **Low water**



*b* **High water**



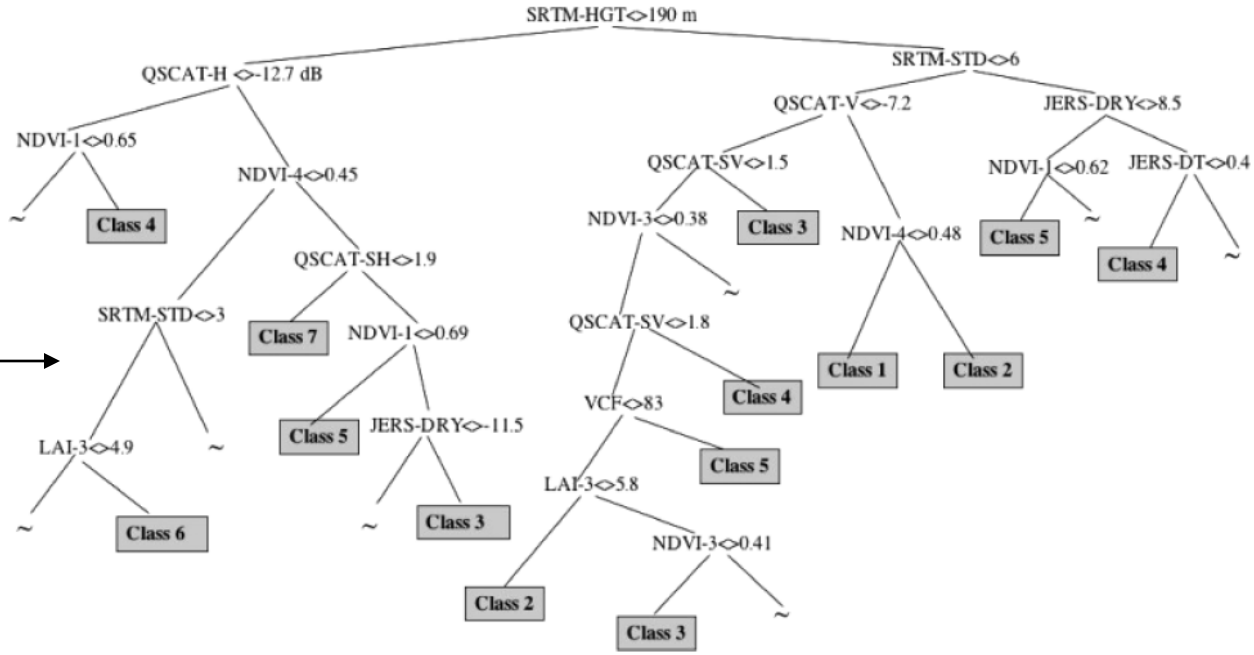


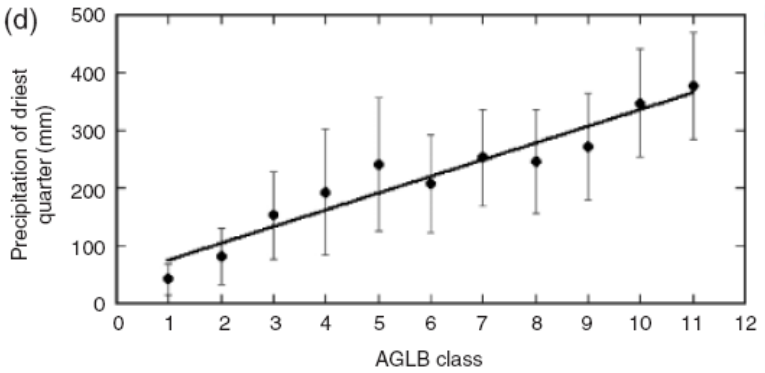
**Saatchi et al. 2007.** Global Change Biology, 13, 816–837.

**>500 plot measurements of biomass**

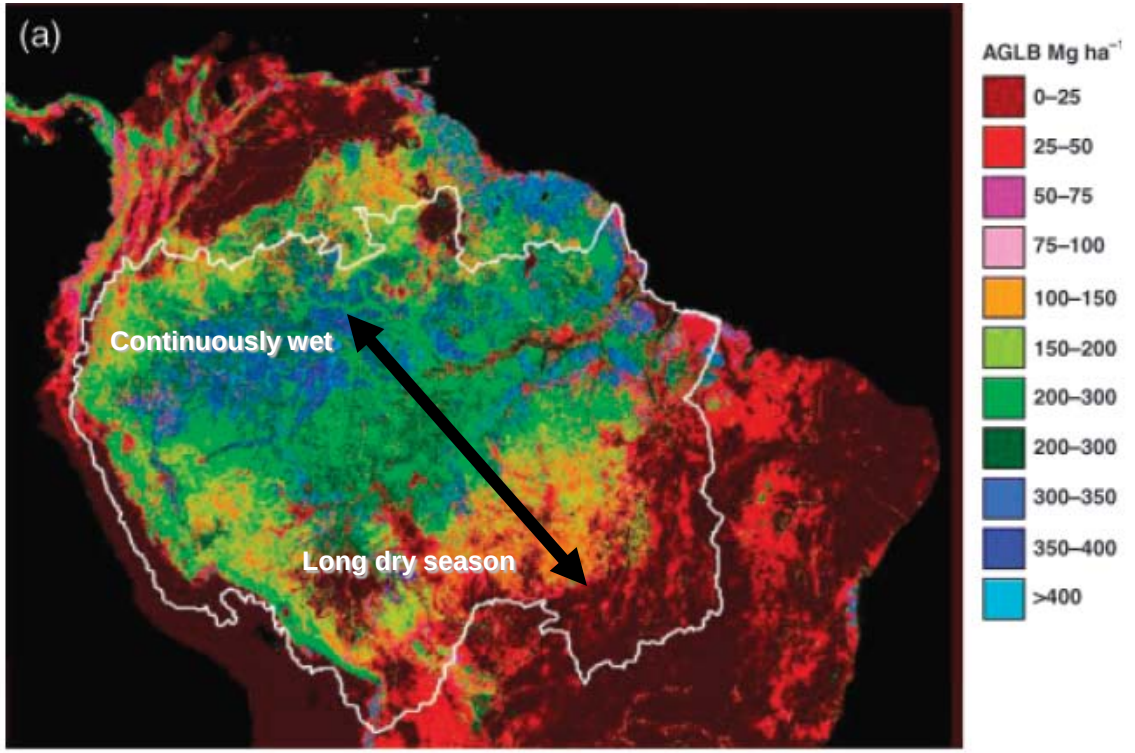
**MODIS, JERS-1,QuikSCAT, SRTM used in decision tree** →

**Total C in Amazon Basin forest biomass (including the dead and belowground) = 86 PgC ± 20% uncertainty**




Dry season precipitation is the best predictor of biomass, but unaccounted for variation may be due to soils, geomorphology, radiation hydrologic features, and management history.



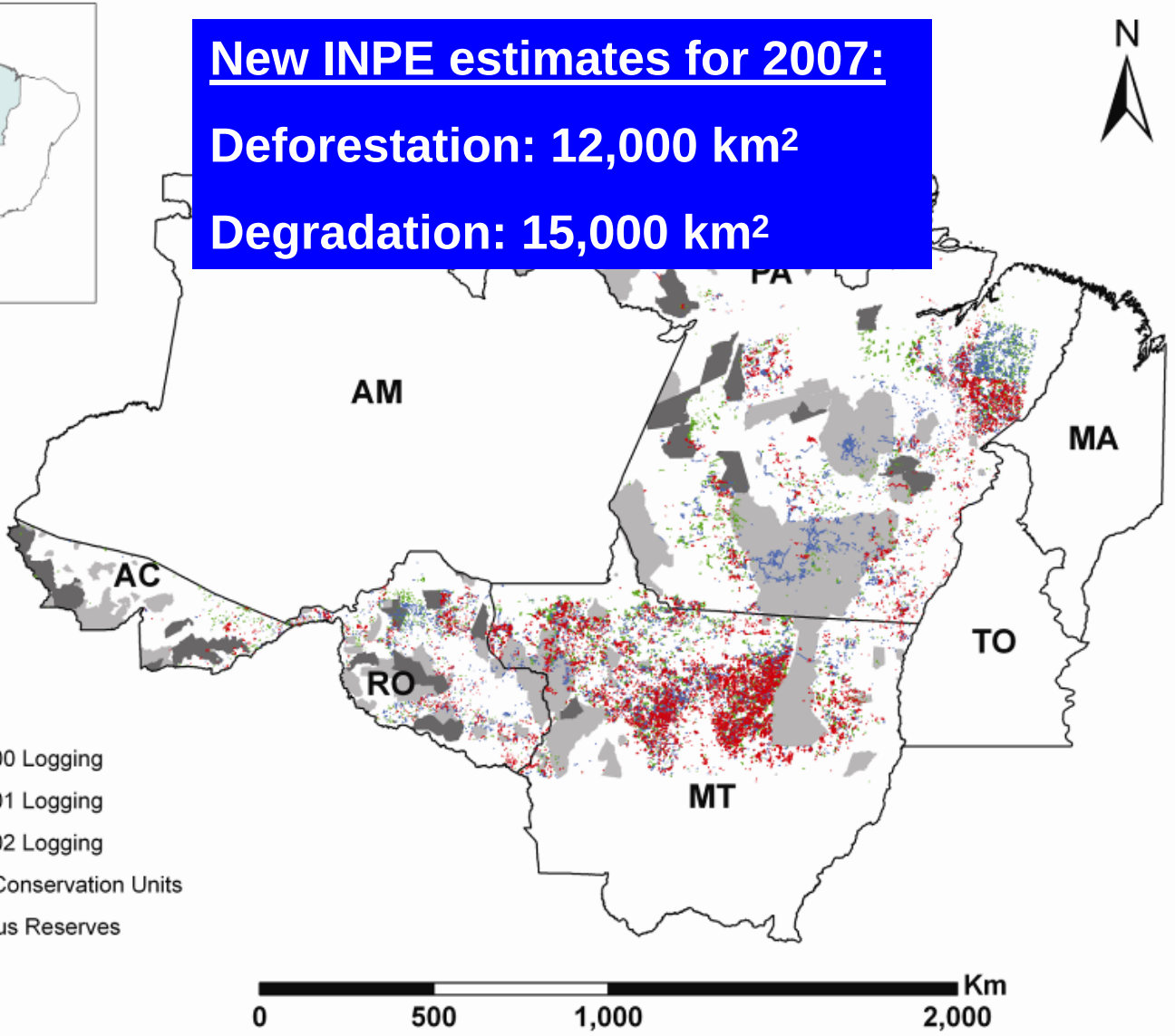
# 12,000-20,000 $km^2$ $y^{-1}$ logging
# 16,000-23,000 $km^2$ y-1 deforestation


**New INPE estimates for 2007:**

**Deforestation: 12,000 $km^2$**

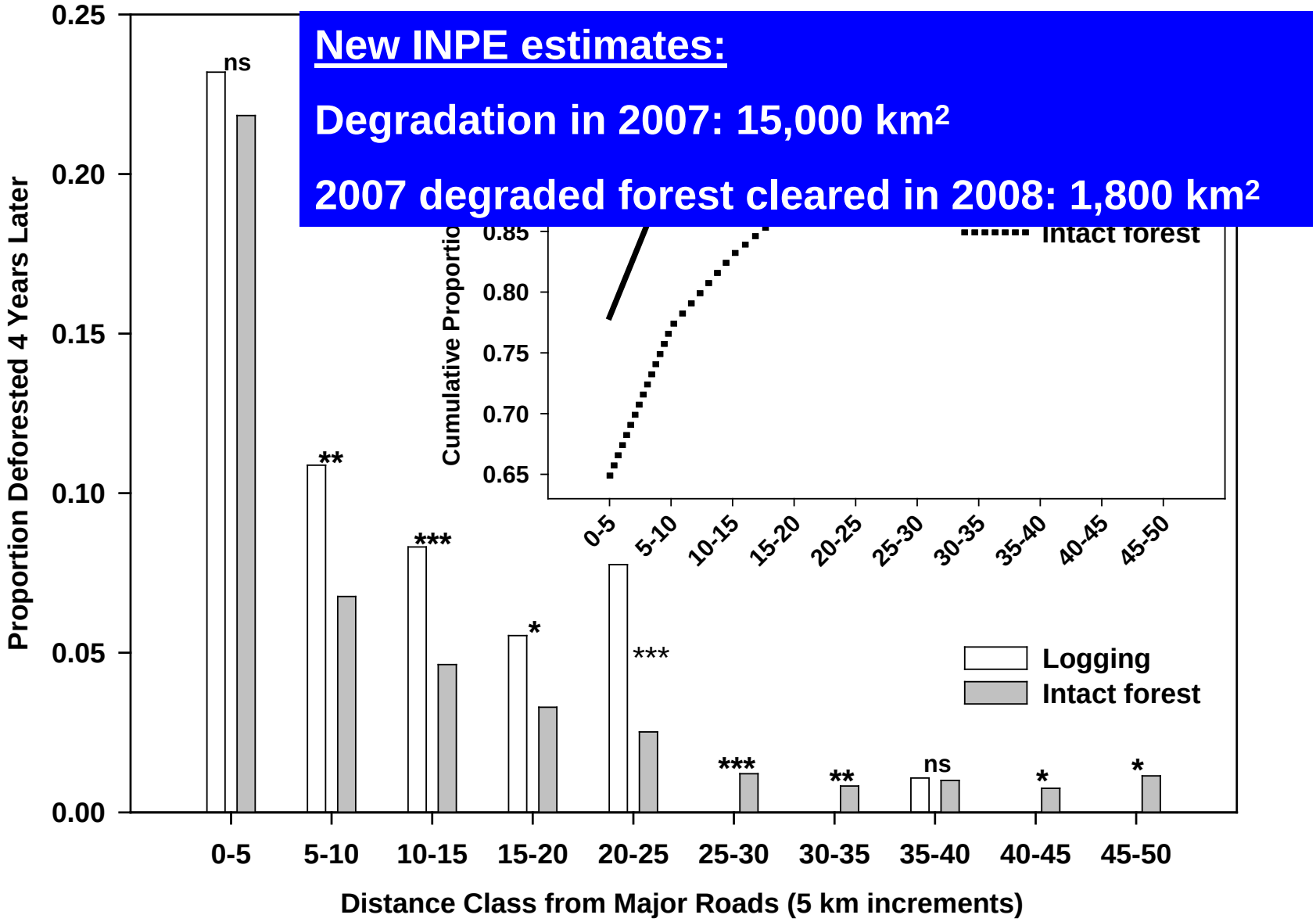
**Degradation: 15,000 $km^2$**

Landsat ETM+ data analyzed with the Carnegie Landsat Analysis System (CLAS)



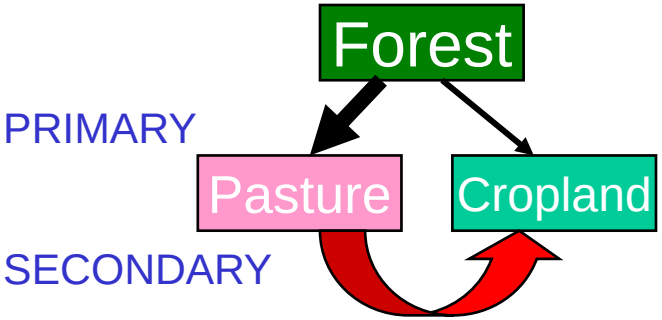

Asner et al. *Science* 2005

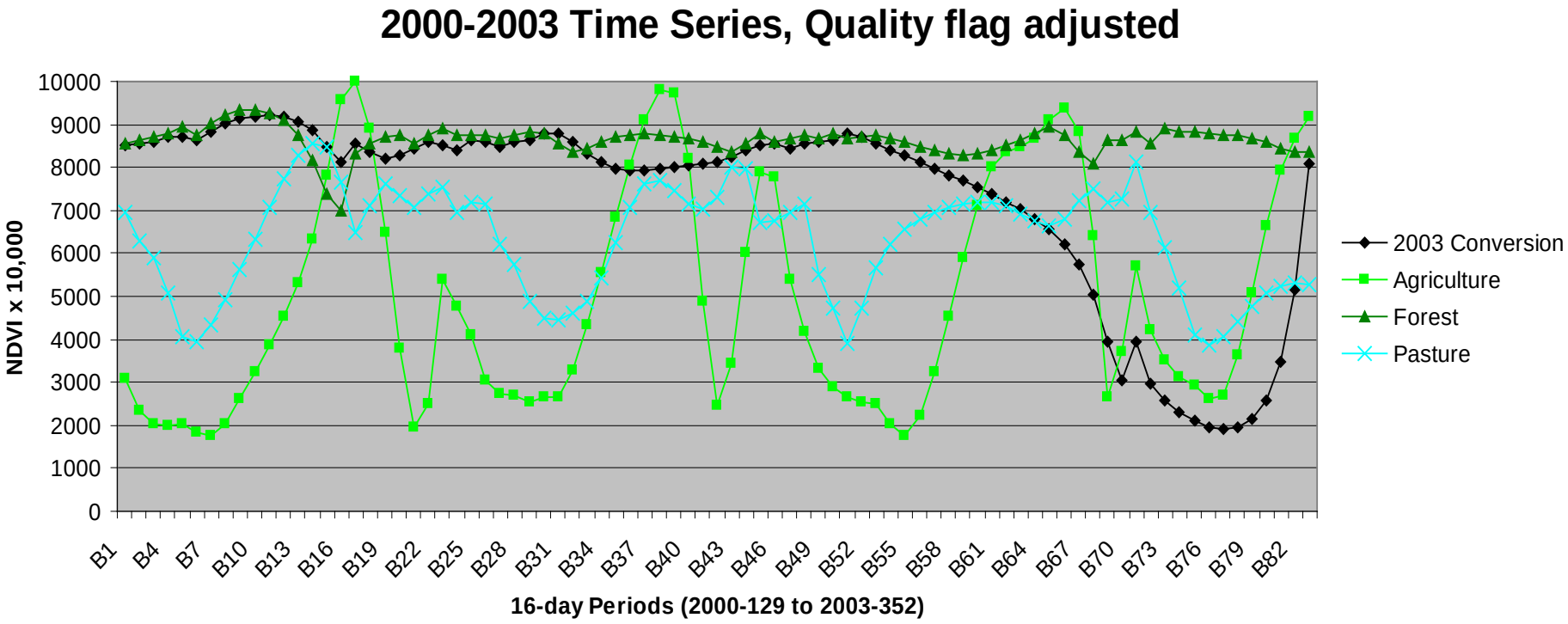
# 32% of logged forest is cleared after 4 years




Asner et al. *PNAS* 2006

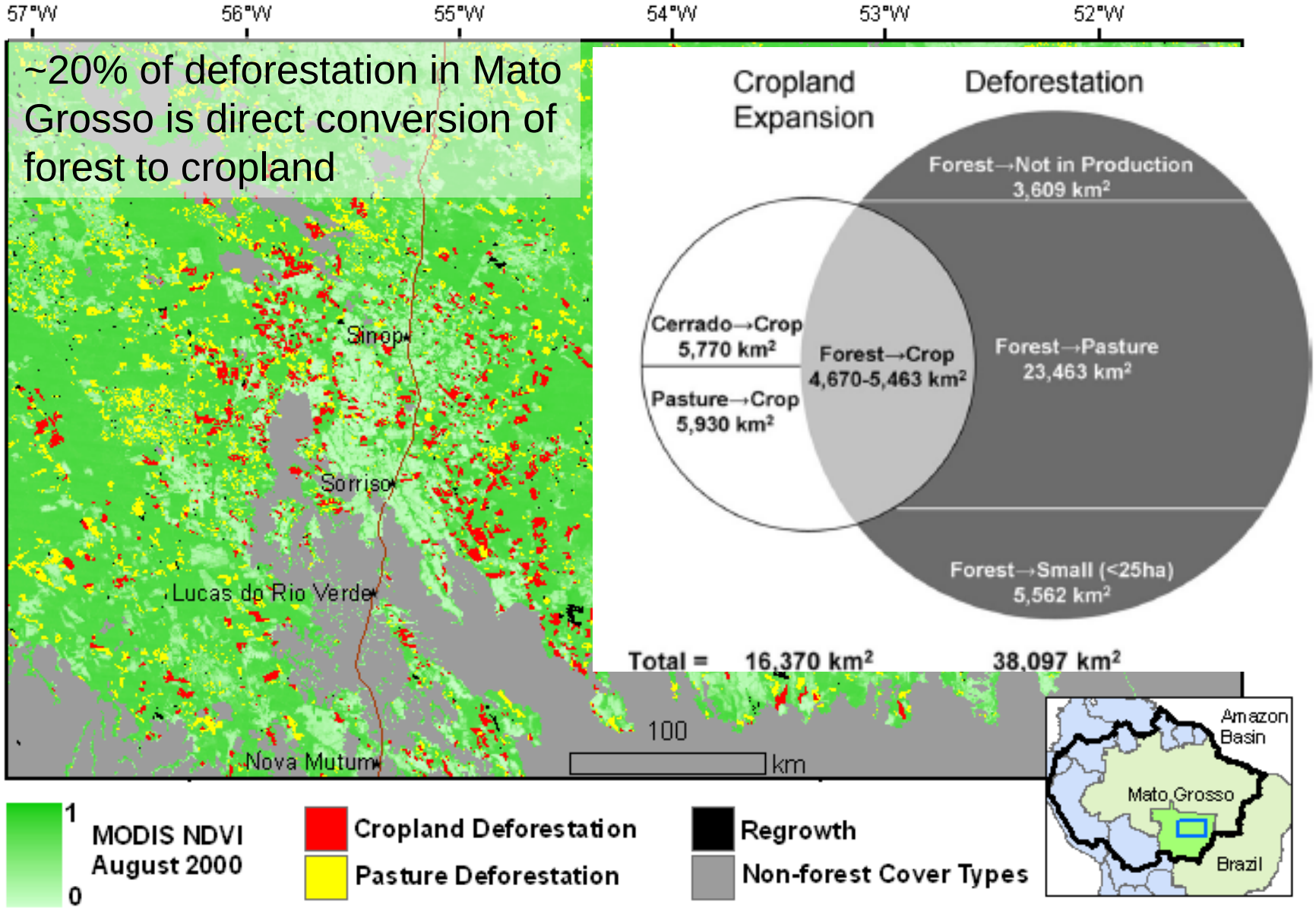
# Distinguishing Fate of Deforestation with Phenology Derived from MODIS



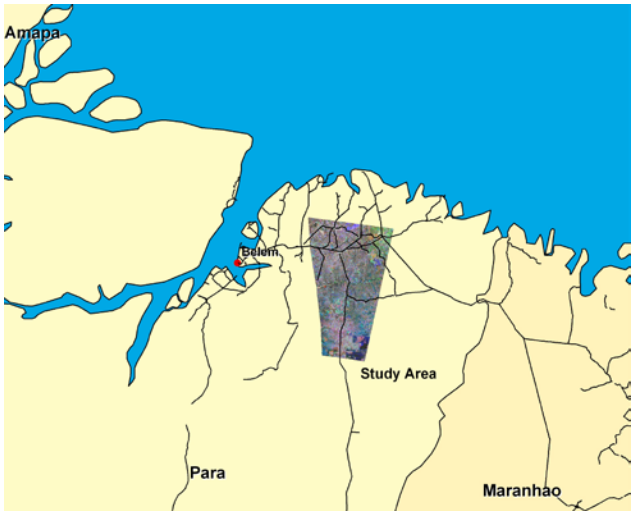



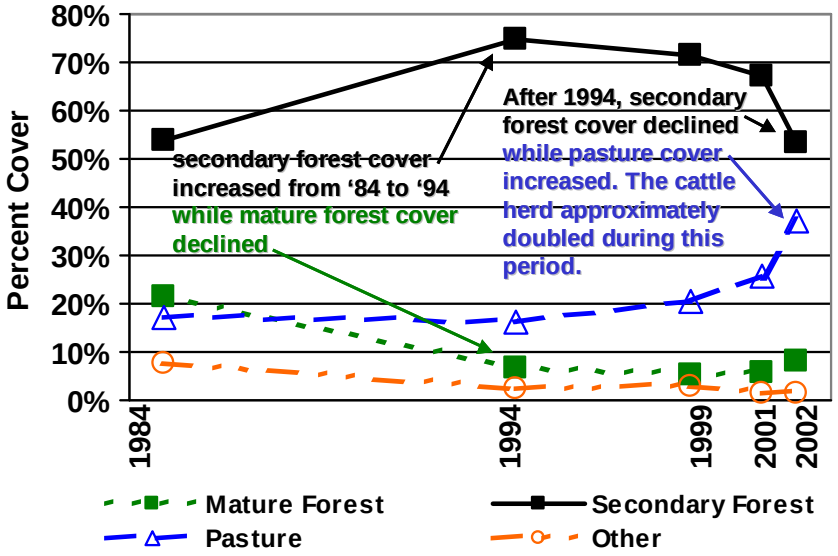

Courtesy: R. DeFries

# Fate of deforestation from 2001-04 from MODIS phenology



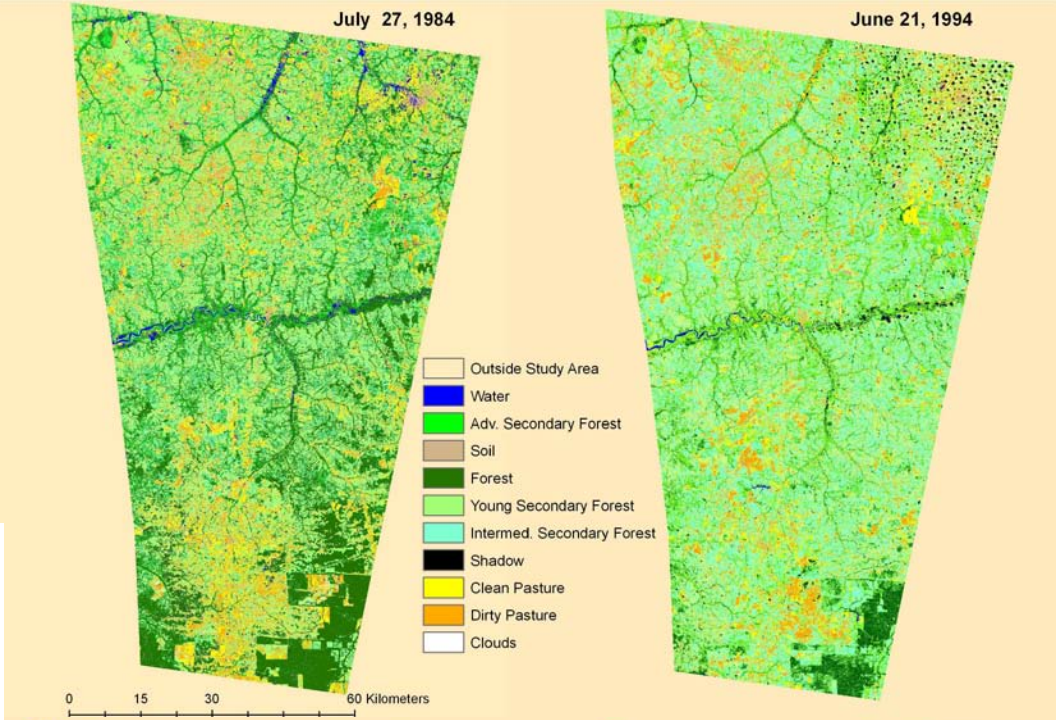

Morton et al., *PNAS,* 2006

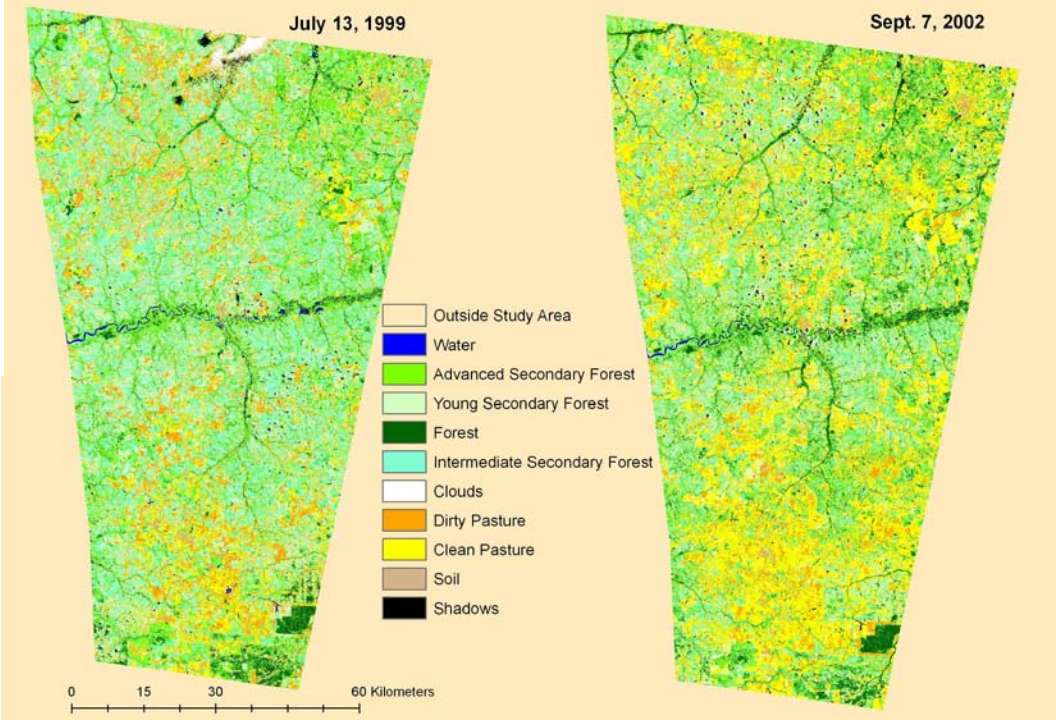



**An area not part of the current deforestation frontier is still losing forest cover & about 1.3 MgC ha $^{-1}$ yr$^{-1}$**

**Almeida, Stone, Vieira, and Davidson, unpublished**



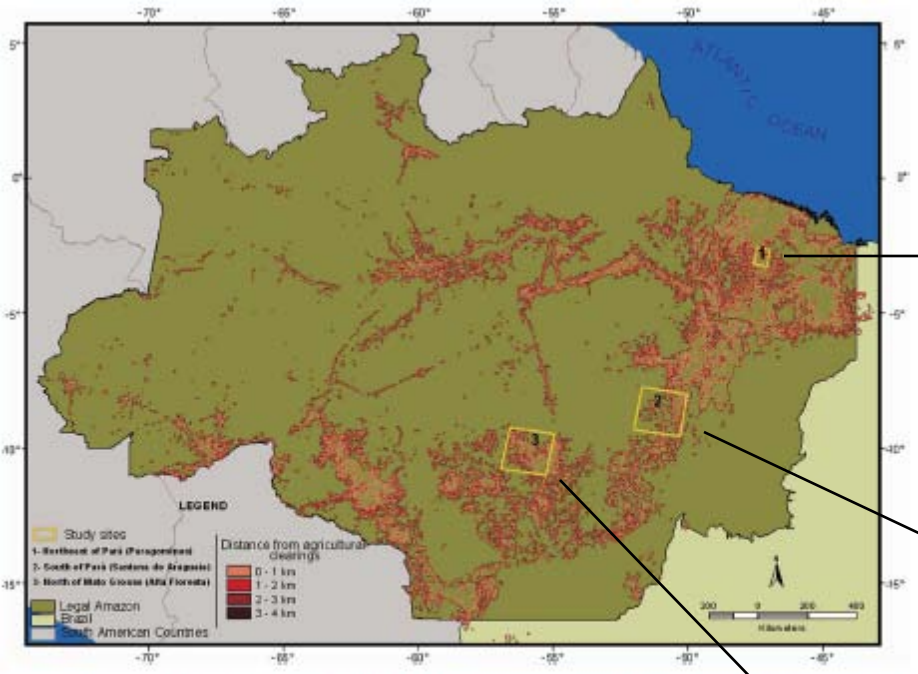



Figure 1. Location of the three study sites (1: Paragominas, 2: Santana do Araguaia and 3: Alta Floresta) and map of 4-km buffer distance from agricultural clearings used to delimitate the forest area used to calculate the areal estimate of understory fire.

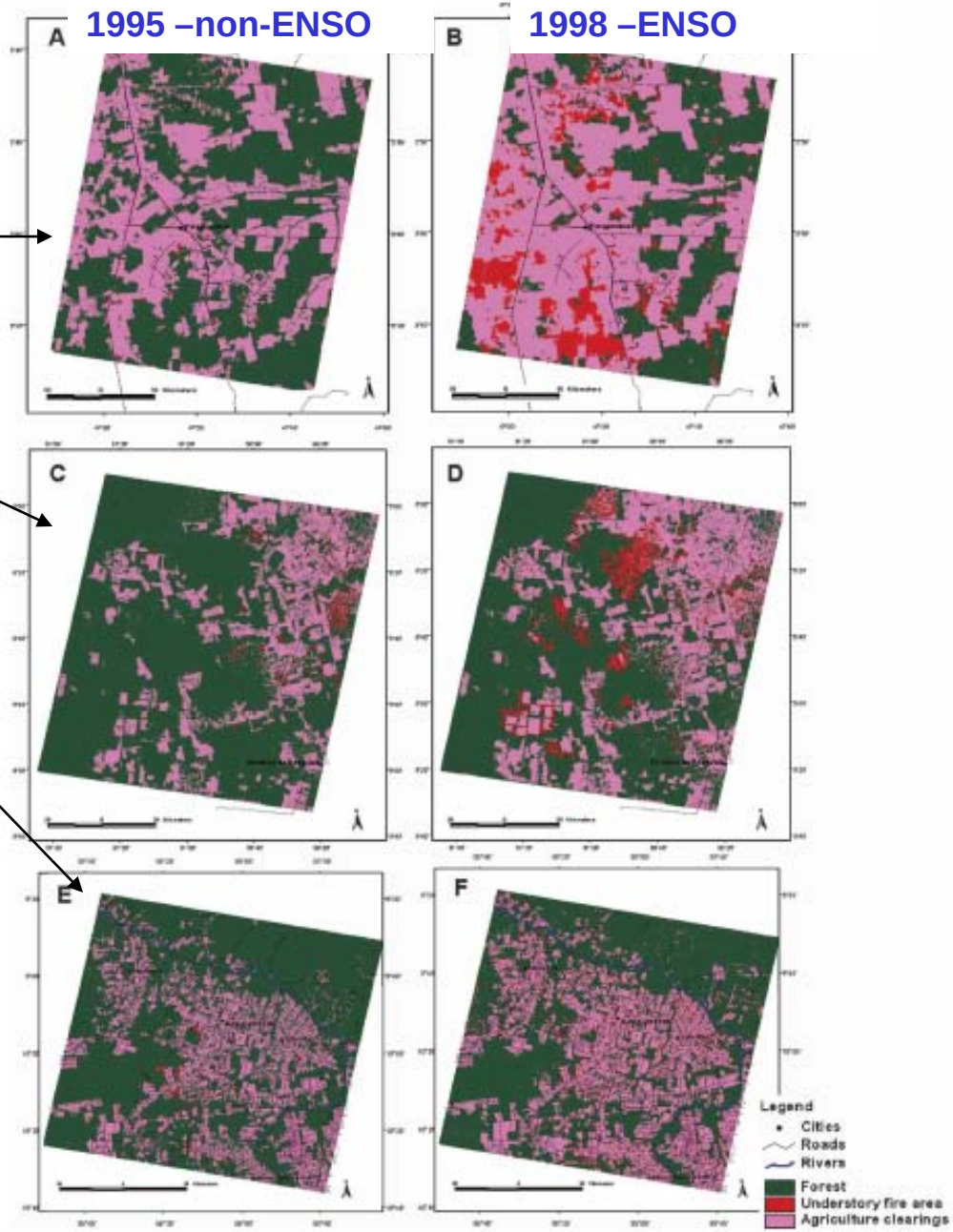



Figure 2. Understory fire scars maps from (a),(c),(e) 1995 and (b),(d),(f) 1998 representing a non-ENSO and an ENSO year, respectively, for the three study sites along the arc of deforestation ((a),(b) Paragominas; (c),(d) Santana do Araguaia; and (e),(f) Alta Floresta ).

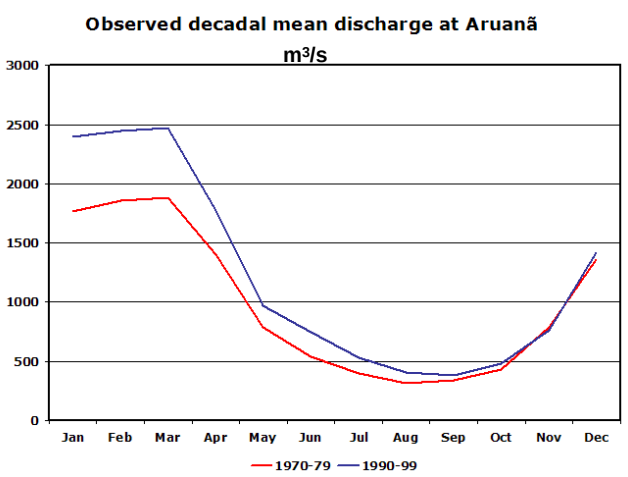
- **Supervised classification of Landsat imagery and land owner interviews used to map fire scars.**
- **Results "scaled-up" using relationships of distance to roads, forest type, precipitation, and biomass estimates.**

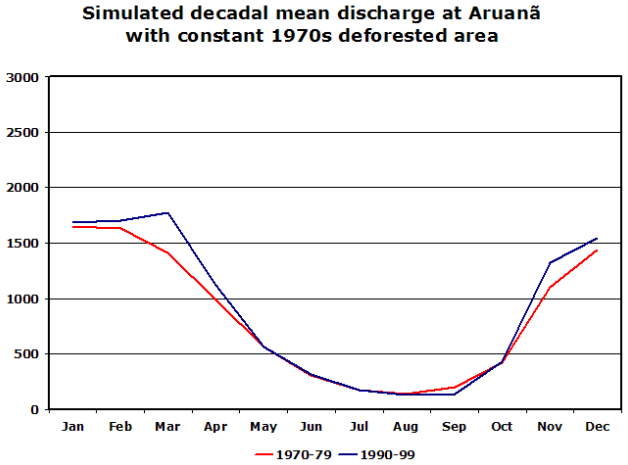
**The estimated forest area burned by understory fire during the severe drought (ENSO) year (2.6 × $10^6$ ha) was 13 times greater than during the average rainfall year (0.2 × $10^6$ ha) and was twice the area of annual deforestation.**

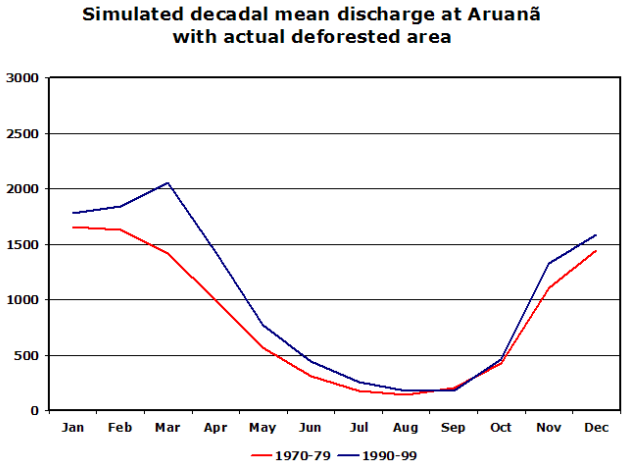
**Alencar et al. 2006. Earth Interactions 10:6**

The middle and Upper Araguaia River basin showing CBERS-derived classification of remnant Cerrado (green) and altered lands (pink). About 62% of the basin vegetation and 45% of all riparian zones had been altered by 2006

★Aruanã




- Discharge has increased by 25% since the 1970s
- Simulations indicate that about 2/3 of the change in discharge is attributable to changes in land cover

Coe, Latrubesse, Ferreira, Davidson, in review

**Topics covered here:**

- **Wetland cover**
- **Forest cover**
- **Logging**
- **Fire**
- **Conversion to cropland**
- **Conversion to pasture**
- **Hydrologic consequences**


**Topics not covered include the consequences of the LCLUC on:**

- **Local, regional, and global climate**
- **Carbon and nutrient cycles**
- **Biodiversity**
- **Economic activity and human dimensions**