

Synthesis Studies of Intensive Agriculture Impacts in the Amazon and Cerrado: Field Data, Remote Sensing, Modeling Approaches

CHRISTOPHER POTTER, NASA Ames Research Center;

MERCEDES BUSTAMANTE, Universidade de Brasília;

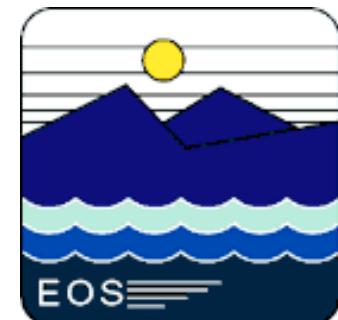
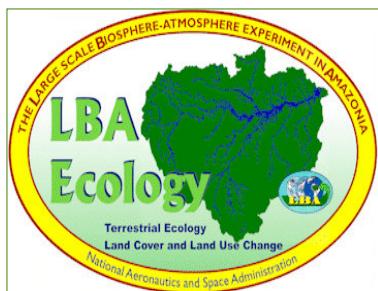
RICHARD ZEPP, US EPA;

LAERTE FERREIRA, Universidade Federal de Goias:

ALFREDO HUETE, University of Arizona;

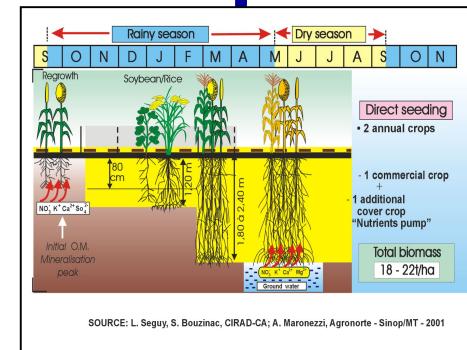
STEVEN KLOOSTER, California State University

LBA-ECO III Team: TG-30



TG-30 SYNTHESIS STRATEGY

- Validate ecosystem model predictions by comparison to tower-based and small plot measurements of net ecosystem production (NEP), trace gas fluxes, and other field-based measurement data sets from intensive field plots.
- Prioritize improvements to ecosystem models, which will incorporate intensive agricultural development, to better constrain source/sink estimates for atmospheric CO₂ and other trace gases (N₂O, NO, CO, CH₄) of importance in LBA.
- Use satellite observations MODIS EVI and FPAR to make regional modeling assessments of trace gas exchange over the past six years.



FIELD SITE DATA SOURCES

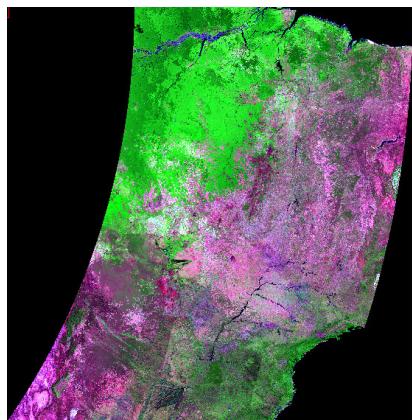




Cerrado MODIS Mosaics



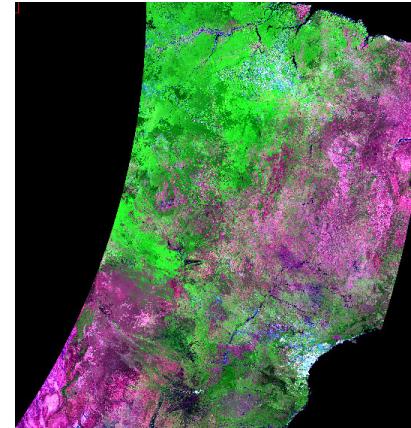
Image collection from 2001 to 2005



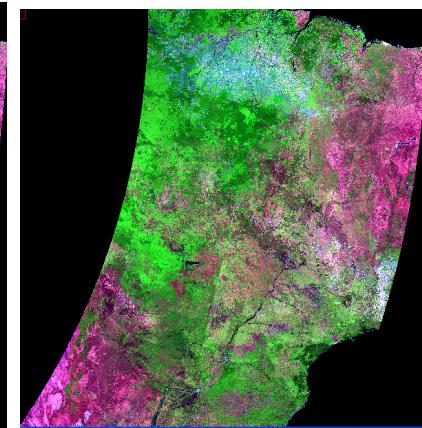
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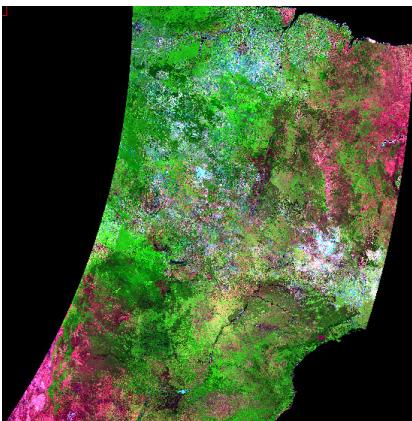
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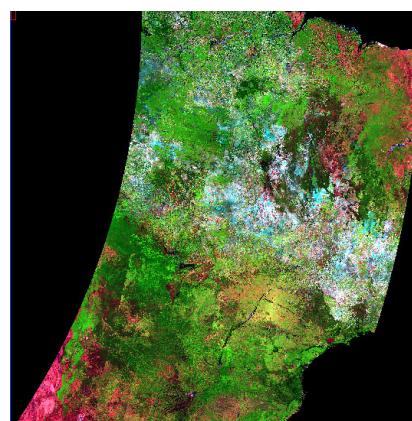
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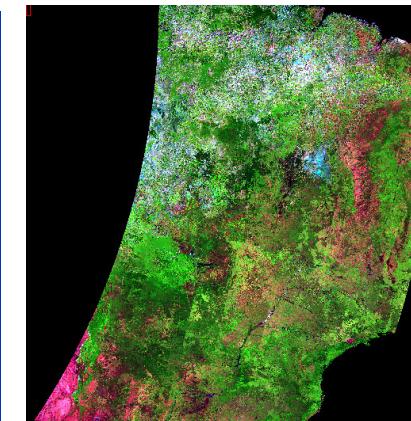
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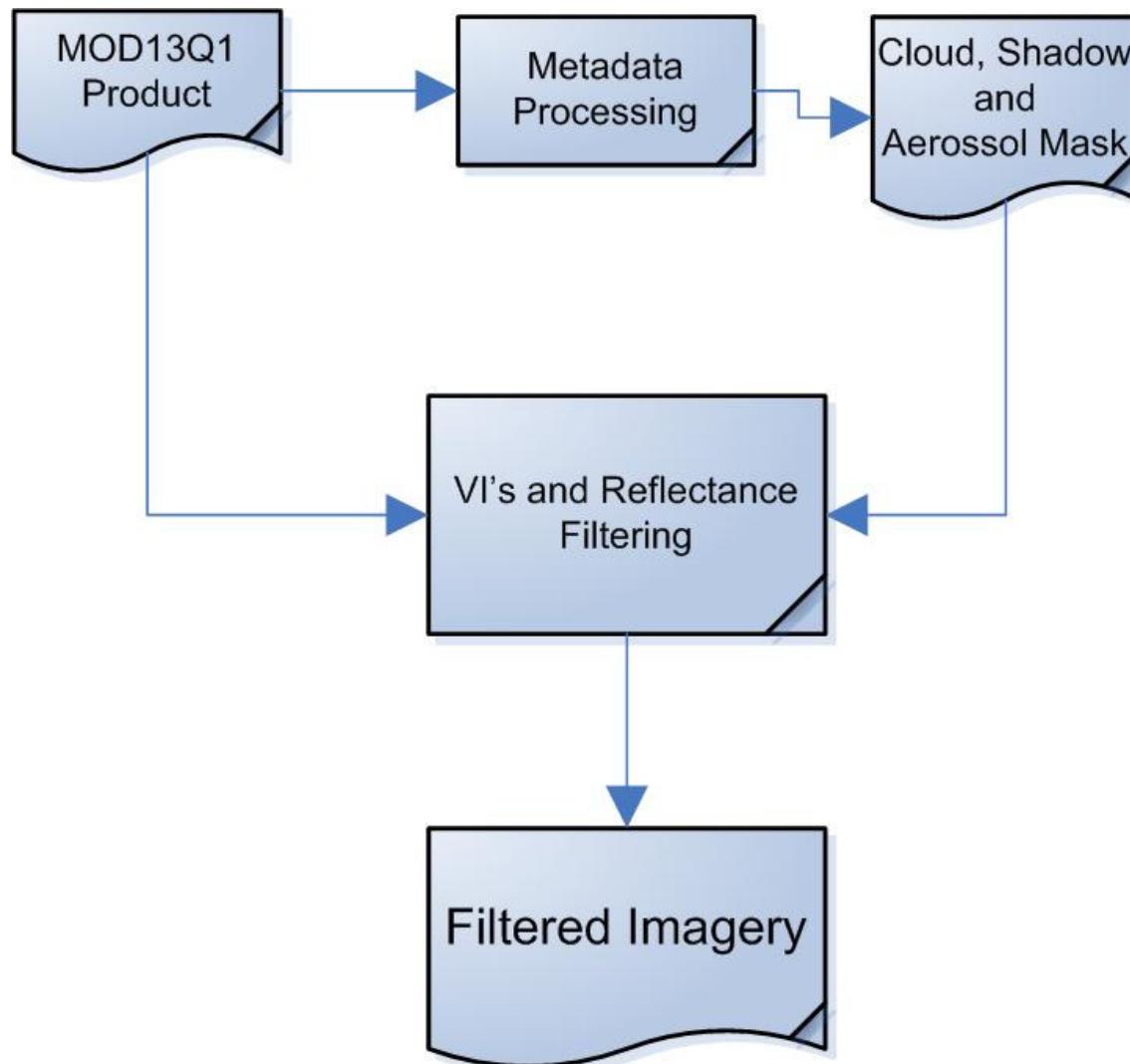
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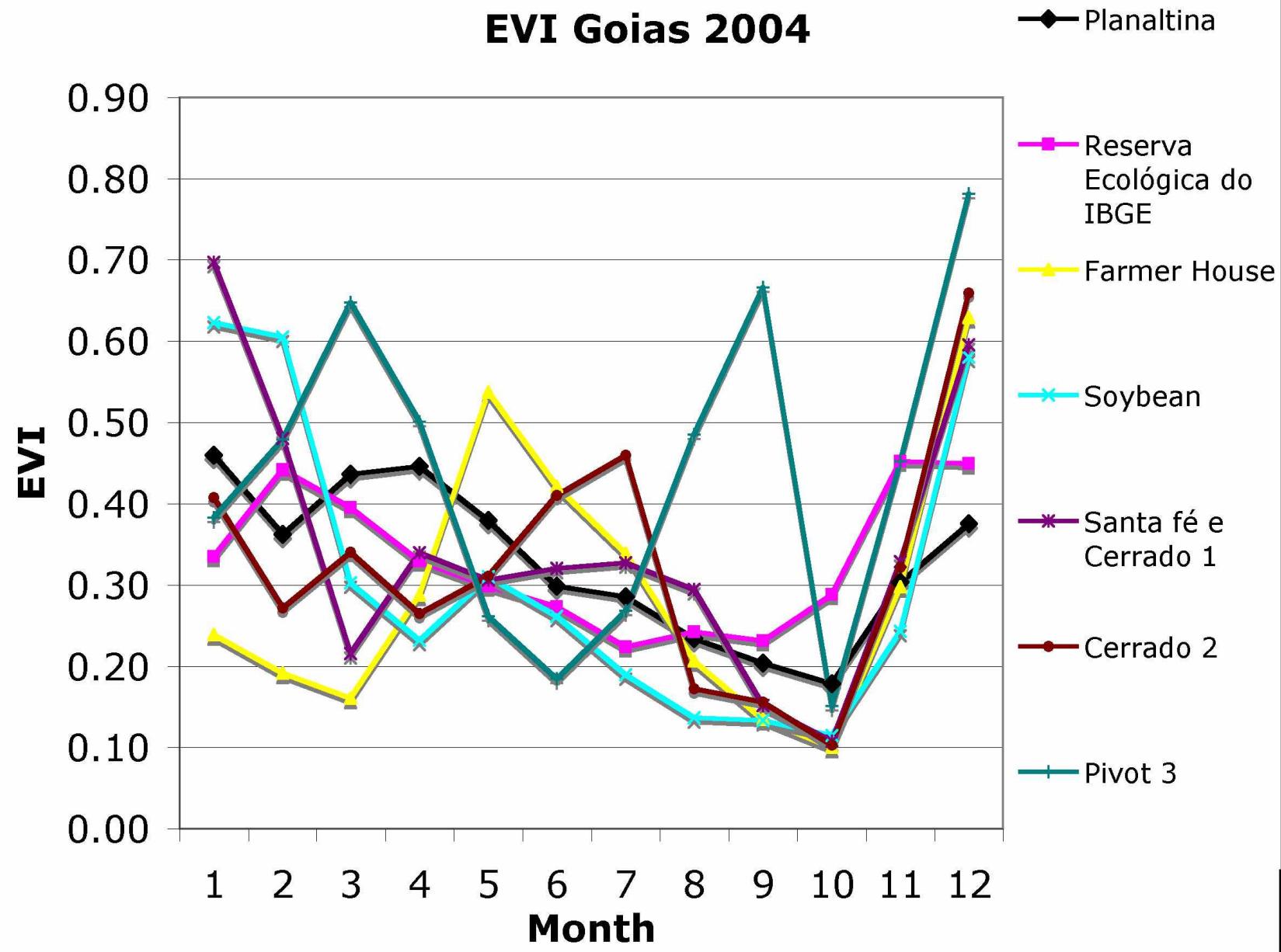
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Data Screening Processing Flow



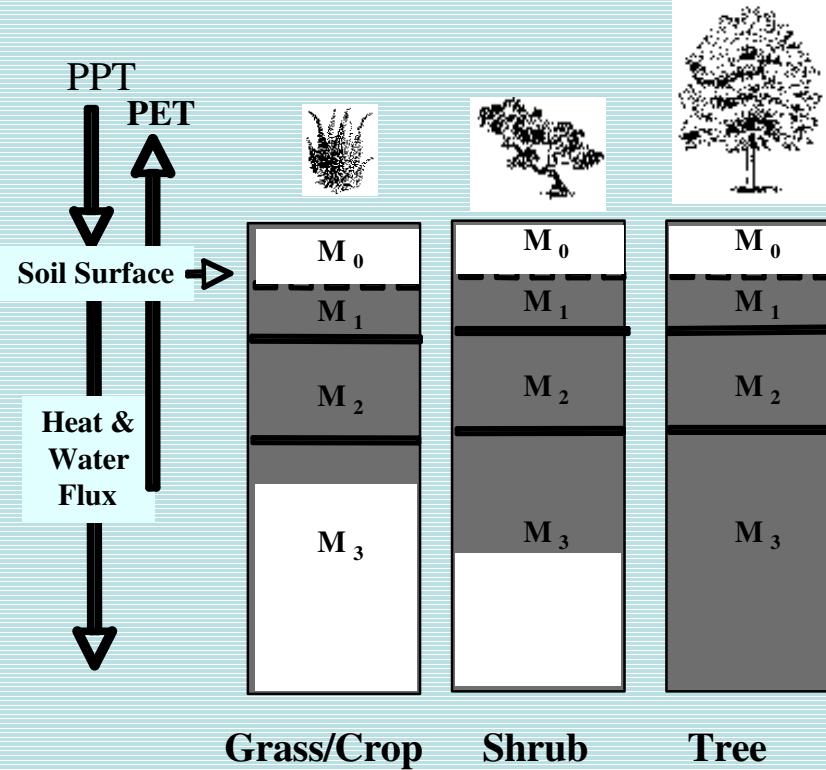
EVI Goias 2004



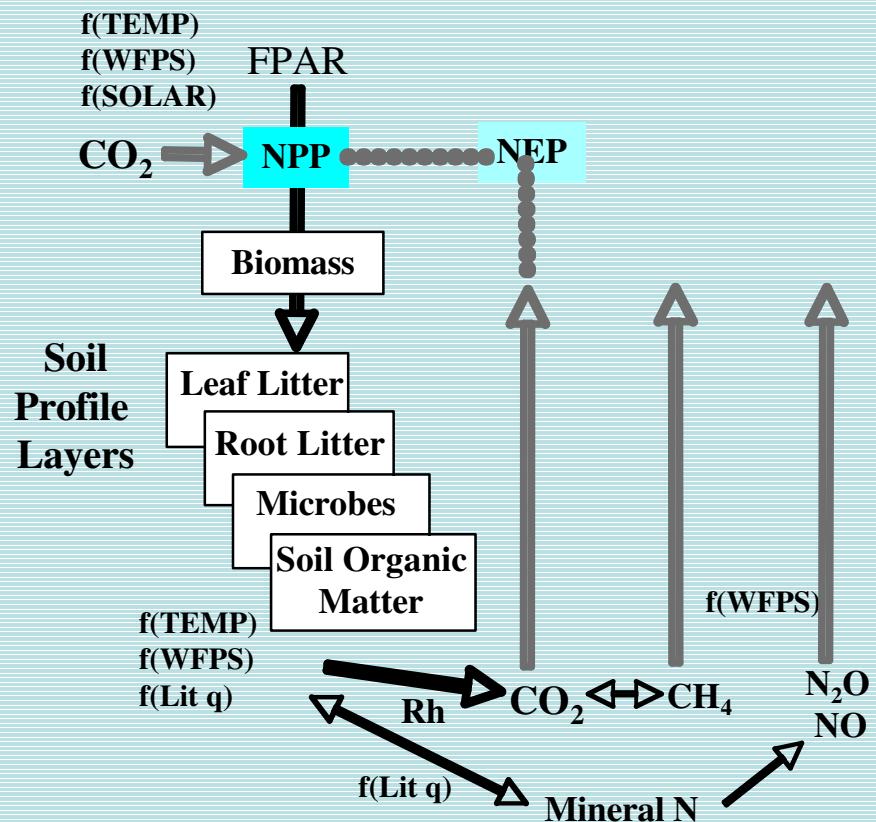
NASA-CASA MODEL

(Potter et al., 2001 and 2004)

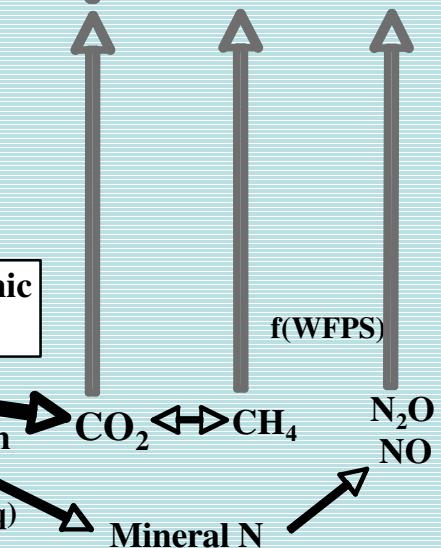
(a) Soil Moisture Balance
and Plant Functional Types



(b) Ecosystem Production
Nutrient Mineralization



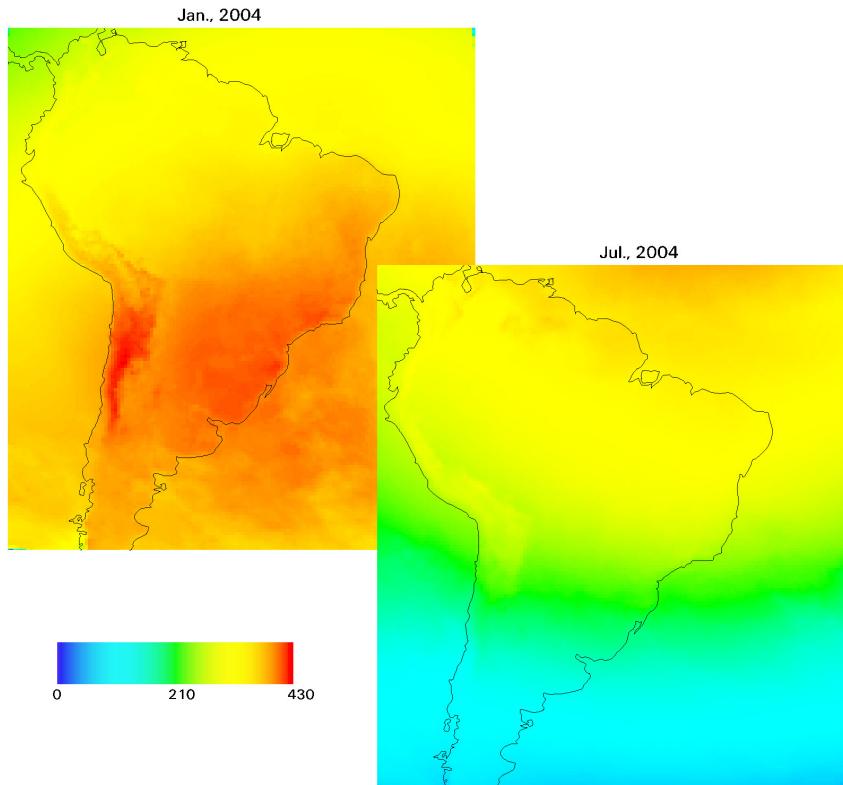
(c) Biogenic Trace
Gas Flux



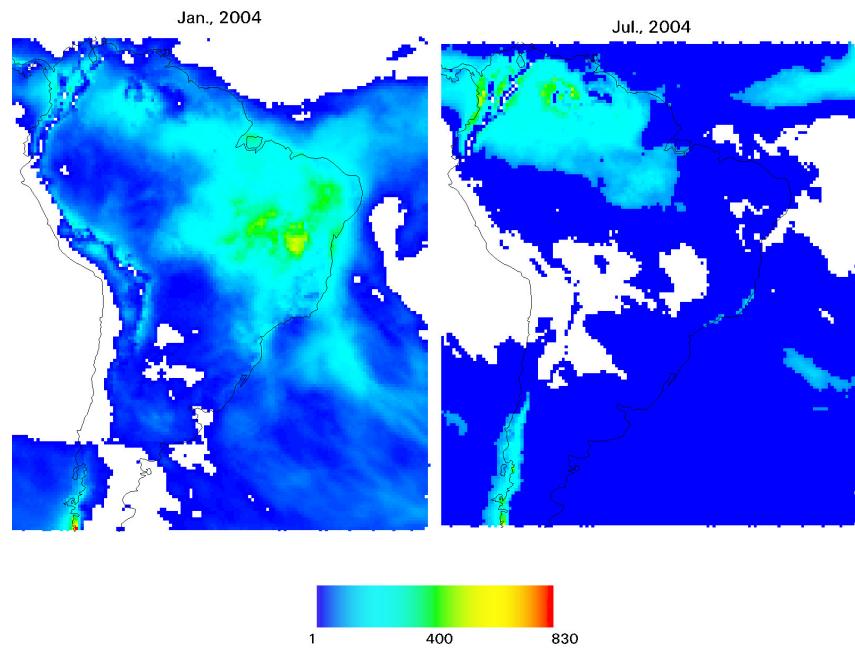
Dados Meteorologicos para a America do Sul

(Source: CPTEC)

Monthly Mean Downward Shortwave Radiation at the Surface (W/m²)



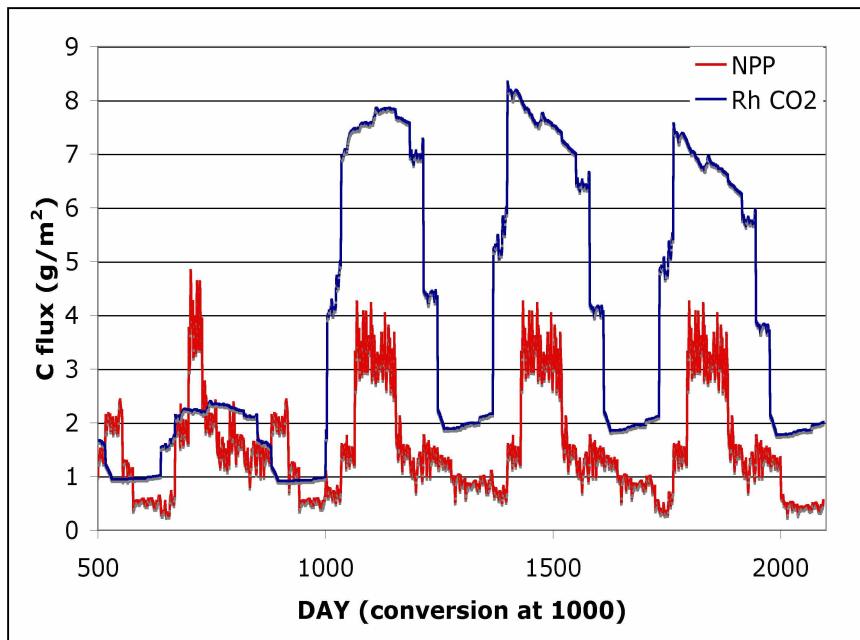
Monthly Precipitation Accumulation (Kg/m²/month)



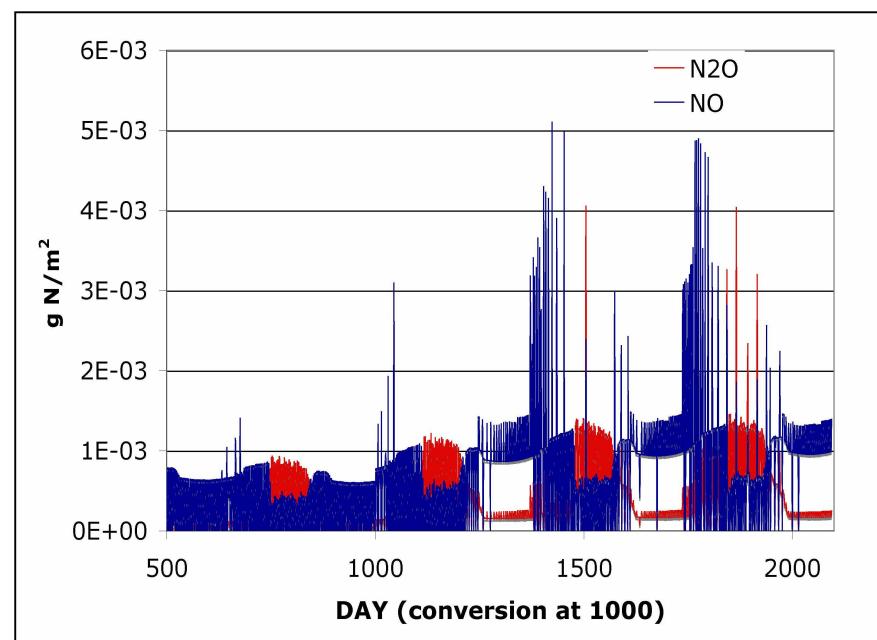
INITIAL CASA MODELING RESULTS

The NASA-CASA model was driven by EVI and NCEP climate inputs. Following conversion of Cerrado vegetation, three years of soybean cultivation were simulated (below), without the addition of fertilizer. Simulated conversion removed all standing live and dead biomass at the soil surface.

Ecosystem Carbon Balance



Nitrogen Trace Gas Emission from Soils



Cerrado | Soybean ----->

Cerrado | Soybean ----->

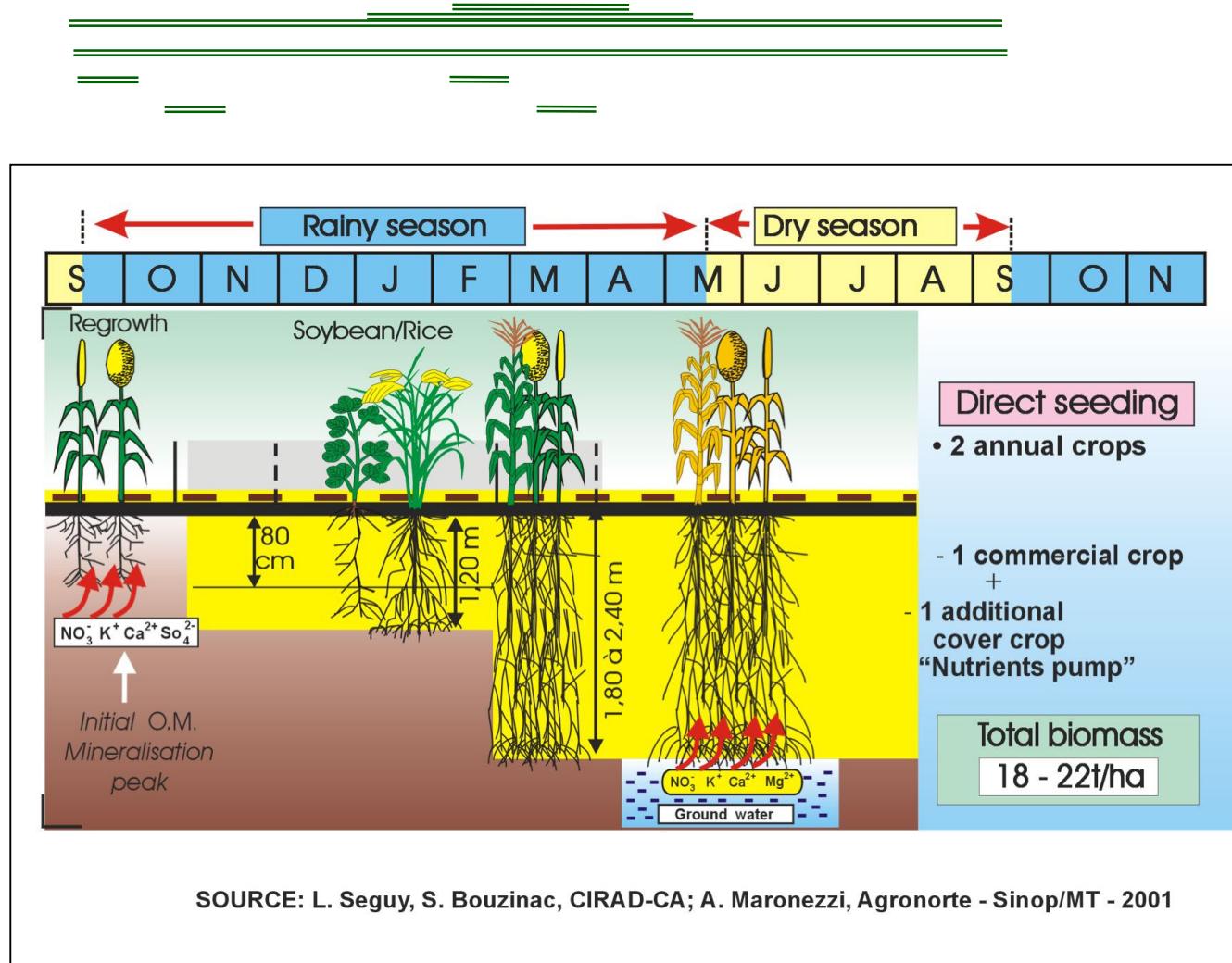
INPUTS:

LAI (EVI)

Crop Type

Fertilizer

Harvest Index



OUTPUTS:

TG (CO_2 , NO, CO)

SOM (30 cm)

TG-30 Data Analysis Activities Underway

- Survey of crop rotation and fertilizer application practices.
- Evaluation of changes in soil properties, nutrient pathways, and moisture dynamics in transition systems.
- Characterization of MODIS EVI seasonal profiles with physiognomic functions for transition systems.

“Soybean Cultivation as a Threat to the Environment in Brazil”

Philip Fearnside, *Environ. Conservation* (2001)

The multiple impacts of soybean expansion on biodiversity and other development considerations have several implications for policy:

- Protected areas need to be created in advance of soybean frontiers,
- Elimination of the many subsidies that speed soybean expansion beyond what would occur otherwise from market forces is to be encouraged,
- **Studies to assess the costs of social and environmental impacts associated with soybean expansion are urgently required,**
- The environmental-impact regulatory system requires strengthening, including mechanisms for commitments not to implant specific infrastructure projects that are judged to have excessive impacts.

Crop Products



Employment



Livestock Products



Benefits



Intensive

Agriculture

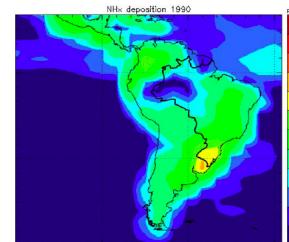
Costs



Pollutants



Sedimentation



Trace Gases



Landlessness



Biodiversity