

Brazil / São Paulo

JECAM/GEOGLAM Science Meeting

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Joint Experiment for Crop Assessment and Monitoring



Site Description

- Brazil, São Paulo state, Eucalyptus plantation area
- Topography: Mostly flat
- Soils: deep Ferralsols, ~20% Clay (in centroid area)
- Drainage class/irrigation: Moderately to well drained
- Crop calendar:
 - Eucalyptus: 6 years rotations/
 - Other land use: sugarcane, pasture, citrus, etc.
- Field size: ~40ha
- Climate and weather: Humid Tropical (Aw Koppen)



Project Objectives

- Crop identification and Crop Area Estimation for all crops, natural and planted forests in the 100 km² area.

Land use change analysis: Eucalyptus and Sugarcane area increase: When ? Where ? What previous land use ?

On Eucalyptus plantations :

- Plantation Condition/Stress
- Biomass estimates
- Yield Prediction and Forecasting

Earth Observation (EO) Data Received/Used

VHSR : Worldview 2, Worldview1, Pléiades

- DigitalGlobe / Airbus Defense
- Optical, 1 to 8 spectral bands, ~2m resolution
- Number of scenes: 5 (about 100 km²)

| | | | |
|-------------|--------------------|--------------------|--------|
| Worldview 2 | PAN+ MS8 | May 11th, 2010 | JECAM |
| Worldview 2 | PAN+ MS8 | August 1st, 2010 | JECAM |
| Worldview 1 | PAN | January 29th, 2011 | |
| Worldview 2 | PAN+ MS8 | July 4th, 2013 | JECAM |
| Pléiades | PAN+ MS4 TRISTEREO | May 4th, 2014 | GEOSUD |

Earth Observation (EO) Data Received/Used

MODIS TERRA

- Space agency or Supplier: NASA
- Optical, 250 m resolution bands (NIR and Red)
- Number of scenes: ~250 scenes between 2000 and 2014

Earth Observation (EO) Data Received/Used

Landsat5

- Space agency or Supplier: NASA
- Optical
- Number of scenes: 4 images were used (2011), but there are more image available

Earth Observation (EO) Data Received/Used

DEIMOS

- Space agency or Supplier: deimos imaging
- Optical
- Number of scenes: 9
 - Archived (2010 (1),2011 (3),2012 (3), 2013 (2))
 - Tasked : 1 image every 3 months (4 images in 2014)

In situ Data

- 422 ground points recorded in May 2012 with a GPS Nomad (Trimble Navigation Limited, Sunnyvale, CA). 33% of these points were Eucalyptus plantations and the other belonged to 21 other land cover types

Method: « *pragmatic* »

1. List of possible land use in the area
2. Choice of roads where the different crops are expected, and covering large transects across the image
3. Identification of all crops along roads where stands are clearly seen on Landsat images (i.e. large enough)

In situ Data

- Many measurements are conducted on a large stand of ~200ha that was planted in 2009 (Eucflux project) on a flux-tower instrumented site.

| | | |
|---------------------------------------|------------------------------|--|
| Evapotranspiration | Leaf temperature | Canopy reflectance spectra |
| Carbon net ecosystem exchange | Soil respiration | Leaf, trunk, litter reflectance spectra |
| LAI, fAPAR | Litterfall | Canopy structural properties (leaf angles, leaf distrib) |
| Carbon Biomass in trunk and roots | Soil carbon content | Tree sizes and location |
| Soil water content 0 -10 m | Root profiles, root turnover | ... |
| Water table depth | Nutrient biomass and fluxes | |
| Meteorological data (weather station) | Transmitted radiation | |
| Soil temperature | NDVI and PRI sensors | |

In situ Data

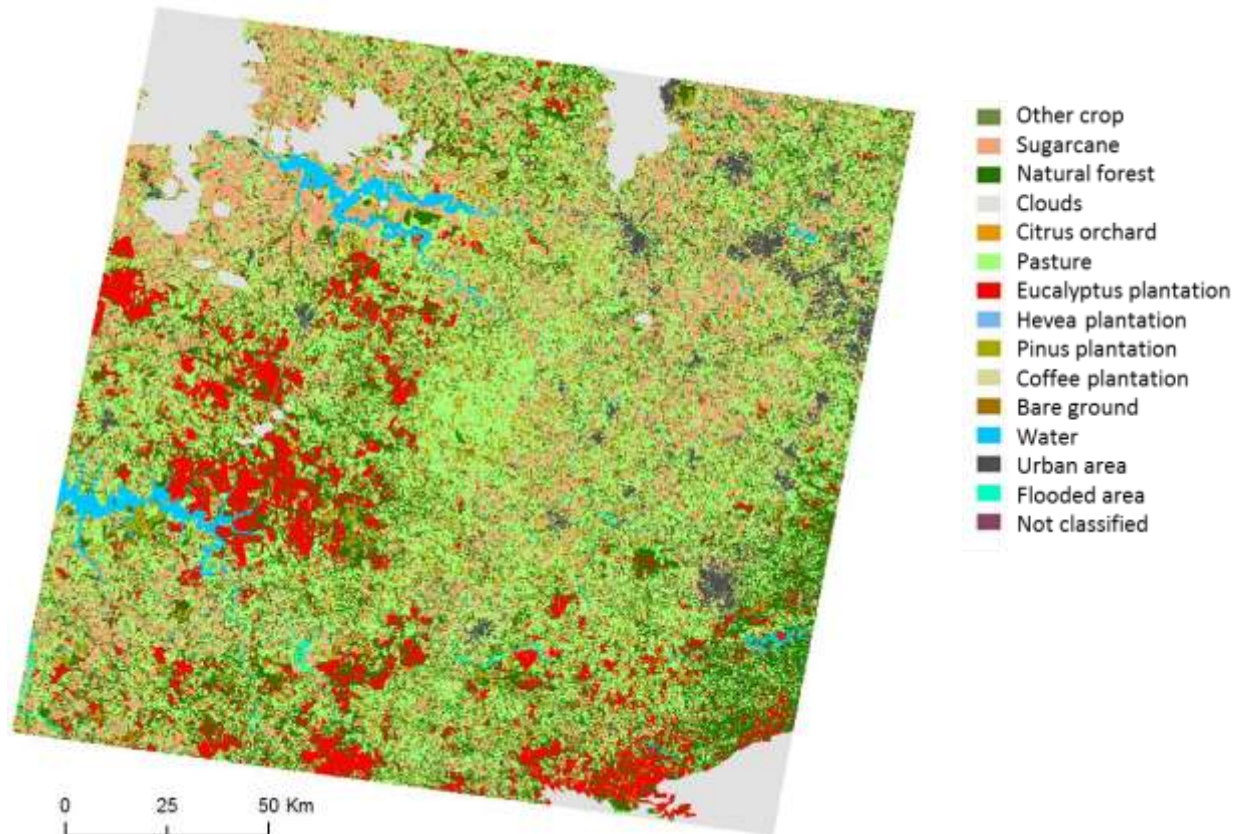
- Spatial data in collaboration with Eucalyptus planting companies: inventories of all stands in the image

Collaboration

- Collaboration with other CIRAD JECAM sites
- SIGMA European Collaborative Project (FP7-ENV-2013 SIGMA — Stimulating Innovation for Global Monitoring of Agriculture and its Impact on the Environment in support of GEOGLAM — project no. 603719)

Results

- A land cover map done for the year 2011 (field measurements in 2012). This map was firstly dedicated to Eucalyptus plantation mapping



Results

- A Brazil map of Eucalyptus plantations from MODIS

le Maire, G., Dupuy, S., Nouvellon, Y., Loos, R.A., & Hakamada, R. (2014). Mapping short-rotation plantations at regional scale using MODIS time series: Case of eucalypt plantations in Brazil. *Remote Sensing of Environment*, 152, 136-149

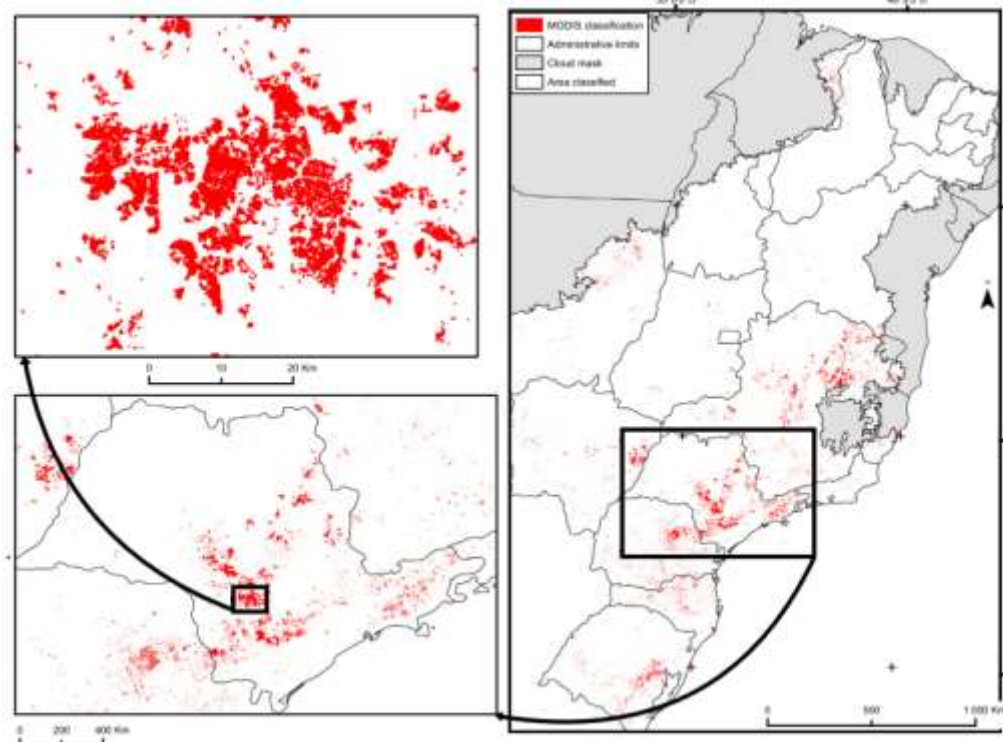


Fig. 8. Map of fast-growing Eucalyptus plantations in 2009 over a large part of Brazil obtained in this study using MODIS 250 m NDVI time series classified with the BE matching function. Left images are two successive zooms on a particular area in the state of São Paulo.

Results

- To what extent have the project objectives been met?

We have obtained an Eucalyptus map of the area, which has been validated. Other land uses were classified, but not validated

- Can this approach be called ‘best practice’?

The approach consisted in the use of 4 images of 2 consecutive years, to be able to classify the Eucalyptus clear-cuts. For other land use, this approach may not be valid, and some adaptations will be necessary. Field data collection protocol to change to meet JECAM requirement

Research Plans for Next Growing Season

- Will you hold the course, or modify the approach?
Modify the next field work according to JECAM protocol
Next field work in december 2014.
- Do you anticipate ordering the same type/quantity of EO data next year?
No, only Landsat type images, maybe other types of data (radar)



