



LC-19 (LBA-Air-ECO)

Use of Airborne Remote Sensing for Uncertainty Assessments in Regional Extrapolations of Ground LBA Ecology Measurements with MODIS Data

Alfredo Huete¹ (USA-PI), Laerte Ferreira², Edson Sano³ (Brazilian-PIs), Tomoaki Miura¹, Kamel Didan¹ (USA-Cols), Yosio Shimabukuro⁴, Mercedes Bustamante⁵ (Brazilian-Cols)

¹ Department of Soil, Water and Environmental Science, University of Arizona, Tucson, AZ 85721, USA

² Universidade Federal de Goiás – UFG, Instituto de Estudos Sócio-Ambientais – IESA, Campus Samambaia - Cx Postal 131, Goiânia, GO, 74.001-970, Brazil

³ EMBRAPA Cerrados, Caixa Postal 08.223 - 73.301-970 - Planaltina – DF, Brazil / ⁴ INPE - Instituto Nacional de Pesquisas Espaciais, Caixa Postal 515 - 12201-970 - São José dos Campos - SP, Brazil

⁵ Universidade de Brasília, Departamento de Ecologia, Campus Universitário Darcy Ribeiro, CEP 70.919-970, Brasília-DF, Brazil

Abstract

- The Cerrado and Amazon Forest - Cerrado transition are the most intensely stressed areas in Brazil, with rapid and aggressive land use conversions.
- Synoptic and repetitive (APAR and LAI) estimations are crucial as inputs in regional-scale productivity and carbon budget models, prompting many remote-sensing investigations for the development of techniques for satellite-based LAI/APAR retrievals.
- We propose low level AVIRIS flights for scaling-up field measured, ecologic parameters across an eco-climatic transect from the diverse Brazilian cerrado biome (grassland - woodland cerrado - cerrado-forest transition) to the seasonal Amazon forest biome, including their land conversions.
- AVIRIS hyperspectral data will be used to discriminate the natural and altered land cover classes along the gradient of vegetation types using mixture models.
- The refined land cover characterization will be used in the scaling up of fAPAR, LAI, and % cover to AVIRIS pixel size (4 m) and the coarser Landsat ETM+ (30 m) and MODIS (250 m to 1 km) sensors.
- Our scaling and extrapolation approach will result in regional mapped products, with an accuracy and uncertainty analyses, that accounts for distinct, land cover dependent, functional relationships between ecologic parameter (linear and non-linear) and vegetation indices.
- The scaled-up regional products will account for inter-sensor translation and provide a 'validation' of the LAI/fAPAR, land cover, and surface reflectance/VI MODIS products.
- The results of this study will enable the detection of 'hotspots' of land conversion activities with the MODIS sensor, allow for their fine-scale analysis with the Landsat ETM+ sensor, and allow a time-series analysis with the AVHRR historical data.
- This will greatly aid seasonal and inter-annual carbon balance studies in the Cerrado and Amazon transition regions.

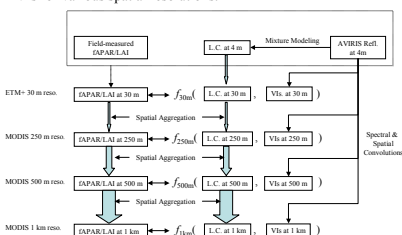
Scientific Objectives

We propose to employ AVIRIS flights for the scaling-up of in-situ ecologic measures to ETM+ and MODIS and for the detection and monitoring of region wide land disturbances. Specific objectives are,

- to utilize hyperspectral data to discriminate land cover conditions across an eco-climatic gradient from Brazilian cerrado biome (dry grassland/ wooded cerrado/ cerrado-forest transition) to the seasonal forest biome, including their associated land converted classes,
- to scale-up ground-measured, biophysical parameters to Landsat ETM+ (30 m) and MODIS sensor resolutions (250m to 1 km) via spatial extrapolation; convolving sensor-dependent bands; and aggregation of land cover-dependent functional relationships between biophysical parameter and vegetation index,
- to establish continuity and translation among the Landsat TM, ETM+, MODIS, and AVHRR sensors and time series, "historical" data sets.

Approaches

Our "scale-up" and extrapolation approach is to develop land cover-dependent functional relationships between fAPAR / LAI / %cover and VIs for various spatial resolutions.



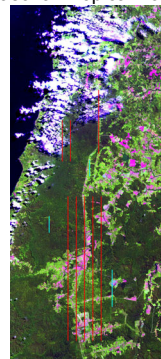
Analysis of Field Data in Combination with AVIRIS Imagery

Integration and Synthesis

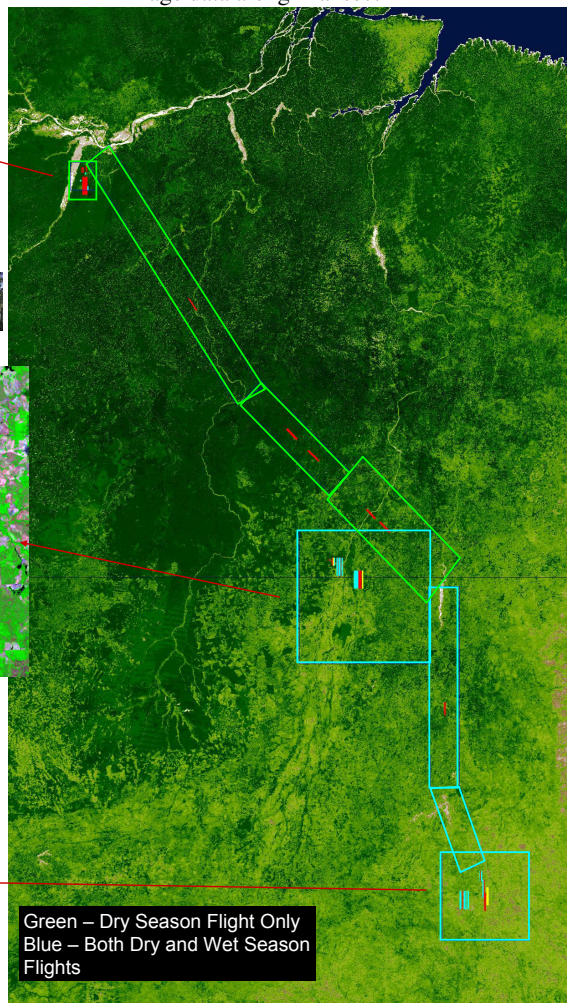
- The scientific relevance of this investigation is an improved understanding of the capacity of the Cerrado Biome to sequester and store carbon as related to land use and land conversion (CD-Q1 and CD-Q3)
- The expected results of this investigation will be the a combined MODIS/ETM+ sensor approach to monitor the spatial & temporal dynamics of land cover, conversions, and biophysical parameters over the cerrado and forest-cerrado transition regions.

Proposed AVIRIS Flight Lines for Wet (May) and Dry (July) Seasons

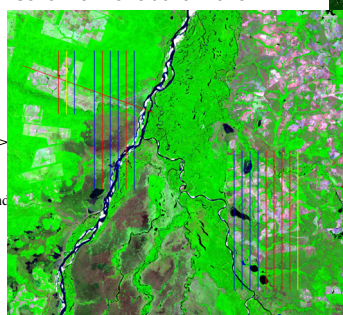
Santarém
Seasonal Tropical Forest



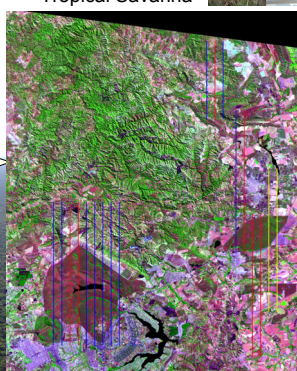
Landsat ETM+ and
Hyperspectral - Hyperion
image data along Transect



Araguaia Tropical Forest –
Savanna Transitional Zone

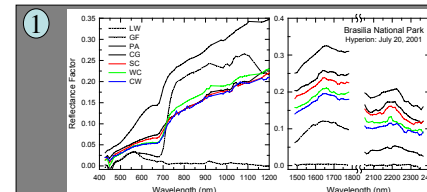


Brasilia
Tropical Savanna



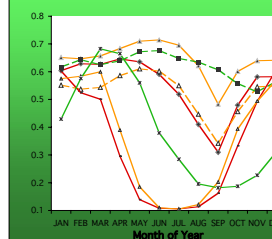
Terra-MODIS Enhanced Vegetation Index: 1 km,
October 16 – 31, 2002

Preliminary Results



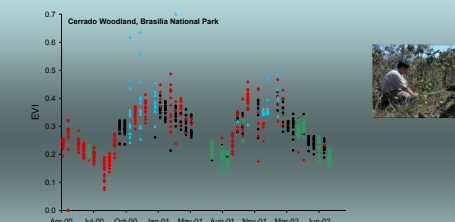
Hyperion reflectance spectra over four cerrado physiognomies (cerrado grassland (CG), shrub cerrado (SC), wooded cerrado (WC), cerrado woodland (CW)), and land converted pasture show improved discrimination capability.

2. Long-term seasonal analysis (20-yr AVHRR-NDVI)



- AVHRR data show decreasing seasonal contrasts along the gradient and 1-month lag in vegetation activity with rainfall.

3. 500-m MODIS data



- The MODIS-VI seasonal profiles for 2000-2002 exhibited very pronounced dry and wet periods in the cerrado region with vegetation.

Current Graduate Students:

- Ana Paula Ferreira
- Fernando Bon Espirito-Santo
- Piyachat Ratana
- Humberto Alves Barbosa

