Introduction

Brazil's Low Carbon Agriculture (ABC Plan) is one of the initiatives that places the climate in the agricultural agenda towards a more sustainable and adapted agriculture under global changes. The GEOABC Project (Methodologies and Technological Innovation for Satellite Monitoring of Low Carbon Agriculture in Support to Brazil´s ABC Plan), aims to develop remote sensing methods to monitor the adoption of the ABC-Plan practices. The practices that will be monitored by satellite are as follows: recovery of degraded pasture, integrated crop-livestock-forestry system and zero tillage sytems.

Project framework

Sectorial emissions in Brazil are changing. From 2005 to 2010 the greenhouse gas (GHG) emissions due to land use and forest has decreased its contribution to the total GHG emission from 57% to 22% placing agriculture and energy as the largest sectors responsible for the total GHG emission in Brazil. In 2009, Brazilian Government has presented its ABC Plan to promote low carbon agriculture to curb its environmental impact (Brasil, 2010). The target is to increase the area of recovered pasture (Figure 1) by 15 M ha, zero tillage system (Figure 2) by 8 M ha, and integrated crop-livestock-forestry (ICLF) system including the popular crop-pasture system (Figure 3) by 5 M ha between 2010 and 2020.

Monitoring land use changes is key for reporting and verification.

Foto: IAPAR

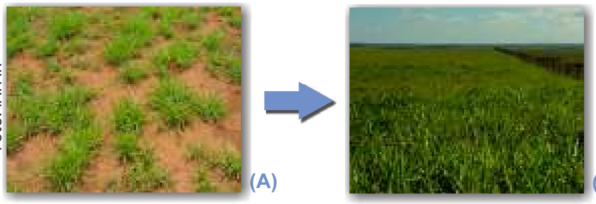

Figure 1. Ferralsol under degraded (A) and under recovered (B) pasture in the neotropical savanna (Cerrado).

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Embrapa MINISTÉRIO DA AGRICULTURA, PECUÁRIA E ABASTECIMENTO BRASIL GOVERNO FEDERAL

Satellite based multi-scale methods to support governance of Brazil`s low-carbon agriculture (ABC Plan)

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GEOABC Project , aligned with SIGMA Project, uses JECAM (Joint Experiment for Crop Assessment and Monitoring) sites of 50x50 km as defined by the GEOGLAM (Group on Earth Observations Global Agricultural Monintoring). Brazilian JECAM sites are being used for as study sites.

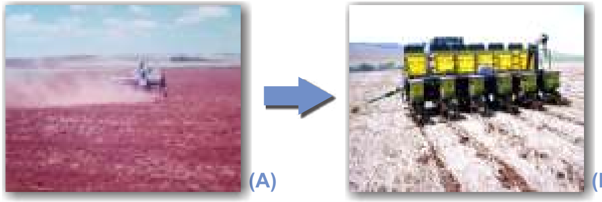

Figure 2. Ferralsol under plowed (A) and zero-tillage (B) system in Southern Brazil.

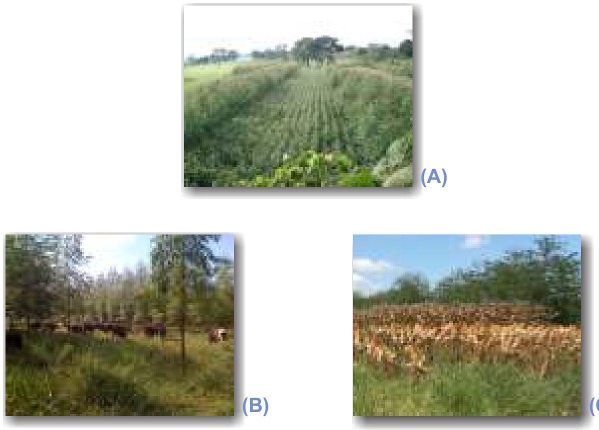

Figure 3 Ferralsol under different ICLF systems: crop-forest (A), livestock-forestry (B), and crop-pasture system (C).

Methods

Different methodological approaches were applied to evaluate how local variables can be scaled-up to be monitored at a regional scale (Bégué et al., 2015). We used spatial, temporal and textural indicators derived from coarse-resolution satellite images.Based on Bellón et al. (2016), crop distribution modelling, up-scaling methods based on satellite-derived variables (temporal, spectral and spatial indicators) and Object Based Image Analysis (OBIA) techniques were applied and tested in the State of Tocantins and at ICLF system sites (Figure 4). The ICLF site was a 190-ha farm paddock in the State of Goias, Brazil. The soil type was a clayey and acidic Ferralsol under degraded pasture grass, mostly Urochloa spp. Pasture was recovered using grain crop after liming and fertilizer application. By the end of October 2006, the soil was prepared using a heavy disc harrow and soybean was sown by mid November. After harvest of soybean by mid March 2007, maize together with pasture grass (Urochloa ssp) was sown and after harvest of maize in June-July, the area was kept under pasture grass for beef cattle. Between October-November 2007, soybean under zero-tillage was sown in the area followed by maize or sorghum between March and June. Regrowth of pasture grass allowed enabled grazing by beef cattle. This double cropping followed by grazing pasture was kept until 2012.

Figure 4 Regional scale landscape stratification of MODIS NDVI derived radiometric and textural indices in homgeneous areas based on radiometry and texture usung OBIA (Bellón et al., 2016).

Results

At local scale, temporal profiles were analysed by experts to check vegetation index on different agricultural systems (Figure 5). ICLF system commonly present a mixed growth of both crop and pasture grasses (Figure 6).

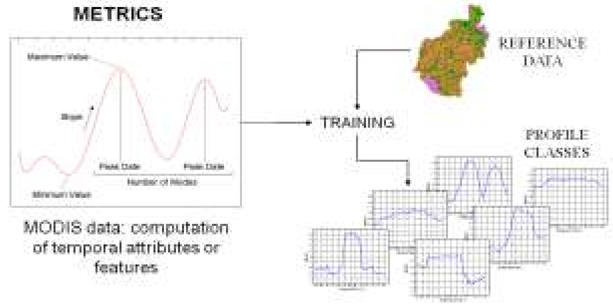

Figure 5 Computation of MODIS temporal attributes.

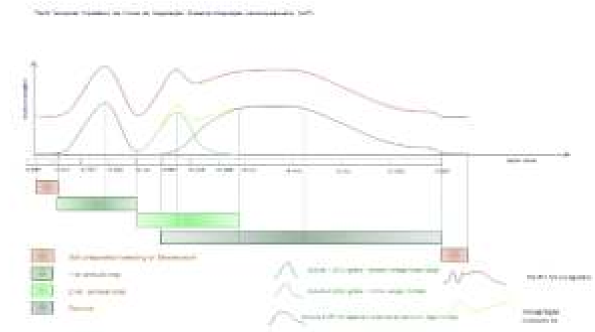

Figure 6 Suggested vegetation index along the time profile of an integrated crop-livestock system.

Conclusions

The complete set of methodological approach establishes methodological protocols to obtain systematic spatial indicators, at multi-scale level providing metrics to the ABC Plan.

References

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