# STRATEGIES FOR MONITORING SAVANNAS USING MODERATED RESOLUTION IMAGERY

*Nilson Clementino Ferreira* [1,2]
*Laerte Guimarães Ferreira Jr.* [1]

Federal University of Goiás; Graduate [1]
Program on Geography
Image Processing and GIS Lab.
Laerte@iesa.ufg.br

Federal Center for Technologic Education [2]
nclferreira@gmail.com

## 1. INTRODUCTION

The Savannas cover almost half the surface of Africa and large areas of Australia, South America, and India. Are composed by grassland scattered with shrubs and isolated trees, which can be found near from a tropical rainforest biome. The climate is an important factor in savanna; the annual rainfall is from about 50.8 to 127 cm per year. It is crucial that the rainfall is followed by a long period of drought when fires can occur. If the rain were well distributed throughout the year, many such areas would become tropical forest [1].

In the savannas occur areas with plan relief and soils of easy management that enable the implantation of large areas of mechanized agriculture and pasture [2]. Due this characteristic, in Brazil about 40% (almost 1 million km$^2$) of the native vegetation cover in the cerrado were converted in pasture and agriculture areas in 30 years [3]. Due this rapid deforestation in Brazilian cerrado, the Image Processing and GIS Lab, located at the Federal University of Goiás, developed a Warning Deforestation System (SIAD) [4], which is applied to monitoring deforestation using moderate spatial resolution satellite images provided by MODIS program. This abstract, is focused on strategies for monitoring tropical savannas using the products MODIS.

## 2. METODOLOGY

In this study, were considered the savannas located in Brazil, Venezuela, Colombia, Africa and Australia, encountered in biome map available in WWF homepage (www.worldwildlife.org/science). Over this areas were identified, and downloaded the product MOD13A2 (1 km spatial resolution and vegetation index) for the Brazil were considered eight tiles, for Venezuela and Colombia two tiles, for Africa fourteen tiles and for Australia seven tiles. For each tile were downloaded products for each 16 days from January 2006 to December 2007.

After downloading, the tiles were merged and clipped for each savanna areas, for each composite day, and the vegetations index (EVI and NDVI) and the pixel reliability were considered for each mosaic. As MODIS is an optical sensor its products are influenced by atmospheric conditions, therefore, for each mosaic from 2006 to 2007 were selected the pixels without problems for the vegetation monitoring. For this selection were considered the pixel reliability images whose pixels value 0 are considered with good conditions for the

monitoring and mapping. As the savannas have mainly two seasons, a wet season and a dry season, this analysis was important to detect the availability of good images for mapping along of the year.

The climate characteristics in savannas are reflected on the vegetation cover. The vegetation seasonality can be mapped with MODIS vegetation index products and is very important on deforestation monitoring. Due this fact, the EVI and NDVI pixels with good conditions were selected and the vegetation indexes for each month were aggregated in a monthly composite image of EVI and NDVI. After this, was calculated the average vegetation index for each month for EVI and NDVI for each savanna area considered in this study.

## 3. RESULTS AND CONCLUSIONS

After the processing of the pixel reliability was obtained the percentage of the pixel with good conditions for monitoring the savannas. In the case of the African Savanna, there are more than 60% of pixels with good conditions, but in May and June is possible to obtain almost 90% of pixels with good conditions for the monitoring. In Brazilian cerrado and in the Australian savanna, there is a similar behavior, when the dry season initiates on May and finishes on October. In the case of Brazilian cerrado, the pixels with good conditions for the monitoring oscillate from 40% to 98% and in the case of the Australian savanna the range is from 45% in to 90%. In the case of the savanna areas in the Venezuela and Colombia, the dry season occurs from November to February when there are almost 80% of pixels with good conditions, and 30% of pixels with good conditions for monitoring from March to October.

The analyses of the EVI and NDVI for each savanna area monthly showed that the NDVI presents values oscillating from 4700 to 5100 for all months, but the EVI oscillates from 3000 to 5100. In the case of the Brazilian cerrado, was possible to observe the large variation on the vegetation cover where the EVI has oscillation from 5100 in wet season to 3400 in dry season.

This study shows that vegetation cover can be mapped in all savannas areas around the world using products MODIS, but is very important to consider the pixel reliability image and the vegetation seasonality.

## 5. REFERENCES

[1] The grassland biome. Available in <http://www.ucmp.berkeley.edu/exhibits/biomes/grasslands.php> accessed in 2008/30/12.

[2] FERREIRA, M. E. ; FERREIRA, L. G. ; LATRUBESSE, E. M. . Current Land Use and Conversion Trends in the Savanna Environments of Central Brazil: a Preliminary Assessment from a Landscape Perspective (in press). Applied Geography (Sevenoaks), v. 1, p. 1-23, 2007.

[3] Sano, E. E.; Rosa, R.; Brito, J. L. S.; Ferreira, L. G. Mapeamento semi-detalhado do uso da terra do Bioma Cerrado. Pesq. agropec. bras., Brasília, v.43, n.1, jan. 2008, p.153-156.

[4] FERREIRA, N. C. ; FERREIRA, L. G. ; HUETE, A. R ; FERREIRA, M. E. . An operational deforestation mapping system using MODIS data and spatial context analysis. International Journal of Remote Sensing, v. 28, p. 47-62, 2007.