

SPECTRAL LIBRARY OF TROPICAL FOREST SPECIES BASED ON HYPERSPECTRAL IMAGES

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INTRODUCTION

Hyperspectral images acquired using Unmanned Aerial Vehicle (UAV) can provide data with high spectral and spatial resolution since properly radiometrical and geometrical corrections applied. This type of information can be useful to forest monitoring, special forests with different species such the Tropical Rain Forest in the interior of State of São Paulo.

Objectives: Acquire spectral signatures of Tropical Rain Forest species using hyperspectral images acquired with camera attached in UAV.

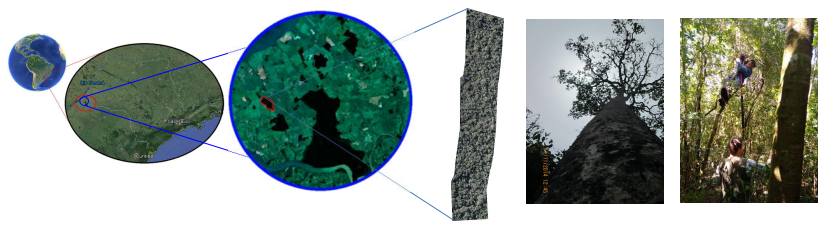
FPI HYPERSPECTRAL CAMERA and SX8 UAV



- Frame sensor
- Adjustable spectral bands
- Fabry-Perot Interferometer (FPI)
- Spectral range between 500-900 nm
- Weighs less than 700 g
- Octocopter
- Attached with Inertial Measurement System
- Able to fly 30 min with 5 kg of payload

STUDY AREA

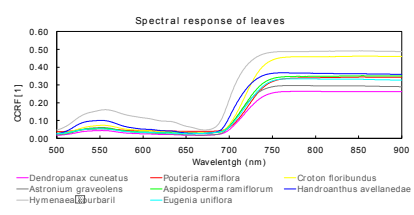
- In the west part of São Paulo State
- Inside the Ponte Branca ecological reserve of Estação Ecológica Mico Leão Preto (ESEC-MLP) managed by Chico Mendes Institute of Biodiversity Conservation (ICMBio)



EXPERIMENTS AND RESULTS

Spectral setting of the camera

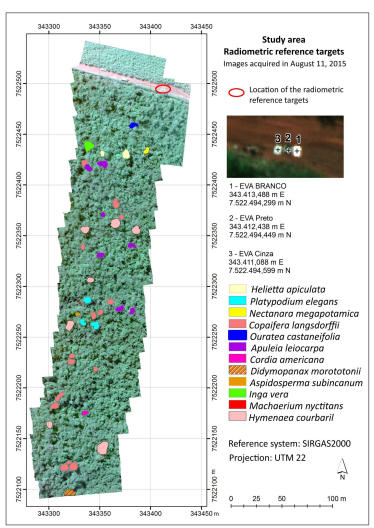
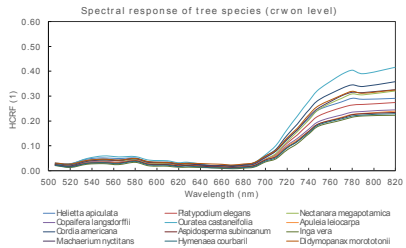
- Spectral response of eight tree species



| λ (nm) | FWHM (nm) | λ (nm) | FWHM (nm) |
|----------------|-----------|----------------|-----------|
| 506.07 | 15.65 | 680.06 | 21.00 |
| 520.00 | 17.51 | 689.56 | 21.67 |
| 535.45 | 16.41 | 699.62 | 21.89 |
| 550.16 | 15.18 | 709.71 | 20.78 |
| 564.71 | 16.60 | 719.99 | 20.76 |
| 580.08 | 15.14 | 729.56 | 21.44 |
| 592.78 | 14.81 | 740.45 | 20.64 |
| 609.79 | 13.77 | 749.65 | 19.43 |
| 619.55 | 14.59 | 770.46 | 19.39 |
| 629.23 | 12.84 | 780.16 | 18.25 |
| 650.28 | 15.85 | 790.21 | 18.50 |
| 660.27 | 24.11 | 819.74 | 18.17 |
| 669.96 | 21.70 | | |

Spectral signature of tree species

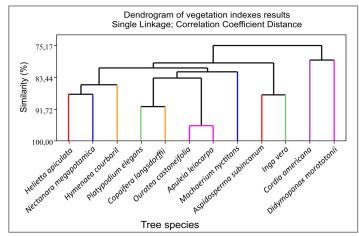
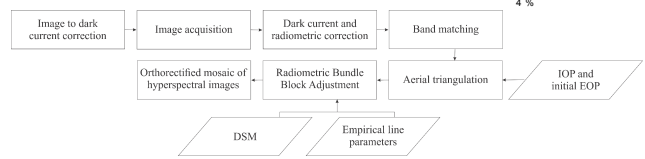
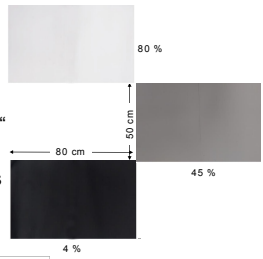
- Field work to recognize the species



Imaging acquisition and processing

- Aerial surveying realized on August 11, 2015

- Sun zenith angle: 45°30'00" to 46°00'36"
- Sun azimuth angle: 323°22'12" to 322°21'36"
- Ground Sample Distance: 11 cm
- Flight height and speed of 160 m and 4 m/s
- Radiometric reference targets
 - White, gray and black



DISCUSSIONS AND CONCLUSIONS

- This camera is able to acquire detailed spectral information of tree species
- It was noticed spectral similarity between the spectral responses and vegetation indexes helped to distinguish them
- The acquisition of high spectral and spatial resolution information can help to monitor this type of vegetation

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References:

Honkavaara, E. et al., 2013. Processing and assessment of spectrometric, stereoscopic imagery collected using a lightweight UAV spectral camera for precision agriculture. Rem. Sensing. 5(10):5006-5039.