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Mapping of invasive Acacia species in Brazilian Mussununga ecosystems using high- resolution IR remote sensing data acquired with an autonomous Unmanned Aerial System (UAS)

Jan Rudolf Karl Lehmann (1), Ondrej Zvara (2), and Torsten Prinz (2)

(1) University of Münster, Institute of Landscape Ecology, Germany (jan.lehmann@uni-muenster.de), (2) University of Münster, Institute of Geoinformatics, Germany

The biological invasion of Australian Acacia species in natural ecosystems outside Australia has often a negative impact on native and endemic plant species and the related biodiversity. In Brazil, the Atlantic rainforest of Bahia and Espirito Santo forms an associated type of ecosystem, the Mussununga. In our days this biologically diverse ecosystem is negatively affected by the invasion of Acacia mangium and Acacia auriculiformis, both introduced to Brazil by the agroforestry to increase the production of pulp and high grade woods. In order to detect the distribution of Acacia species and to monitor the expansion of this invasion the use of high-resolution imagery data acquired with an autonomous Unmanned Aerial System (UAS) proved to be a very promising approach. In this study, two types of datasets - CIR and RGB – were collected since both types provide different information. In case of CIR imagery attention was paid on spectral signatures related to plants, whereas in case of RGB imagery the focus was on surface characteristics. Orthophoto-mosaics and DSM/DTM for both dataset were extracted. RGB/IHS transformations of the imagery's colour space were utilized, as well as NDVIblue index in case of CIR imagery to discriminate plant associations. Next, two test areas were defined in order validate OBIA rule sets using eCognition software. In case of RGB dataset, a rule set based on elevation distinction between high vegetation (including Acacia) and low vegetation (including soils) was developed. High vegetation was classified using Nearest Neighbour algorithm while working with the CIR dataset. The IHS information was used to mask shadows, soils and low vegetation. Further Nearest Neighbour classification was used for distinction between Acacia and other high vegetation types. Finally an accuracy assessment was performed using a confusion matrix. One can state that the IHS information appeared to be helpful in Acacia detection while the surface elevation information in case of RGB dataset was helpful to distinguish between low and high vegetation types. The successful use of a fixed-wing UAS proved to be a reliable and flexible technique to acquire ecologically sensitive data over wide areas and by extended UAS flight missions.