

## Abstract

Invasive alien plants, like the introduced *Acacia mangium* Willd. in Brazil, can be a threat for the native biodiversity and can cause environmental and economic damage. This study intends to discriminate *A. mangium* in a Brazilian Mussununga ecosystem by use of WorldView-2 multispectral satellite data. The Mussununga belongs to the Atlantic Rainforest, contains sandy soils where woody vegetation is growing and is water and nutrient limited. The satellite image was acquired for a 6 ha area located 23 km west of Caravelas in the State of Bahia, Brazil. The image was enhanced by ATCOR-2, which was implemented in remote sensing software ERDAS Imagine. After creating training sample layers with areas of interest, the Signature Editor was used to extract spectrum-based features of the target and background objects. To fit the different pixels of the image in specific classes, a supervised classification was used with maximum likelihood as parametric rule. For evaluation a Signature Separability, Contingency Matrix and an Accuracy Assessment were done. The assessment showed a good allocation of the pixels into the classes and an overall accuracy of 86 % to detect *A. mangium* in the field. Additionally, other filtering functions in ERDAS Imagine were used to improve the classification, but without achieving better results. The applied spectral matching image analysis in this study demonstrates a good recognition and classification of *A. mangium* on a broad scale. In specific areas, like in the Mussununga ecosystem in Brazil, the tree crowns are required to have a minimum size of 2.7 m in diameter in order to be recognized by this analysis.

**Keywords:** Classification, Drone, ERDAS Imagine, Ground Truthing, Invasive alien plants, Remote sensing, Spectral Matching Image Analysis

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## 1. Introduction

Invasive alien plants are plants which are introduced to an ecosystem where they are non-native “and which may cause economic or environmental harm or adversely affect human health” (CBD, 2009). They can be a threat to the native biodiversity with a negative impact on the species richness, their environment, disturbing the nutrient cycling, and resulting in high financial costs and management effort (Aguiar Jr. et al., 2014; Vitousek et al., 1996). Therefore, a good monitoring is important to locate the plants and to control and manage them effectively.

In this case, remote sensing presents a quick, low cost, and time effective method for the monitoring of the plants distribution and furthermore a method for modelling the future spreading (Tomar et al., 2013; He et al., 2011). The main issue - working with satellite data - is to discriminate vegetation, which is spectrally similar to each other (Marshall et al., 2012; Albertz, 2009). Luckily, invasive plants usually have a different appearance than the native landscape and therefore make it possible to discriminate them from their surrounding vegetation (Amaral et al., 2015). The image of the study area was recorded by the WorldView-2

satellite, which launched in 2009. The satellite is equipped with a high resolution (0.5 m) panchromatic and an 8-band multispectral sensor with a resolution of 2 m (DigitalGlobe, 2013).

Native to Australia, Papua New Guinea and Indonesia (Pagad, 2008), *Acacia mangium* Willd. was introduced to Bangladesh, India, Hawaii and most of all to Africa (CABI, 2014; Richardson et al., 2011). *Acacia mangium* was also introduced to Brazil for commercial plantations. In these regions, the plant has similar bioclimatic conditions like in its native range that is fundamental for a successful introduction (Richardson et al., 2011). Brazil uses the plant for paper, tannin (tanbark), wood fuel, charcoal or timber and it has become a major importance for their economy (ICRAF, 2016; Maslin & Grace, n.d.). Spreading from these plantations onto unused land, the tree acts as a pioneer species, unfortunately affecting most provisioning services negatively and becoming a serious threat to biodiversity (Aguiar Jr. et al., 2014; Kull et al., 2011; Le Maitre et al., 2011). In particular, the negative effects of Australian acacias, where *A. mangium* inherent, are widely documented. As invaders in native ecosystems they reduce stream flows and native species,