

Towards a semi-automated mapping of Australia native invasive alien Acacia trees using Sentinel-2 and radiative transfer models in South Africa

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**Abstract:**

Invasive alien plants (IAPs) threaten biodiversity and critical ecosystem services worldwide. There is, therefore, an urgent need to develop intervention measures to control the spread of IAPs. Efforts to control and monitor the spread of IAPs would require their current and detailed distribution over a large geographic area. Recently launched multispectral instrument on-board Sentinel-2 provides free data with good spatiotemporal and spectral resolution, compared to Landsat datasets. The Sentinel-2 dataset, therefore, can be a useful source of the IAPs spatial information required for detection and monitoring purposes. We combined Sentinel-2 data with a radiative transfer model to discriminate IAPs (*Acacia mearnsii* and *Acacia dealbata*) from surrounding native tree species in Van Reenen, KwaZulu-Natal, South Africa. The forward mode of combined PROSPECT leaf optical properties model and SAIL canopy bidirectional reflectance model, also referred to as PROSAIL was used to simulate reflectance corresponding to bands of Sentinel-MSI, while the PROSAIL model inversion retrieved leaf area index (LAI) and canopy chlorophyll contents (CCC) of the IAPs and native species. Both reflectance and retrieved properties were used to map the distribution of the species within the study area. Our results showed that *A. mearnsii* and *A. dealbata* could be accurately discriminated from the surrounding native trees using integrated PROSAIL Sentinel-2 based model. We found that CCC- and LAI-based (% accuracy = 92.8%, 91.4% for CCC and LAI, respectively) modelling produced a higher classification accuracy than field sampling-based modelling (Accuracy = 90.2% (IAP), 82.2% (NAT) and kappa coefficient = 0.84 (IAP), 0.78 (NAT)). Simulated bands corresponding to Sentinel-2 data, on the other hand, produced species maps comparable to field sampling-based maps. Overall, the integrated PROSAIL Sentinel-2 inversion approach proved suitable for detecting and mapping IAPs over a large area. Due to the high spatiotemporal coverage of Sentinel-2, satellite images, the model developed showed the potential to contribute to the IAPs monitoring systems.