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Multi-phenology WorldView-2 imagery improves remote sensing of savannah tree species

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ABSTRACT:

Biodiversity mapping in African savannah is important for monitoring changes and ensuring sustainable use of ecosystem resources. Biodiversity mapping can benefit from multi-spectral instruments such as WorldView-2 with very high spatial resolution and a spectral configuration encompassing important spectral regions not previously available for vegetation mapping. This study investigated i) the benefits of the eight-band WorldView-2 (WV-2) spectral configuration for discriminating tree species in Southern African savannah and ii) if multiple-images acquired at key points of the typical phenological development of savannahs (peak productivity, transition to senescence) improve on tree species classifications. We first assessed the discriminatory power of WV-2 bands using interspecies-Spectral Angle Mapper (SAM) via Band Add-On procedure and tested the spectral capability of WorldView-2 against simulated IKONOS for tree species classification. The results from interspecies-SAM procedure identified the yellow and red bands as the most statistically significant bands ($p = 0.000251$ and $p = 0.000039$ respectively) in the discriminatory power of WV-2 during the transition from wet to dry season (April). Using Random Forest classifier, the classification scenarios investigated showed that i) the 8-bands of the WV-2 sensor achieved higher classification accuracy for the April date (transition from wet to dry season, senescence) compared to the March date (peak productivity season) ii) the WV-2 spectral configuration systematically outperformed the IKONOS sensor spectral configuration and iii) the multi-temporal approach (March and April combined)

improved the discrimination of tress species and produced the highest overall accuracy results at 80.4%. Consistent with the interspecies-SAM procedure, the yellow (605 nm) band also showed a statistically significant contribution in the improved classification accuracy from WV-2. These results highlight the mapping opportunities presented by WV-2 data for monitoring the distribution status of e.g. species often harvested by local communities (e.g. *Sclerocharya birrea*), encroaching species, or species-specific tree losses induced by elephants.