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Savannah fractional woody vegetation cover mapping with optical and radar data and machine learning

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The fraction of woody vegetation plays an important role in natural and anthropogenic processes of savannah ecosystems. We investigate the optimal combination of Landsat optical and thermal bands as well as ALOS PAL-SAR L-band radar data from both wet and dry seasons for the mapping of fractional woody vegetation cover in southern African savannah environments. We employ colour aerial photography for sampling and validation and a random forest classification approach to map the fraction of woody cover in the Northwest Province of South Africa. Our results from random forests classifications show that the most accurate estimates are produced from the model that incorporates all parameters: Landsat optical and thermal bands and vegetation indices for the dry and wet seasons, and HH and HV polarised ALOS PALSAR L-band data. However, the combination of the six Landsat bands from either the wet or the dry season with either the HH or the HV PALSAR band, appears to be sufficient for achieving fractional woody cover balanced accuracies of >85%. Dry season optical bands alone are able to map fractional woody cover with more than 80% balanced accuracy. Our findings can provide much needed assistance to woody vegetation monitoring efforts in southern African savannahs where its expansion over the last decades is partly attributed to bush encroachment and land degradation brought about by recent climatic changes and/or land mismanagement.