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Comparison of Landsat 8 OLI and Landsat 7 ETM+ for estimating grassland LAI using model inversion and spectral indices: case study of Mpumalanga, South Africa

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ABSTRACT:

The leaf area index (LAI) is the key biophysical indicator used to assess the condition of rangeland. In this study, we investigated the implications of narrow spectral response, high radiometric resolution (12 bits), and higher signal-to-noise ratio of the Landsat 8 Operational Land Imager (OLI) sensor for the estimation of LAI. The Landsat 8 LAI estimates were compared to that of its predecessors, namely Landsat 7 Enhanced Thematic Mapper Plus (ETM+) (8 bits). Furthermore, we compared the radiative transfer model (RTM) and spectral indices approaches for estimating LAI on rangeland systems in South Africa. The RTM was inverted using artificial neural network (ANN) and lookup table (LUT) algorithms. The accuracy of the models was higher for Landsat 8 OLI, where ANN (root mean squared error, RMSE = 0. 13; R2 = 0. 89), LUT (RMSE = 0. 25; R2 = 0. 50), compared to Landsat 7 ETM+, where ANN (RMSE = 0. 35; R22 = 0. 60), LUT (RMSE = 0. 38; R2 = 0. 50). Compared to an empirical approach, the RTM provided higher accuracy. In conclusion, Landsat 8 OLI provides an improvement for the estimation of LAI over Landsat 7 ETM+. This is useful for rangeland monitoring.