Incorporating Remote Sensing as a Tool to Assist Rehabilitation Monitoring in a Dolomite Mining Operation in South Australia

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SUMMARY

Monitoring for rehabilitation success in the mining industry has grown in use and relevance in recent years. Remotely sensed data are considered as a reliable alternative for the field-based monitoring methods which are usually expensive and time-consuming. This study conducted at the Ardrossan Dolomite Operation (ADM) in South Australia, utilises freely available Landsat Thematic Mapper (TM) and Enhanced Thematic Mapper (ETM+) satellite images of last 13 years to monitor and assess the status of permanent re-vegetation using different spectral derivatives including vegetation indices, reflectance and reflectance transformation. Four vegetation indices namely - the Simple Ratio (SR), Tasseled Cap Greenness/Brightness (TC G/B), Normalized Difference Vegetation Index (NDVI) and Inverse Band 3 (B3I) were evaluated through Landsat images, and then compared against high-resolution contemporary Google EarthTM imagery as well as ground based observations to evaluate the utility of each spectral derivative for this task. The NDVI was found more robust among the four spectral derivatives and was consequently used to analyse the time series (2000-2012) of the imagery to monitor the relative health of the re-vegetation at the ADM. Satellite image driven results were further compared with ground-based photographs, historical rainfall records and the conventional monitoring data of the mine site. The results indicated that the use of remotely sensed data can be useful for monitoring the health of re-vegetated areas where the vegetation dominates the ground area of the pixel, e.g. NDVI more than 0.2. However, for the areas where the vegetation cover decreases, e.g. NDVI lower than 0.2, the remotely sensed data failed to map the ground conditions. It seems this issue originated from the coarser spatial resolution (30m) of the Landsat data, which contaminates the spectra of vegetation with the presence of soil. Furthermore, NDVI showed a strong correlation with historical rainfall records and clearly quantified the severity of the 2006 drought on the rehabilitated areas.