Feasibility of eco-environmental gradient information extraction with imaging spectroscopy in karst region, Southwest China

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ABSTRACT

As band widths are narrow and range of spectra is wide, subtle differences in spectral features can be extracted and used for mapping physical and chemical properties of bare substrate with imaging spectroscopy. However, the use of spectral characteristics of substrates is not accessible if substrate was covered by vegetation. In this study, we explored the feasibility of extracting karst eco-environmental gradient with covered vegetation spectral properties.

Eco-environmental factors (slope, aspect, altitude, soil moisture, organic matter (SOC), pH and calcium carbonate content (Ca)) and vegetation biochemical materials were recorded simultaneously with the collection of vegetation reflectance spectra. Data collection took place during May 1-8, 2008, which was in the peak growing season. The sampling plot was random to cover a relative homogeneous vegetation species and contain different eco-environmental gradient. *t-tests* and derivative reflectance spectra were used to analyzed the vegetation spectral differences along the eco-environmental gradient, while Canonical correspondence analysis (CCA) was exploited to explore the relationship between vegetation spectra and eco-environmental factors.

The results showed that there were significant differences between spectral features of vegetation mainly distributed in karst and non-karst regions, and combination of 1300-2500 nm reflectance and 400-700 nm first derivative spectra could delineate vegetation mainly distributed in karst and non-karst region. CCA successfully assessed to what extent the variation of vegetation spectral features

can be explained by associated eco-geo-environmental variables， and it was found that soil moisture and calcium carbonate contents had the most significant effects on vegetation spectral features in karst region. Along with the gradient for soil water and calcium carbonate content, the most of sampling plots of vegetation reflectance were apparently plotted out with two groups by CCA ordination diagram. CCA ordination diagram successfully distributed the vegetation spectral features along the main eco-environmental gradient of karst and non-karst regions. Vegetation spectra thus well illuminated the eco-environmental gradient in karst region.

Our study indicates that vegetation spectra is tightly linked to eco-environmental gradient and CCA is an effective means of studying the relationship between vegetation spectral features and eco -environmental variables. Employing a combination of spectral and spatial analysis, it is anticipated that imaging spectroscopy can be used in interpreting or mapping eco-environmental gradient covered with vegetation in karst region.

Keywords: Reflectance spectra, eco-environmental gradient, Canonical correspondence analysis, imaging spectroscopy, karst, Southwest China