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Imaging Spectroscopy: a new era for biodiversity science and conservation

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ABSTRACT:

A thorough understanding of the patterns, causes and consequences of terrestrial ecosystem dynamics is important in light of the current concerns to secure ecosystem service provision in face of Global Change. This understanding has been difficult to achieve, however, due largely to a lack of standardized spatially and temporally explicit information on various ecosystem features. For 30 years now, remote sensing capacity has been available that could enable rigorous global monitoring of key ecosystem features. Yet, to date, the full potential of optical remote sensing data is still not fully exploited where it concerns the monitoring of dynamic vegetative systems. The most critical bottleneck for the detailed monitoring of these ecosystems using traditional remote sensing technology is that image interpretation is complicated by the high spectral similarity between different co-occurring plant species. The lack of spectral detail provided by traditional space-borne sensors prevents as such a detailed characterization of ecosystem state. In this presentation we will elaborate on the potential of imaging spectroscopy for biodiversity science and conservation. The high spectral detail provided by these new generation sensors allows making a better discrimination between subtle physiological changes among plant species, whereas the systematic revisits of currently available and upcoming space-borne sensors allow for a continuous monitoring of ecosystem changes. We will give an overview of state-of-the-art hyperspectral image analysis techniques to study biodiversity dynamics in tropical forests as well as temperate ecosystems. First, we examine recent modelling studies that have advanced our understanding of leaf and canopy reflectance spectra in relation to plant biochemistry. Second, we present recent examples of how hyperspectral image processing techniques are applied to characterize vegetation canopies, communities and ecosystems. Finally, we demonstrate the added value of hyperspectral time series analyses for biodiversity mapping and monitoring.

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