
Bringing image-based methods into the assessment of riparian ecosystems health

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Abstract

Riparian vegetation drives flow regime, water quality, habitat and biota in freshwater ecosystems. In this presentation, we summarize ten years of research on image-based methods to characterize riparian ecosystems health, in Mediterranean areas, from spatial, temporal and spectral perspectives. Structural and compositional indicators of riparian vegetation, such as the lateral and longitudinal continuity, diversity and naturalness of vegetation were assessed using a combination of remote sensing techniques, GIS, landscapes metrics and historical cartography. Results showed that spatial resolution and especially high-scale resolution (< 2m pixel size) is mandatory to achieve accurate classifications due to the small width of Mediterranean riparian zones and high spatial complexity of riparian communities. In addition, the linear nature of these ecosystems constrains remote sampling procedures and restrains the selection of classification methodologies, such as object-based approaches. Nevertheless, riparian vegetation show peculiar phenological, structural and physiological traits, at species and community level, with clear implications in the spectral behaviour, that can be used to improve the remote detection of these communities. Particularly, spectral separability analysis, using aircraft or satellite multispectral data, are able to distinguish between riparian species, namely alder, willow and oleander based solely on their optical traits. However, to distinguish similar native and alien invasive stands, hyperspectral data and complementary phenological information are required. For instance, the spectral distinction of the invasive alien species *Arundo donax*, from the alike native species *Phragmites australis* can only be obtained in a reduce number of wavelengths located in near infrared region. Likewise, image-based methods, combined with the application of landscape metrics, to actual and historical cartography allowed the remote characterization of near-natural and impaired riparian areas using solely structural parameters. Well-preserved riparian woodlands are characterized by large and highly complex vegetation patches while riparian zones invaded by alien species usually showed monospecific and elongated stands.

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