Stable isotopes as early indicators of high impact after plant invasion: A remote sensing perspective

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High impact invasive plant species, such as the N-fixing and water-spending tree Acacia longifolia, are a major threat to ecosystem functioning worldwide. For example, Acacia's impact on nutrient and water-cycling in Mediterranean dune ecosystems is well understood. However, early detection of such impacts remains challenging. Therefore, novel approaches are required to map functional indicators of high invader impact. Here, we tested in a real world context if the stable isotopes δ¹³C and δ¹⁵N could be such mappable indicators. First, we show that A. longifolia differs regarding its biochemical leaf traits from the native species of the same growth form particularly regarding leaf N content as well as δ¹³C and δ¹⁵N. This may indicate a high impact on N and water cycling, and can be retrieved from hyperspectral data. Second, the impact of the invader on N cycling was mapped joining the spatial distribution of δ¹⁵N with airborne laserscanning data. Foliar δ¹⁵N of a non-fixing, native species increased in vicinity of invasive stands indicating an uptake of N previously fixed by the invader. Finally, those impacts possibly result in an increase of productivity of the whole dune ecosystem even when invader cover is low. This increase can be mapped integrating hyperspectral imagery with LiDAR data. Thus, there is potential to retrieve functional indicators of high impact including stable isotopes using remote sensing.