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Mapping biological soil crusts for understanding their functional relevance in dryland ecosystems

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Biological soil crusts (BSCs) are considered a key element in the functioning of arid and semiarid ecosystems as they modify numerous soil surface properties involved in primary ecosystem processes such as hydrological and erosion processes, and nutrient cycling.. It is known that arid and semiarid ecosystems are conformed by a complex matrix of vegetated and open ground patches usually covered by BSCs. Geomorphic evolution of drylands depends on the individual response of patches and also on the interactions and feedback-processes among patches. These interactions are controlled by patch spatial distribution. On this account, to understand the role of BSCs in the system, it is necessary to introduce their effect at coarser scales, and to have accurate and spatially continuous information of BSC distribution. The inherent complexity and the spatial heterogeneity of drylands make field survey methods very limited for BSC mapping. Images reported by remote sensors are presented as a powerful tool for mapping BSC spatial distribution. Remote sensors provide synoptic and spatially continuous information of the territory. Different indices for mapping BSCs have been published. These indices are based on distinctive spectral characteristic of BSCs and differ in nature and objectives. The aim of this work was to analyze the feasibility of some of these indices in a semiarid area characterized by sparse vegetation cover usually mixed at subpixel level with elements characterized by very similar spectral response (bare soil, BSCs and dry vegetation). These indices were: i) CRCIA, index applied for mapping BSCs from hyperspectral images. ii) CI, index developed for mapping of cyanobacteria-dominated BSCs and iii) BSCI, index for mapping of lichen-dominated BSCs. The multispectral indices (CI and BSCI) classified as BSCs 50% of the pixels dominated by BSCs. The CRCIA hyperspectral index, showed better results than those obtained with multispectral indices. This index correctly classifyed as BSCs the 75% of the pixels dominated by BSCs. All indices showed omission errors in pixels with high vegetation cover, due to masking of the spectral response of BSCs by vegetation. . The results reported by this work show that BSC spectral features can be used for a feasible cartography of their cover using remote sensing images. The precision and accuracy of this cartography greatly depends on the spatial and spectral resolution of the image. More effort is needed to develop a correct methodology to distinguish BSC cover at sub pixel scale, which represents an important challenge for future applications on geomorphologic dynamics and ecosystem functioning of arid and semiarid regions.