Multi-scale Geographic Object-Based Image Analysis (GEOBIA) Approach to Segment a Very High Resolution Images for Extraction of New Degraded Zones. Application to The Region of Mécheria in The South-West of Algeria

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Abstract : A considerable area of Algerian lands are threatened by the phenomenon of wind erosion. For a long time, wind erosion and its associated harmful effects on the natural environment have posed a serious threat, especially in the arid regions of the country. In recent years, as a result of increases in the irrational exploitation of natural resources (fodder) and extensive land clearing, wind erosion has particularly accentuated. The extent of degradation in the arid region of the Algerian Mécheriadepartment generated a new situation characterized by the reduction of vegetation cover, the decrease of land productivity, as well as sand encroachment on urban development zones. In this study, we attempt to investigate the potential of remote sensing and geographic information systems for detecting the spatial dynamics of the ancient dune cords based on the numerical processing of PlanetScope PSB.SB sensors images by September 29, 2021. As a second step, we prospect the use of a multi-scale geographic object-based image analysis (GEOBIA) approach to segment the high spatial resolution images acquired on heterogeneous surfaces that vary according to human influence on the environment. We have used the fractal net evolution approach (FNEA) algorithm to segment images (Baatz&Schäpe, 2000). Multispectral data, a digital terrain model layer, ground truth data, a normalized difference vegetation index (NDVI) layer, and a first-order texture (entropy) layer were used to segment the multispectral images at three segmentation scales, with an emphasis on accurately delineating the boundaries and components of the sand accumulation areas (Dune, dunes fields, nebka, and barkhane). It is important to note that each auxiliary data contributed to improve the segmentation at different scales. The silted areas were classified using a nearest neighbor approach over the Naâma area using imagery. The classification of silted areas was successfully achieved over all study areas with an accuracy greater than 85%, although the results suggest that, overall, a higher degree of landscape heterogeneity may have a negative effect on segmentation and classification. Some areas suffered from the greatest over-segmentation and lowest mapping accuracy (Kappa: 0.79), which was partially attributed to confounding a greater proportion of mixed siltation classes from both sandy areas and bare ground patches. This research has demonstrated a technique based on very high-resolution images for mapping sanded and degraded areas using GEOBIA, which can be applied to the study of other lands in the steppe areas of the northern countries of the African continent.

Keywords : land development, GIS, sand dunes, segmentation, remote sensing
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