Assessment of Rangeland Condition in a Dryland System Using UAV-Based Multispectral Imagery

Authors : Vistorina Amputu, Katja Tielboerger, Nichola Knox

Abstract : Primary productivity in dry savannahs is constraint by moisture availability and under increasing anthropogenic pressure. Thus, considering climate change and the unprecedented pace and scale of rangeland deterioration, methods for assessing the status of such rangelands should be easy to apply, yield reliable and repeatable results that can be applied over large spatial scales. Global and local scale monitoring of rangelands through satellite data and labor-intensive field measurements respectively, are limited in accurately assessing the spatiotemporal heterogeneity of vegetation dynamics to provide crucial information that detects degradation in its early stages. Fortunately, newly emerging techniques such as unmanned aerial vehicles (UAVs), associated miniaturized sensors and improving digital photogrammetric software provide an opportunity to transcend these limitations. Yet, they have not been extensively calibrated in natural systems to encompass their complexities if they are to be integrated for long-term monitoring. Limited research using drone technology has been conducted in arid savannas, for example to assess the health status of this dynamic two-layer vegetation ecosystem. In our study, we fill this gap by testing the relationship between UAV-estimated cover of rangeland functional attributes and field data collected in discrete sample plots in a Namibian dryland savannah along a degradation gradient. The first results are based on a supervised classification performed on the ultra-high resolution multispectral imagery to distinguish between rangeland functional attributes (bare, non-woody, and woody), with a relatively good match to the field observations. Integrating UAV-based observations to improve rangeland monitoring could greatly assist in climate-adapted rangeland management.