MONITORING OF VEGETATION SPATIO-TEMPORAL HETEROGENEITY WITH UNMANNED AIRCRAFT SYSTEMS

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Abstract

In our work we have reviewed state in the art scientific papers which put emphasis on the spatio-temporal heterogeneity of ecosystems and employed unmanned aircraft system. At the end 68 scientific papers were used for analysis with study plots from whole world. We have analysed characteristics of the study sites, parameters of the UAS, sensors, final data obtained and which ecosystem were addressed.

Keywords: unmanned aircraft system, unmanned aerial vehicle, vegetation monitoring, heterogeneity, ecosystem, spatial resolution, temporal resolution.

Within the HARMONIOUS COST Action, we have focused on two particular and most important benefits that unmanned aircraft system provides within research focused on vegetation monitoring. Firstly, the spatial resolution which can range from millimetres to meters and secondly the temporal resolution which can range from minutes to years. These capabilities must be set correctly in order to guarantee efficiency together with full coverage of the study area taking also into account with the level of spatial and temporal heterogeneity of observed phenomena.

We have analysed most of the recent research articles which focused on survey of different kind of ecosystems by UAS with emphasis on the ecosystem heterogeneity, across the whole world. Within the papers we have analysed characteristics of the study sites and also the parameters of the UAS, sensors and data obtained. Furthermore, we analysed how authors addressed challenges and benefits offered by UAS.

We have found out that the choice of the spatial resolution used across studies is based on technical parameters and it is not set based on the ecosystem heterogeneity. This choice can have profound effect on the results of any particular study. Furthermore, within the studies it is mainly the state of the ecosystem heterogeneity addressed for both spatial and temporal. RGB cameras are the majority but we can see other sensors are on the rise (for example UAS Lidar). Within almost all reviewed studies the ground sampling distance was under 10 cm and majority was under 5 cm (median was 4.6 cm).

The UAS together with accurate and high-resolution sensor is technology which is suitable to survey and monitor state of the vegetation and their dynamics on very detail scale. Either from spatial or temporal perspective. On the other hand, there is still high level of uncertainty with decision on how to use the correct hardware and data acquisition parameters based on the observed phenomena. Furthermore, authors should focus more on the dynamics or functions of the ecosystem.

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