Assessing pine processionary moth defoliation using unmanned aerial systems

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ABSTRACT

Pine processionary moth (PPM) is a common destructive pest in the Mediterranean for many conifers, causing losses of vitality and growth during outbreaks and eventually the death of individuals. PPM has shown a meaningful spread of the outbreak area both northward and upward in Europe in the last decades, aggravated by extreme climatic events. Spatial and temporal monitoring of PPM impacts on forests is a growing need in forest ecology and management to assess the spread patterns, levels of defoliation and understand the dynamics of the insect to help identify adequate measures in minimizing the negative impacts on forest health and industry. High resolution image processing using remote sensing technology on unmanned aerial systems (UAS) has been proposed as a cost efficient method to assess impacts of insect outbreaks. UAS acquired imagery were used to identify healthy, infested and completely defoliated trees, assessing the level of defoliation at tree-level scale, analyzing ecological patterns in PPM nest and defoliation distribution. Results suggest that defoliation estimates on pines using UASs are robust and allow deriving field-based, infestation indices used by forest technicians with high reliability. Our approach provides PPM impact assessments with a more efficient data acquisition method in terms of time and staff allowing the quantitative estimation of defoliation at tree-level scale in large areas due to the low acquisition cost of the images. An integrated methodology could be useful to obtain and aggregate aerial images from citizens using drones to develop innovative monitoring projects that could be eventually expanded to other pest monitoring activities. It would allow creating a network of observers to assess the spread of numerous pests, evaluate the damages and outbreaks and monitor their expansion and complement measures and monitoring from forest technicians and managers.