SOMETHING IN THE AIR – DRONE-BASED HIGH-THROUGHPUT PHENOTYPING OF TREES

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The field of forest genomics has seen unprecedented advances during the past decade. A suite of genomic resources is now available for enhanced genomic selection. These resources can be used to accelerate breeding cycles and to select genotypes that are better adapted and more resilient to future climate change and diseases. The large-scale phenotyping of populations has become the bottleneck for identifying and connecting the different genomic resources with adaptive traits in populations with thousands of trees. Measuring leaf optical properties using spectral reflectance sensors carried by remotely piloted aircraft systems (drone systems) represent an innovative approach for large-scale phenotyping of tree responses to drought, monitor phenology, and assess differences between tree genotypes in large-scale field experiments. In this presentation I will give an overview of leaf-level, canopy–level and drone based observations of leaf spectral reflectance. I will demonstrate that some of the widely used vegetation indices such as the normalized difference vegetation index (NDVI) and photochemical reflectance index (PRI) vary in their ability to adequately track important traits such as phenology or photosynthetic efficiency. Finally, I will discuss some of the technical challenges of using optical sensors when monitoring complex canopies and why using carotenoid based vegetation indices are particularly useful in order to monitor evergreen conifer canopies.