

## **Using airborne hyperspectral imagery to develop a future vegetation-targeted space mission**

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A major pillar of the UK's national response to the climate emergency is a significant increase in tree planting for a nature-based carbon capture and storage solution. Carbon storage and other vital ecosystem services provided by trees are reliant on the types of tree and their condition. As such, characterising and monitoring the UK's trees is of vital importance across a range of academic and commercial sectors. Current remote sensing of trees in the UK is limited either by the temporal and spatial resolution of free datasets or the prohibitive cost of commercial missions and so a need has been identified for a new space mission to address the requirements of the UK's tree stakeholders. Under a current National Space Innovation Program grant - TreeView - we are carrying out a feasibility study to design a mission that will deliver unprecedented vegetation data at a high enough temporal and spatial resolution to monitor trees at the individual level. This will be the UK's first Precision Forestry tool with a national focus but global potential.

As a "new space" mission with tight cost and time constraints, novel techniques must be leveraged to accelerate the design process. One such technique is a fast, high-level simulation tool for generating sensor data from high-resolution hyperspectral aerial data. We present, both as a case study for our particular use and as a technique for other future earth observation missions, a set of tools to rapidly convert a hyperspectral aerial scene to an at-sensor multispectral image, with associated noise properties. This allows modelling of different signals across space and time as well as testing associated parameter retrievals - in our case those associated with vegetation pigments, but applicable to a wide range of earth observation approaches. This simulator has proven central to our feasibility study and informs bandpass response design, sensor selection, optic design and other crucial mission parameters.