Fera UAV

Animal and Plant Health Agency (APHA) Tree Species Identification

Case Study

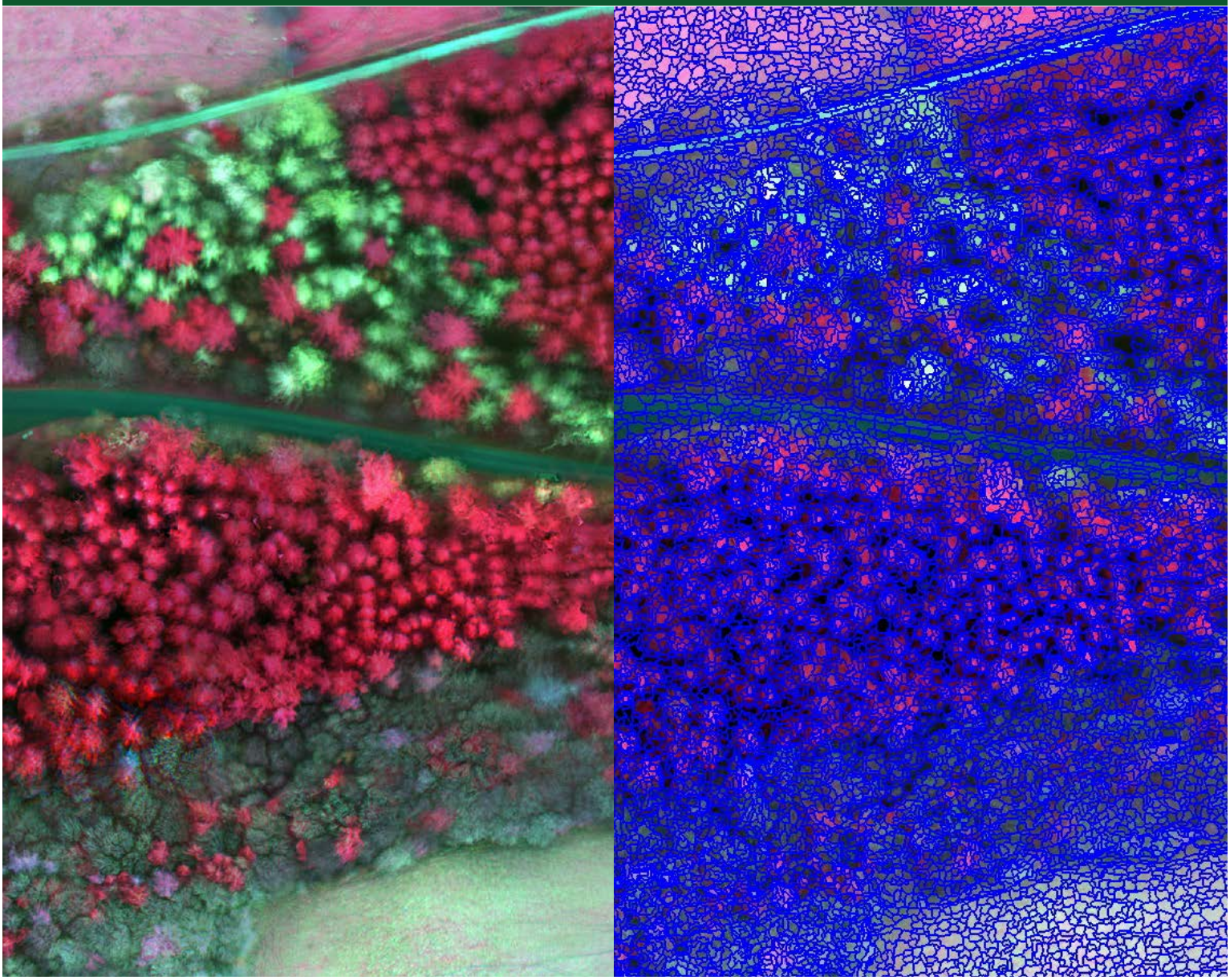
Contact us
Tel: +44 (0)1904 465731
Email: UAV@fera.co.uk
www.fera.co.uk/remote-sensing-and-mapping

Project Background

APHA is an executive agency of the Department for Environment, Food and Rural Affairs (Defra). One of APHA's roles across England and Wales is to identify, monitor and prevent the spread of plant pests and diseases such as the Asian Longhorn Beetle, Oak Processionary Moth and Phytophthora. APHA do this through ground based inspections. Once a pest or disease has been identified in a specific location, APHA inspectors will walk woodland within a set radius of the initial outbreak in order to identify other host tree species of the pest or disease to check whether they are also infected. These radiuses can vary from 500m up to 1500m. Walking large areas of woodlands while looking for specific tree species in this manner is both time consuming and inefficient.

Fera has a long history of working with APHA and both organisations were keen to look in to ways in which Fera could assist in the inspection process by identifying individual tree species from Unmanned Aerial Vehicle (UAV) imagery to better target APHA ground inspections.

Figure 1 - An example section of UAV imagery pre and post segmentation.



Flight Planning

Fera acquired four band high resolution multispectral UAV imagery over a woodland area in North Yorkshire. This imagery was processed and mosaicked using Pix4D photogrammetry software. With the imagery processed, Fera used eCognition to analyse the imagery. eCognition is an image analysis package that allows Fera to perform advanced object-based data analysis. Using image segmentation methods, Fera was able to develop a rule set which segmented the imagery up into objects of similar spectral response (see figure 1).

After the initial segmentation had been conducted further conditions and thresholds were added to the rule set to identify individual objects that relate to the spectrally brightest areas of individual trees (see figure 2).

With the imagery segmented down to individual tree objects, a classification rule set was then developed and applied to these objects of brightest spectral response. This rule set used a supervised classification algorithm to classify each individual tree crown segment into tree species based on the objects spectral response. The sample data for the supervised classification was collected via ground truthing within the woodland on a sample of trees from the imagery. These samples were then used to train the classification; the spectral responses from the known sampled species were used to extrapolate the classification for all trees in the imagery.

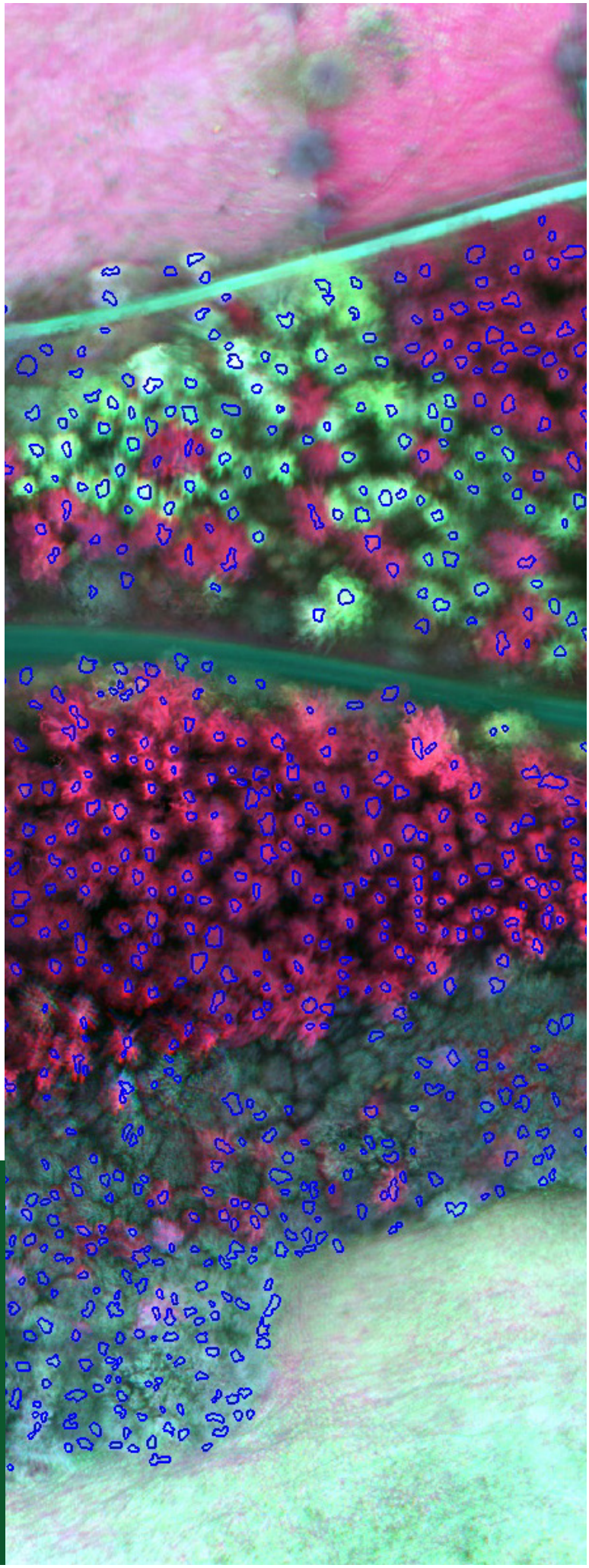


Figure 2 – Image objects relating to the spectrally brightest areas of individual tree crowns.

Output

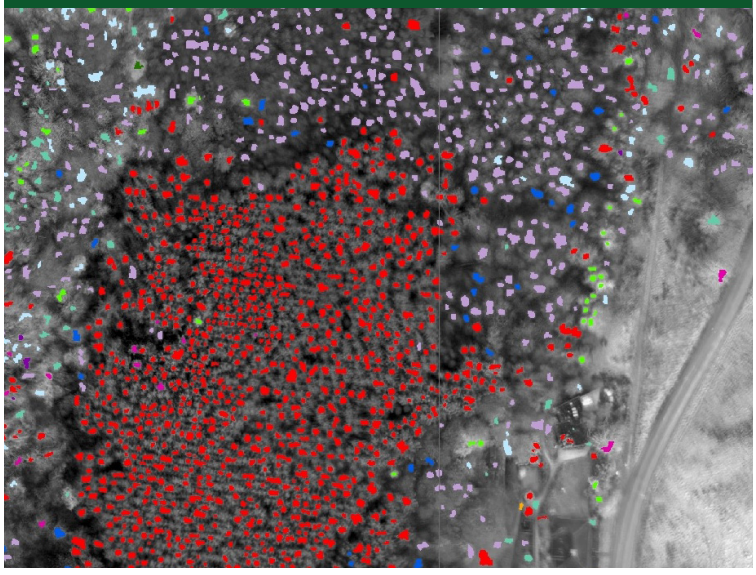
This study was able to accurately identify individual tree species from UAV imagery flown over the woodland. Figures 3a & 3b show a comparison between the collected UAV imagery and the output from the tree species classification.

These images are able to give APHA inspectors a much clearer picture to where tree species of interest are located in a specific area. Individual species of interest in a particular pest or disease outbreak zone can be extracted from the imagery and supplied to inspectors as a host species target map. Figure 4 highlights the locations of Larch trees across the imagery which would be invaluable to inspectors in the event of a Phytophthora ramorum (a disease affecting Larch trees) outbreak where inspectors would need to locate and inspect Larch trees near to a recorded finding.

The tree species data derived from the classification process can be supplied to inspectors via hard copy or soft copy maps, uploaded directly to mobile GPS devices, or supplied as web applications viewable on a desktop PC, smart phone or tablet.

Figure 3a - Collected UAV imagery

Figure 3b - Image classification using the tree species identification ruleset



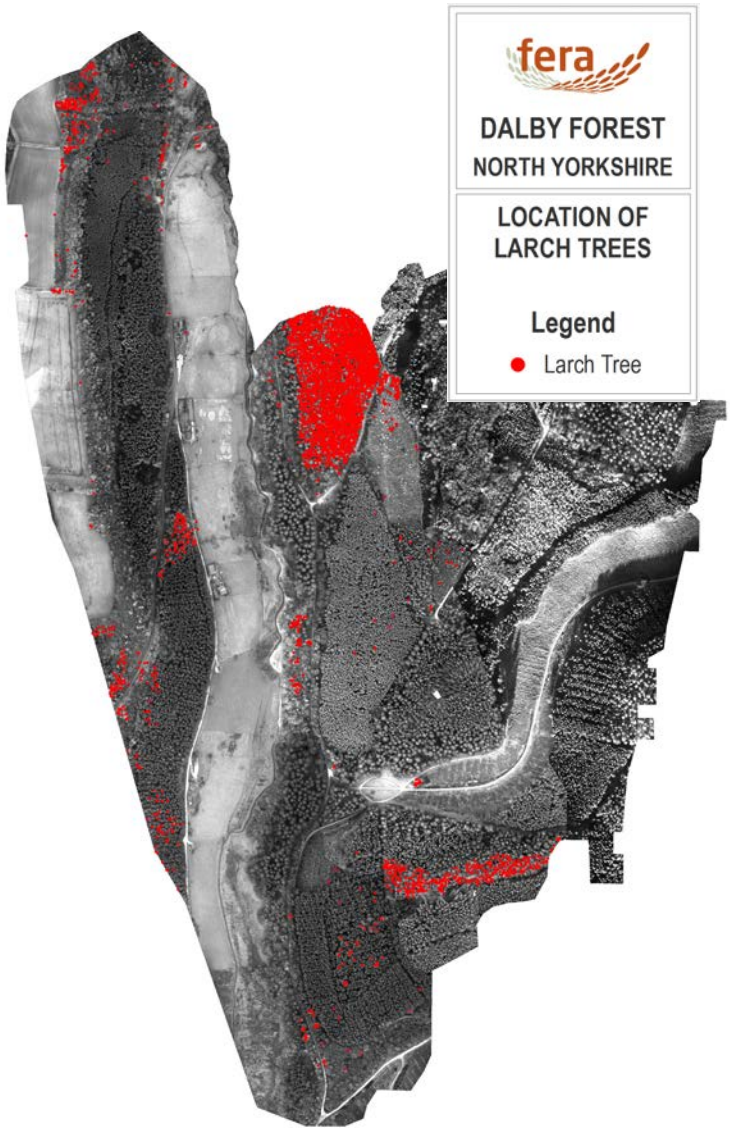


Figure 4 - Example host species target map highlighting Larch tree locations across the study site