Early Monitoring of Tree Health Status via Visible Spectrum Imaging of Tree Foliage using Unmanned Aerial Vehicles

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Introduction

Geospatial technology such as GIS, GPS, UAV, & RS is being used for monitoring potential pest & disease outbreak on large plantation area in short amount of time and without intensive labour. The objectives of this study are;

- To investigate tree health status of young *Eucalyptus pellit*a plantations using Unmanned Aerial Vehicle (UAV) technologies.
- To develop an index classification based on a VARI-green algorithm in young *Eucalyptus pellit*a plantation.
- To investigate the difference between VARI-green and normalized digital vegetation index (NDVI) in terms of index value signature relative to the tree health.

Method

- Red, blue and green image data was acquired using UAV flying a pre-programmed flight path at 129 m altitude (Figure 1).
- Image data was downloaded and processed using ArcGIS 10.3 software to produce VARI-green based map using formula (G-R)/(G+R-B), and normalized VARI-green index (Figure 2).
- Ground truth was made to verified the tree health status, the disease symptom and casual agent (figure 3).

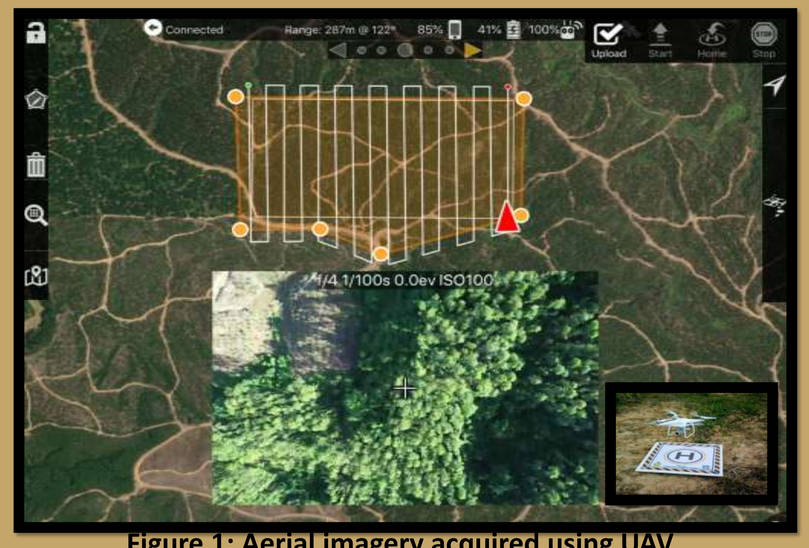
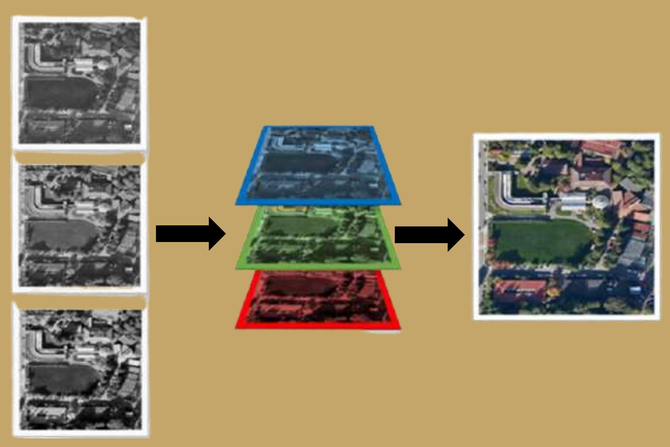


Figure 1: Aerial imagery acquired using UAV



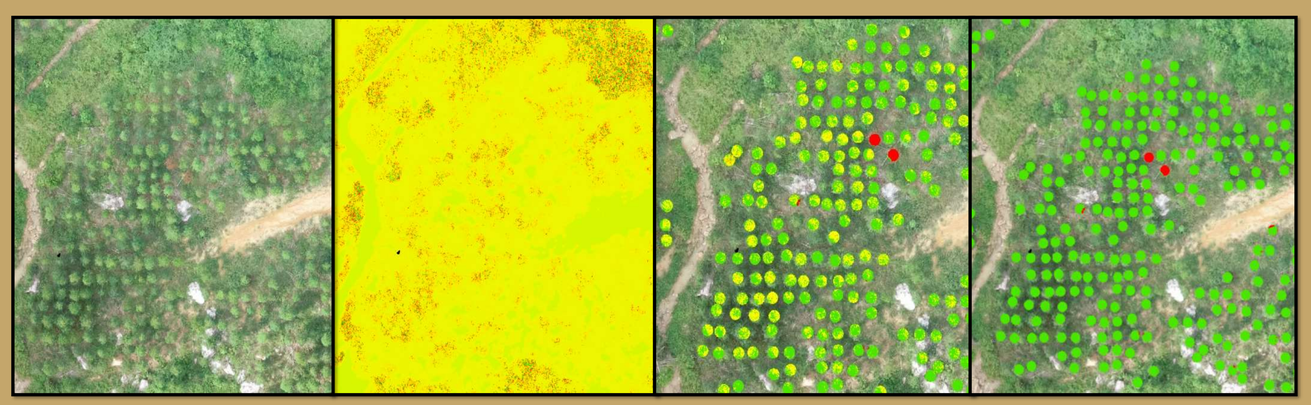


Figure 2: Developing VARI-green based map using formula (G-R)/(G+R-B), and normalized VARI-green index.

- VARI-green data was classified into four classes based on a *Crown Health* index (Figure 3).

Figure 3: Crown health classification (1-4) developed from VARI-green remote data (Left to right; -2 to 0 "Dead", 0 to 0.05 ""Severe infection", 0.06 to 0.16 "Mild infection", 0.17-2.0 "Healthy"

Results & Discussion

- In Block 42H, a total of 11,069 E.pellita trees were recorded and assigned to four classification seven were classified as a dead (-2 to 0), five were severely infected (0 to 0.05), 967 trees were mildly infected (0.06 to 0.16) and 10,090 were considered healthy (0.17 – 2.00) (figure 4).
- This study has verified the remotely-sensed VARI-green indices with proximal NDVI measure, which have shown acceptable agreement with 0.7 correlation value.

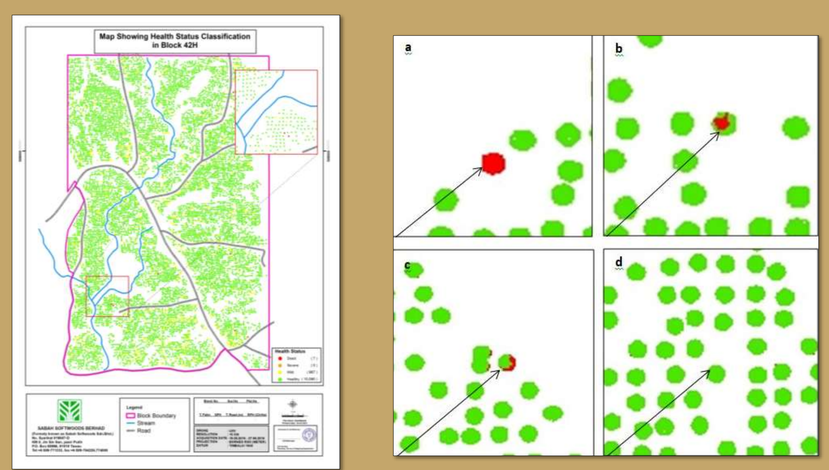


Figure 4: Tree health status map a block 42H with four classification a. Dead, b. Severally c. Mild d. Healthy

Conclusion

There are competing needs for speed and ease of monitoring large areas of planted forest. In a practical operation, aerial survey of forest health using VARI-green from RGB imaging, is a qualitative assessment that is provides information across a large area at a small expenses.

Reference

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