Automated Glasshouse Detection with Remote Sensing

Kerry Mazhindu-Page
Supervisor:- Dr. Toby Waine

Cranfield UNIVERSITY

1. Introduction

It is the responsibility of the Horticultural Development Company (HDC) to collect levies from farmers who produce high value crops. Many of these crops are grown under cover such as in glasshouses, poly-tunnels or under fleece. If it is possible to automatically detect these structures using satellite imagery, it would provide an additional way of mapping locations of high value crop production, thus improving the targeting of levy collection. The levies collected by the HDC go towards research and development within the agricultural sector benefiting the whole industry.

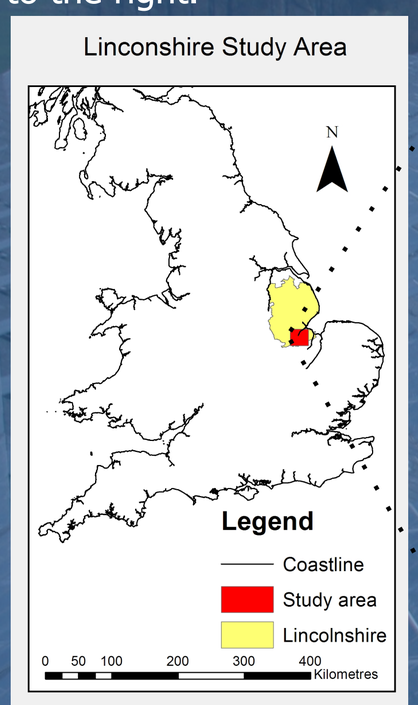
2. Aims and Objectives

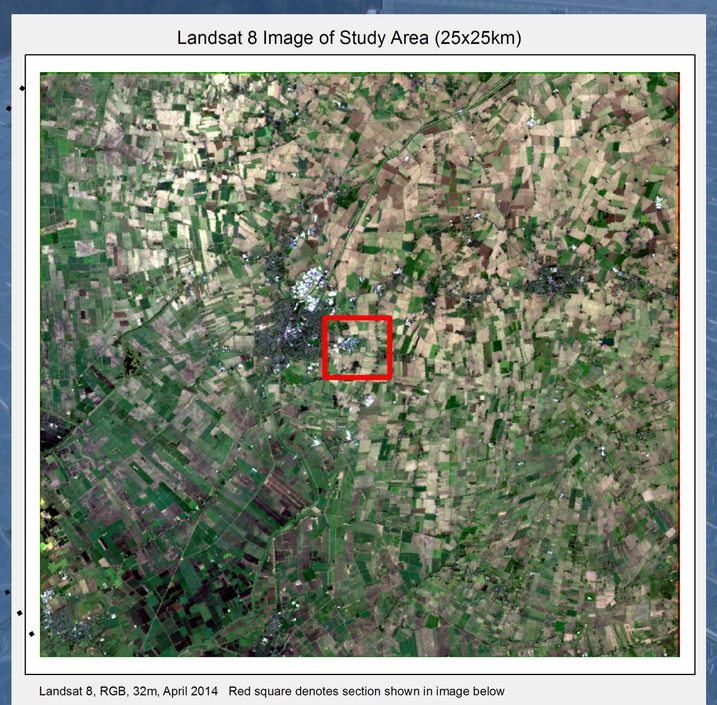
The aim of this project is to investigate the the effectiveness of using remote sensing, specifically medium resolution satellite imagery, to detect glasshouses, poly-tunnels and fleece.

- To develop a methodology to identify and discriminate glasshouses, poly-tunnels and fleece from the surrounding fields by utilising satellite remote sensing.
- To detect newly constructed and derelict glasshouse infrastructure, that can be used indicate changes in horticultural production within a selected study area.
- To make recommendations for implementing the chosen approach over the whole of the UK

3. Approach

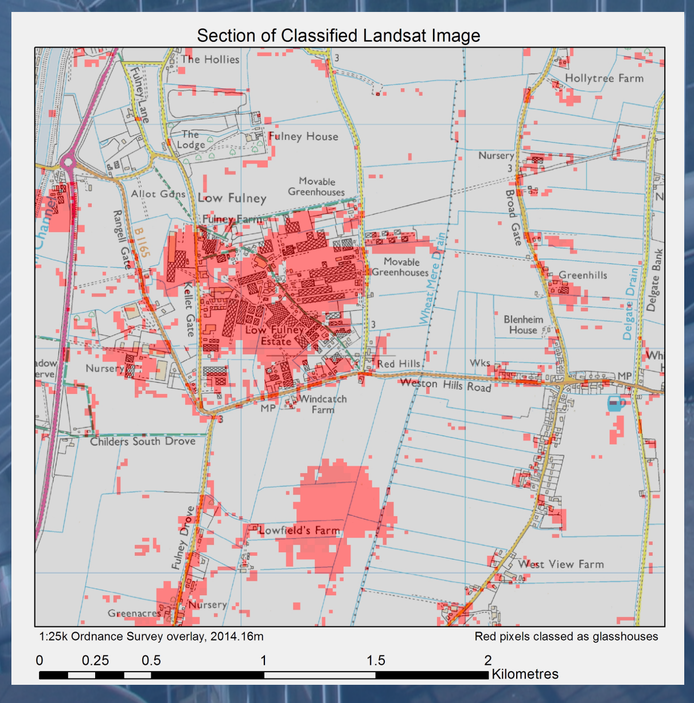
A 25x25 km Study area in Lincolnshire was selected (Study area shown below). Satellite imagery from DMC 2 and Landsat 8 was then clipped to the extent of the study area, the results are shown below to the right.





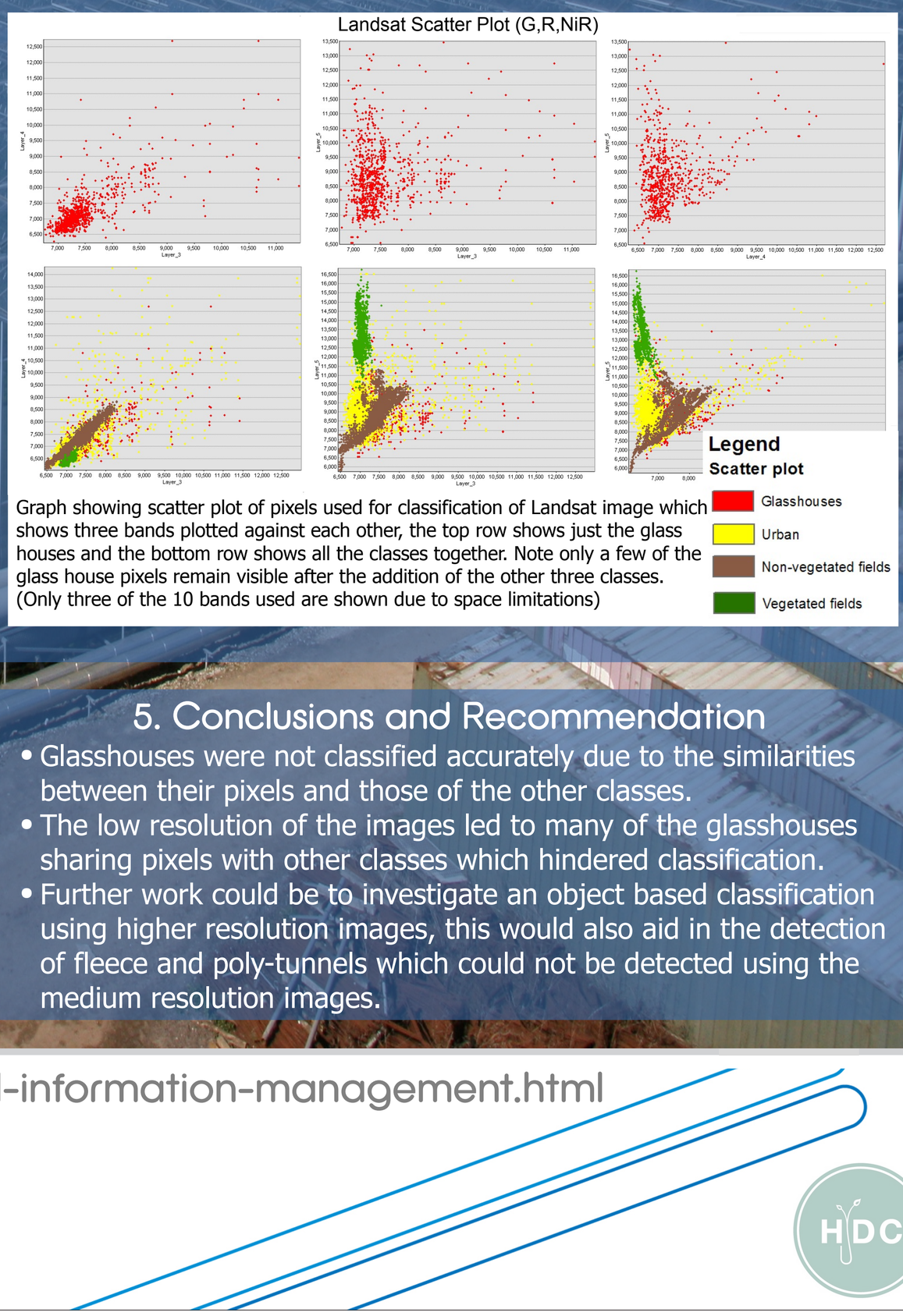
A supervised classification was then carried out on the clipped images;-

- An Ordnance Survey map (1:25k) was used as a reference to find the glass houses, spectral signatures were then derived from over 100 glasshouses large enough to be seen in the medium resolution images.
- 200 more signatures were then derived for the other land uses in the area such as urban and fields.
- A maximum likelihood classification was carried out using the spectral Signatures (the result of a classification of the Landsat imagery is on the right). Accuracy assessments were then carried out using training data.



4. Findings

- Overall accuracy of DMC and Landsat8 classifications were 62% and 74% respectively, glasshouses had low classification accuracy due spectral confusion with urban and non-vegetated field classes.
- Classifications using Landsat imagery proved to be more accurate than those done on DMC imagery. Highest accuracy achieved with DMC, Producer Accuracy (PA) =21%, User Accuracy (UA) =46%. With Landsat PA=40%, UA=62%, this is due to Landsat's additional bands.
- Some glasshouses in OS reference map are derelict or have been dismantled and some glass houses are listed) as other buildings.



Graph showing scatter plot of pixels used for classification of Landsat image which shows three bands plotted against each other, the top row shows just the glass houses and the bottom row shows all the classes together. Note only a few of the glass house pixels remain visible after the addition of the other three classes. (Only three of the 10 bands used are shown due to space limitations)

5. Conclusions and Recommendation

- Glasshouses were not classified accurately due to the similarities between their pixels and those of the other classes.
- The low resolution of the images led to many of the glasshouses sharing pixels with other classes which hindered classification.
- Further work could be to investigate an object based classification using higher resolution images, this would also aid in the detection of fleece and poly-tunnels which could not be detected using the medium resolution images.

www.cranfield.ac.uk/courses/masters/geographical-information-management.html

Cranfield University, Cranfield, Bedfordshire, MK43 0AL

t.w.waine@cranfield.ac.uk

HDC