Bedfordshire
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Monitoring & Research Report

Cherry Hinton Chalk Pits: Analysis of aerial photography using QGIS

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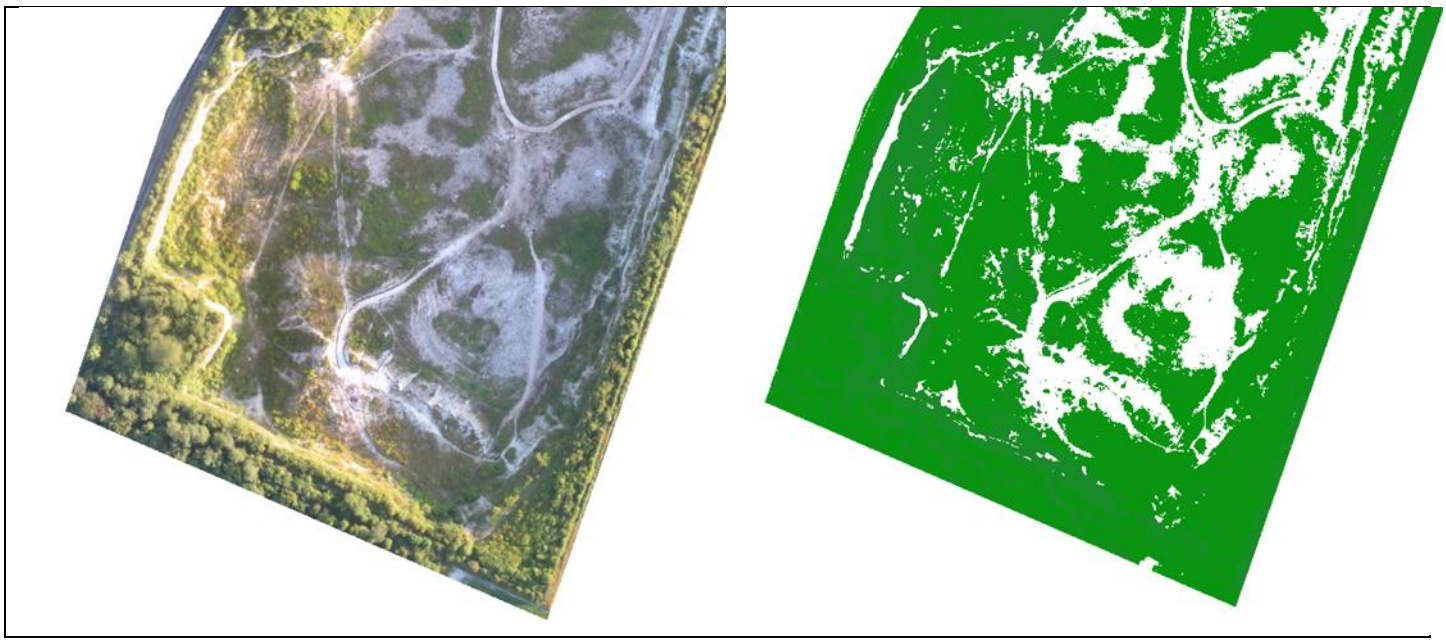

Aerial imagery and analysis of Cherry Hinton East Pit (Photo by Red Kite Rural Services)

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Summary

Aerial imagery of East Pit was analysed using QGIS and remote-sensing plugins. The area of bare chalk at the site was calculated and has decreased between 2010 and 2016.

Introduction

Cherry Hinton East Pit is a former chalk quarry that is now manged to provide a variety of habitats for wildlife. It is notified as a Site of Special Scientific Interest (SSSI) for herb-rich chalk grassland and four nationally uncommon plant species: great pignut *Bunium bulbocastanum*, moon carrot *Seseli libanotis*, grape hyacinth *Muscari neglectum* and perennial flax *Linum perenne ssp. anglicum*.

The bare chalk habitat at the site has decreased over time due to encroaching vegetation. The purpose of this investigation was to compare the relative areas of bare chalk and vegetation.

This report describes the analysis of aerial photography of the site using remote sensing techniques.

Method

Field Survey

Aerial imagery was conducted at Cherry Hinton Chalk Pits in 2010 by Suave Aerial Photographers and in 2016 by Red Kite Rural Services; using an unmanned aerial vehicle (UAV). In both cases a single image (geotiff) was produced of East Pit from multiple overlapping images. This image is referred to as an orthomosaic.

Data analysis

The georeferenced raster image (geotiff file) was processed using Quantum GIS (QGIS) version 2.18. This is an open source Geographic Information System (GIS). This software was used due to additional image processing ability that is not available on MapInfo Pro. Before processing, the image was cropped to include only the East Pit area.

The Semi-Automatic Classification Plugin (SCP) was used to analyse the images. This software allows the classification of aerial photography into landuse categories. Classification was achieved by selecting regions of interest (ROIs) on the aerial image. The following ROIs were classified: bare chalk, trees/scrub and other vegetation.

ROIs were created using the 'automatic region growing' algorithm. This allows the user to click on a known area of landuse and the software automatically creates a ROI. The Dist value was set to 40. This value decides how similar the surrounding pixels need to be to be included in the ROI.

The 'spectral angle mapping' algorithm was used for the classification.

Results & Discussion

It was not considered necessary to differentiate between vegetation types. Therefore all vegetation (trees, grass herbs & scrub) was reclassified as a single ROI. This produced a 2 colour image with bare chalk displayed in white and all other landuse categories in green.

Figure 1 East pit aerial photo and remote sensed images from 2010 (top and 2016 (bottom) showing bare chalk in light grey and vegetation in green.

A visual check of the remote-sensed images suggested that bare chalk was accurately differentiated from vegetated areas (fig 1). The following issues were found with the analysis:

- The road and other hard surfaces could not be differentiated from bare chalk due to similar reflectance. This will be consistent in all years;
- Areas of very high reflectance on trees were occasionally classified as bare chalk. This is unlikely to make a significant difference to the results;

- The gradient of the sides of the quarry mean that landuse categories may have been under recorded in these areas. This is an issue with aerial photography analysis at steep sites but will be consistent for all years;
- The classification is less accurate in heavily shaded areas where colour differences are unclear.

Table 1 Landuse categories at East Pit calculated from remote sensed image

Landuse Category	2010	2016
Bare Chalk	58	24
Vegetation	42	76

The analysis (Table 1) found that the area of bare chalk at the site has decreased from 58% of the total area in 2010 to 24% of the total area in 2016.

Management Suggestions

The results will be used to inform the management plan for the site.

It is recommended that aerial photography is conducted at the site at 3 year intervals.