RGB color image of the Wilsford enclosure for reference.

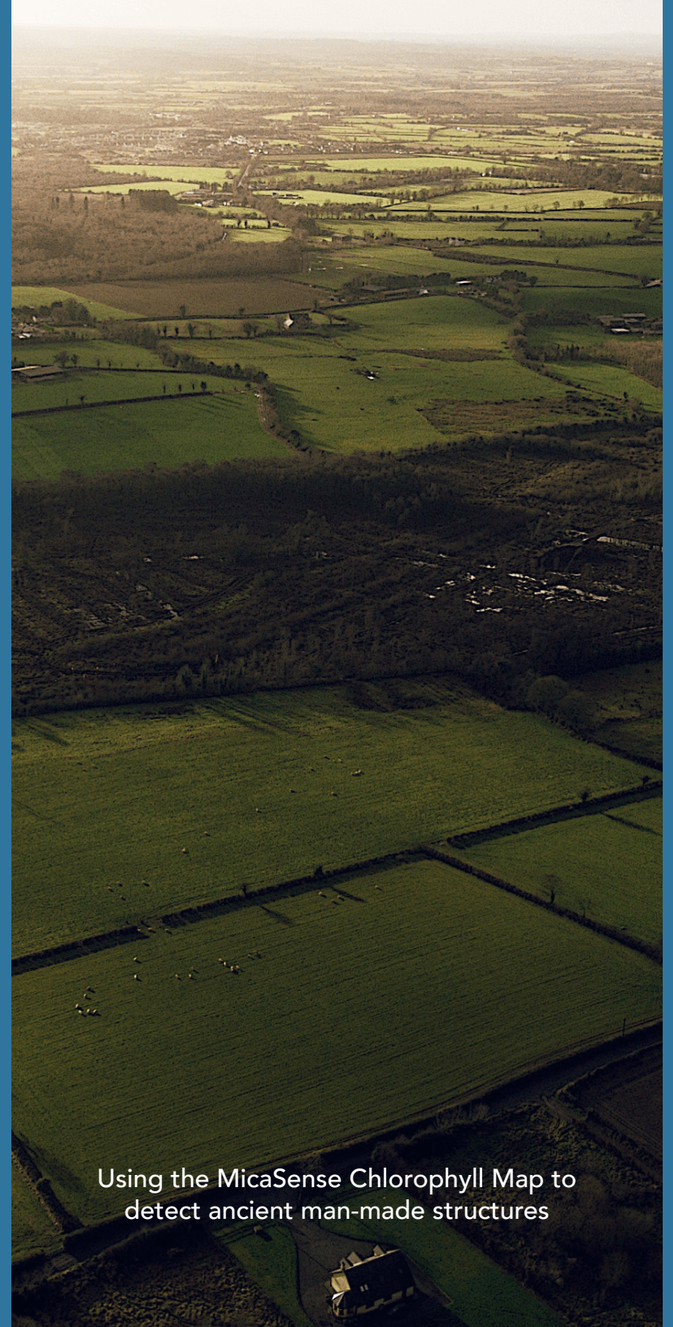
Henry is looking forward to continuing to explore the capabilities of multispectral imaging using advanced sensors as a tool to complement other archeological tools. "It is clear that there is value in this type of imagery, even in areas that have been mapped before," Henry explains. "The ability to see new features and potential anomalies and to compare existing surveys with new ones opens new possibilities for understanding more about the ancient structures that lie beneath our feet."

Henry Webber holds the drone and the RedEdge multispectral sensor he used in his research. Photo courtesy Henry Webber.

Turning imagery into actionable information.

ARCHAEOLOGY - UK

Chlorophyll Map



Using the MicaSense Chlorophyll Map to detect ancient man-made structures

MicaSense®
CASE STUDY

Using the MicaSense Chlorophyll Map to detect ancient man-made structures

For the past year and a half, Henry Webber, a Ph.D. candidate at the University of Bristol's Department of Archaeology and Anthropology, has been gathering data using a drone that carries a MicaSense RedEdge multispectral sensor. He has flown over agricultural fields that have known archaeological features beneath them and has compared his findings with more conventional tools for surveying such as a magnetic gradiometers, which detect changes beneath the surface by measuring the strength and orientation of the magnetic field of the ground below.

SENSOR	RedEdge
ANALYTICS	MicaSense Atlas
LOCATION	United Kingdom
CROP	Wheat
INDEX	NDRE, Chlorophyll Map
AREA	Archaeology / Research

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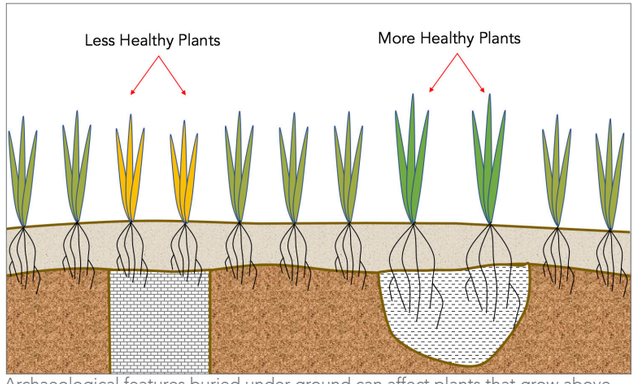
Agriculture and archaeology: two disciplines that typically are not thought to go together. But in regions that are rich in archaeological features, the link can be strong.

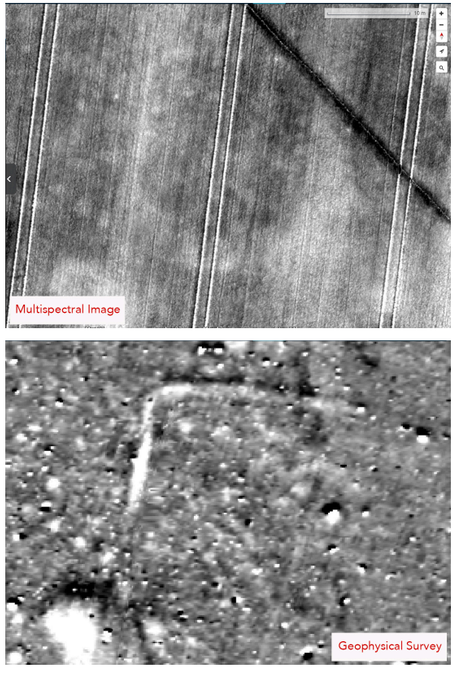
Soils defines how plants grow and the characteristics of soils are many times affected by man-made features that are buried below the ground. This interaction leads to what are called "cropmarks". Sometimes these effects are noticeable to the naked eye. Many times, the soil variability is subtle and results only in small changes in the vigor of the plant or the chlorophyll content in the leaves. That small variability (if natural or man-made) can be detected through remote sensing by using multispectral sensors, especially advanced sensors that are able to detect changes in chlorophyll content in leaves.



Archaeological features buried under ground can affect plants that grow above them. Plants that grow on soil above the remains of a foundation for a wall (left) will generally not fare as well as plants that are above the remains of an old ditch that has been filled in (right).

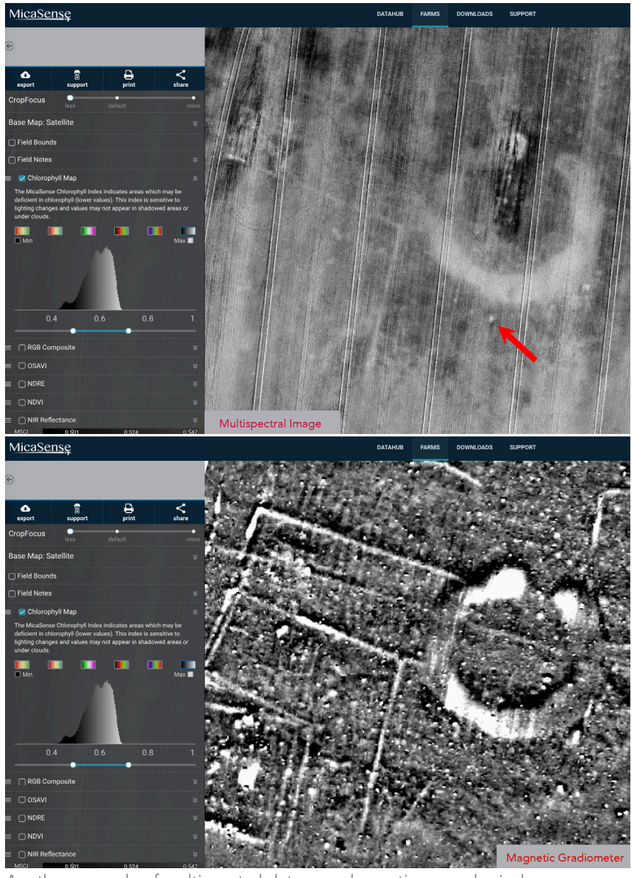
A winter wheat field near the village of Wilsford in the English county of Wiltshire provides an example. The field contains a Neolithic henge (a Stone Age monument that is thought to have been used for rituals and burials) as well as a Roman era farmstead. Henry has been mapping archaeological features in this study area as part of his Ph.D. research using a variety of geophysical surveying tools. The magnetic gradiometer surveys have yielded impressive results, revealing in high detail the structure of archaeological features beneath the surface. But the information acquired with multispectral remote sensing has not only largely replicated these surveys but has also shown a previously unknown detail.

Referencing the figure below, the image on the top, obtained with the RedEdge sensor, is a representation of a vegetation index in MicaSense Atlas called the Chlorophyll Map. This index uses multiple spectral bands, including the Red Edge and Near-Infrared bands (not visible to the human eye) and is generally correlated to chlorophyll content on leaves. Brighter areas in the map indicate areas where the winter wheat has slightly higher index values (and correspondingly higher levels of chlorophyll). The image on the bottom comes from the magnetic gradiometer survey and shows an L-shaped structure under the ground.



A rectangular enclosure buried under-ground becomes visible when using multispectral data and vegetation indices sensitive to chlorophyll content (top), revealing features that were not directly visible using conventional geophysical survey tools (bottom).

The multispectral imagery shows that the boundaries of this archaeological feature extend to the bottom and to the right, forming what appears to be a rectangular enclosure. This under-ground feature, not directly visible in the geophysical survey, becomes evident when the effects of changing soil affect the health of the plants above. "This discovery invites a number of exciting questions," says Henry. "Is this enclosure part of the Neolithic henge? Or is it part of the Roman farmstead, making it much larger than originally thought?" Henry is hoping that future archaeological surveys in this area will help answer these questions.



Another example of multispectral data complementing geophysical surveys. Here, two circular pits below the henge are visible in the chlorophyll map image (top) but not in the map generated with magnetic gradiometer surveys (bottom).

In the same wheat field, a large neolithic henge is clearly visible. A number of small circular pits lie buried just below this feature. While inspecting the results from the multispectral data, Henry noticed that two of the three pits were clearly visible in the chlorophyll map output but not in the geophysical survey. Henry believes these findings can help guide researchers to understand the circumstances under which magnetic-sensor based surveys sometimes miss certain archaeological features.