ABSTRACT
Within local communities there are a number of motivations that can create an interest in initiating an archaeological remote sensing project that can lead to community gain. There are a number of factors that may affect the ability of a particular community to carry out a project. These include: the availability of low cost acquisition equipment and open source processing and visualization software; the availability of training and experience in data acquisition, processing, interpretation and in the subsequent public presentation of results.

Work within communities has to be sensitive to both the initial motivations and potential limiting factors. We review short case histories of work-in-progress involving the introduction, development and use of aerial and ground-based remote sensing technologies by a primary and a secondary school, two adult heritage groups and a community museum. Most projects have not involved formal classroom-style tuition; the delivery mode being ‘learning while doing’.

Keywords
Archaeology, ArchaeoLandscapes Europe, remote sensing, geophysics, LiDAR, community training, community museum, heritage groups, remote sensing technology, remote sensing in schools, visualization software, kite aerial photography, QuikGrid, TR/CIA earth resistance meter, Rathcoon mound, Kilmokea enclosure, Rathcroghan mound, Rathmore mound, electrical resistivity tomography, Council for Independent Archaeology.

INTRODUCTION
The ArchaeoLandscapes Europe Project (ArcLand) [1] has provided us with a network and support to explore and develop aspects of community engagement in remote sensing. One aim of the five-year European Union-supported ArcLand project which commenced in 2010 is to address imbalances in the knowledge and use of modern archaeological surveying and remote sensing techniques. This is particularly the case in Ireland in schools and within community-based local archaeological and historical groups.

REMOTE SENSING IN SCHOOLS
For primary school pupils (4 to 13 years) the most accessible and cost effective introduction to remote sensing is Kite Aerial Photography (KAP). Work in Ireland has largely followed the SNAPS model developed by West Lothian Archaeological Trust [11] who have encouraged
and supported us with advice and the donation of kites and cameras to schools and community groups.

KAP at Mayo Abbey National School, County Mayo combined kite flying with downloading, processing and discovery of archaeological and landscape features recorded by a still or a video camera (Figure 1). Advanced work involves an introduction to spatial data by manually digitizing simple shapes and then inputting and visualizing them using freely available QuikGrid v5.4 software [3]. The referencing and visualization of simple shapes provides an introduction to airborne LiDAR (Light Detection And Ranging) survey data [5] from a flight over an archaeological landscape which consists of earthen mounds. Spatially referenced digital LiDAR data (x, y, z data) over a series of mounds can then be used to make simple 3D archaeological models using QuikGrid (Figure 2).

Transition Year (TY) secondary school students (15 to 17 years) at Balla Secondary School in County Mayo, took part in KAP and ground remote sensing surveys. Remote sensing techniques offered the possibility of cross-curriculum projects which interested both teachers and students in the school. Spatial field data collection in the initial project in Balla in 2013, the Balla Archaeological Remote Sensing1 project (BARS1), used a TR/CIA earth resistance meter (Figure 3) with integral digital data logger. The instrument was designed and produced by the Council for Independent Archaeology which represents community heritage groups [4]. Data were collected on a 0.5m x 0.5m spacing set out within a series of 10m x 10m grids. Metal detection and magnetic susceptibility survey on the same 10m x 10m grids used manual data recording.

Classroom facilities were used for an informal introductory class and a computer laboratory for more formal data processing, visualization and interpretation (Figure 4).

The project was presented at the K2U2 Conference [13]. A BARS2 component in 2014 was the Archaeology Above and Below event which was a one-day schools invited seminar and two-day community conference [2]. The two-day conference was delivered by the community-run Rathcroghan Visitor Centre, Tulsk, County Roscommon [9].

REMOTE SENSING WITH LOCAL HERITAGE GROUPS
Two projects are being carried out with Community Heritage Groups. Delivery is by two-day workshops over a series of weekends [6, 12]. Both groups purchased LiDAR data and followed up low topographic profile anomalies by fieldwalking.

At Kilberry, County Meath the recently formed Heritage Group is part of an Amenity Group involved in village enhancement. Interest is in investigating a series of...
monuments in order to raise awareness, aid conservation and present the sites as part of possible tourism development. Each monument investigated has been the subject of local folklore or questions about its function.

The survey of Rathcoon mound, a possible Bronze Age barrow, involved the use of multiple remote sensing techniques to investigate the mound and its internal structure. Aerial photography by a local pilot enabled the mound and survey area to be reviewed in its landscape setting (Figure 5).

One question about the mound that the community asked was “what is inside the mound?” The Heritage Group participated in an electrical resistivity tomography (ERT) survey [7] across the mound which provided a depth section (Figure 6). The depth section shows the mound to have a possible stone core which may be related to a small burial chamber.

Sliabh Coillte Heritage Group, County Wexford has been active in heritage studies for over 20 years. The current project is investigating a large enclosure on Great Island for which substantial documentary evidence has been gathered. Analysis of the evidence has raised questions which are being addressed through remote sensing surveys. Analysis of LiDAR data showed there was a previously unknown feature in Kilmokea Enclosure. The feature was investigated using the earth resistance method [8] during a series of weekend training workshops (Figure 7).

The earth resistance results showed there are many features hidden beneath the soil in the enclosure (Figure 8).

The groups have presented their work at local, national and international events or conferences thus raising awareness of their local archaeological heritage.

USING REMOTE SENSING IN A COMMUNITY MUSEUM
Use of remote sensing data at Rathcroghan Visitor Centre [10], a community-established and run interpretive experience and resource hub for the Rathcroghan

Figure 5. Aerial photograph of Rathcoon mound showing the 40m x 40m survey area surrounding the mound.

Figure 6. ERT depth section across Rathcoon mound.

Figure 7. Tuition on the earth resistance survey technique during a weekend training workshop at Kilmokea enclosure.

Figure 8. Processed earth resistance image from Kilmokea enclosure. Black lines are interpreted as buried ditches.
archaeological complex, is well established. In recent times, academic investigation of the monuments in the Rathcroghan complex has almost exclusively been achieved through the use of a suite of remote sensing techniques [14]. Advances in technology have resulted in repeat surveys at higher spatial resolution. Recent availability of LiDAR data has enabled us to visualize and present the Rathcroghan landscape in new ways. Recent work is used to update the public presentations in the Museum.

The most recent realization of the now annual Rathcroghan Conference has sought to harness and embrace the two central themes that have allowed the Visitor Centre to exist and survive from its foundation in 1999; those of community input and remote sensing to visualize and interpret the monuments and surrounding landscape. The new focus of the annual conference, that of community archaeology, fits perfectly, under the title of ‘Archaeology Above & Below’ [9].

The conference format of a combination of talks, workshops and practical demonstrations focuses on the use of remote sensing and the analysis of results. It is delivered by community group representatives and academics alike, which in turn creates a vibrant and refreshing forum for two, sometimes divergent, areas of the discipline to interact, discuss, and progress.

CONCLUSION
The increasing availability of remote sensing data and survey equipment together with the software tools to aid processing, visualization, interpretation and presentation is enabling communities to investigate and appreciate their local cultural heritage.

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