

INSTITUTE OF TERRESTRIAL ECOLOGY  
(NATURAL ENVIRONMENT RESEARCH COUNCIL)

Project. T02083F5/C00324

## Countryside Survey 2000 - Part I

### Module 8: Airborne Scanner Applications

### **Classification of airborne *casi* and LIDAR data of selected CS2000 sample squares**

### **Quarterly Progress Report**

**CSCL/prog**

R.A. Hill<sup>1</sup>, R.M. Fuller<sup>1</sup> & N. Veitch<sup>2</sup>

<sup>1</sup>Institute of Terrestrial Ecology, Monks Wood,  
Abbots Ripton, Huntingdon, Cambridgeshire, PE17 2LS

<sup>2</sup>The Environment Agency, National Centre for Environmental Data and Surveillance,  
Rivers House, Lower Bristol Road, Twerton, Bath, Avon, BA2 9ES

**Corresponding author:**

R.A. Hill  
Section for Earth Observation  
Institute of Terrestrial Ecology  
Monks Wood  
Abbots Ripton  
Huntingdon  
Cambs PE17 2LS

Telephone: 01487 772485  
Fax: 01487 773467  
e-mail: Ross.Hill@ceh.ac.uk

03 March 2000

## SUMMARY OF PROGRESS

- This report covers progress made between May 1999 and February 2000 (*i.e.* since the Third Interim Report). Developments before May 1999 are reviewed in the first three Interim Reports (Fuller *et al.* 1998, Hill *et al.* 1998, 1999). Some of the issues discussed here are reviewed in the redrafted project specifications (Hill *et al.* 2000), whilst other developments are as yet unreported.
- Module 8 aims to evaluate the use of airborne sensor data in the context of CS2000, at a scale of survey intermediate between the detailed field survey and the synoptic satellite census of the UK.
- Due to the exacting nature of the Countryside Survey, which made demands of airborne data exceeding those of normal EA operations, a new project specification (with a reduced set of objectives and a longer time-frame) has been agreed with the EA and DETR (Hill *et al.* 2000).
- As with the previous project specification, the aim is still to develop procedures, refine methods and validate products on 4 trial squares (one in each of the Arable, Pastoral, Marginal, and Upland Landscape types), with results applied in 'blind trials' to the remaining 4 check squares. However, analysis will focus primarily on the central 1 x 1 km CS square.
- Due to data quality problems with the 1998 airborne imagery, all eight sites were re-flown by the EA with both the *casi* and LIDAR instruments in the summer of 1999.
- The specification for the airborne data retrieval was the same as for 1998. Thus, at least a 3 x 3 km area was recorded for each Countryside Survey square, from which the central 1 km<sup>2</sup> can be extracted. The LIDAR data were first pulse only, capturing height information for vegetation canopies. The *casi* data were recorded in twelve wavebands, which focused particularly on the red and near infrared spectral boundary, and with a pixel size of 3 m.
- Pre-processing of the 1999 *casi* data at the EA involved roll-correction only for flightlines covering the Arable, Pastoral, and Marginal squares. This was because of a problem in their *Itres* 'geocor' software, which caused data shifts in the processed *casi* imagery. Upland squares, however, were given the higher order geometric conversion, as conventional geometric correction of imagery can be a near impossible process in upland areas where fewer prominent landmarks (e.g. field boundaries, crossroads) are found.
- The 1999 *casi* and LIDAR data have been delivered to ITE and assessed. The LIDAR data for the southern squares are within instrument specifications, whilst an edge-of-flightline z-displacement is visible for the northern data (especially Squares 691 and 1214). For the *casi* data, the atmospheric quality is excellent and the geometric quality is as good as the EA systems will allow. For the Arable, Pastoral and Marginal sites, the *casi* data contain residual geometric distortions where aircraft roll has been either under- or over-compensated. In addition, geometric distortions also result from underlying topography, which has not been accounted for in the pre-processing. For the two Upland sites, the higher level processing has dealt with these but introduced additional geometric errors by causing data shifts which are more severe for Square 1214 than for Square 692.
- Pre-processing of the LIDAR data has been completed for all eight sites. This has involved: generating digital surface models from spot height information; masking off trees, hedges, buildings etc and re-interpolation to give digital elevation models; and estimating above ground height information. The relative accuracy of surface height estimation has been assessed for Square 208, in which detailed hedge and tree height measurements were made in 1998.

- The *casi* data for all eight sites will need to be registered to the LIDAR data by a process of ‘rubber sheeting’. This has been completed for the central 1 x 1 km area of the selected trial squares (Sq 180, 208, 692, 708) in 1999 *casi* data, and in addition for 1998 *casi* data of Sq 180. The process of flightline mosaicking is also complete for these four squares, giving fully integrated *casi* and LIDAR data for the trial squares (Figure 1).
- Geometric registration is underway for a 3 x 3 km area of 1998 *casi* data for Sq 180, which will allow comparison of the central 1 x 1 km square with the surrounding countryside.
- Trial analyses of image segmentation and object-oriented classification using test sections of integrated *casi* and LIDAR data have demonstrated promising results (presented at the Remote Sensing Society 1999 conference in September (Hill & Veitch 1999)). This can now begin for complete 1 x 1 km squares, generating land cover statistics for comparison with CS 2000 field survey data.
- The GANNT chart is attached (Table 1), showing the amended schedule and highlighting that progress is currently up-to-date. The project completion date is March 2001.

## REFERENCES

- Fuller, R.M., Hill, R.A., & Veitch N. 1998. Airborne Scanner Applications: Classification of airborne *casi* and LIDAR data of selected CS2000 sample squares. First Interim Report, CSCL/Int1.
- Hill, R.A., Fuller, R.M., and Veitch, N., 1998. Airborne Scanner Applications: Classification of airborne *casi* and LIDAR data of selected CS2000 sample squares. Second Interim Report, CSCL/Int.2.
- Hill, R.A., Fuller, R.M., and Veitch, N., 1999. Airborne Scanner Applications: Classification of airborne *casi* and LIDAR data of selected CS2000 sample squares. Third Interim Report, CSCL/Int.3.
- Hill R. A. & Veitch N. 1999. Integrated *casi* – LIDAR data for land-cover classification’. *Proceedings of the 25 th Annual Conference of the Remote Sensing Society*, 8-10 September 1999, Cardiff.
- Hill, R.A., Fuller, R.M., & Veitch N., 2000 - . CS2000 Project Specification Module 8: Airborne Scanner Applications - classification of airborne *casi* and LIDAR data of selected CS2000 sample squares - a revised joint proposal.

Square 180 (Arable)



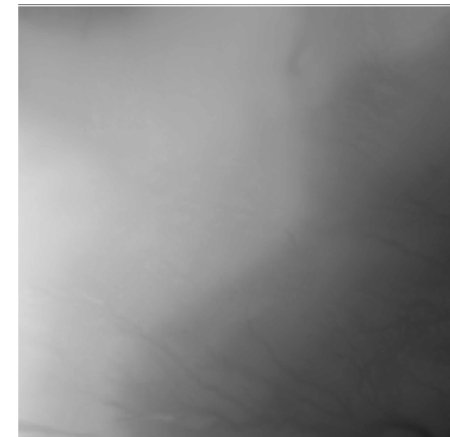
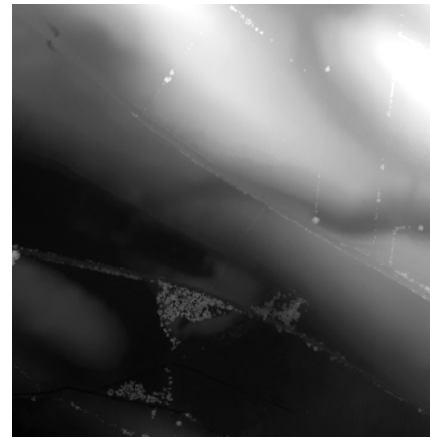
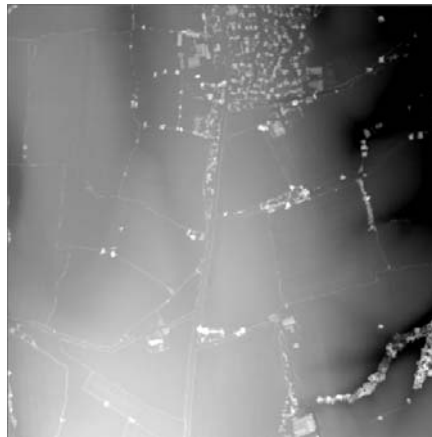
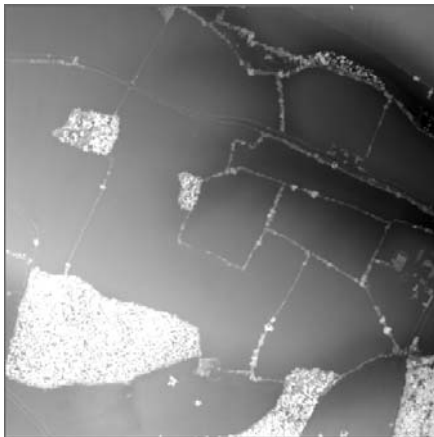
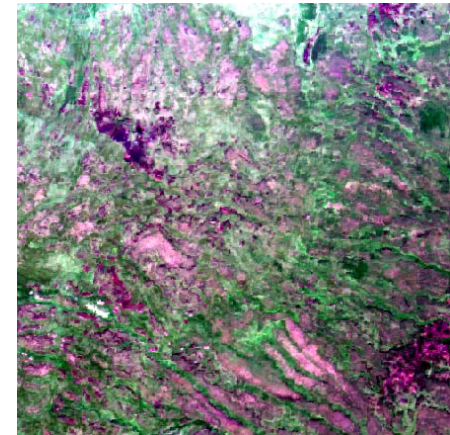
Square 208 (Pastoral)



Square 692 (Marginal)



Square 708 (Upland)



**Figure 1** - Integrated *casi* and LIDAR data for the four trial C. S. 2000 1 km<sup>2</sup> squares.  
Casi imagery- true colour composites, 3m pixel size, LIDAR - digital surface models (metres above sea level)

Table 2. Revised GANNT - *casi* /LIDAR project

