

INSTITUTE OF TERRESTRIAL ECOLOGY
(NATURAL ENVIRONMENT RESEARCH COUNCIL)

**AGGREGATION OF JERSEY
LAND COVER MAP DATA**

Report to the States of Jersey

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Outline of work

This project aimed to produce an aggregated land cover data set for Jersey for 500 m by 500 m grid squares based on the 1997 Land Cover Map of Jersey (Smith and Fuller, 1998).

Background

In 1997, the States of Jersey commissioned the ITE to map the land cover of the Island using remotely sensed images recorded by satellite. ITE used its recently developed parcel-based CLEVER-Mapping procedure which was ideally suited to land cover mapping in Jersey due to the distinct parcel structure of the Island's landscape.

Ordnance Survey digital cartography, consisting of unstructured linework, was generalised and polygonised into a land parcel data set; the first of its kind available for Jersey. Multi-date and multi-resolution remotely sensed images were combined into a single composite image for land cover classification at a high spatial resolution suitable for Jersey and with spectral detail sufficient for interpreting complex vegetation and crop types. This composite image allowed the classification of land cover of Jersey from satellite data to be realised. Ancillary data sets were pre-processed to generate contextual information (for instance, terrestrial flags and urban linework density) for each land parcel to aid in the classification procedure. The land parcel data set, composite image and ancillary data sets were integrated within an object-oriented Geographical Information System (GIS). The CLEVER-Mapping procedure assessed the land cover type for each land parcel by classifying on a per-parcel basis from the composite image, and then applied knowledge-based corrections to refine the result based on contextual information. Land parcels with high within-parcel variation were further assessed by examining the results of a conventional per-pixel classification.

A state-of-the-art parcel-based land cover map of the Island was generated for spring 1997 with 21 land cover types and 9 arable sub-types (Figure 1; Appendix 1 & 2). Validation estimated the correspondence of the classification to be between 85 % and 90 %. When these results were weighted to take account of the land cover distribution for the whole Island the correspondence was increased beyond 90 %, as the most extensive land cover types were the most accurately classified. Agricultural statistics published by the States of Jersey for 1996 closely matched summary statistics from the land cover map for spring 1997, supporting the accuracy estimates from the validation land parcels.

Methodology

The 1997 land cover map of Jersey exists in an object-oriented GIS data base and consists of land parcel objects which are made up of information related to their shape and extent and attributes holding information on their land cover type. It would have been possible to have created the aggregated land cover data set by interrogating the land parcel objects directly, but this functionality was not easily available with the standard analysis system and would have required time-consuming and costly software development. A simple and effective, although slightly less elegant, approach was adopted here to make the results available quickly and at low cost.

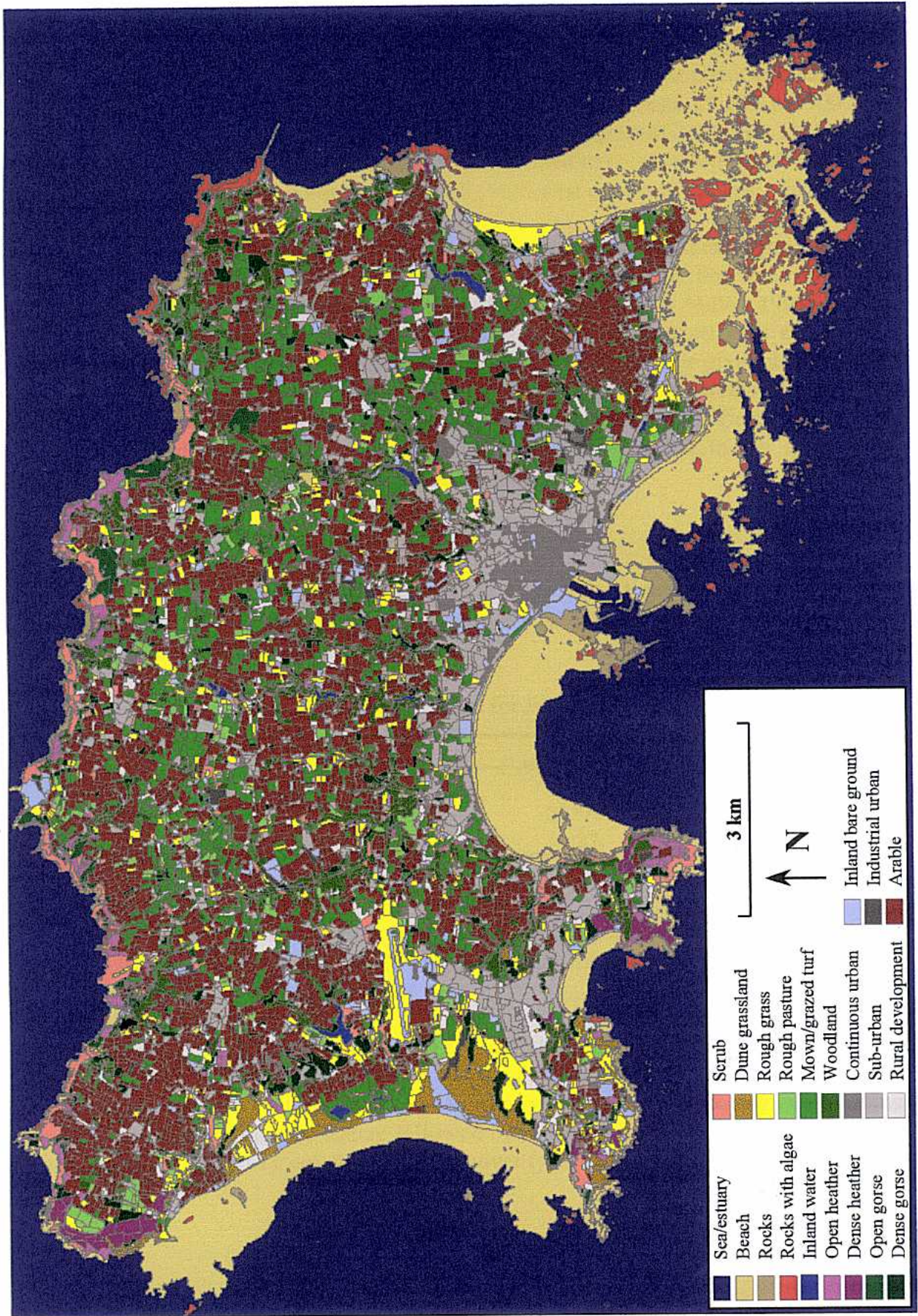


Figure 1: Land cover map of Jersey in spring 1997.

The approach began with the creation of a raster version of the GIS database. A raster grid registered to the area of the land cover map of Jersey, was created with a cell size equivalent to 5 m by 5 m on the ground. Each cell within the raster grid was coded with the appropriate land cover type of the GIS database (nearest neighbour sampling). This raster version of the land cover map of Jersey was then aggregated by interrogating groups of 100 by 100 cells representing the 500 m by 500 m grid squares required in the aggregated data set. The number of cells of each land cover type were calculated and converted to record proportional cover for the grid square together with the co-ordinates of the south west corner of the grid square.

When aggregating the land cover map of Jersey, it was necessary to alter slightly the land cover types recorded (Appendix 1). The nine arable sub-types were not retained as the suggested mapping to crop type and stages of the potato crop (Smith & Fuller, 1998) had not been confirmed. The parcels which were identified as containing mixed land cover types (multi-class) were recorded as the dominant land cover type from the per-pixel classification. This is the procedure usually applied when plotting the multi-class land parcels. As they only constitute 5 % of the whole Island and they only make up a small fraction of each grid square within the aggregated data set. The unclassified parcels were ignored in the aggregation process as they represented less than 0.1 % of the whole Island.

Results

The results of this work consist of proportional values for 21 land cover types within 500 m by 500 m grid squares for Jersey, covering the area given in Table 1. The results are provided in both hard copy and digital formats.

Table 1: Extent of the aggregated land cover data set for Jersey.

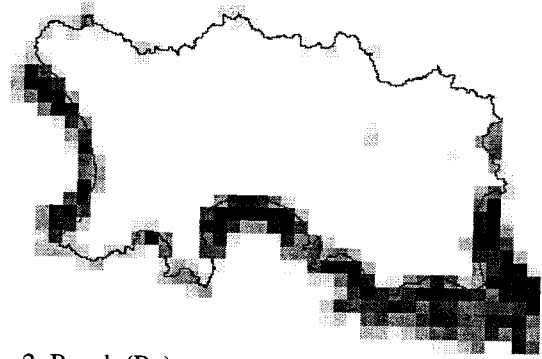
	Easting	Northing
Minimum	553500	5443000
Maximum	574000	5457500
No. of grid squares	39	27

The hard copy results give maps of proportional cover (Figure 2) for each of the land cover types, overlain by an outline of the Island (high water mark) for reference. The shading ranges from black, 100 % cover, to white, 0 % cover.

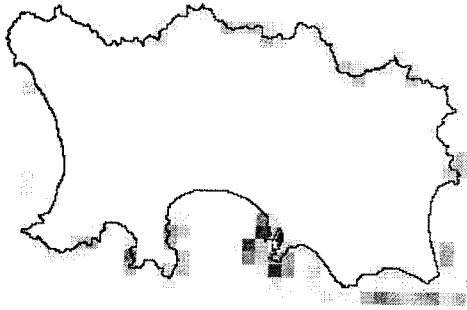
The digital versions of the results (Appendix 3) are in both Microsoft Excel 97 and flat ASCII text formats. The results consist of a table where each row represents a 500 m by 500 m grid square in the aggregated data set. Each grid squares entry consists of the easting and northing of the south west corner of the grid square followed by 21 proportional values (expressed as a proportion ranging from 0 to 1), one for each land cover type, as per Appendix 1.



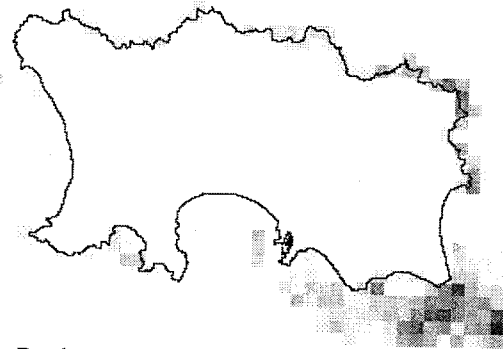
1. Sea/estuary (SE)



2. Beach (Be)



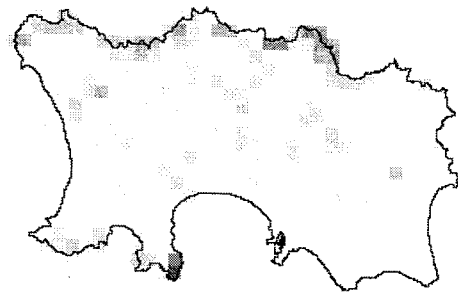
3. Rocks (Ro)



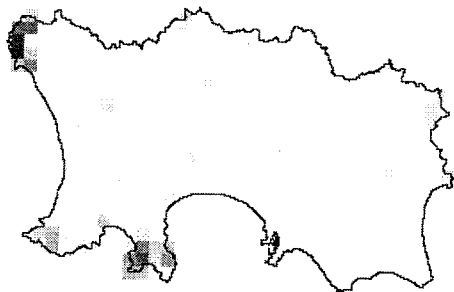
4. Rocks with algae (RA)



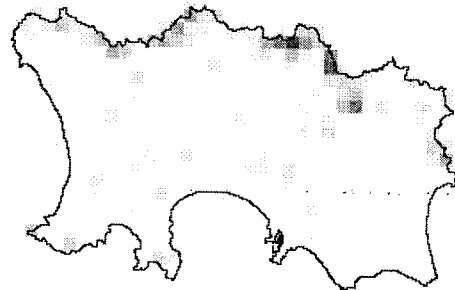
5. Inland Water (IW)



6. Open heather (OH)



7. Dense Heather (DH)

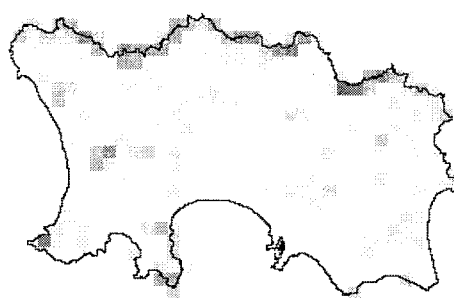


8. Open Gorse (OGGo)

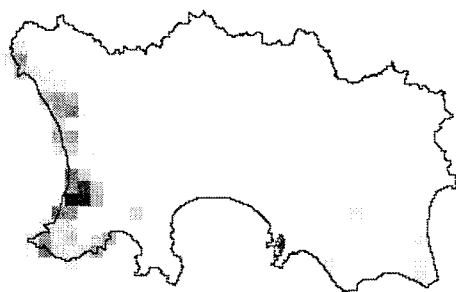
Figure 2a: Proportional maps for each land cover type



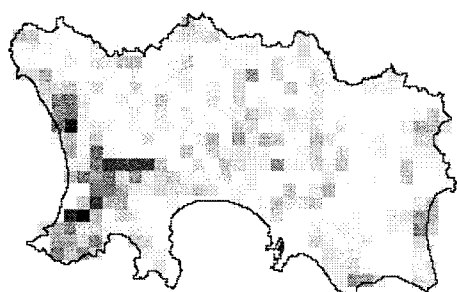
9. Dense Gorse (DGo)



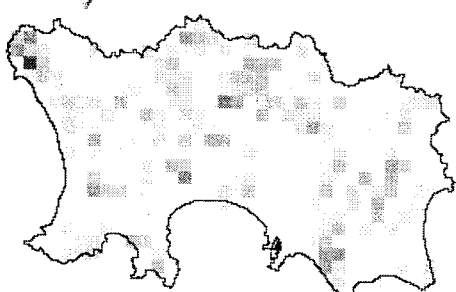
10. Scrub (Sc)



11. Dune grassland (DG)



12. Rough grassland (RG)



13. Rough Pasture (RP)



14. Mown/grazed turf (MGT)

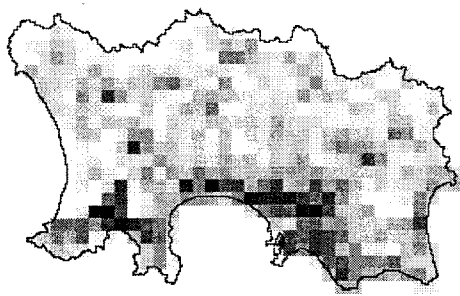


15. Woodland (Wo)

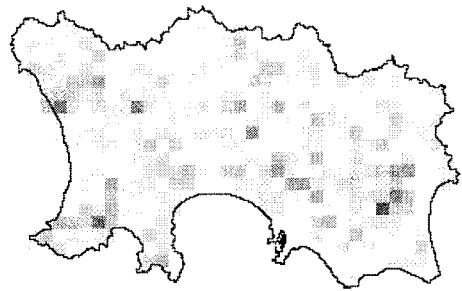


16. Continuous urban (CU)

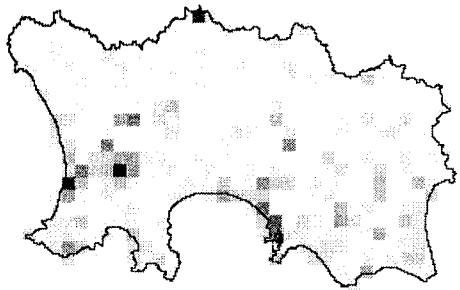
Figure 2b: Proportional maps for each land cover type



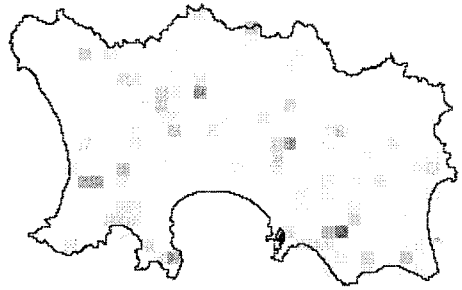
17. Sub-urban (SU)



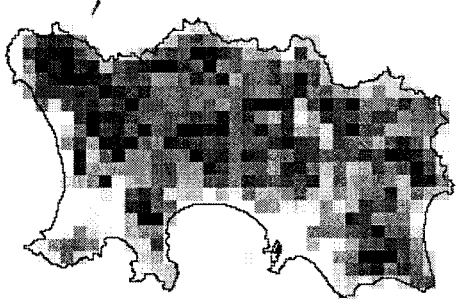
18. Rural development (RD)



19. Inland bare ground (IBG)



20. Industrial urban (IU)



21. Arable (A)

Figure 2c: Proportional maps for each land cover type

Discussion and conclusions

The aggregated land cover data set for Jersey forms a simple but informative summary of the distribution and inter-relationships of land cover types across the Island. The tabulated data provides the information in an easily accessible format which can be analysed using standard desk top software such as spreadsheets.

The 500 m by 500 m aggregated land cover data for Jersey is analogous to the 1 km by 1 km summary land cover data in the ITE's Countryside Information System (CIS), which integrates a range of geographic data sets for Great Britain. Current development work on the next release of the CIS will allow it to be tailored to any geographic area and summary scale. This system would provide a flexible and powerful framework in which to analyse the results of this project, along with other geospatial data sets for Jersey.

References

Smith, G.M., and Fuller, R.M., 1998, *CLEVER-Mapping of land cover in Jersey. Final Report*. Institute of Terrestrial Ecology Report to the States of Jersey.

Appendix 1: Land cover types used to map the land cover of Jersey

Land cover type group	Land cover type	Code for aggregated data set	Code(s) for Land Cover Map of Jersey
1. Sea	Sea/estuary (SE)	1	37
2. Inter-tidal	Beach (Be)	2	1
	Rocks (Ro)	3	35
	Rocks with algae (RA)	4	2
3. Inland water	Inland water (IW)	5	3
4. Semi-natural	Open heather (OH)	6	4, 5
	Dense heather (DH)	7	6
	Open Gorse (OG _o)	8	7
	Dense Gorse (DGo)	9	8
5. Grassland	Scrub (Sc)	10	16, 17
	Dune grassland (DG)	11	9
	Rough grass (RG)	12	10, 11
	Rough pasture (RP)	13	12
	Mown/grazed turf (MGT)	14	13, 14
6. Woody	Woodland (Wo)	15	18, 19, 20
7. Development	Continuous urban (CU)	16	21
	Sub-urban (SU)	17	22
	Rural development (RD)	18	36
	Inland bare ground (IBG)	19	23
	Industrial urban (IU)	20	24
8. Arable	Arable purple pink (A _{pp})	21	25
	Arable dark blue (A _{db})	21	26
	Arable red pink (A _{rp})	21	27
	Arable light blue (A _{lb})	21	28
	Arable white (A _w)	21	29
	Arable green yellow (A _{gy})	21	30
	Arable light green (A _{lg})	21	31
	Arable orange (A _o)	21	33
	Arable light pink (A _{lp})	21	34
	9. Miscellaneous	Multi-classed (Multi-classed)	n/a
Unclassified (Unclassified)		n/a	0

Note: The colour for each arable subclass is related to its appearance in one particular band combination of three bands from the six band composite image (E.g., A_o is arable orange).

Appendix 2: Definition of land cover types

Sea/Estuary (SE): Marine areas beyond the mean low water mark.

Beach (Be): Inter-tidal areas of sand and areas of sand between the mean high water mark and the terrestrial area.

Rocks (Ro): Bare rock surfaces beyond the terrestrial area. Only classified at the knowledge-based correction stage where contextual data could be used either to assign the land cover type to parcels beyond the area of image data or to correct for other types of bare surface.

Rocks with algae (RA): Rock surfaces beyond the terrestrial area which had large amounts of algal or seaweed cover.

Inland water (IW): Fresh water bodies within the terrestrial area. Confusion with shaded steep cliff cover types caused inland water to be mis-classified. Due to the small number of water bodies on Jersey this land cover type was checked visually against map and image data sources and labelled manually.

Open heather (OH): Semi-natural areas with a mix of predominantly heather and grass.

Dense heather (DH): Semi-natural areas dominated by heather.

Open gorse (OGo): Semi-natural areas with a mix of predominantly gorse and grass.

Dense gorse (DGo): Semi-natural areas dominated by gorse.

Scrub (Sc): Areas of shrubs, rough grassland and open woodland.

Dune grassland (DG): Unmanaged coastal grasslands dominated by dune grass species, but also containing blow outs revealing sand substrate.

Rough grassland (RG): Unmanaged grassland predominately in semi-natural areas.

Rough pasture (RP): Managed unimproved rough grassland used for grazing.

Mown/grazed turf (MGT): Managed improved grassland used as pasture and mown for silage.

Woodland (Wo): Deciduous and mixed woodlands.

Continuous urban (CU): Areas of concentrated buildings with no vegetation.

Sub-urban (SU): Area of buildings and vegetation related to residential housing and gardens.

Rural development (RD): Areas of vegetation with a small amount of urban related to housing/farm buildings with large gardens or paddocks. Only classified at the knowledge-based correction stage.

Inland bare ground (IBG): Areas which are unvegetated the whole year.

Industrial urban (IU): Areas with a mix of large buildings and bare ground.

Arable (A_colour): Areas of arable land sub-divided by their spectral sub-types (*colour*).

Multi-classed (Multi-classed): Areas where more than one land cover type has been identified within a land parcel by examining a per-pixel classification.

Unclassified (Unclassified): Areas which have failed to classify.

Appendix 3: Digital versions of the aggregated land cover data set (2 copies)