Kent Habitat Survey

2012

4

Methodology

4

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4.1 Introduction

The Kent Habitat Survey data set was produced from results of aerial photo interpretation, field survey and integration of external data. All stages of the data production and analysis were recorded using GIS (ESRI ArcGIS).
This section describes the data and processes used in the creation of the final data sets. In addition to the Kent Habitat Survey 2012 data set, data was derived to generate a habitat change analysis, a land cover analysis (described in the report on Land cover change analysis 1961 – 2008) and a cross-border map of the habitats in Kent and Nord-Pas de Calais region in France, using a modified CORINE classification.

The process described in the following sections was established early in the ARCH project, and methods refined over time as the project progressed. Figure 4.1 shows the various stages in the processing.

4.2 Data Management

4.2.1 Data Sources

The source data for the base mapping of the Kent habitat survey are listed in Table 4.1. Further external data sources were incorporated at several points during the data preparation or used for reference to inform classification of complicated areas. Table 4.2 lists the most important external data sources used. The overall data production process is represented in the flow diagram in Figure 4.1. Each stage of the process is briefly explained in the following sections.

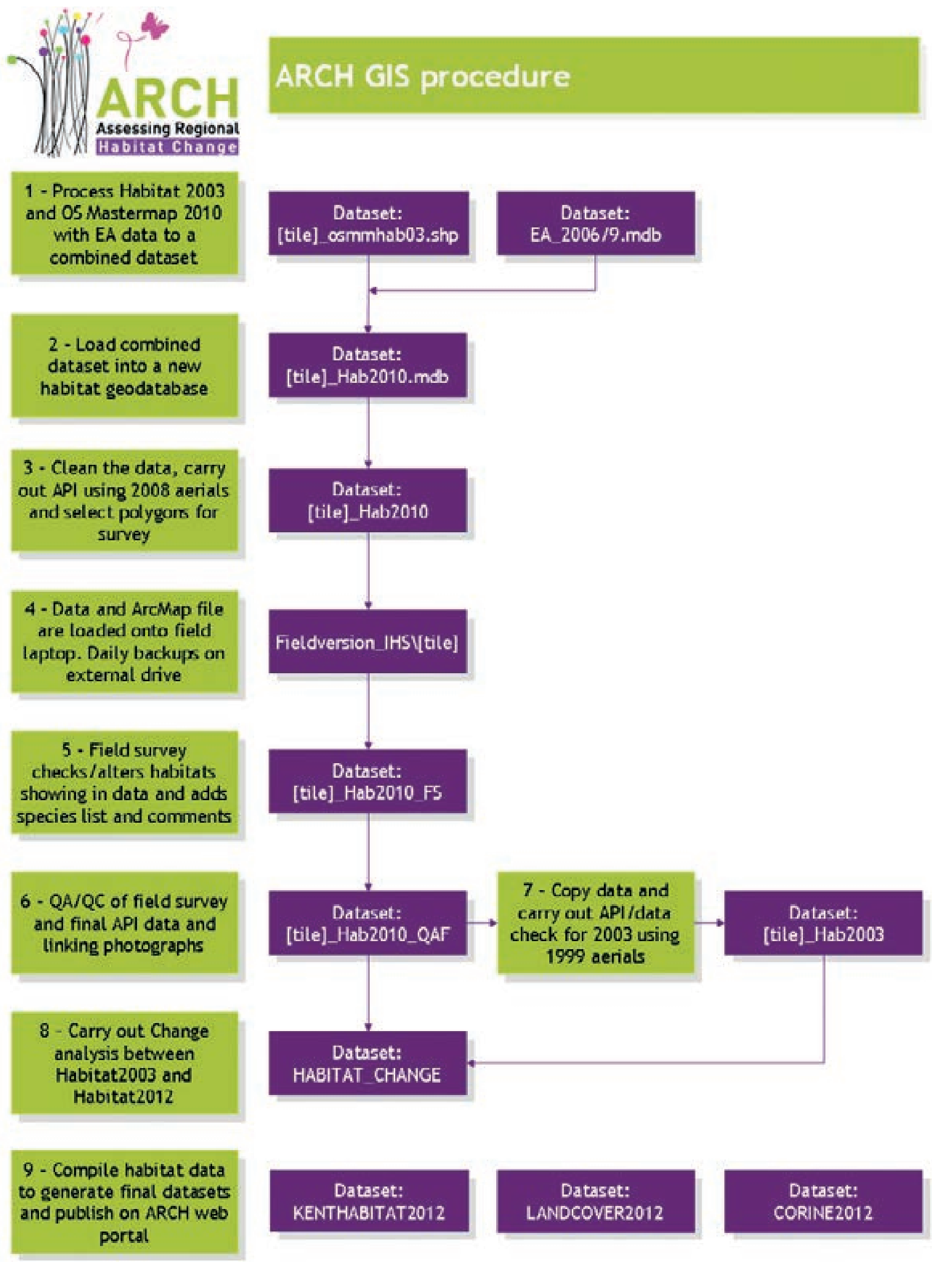

Figure 4.1 Stages of the data processing (left in green) with resulting data sets (right in purple).

Table 4.1 Data sources used as base mapping for the Kent Habitat Survey data

Data set name	Source	Description
Hab2003.shp	KCC Habitat 2003	Kent habitat survey from API and field survey, finished in 2003
Hab1195copy.shp	KCC Habitat 1990	Phase 1 habitat survey from API and field survey, finished 1993
TargetNotes.mdb	KCC Habitat 1990	Database with all Phase 1 habitat survey target notes of 1990 as data points, with locations corrected based on grid reference and duplicates removed in 2010.
EA2006.mdb	Environment Agency (EA)	**OS Mastermap + Hab2003.shp + field survey (2006)** Review of coastal areas of Kent Habitat 2003, including some field survey carried out by EA.
EA2009.mdb	Environment Agency (EA)	**OS Mastermap + Hab2003.shp + field survey (2006)** Review of coastal areas of Kent Habitat 2003 and EA2006, including some field survey carried out by EA.
OS MasterMap (March 2010)	Ordnance Survey (OS)	Ordnance survey base mapping at scale 1:1250 (OSMM)

Table 4.2 Data sets from external organisations used for reference in habitat classification

Source	Description
People's Trust for Endangered Species (PTES)	Traditional orchard data. This dataset was based on both field survey and references from historic maps. The data contained errors and was used as an indicator of possible traditional orchard, to flag areas for field survey.
Kent Wildlife Trust (KWT)	Local Wildlife Site boundaries and citations, which were updated each year
Kent Wildlife Trust (KWT)	Roadside Nature Reserve locations with habitat management descriptions
High Weald Area of Outstanding Natural Beauty (AONB)	Data on Heathland fragments from the High Weald
High Weald Area of Outstanding Natural Beauty (AONB)	Data on semi-improved grasslands from the Weald Meadow Initiative. This proved to have information of variable reliability, and so was used as an indicator of possible semi-improved grassland only
Natural England (NE)	Data on Land in Environmental Stewardship Schemes

4.2.2 Some Data Issues

The base mapping data for the Kent habitat survey consisted of OS MasterMap data of 2010 and the Habitat survey data of 2003. Through a series of processes in GIS (ArcINFO) these two data sets were combined and partially cleaned up (Box 1 in Figure 4.1). A major issue with the resulting base map was the difference in geometry between the two source data sets, which resulted in thousands of sliver polygons. These sliver polygons were largely removed during the manual data cleaning phase (Box 3 in Figure 4.1). Figure 4.2 below shows the difference in geometry between the OS MasterMap data in white and the Habitat 2003 data in blue.

In 2006, and again in 2009, the Environment Agency (EA) carried out a review of the coastal habitats recorded in the 2003 Kent habitat survey. The data was collected through aerial photo interpretation and field survey using the IHS classification. Data from these surveys covered the coastal areas (See Figure 4.3).

Figure 4.2 In blue: Habitat 2003 data; in white: 2010 OS MasterMap; yellow label: new IHS classification

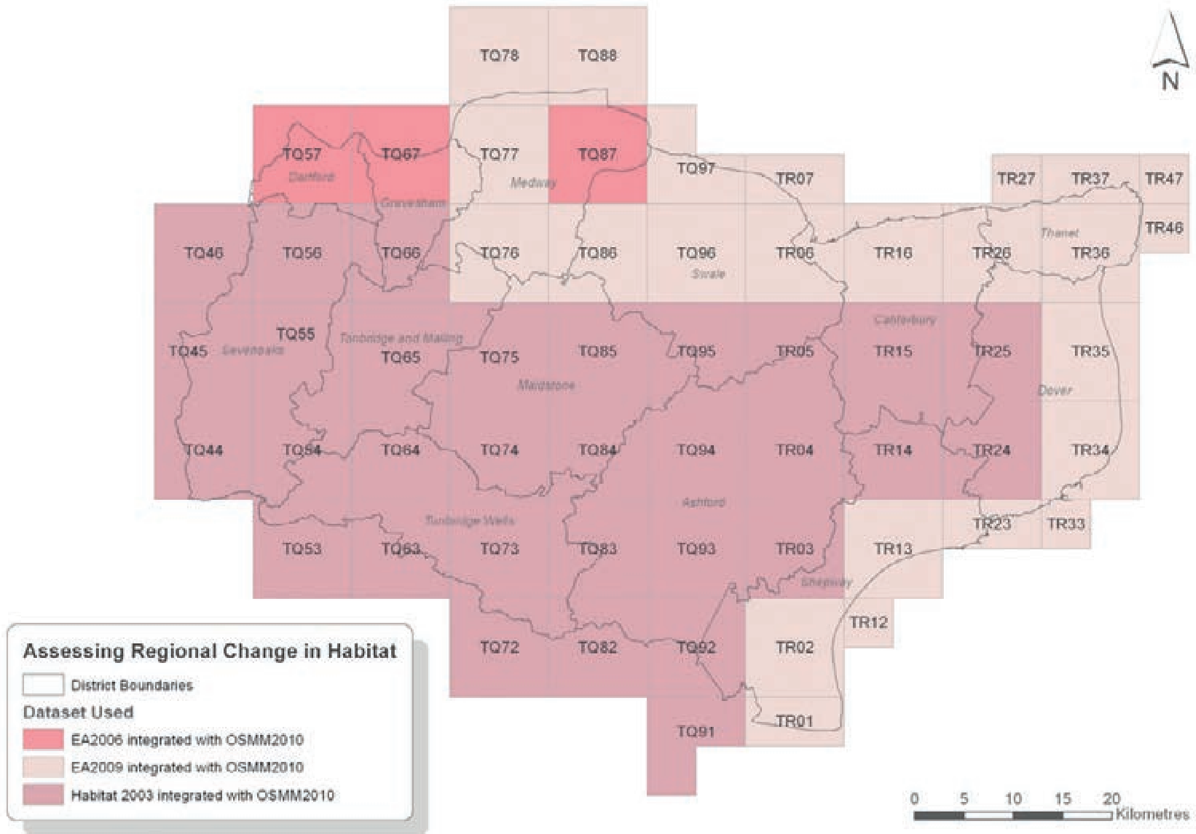

Figure 4.3 Distribution of source data used for the project

The EA data were provided in the form of personal geo-databases for each coastal 10x10km OS map sheet ('tile'), including polygons, attributes and species data of surveyed areas. The data had been integrated with OS MasterMap data of an unknown year, and on checking the geometry proved to be incompatible with the most recent OS MasterMap data used for the Kent habitat survey base mapping (see Figure 4.4). The EA data set was therefore updated with the current OS MasterMap data (2010), while retaining any field survey data and API classifications from the 2006-2009 surveys. These survey data were reviewed during the aerial photo interpretation phase and updated to the amended IHS classification used for this project.

4.2.3 Data Preparation

The base mapping for the Kent Habitat Survey was organised by Ordnance Survey 10km map sheets (see figure 4.2). Combining the Habitat 2003 (shapefile) and OS MasterMap 2010 (file geodatabase converted to shapefile) was achieved through a script with geo-processing instructions in ArcInfo Workstation. Advantages of using Workstation include: the ability to set attributes of polygons boundaries so certain boundaries can be retained during overlay processes, an option to eliminate sliver polygons of non-priority habitat and automatic fixing of corrupted polygons. The result, exported as a shapefile for each OS map sheet, was then imported into a template personal geodatabase in ArcGIS, specifically set up to work with the IHS habitat capture tool. A feature class called 'Habitat Survey Polygons' is created and used with the tool.

In order to be able to use the habitat 2003 data as part of the base mapping, the habitat and associated codes needed to be corrected. These corrections were carried out in an MS Access database, with the attribute table of the relevant 'habitat survey polygons' feature class linked in. Through a set of queries, invalid or incomplete habitat codes, matrix codes and keywords were corrected. The IHS habitat capture tool did not function with empty fields and these were given 'NULL' values through an automatic update.
Table 4.3 lists some of the code differences between the 2003 and current habitat classifications.

Where data from the EA were used, a link to any recorded species had to be re-established after the above process. The link was based on the automatically generated unique identifier for each polygon, which is also entered into a separate species table in the same geo-database. With any geo-processing in ArcGIS however, this identifier is updated and the link to the species list is lost. To counter this issue a separate Unique Identifier (UNIQID) was introduced in both the habitat polygons attributes and species table.

Figure 4.4 Mis-match between OS MasterMap 2003 in red and OS MasterMap 2010 in yellow

Table 4.3 IHS classification differences between 2003 and 2012

Old code (2003)	New code (2010)	Description
UR0.UA5	UR0.UAZ	Other built environment
UR0.UL1	LF271.UL1	Railways built
UR0.UL21	LF271.UL21	Motorways
UR0.UL22	LF271.UL22	A roads
UR0.UL23	LF271.UL23	B or other roads
UR0.UL24	LF271.UL24	C or other roads
UR0.UL3	LF271.UL3	Tracks and footpaths
.UL5	. LT4	Road verges
UR0.UL5	LF272.LTZ	Built verges
.UL6	. LT3	Rail verge
GI0.CL3	FT1.OM0	Traditional orchard, management unknown
GI0.UA42	GI0.GL1	Amenity grassland
CR0	CR0.CL1	Crop
SR0	SR2	
LR0	LRZ	
Keyword 'contains coppice' and Habitat=WB*	WM2 and remove keyword	
Keyword 'Field margins'	CR61, management CL1. Remove keyword	

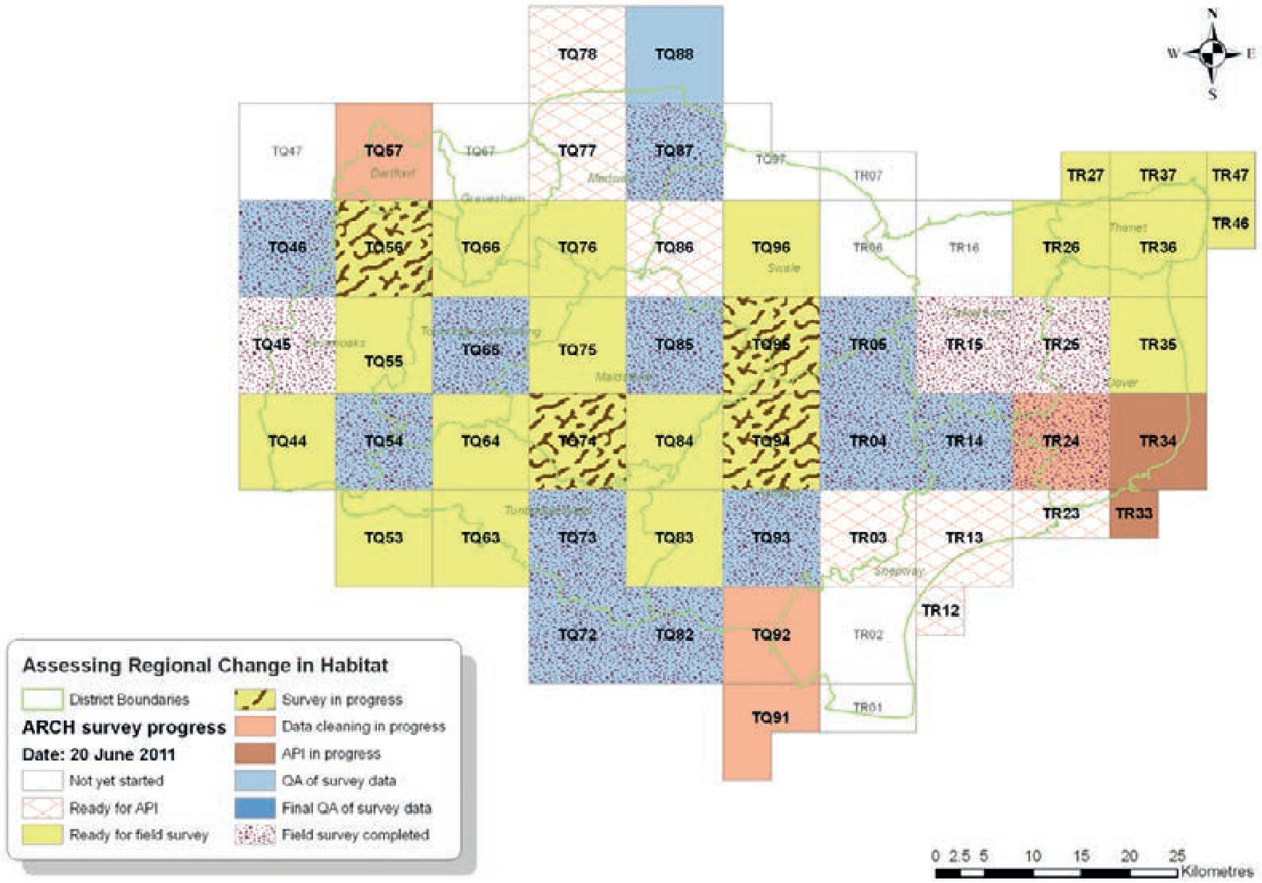

Figure 4.5 Progress map of 20 June 2011 showing the stage of processing for each OS map sheet

4.2.4 Progress Monitoring

The project area was covered by 48 OS map sheets ('tiles'), with a separated dataset for each. Every stage of the data processing listed in Figure 4.1 produced a new data set. For example, a data set was prepared and cleaned for API and called TQ94_Hab2010.mdb. After API, the data set was copied and used in field survey and 'FS' added to the filename. Once field survey was completed, the data set was copied for final checking and 'QAF' introduced to the filename. Finally this data set was copied and used to re-generate habitat 2003 data for change analysis.

Progress of each map sheet through the various stages was recorded in a database, linked to ArcGIS to enable visualisation. Figure 4.5 shows the state of all map sheets on 20 June 2011. Weekly update maps were produced to keep track of progress. Any tile was only used by one person at a time and the order of processing was strictly observed with only one or two exceptions early in the project.

4.2.5 Data Cleaning for Aerial Photo Interpretation

Manual data cleaning of the base mapping was needed before the data was ready for aerial photo interpretation (Box 3 in figure 4.1). A systematic review of each map tile was carried out, editing the data where:

- The classification was obviously wrong compared to the 2008 aerial photographs: correct the classification in the Habitat Capture tool (see Figure 4.6)
- There were slivers. In most cases these were merged with the larger polygon in which they fell. This generally involved very small priority habitat polygons, caused by digitizing at a different scale in 2003, which slipped across genuine field boundaries
- Habitats were not sufficiently accurately mapped: for example dense scrub on chalk grassland needed to be digitised to create a separate polygon. On arable fields separate significant headlands/uncultivated strips, on golf courses separate rough from smooth grassland (see figure 4.7 and 4.8)
- Rivers were classed as AS0 (Standing water and canals): updated classification to AR0 (Rivers and streams)

In addition, polygons were flagged for the attention of the API officer where the classification appeared incorrect, but the correct habitat could not be assigned without further investigation. The cleaned data set was then copied, ready for Aerial Photo Interpretation.

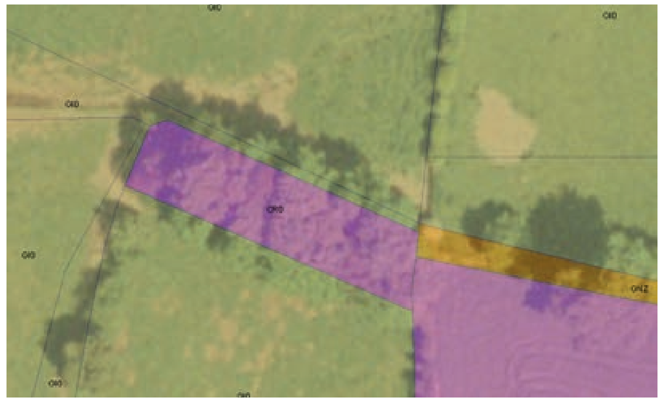

Figure 4.6 Reclassification of incorrectly classed areas (woodland classed as arable)

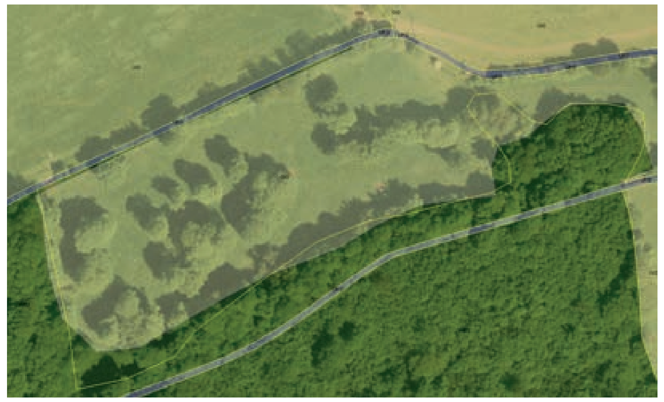

Figure 4.7 Habitat 2003 polygon before editing (grassland with trees in light green)

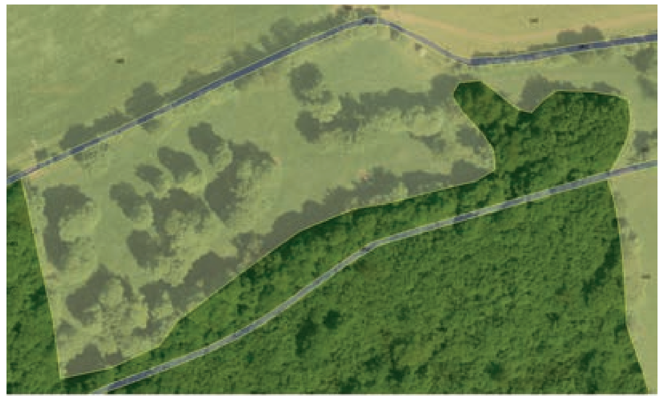

Figure 4.8 Habitat 2003 polygon after editing, showing the boundary of the grassland with trees, not the boundary of the tree canopy

4.2.6 Data for Field Survey

The API stage marked areas for field survey by adding a value ‘1’ in a column called ‘Flag’ in the geo-database (Box 4 and 5 in Figure 4.1). For field survey the data was set up on a rugged laptop computer (Panasonic Toughbook CF-19, see Figure 4.9), suitable for outdoor use in almost all weathers.
ArcGIS with the IHS habitat capture tool, as well as base mapping and other useful reference data were set up on these laptops. The habitat data displayed areas marked for survey in red hatching over 1:10,000 OS mapping and aerial photographs, allowing the surveyors to easily plan their work.

Data entry (habitat, species, comments) was done through the IHS habitat capture tool (Section 3). Once data input was finished for a polygon, the surveyor’s name appeared against the polygon and the red hatching changed to a solid colour, indicating that the area had been surveyed. Where polygon boundaries needed adjusting, the surveyor had to use the editing facilities of ArcGIS to split existing polygons, rather than creating new ones (thus retaining all attributes and links to the species table).

Field survey data was backed up daily on external hard drives, and handed to the GIS officer frequently. Equally when a tile was finished, a new one would be set up for the field surveyor. On rare occasions, the field surveyor would work on two data sets at once, alternating between the areas.

4.2.7 Quality Checks

The data received from the field survey was the final dataset in most instances (Box 6 in figure 4.1). Exceptions include areas where the base data was made up of the temporary dataset based on an earlier version of the habitat 2003 and OS MasterMap data and areas that had not undergone full API before field survey. These areas were returned to the cleaning and/or API stage of the process before final quality checks.

Some field survey areas in East Kent were found to be incorrectly classified based on the species data and comments recorded. An attempt was made to correct the classification for the more important polygons, but due to lack of recorded grasses a satisfactory classification was not always possible. Species recorded during the 2003 survey were taken into account where necessary, and the original classification was retained if the field survey of 2010 was considered unreliable. Some remedial field survey was undertaken in east Kent in 2012.

Over time, the IHS classification has been adapted to include further classes, subclasses and management codes. The habitat capture tool lookup data was updated, but datasets edited before updates would still carry older information. Therefore, the checking procedure included checking the validity of the classifications, ensuring that the summary code corresponded with the habitat/matrix/management code combination and setting the process = 'Field Survey' where applicable. A Unique ID was added so all final field data could be incorporated into a single survey database, with all links to recorded species intact (e.g. through a relationship class in a personal geo-database).

Following the field survey the resulting data had to be checked for a number of issues:

- To ensure that all habitat codes were valid. Certain habitats do not occur in Kent, but were accidentally selected in the habitat capture tool instead of the code above or below in the list
- To ensure that habitat classifications were as detailed as possible. For example use of codes such as LR0, SR0, GM0, OV0 were removed in favour of LRZ, SR2, GI0/GM1 and OV3 respectively
- Some habitat codes were duplicated in the original habitat tool (for example LF12 and LF21 both indicated a line of trees) and applied simultaneously in the survey and API

The quality checks were performed on the field survey data (Habitat Survey Polygons) through an MS Access database. This database linked to the habitat survey polygons of the survey data and associated species data. Once the link was established, a set of queries were run in sequence, each checking and updating a specific code. A detailed overview of the checks is listed in Table 4.4.

Polygons were marked for further manual checking, where habitat codes were incomplete, for example where a required management code was missing. Table 4.5 lists the codes that needed manual checking, based on the reason given for each code. The manual checks were carried out on the final version of the data. In addition the link between polygons and species data was checked and the UNIQID column in both tables populated to serve as a permanent link.
Table 4.6 gives a complete list of automated checks carried out in the final checking procedure.

Figure 4.9 Panasonic Toughbook C19 used for field survey

Table 4.4 List of automated processes in MS Access that fix codes or flag for manual checking

Name of script in MS Access	Actions carried out by script
KentHabitats_updHab2010()	Updates field Hab2010 where null
ReplaceHabitats()	Replaces habitat codes where criteria are met
ReplaceManagement()	Replaces management codes
ReplaceFormation()	Removes formation codes from habitats that should not have formation
ReplaceMatrix()	Replaces matrix code LF12 with LF21
ReplaceNames()	Replaces actual usernames with codes from table ReplaceNames
UpdateDATE()	Reformat date and put 01/06/2012 if value is null
SetPriorityHab ()	Update field Priority to null, then populate with BAP if BAP habitat
FlagManualChecks ()	Set flags and update comment for manual checks
SummariseManualChecks ()	Summary of flags and comment for manual checks by OS Tile
KentHabitats_AllSQL()	Summarises all habitat codes in Kent found during the survey
UpdateOSTILE()	Updates the OS sheet name where blank

Table 4.5 List of manual checks

Code	Reason for manual check
Null	must have habitat
AR5	must have formation
ARZ	Non tidal: AR0, tidal: AR41
ARZ	coastal tidal: AR4 or AR42
AS0	must have formation
AS0.AO0	must be pond AP1 or ditch AC11 or articial open water AO1
BRZ	must have management
CR	must have management
EM3Z	probably EM1Z, but check polygon
GI0.**UA3Z**	If built UAZ; if "green" then GL1 or possibly UA32
UR0.UA3Z	
IR11	not mapping underwater features
IRZ	not mapping underwater features
IS0	not mapping underwater features
LF26	GI0.GL2
LS3	probably LS33* group
LS33	probably LS33* group
LS3Z	probably LS33* group
SR112	HEATH ON CLIFF NEEDS CHECKING
UR0.**UA2**	UAZ if built surface but UA31 if a building
UR0	must have management

4.2.8 Edge Checking

GIS data for the ARCH habitat survey was managed in OS map sheets of 10x10km. Many areas (polygons) crossed the straight borders of these tiles, and were classified in each tile with which they overlapped (figure 4.10).

This meant that a border polygon was duplicated and in some cases even triplicated. With the ultimate goal of a joined up map layer, these duplicate polygons needed to be removed (figure 4.11).

Polygons were classified in 4 ways: by field survey, by aerial photograph interpretation, by data cleaning and automatically by converting the OS Mastermap classification to habitat codes. When deciding which of the overlapping polygons to retain, the above order of classification is used as a rule. So field survey trumped API, which in turn trumped data cleaning and so on.

Once this task was finished, the data (still divided in OS tiles) underwent further checking to ensure habitat codes and combinations were correct, and to add various other codes for future use. These quality checks were carried out through queries in MS Access. After the final checks, the data was ready to be integrated into a final joined up data layer.

4.2.9 Change Analysis

For the change analysis, a single GIS dataset needed to contain classifications for both 2003 and 2012 to enable a correct comparison of areas (Box 8 in figure 2.1). The data preparation to re-create the Habitat 2003 data used the 2012 final QA field survey data. The final version of the habitat survey 2012 was re-interpreted at habitat level only. The data preparation and results of the change analysis are described in Section 6.

4.2.10 Preparing Final Data Sets

The final 48 quality checked habitat data sets were combined into 3 personal geo-databases, covering west, central and east Kent. Personal geo-databases have a size restriction of 2 Gb. The total for the Kent habitat data in this format was 3.6 Gb.

By combining the individual habitat data sets into 3 larger files, the automatic identifier of most polygons was changed, thus losing the direct link to any species recorded for those polygons. With the earlier introduction of an additional unique identifier (UNIQID) in polygon and species attribute data, a permanent link was created. This link was then used to update the current automatic polygon id into the species table, thus ensuring that the IHS habitat capture tool continued to work with the combined data set.

Table 4.6 List of automated checks carried out in MS Access

Action	Old Code	New Code	Condition
Replace habitat code	ASZ	AS0	
	BR0	BRZ	
	CL5Z	CR0	
	CR2Z	CR2	
	CR4	CR0	
	CR6Z	CR6	
	CRZ	CR0	
	EM0	EM1Z	
	FT0	FT1	
	GA2	GA1Z	
	GN0	GNZ	
	GP0	GI0	
	GU0	GI0	
	HE1	HE11	
	LF12	LF21	
	LF0	LF2	
	LR0	LRZ	
	LS0	LS41	
	LS341	LS3361	
	LS342	LS3362	
	LS343	LS3363	
	OV0	OV3	
	RE1	RE112	
	RE2	RE2Z	
	SR0	SR2	
	SR123	SR113	
	SR125	SR115	
	SRZ	SR2	
	SSZ	SS19	
	SS3	SS3Z	
	WB0	WB3	
	WC0	WCZ	
	GM0	GI0 if in TQ54	
	GM0	GM1 near coast	
	GI0	UR0	UA33
	UR0	LF271	UL21
	UR0	LF271	UL22
	UR0	LF271	UL23
	UR0	LF271	UL24
	UR0	LF271	UL1
	UR0	LF271	UL2
	TH1	GI0.OT3	
Replace management code	CL5Z	CL1	
	GI0.**CL1**	GL2	
	GI0.**LT2**	GM1	
	GI0.**LTZ**	LT4	
	GI0.**UA4**	GL1	
	GI0.**UA4Z**	GL1	
Remove formation code	GXx.WF0	GXx	
	GXx.WF11	GXx	
	LF271.WF0	LF271	
	LF271.WF1	LF271	
	LF271.WF11	LF271	
	UR0.WF0	UR0	
	WF*	A*	

For other uses, such as for the web portal and KCC central data repository, the data were further combined into a single file geo-database (ArcGIS). This is an efficient way to store the GIS data, but not suitable for analysis with MS Access. The IHS habitat capture tool does not function with data in file geo-database format, therefore a relationship class was set up that linked the polygons and species data, available through the 'identify' tool in ArcGIS.

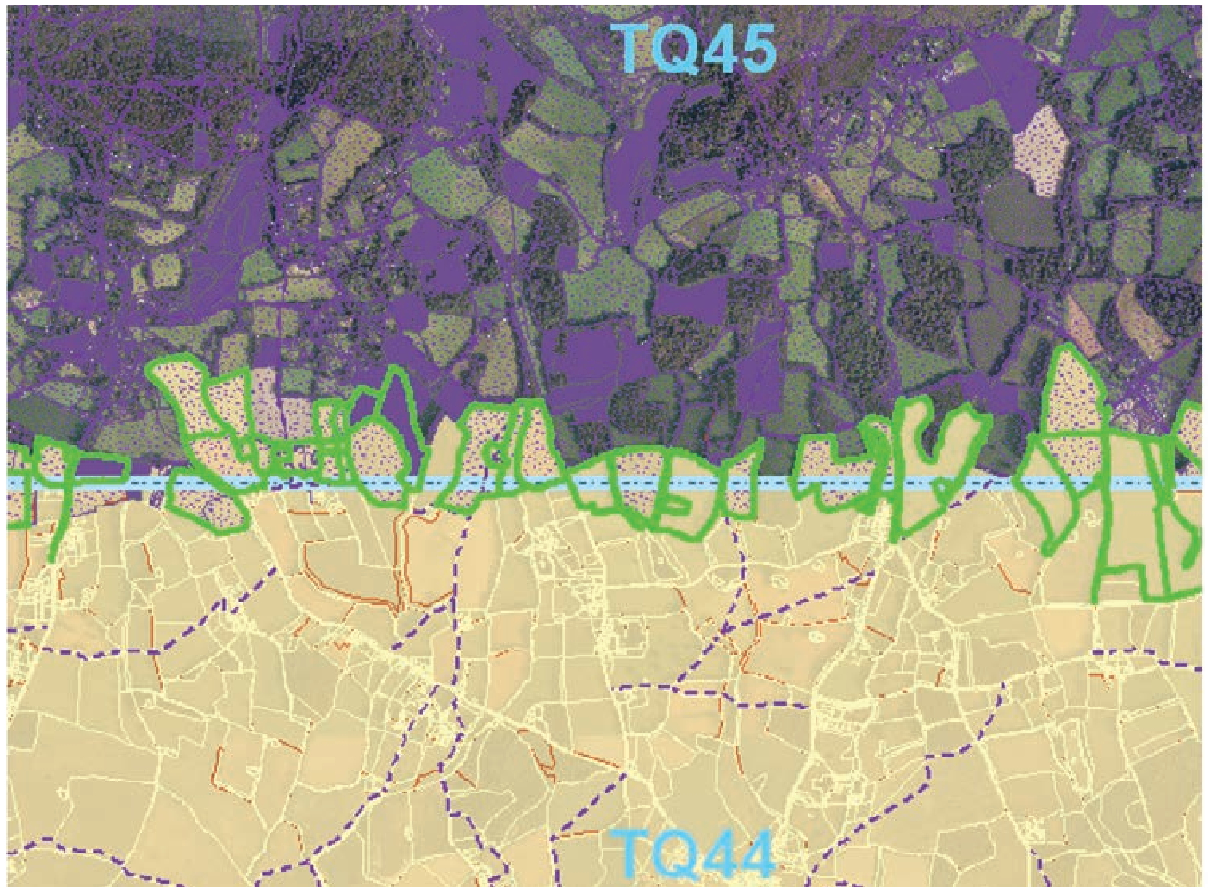

Figure 4.10 In green outline are shown the polygons that exist in both TQ44 and TQ45 map sheets

Figure 4.11 Selecting a duplicate polygon in both map sheets and based on the attributes determine which will be deleted (yellow highlighted row in the bottom table)

Standard legends for maps were developed in ArcGIS to display the habitat data at different levels of detail and with various selections. At the most detailed level habitat classes are shown in colours and textures. A more generalised version describes the 24 broad habitats in separate colours with fewer different textures. Further legends were available for selections of the data including field surveyed areas and priority habitats.

Several other data sets were created from the final habitat data. Correlation with a modified CORINE classification formed the basis of a joint map with the project partners in Nord-Pas de Calais. This classification was less detailed than the IHS classification used in Kent, with many habitats grouped together into more generic categories. In addition, some classes in the joint classification were based on management, rather than habitat, thus losing some important habitats in the final data. For example, a golf course was classed as 'Urban', even where it contained priority grassland habitat. Similarly cemeteries, road and rail verges and parkland were classed in urban category, despite containing important habitats.
The joint map CORINE codes and descriptions for each polygon were added to the Kent habitat data in separate columns through MS Access. A single data set was then exported into file geo-database and used in the final joint map produced by the French partners.

Land cover data were derived from the Kent habitat data and described in detail in a separate report for this project. Correlation between habitats and land cover provided a land cover code for each habitat polygon. The habitat polygon data was then converted to grid format with cell sizes of 100x100m, showing the land cover codes. This rather coarse data was used in comparisons with older data in the same format, to establish trends in land cover change since the early 1960's.

During the field survey, photos were taken of many areas, and where possible a location recorded as well. The photo and location were combined into a hyperlinked data set. This enables users to highlight a point in ArcGIS and automatically open the associated photograph.

4.2.11 Preparing Data for Analysis

Data for the final analyses in Section 5 were derived from the Kent habitat personal geo-databases. All attribute data were extracted and combined into a single MS Access database. Queries and scripts generated summaries of the data, such as totals for detailed habitats and broad habitats, summarised by county, district, AONB and landscape character areas. The summary data were exported to MS Excel spreadsheets for further analysis. Various iterations were necessary to achieve all necessary information in the right format for final analysis.

4.2.12 Making the Data Available

The Kent habitat Survey 2012 is made available through mapping tools on the ARCH website: http://www.archnature.eu/navigator.html (see figure 4.12). The mapping tools were generated using ESRI LocalView Fusion, with data made visible via Web Mapping Services (WMS). ArcGIS users can also download the WMS through a link at the bottom of the map window on the ARCH website.
The data provided includes:

- Kent Habitat Survey2012, with individual layers Habitat data 2012, Broad Habitats, BAP Priority habitats, Field Survey and Change analysis
- Land Cover 2008, with individual layers for Land Cover Classes, Land Cover Categories and Land Cover Broad categories

4.3 Aerial Photograph Interpretation

The survey used aerial photograph interpretation (API) as the main method of updating habitat classification across the county. Here, we describe the process and issues associated with this method.

4.3.1 API Procedure

The aim of the API was:

- To obtain an accurate up to date record of Kent's habitats and land cover
- To correct remaining errors introduced by combining habitat and OS MasterMap data
- To mark areas for field survey

The aerial photo interpretation was based on aerial photographs flown for Kent County Council during the summer of 2008, with areas across the north of Kent being flown in 2009. The images were supplied as a continuous ortho-rectified digital image mosaic.

Aerial photographs were viewed at 1:1000, on wide, flat-screen monitors. Data for API input was provided in geo-database format containing the cleaned, combined OS MasterMap and Habitat 2003 data as described in Section 4.2. A data set covered a single OS 10x10km map sheet or 'tile'.
Each tile was reviewed systematically to ensure that the entire area was examined. The polygon data overlaying the aerial photographs had been assigned habitat classifications based on the 2003 habitat and OS MasterMap data, and to some extent based on the preparation data cleaning. These classifications were checked and altered where necessary in the API procedure.

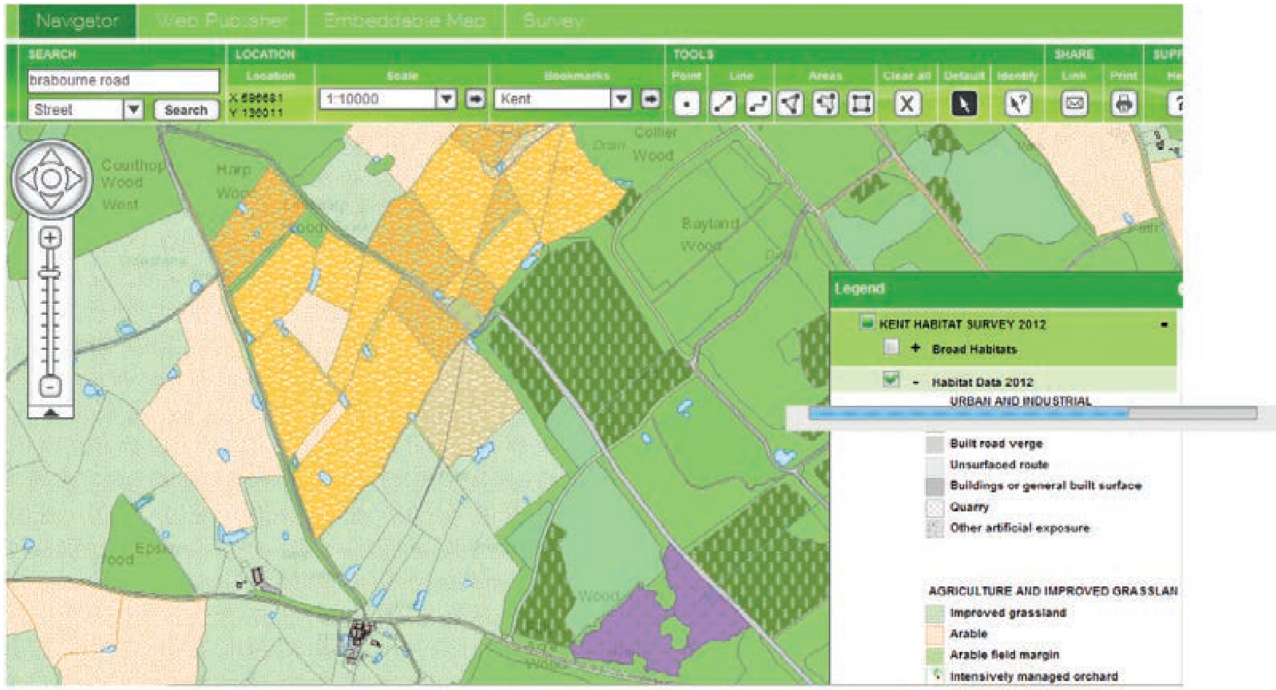

Figure 4.12 Kent habitat survey data is available via the project website

Four areas were considered during the process:

- Polygon classification,– confirmation that the polygon was classified correctly, including matrices, formation, management and complex codes where appropriate
- Habitat boundaries – checking that boundaries correlated with the most recent aerial photos
- OS MasterMap errors – checking for and removing slivers (very small polygons) of habitat in the habitat survey polygon layer not corresponding to polygons within the OS MasterMap area, where these had not been cleaned in the data preparation stage
- Flagging for field survey – labelling areas of priority or potential priority habitat for field survey or ground-truthing

The following sections describe details, issues and exceptions of the API procedure.

4.3.2 Minimum Mappable Area

The routine minimum mappable area for API was 0.25ha. However, when mapping priority habitat, this sometimes involved mapping at around 0.1ha or less, depending on the habitat type. This was particularly true in coastal and wetland areas. In some instances the minimum mapping area was dictated by the MasterMap framework.

Where a mosaic of habitats was observed or where priority habitats were present under the minimum mappable size, the main habitat type was recorded and the associated habitats recorded as matrices. For example, where lakes or ponds contained reedbeds or wet woodland under the minimum mappable area, these were included as matrix codes under the habitat code for lake or pond (Section 3).

4.3.3 IHS Habitat Capture Tool

The IHS habitat capture tool (described in section 3) was used to record the habitat type, matrices and formation or management associated with each polygon.

The tool also recorded the type of analysis being undertaken during changes to the polygon, i.e. whether the information came from API, field survey habitat records or from Ordnance Survey. The majority of the changes during this process were from API, with a small selection informed by habitat records or previous field surveys where these gave appropriate and up to date information.

4.3.4 Habitat Classification

During API, the habitat classification of each polygon was checked against the aerial images. Each habitat was assigned a management code, according to the apparent management of the site. Matrices, formation and complex codes were added, where appropriate, to further describe the habitat within the polygon (see Section 3). An example of this is shown in Figure 4.13.

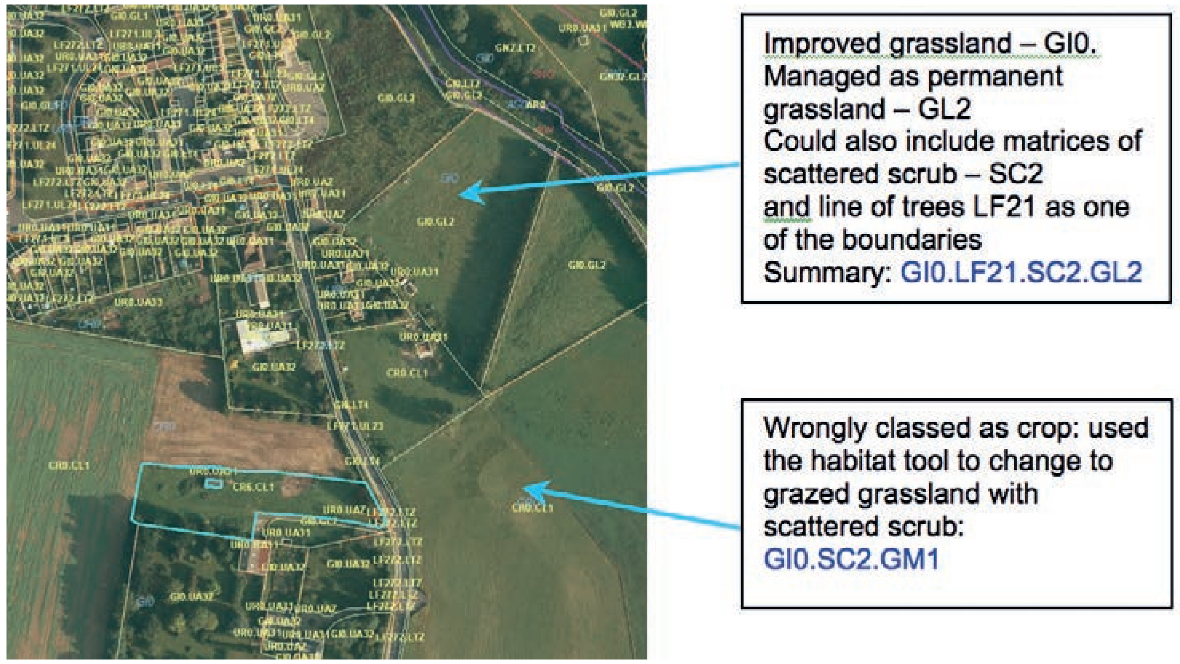

Figure 4.13 Examples of change of habitat class and use of matrices during API

Supporting information regarding the habitat classification was obtained by using a range of aerial images from different years. This was helpful to determine previous land use, such as whether areas were permanent grassland as opposed to a grass ley (crop), or if the grassland had previously been arable / fertilized / reclaimed from scrub.

Where habitat classification remained a problem (for example where shadows existed in the aerial photographs, clashes between OS MasterMap attribution and apparent aerial photograph evidence) then limited use of Google Streetview was applied. However, using the latter source of evidence slowed the API procedure down considerably, and not all areas in question were visible from Streetview.

Additional information such as classification and target notes from the 1990 KHS, Local Wildlife Site (LWS) citations and other external data were used to help classify polygons, or target areas for field survey

4.3.5 Recording Additional Habitat Information

One of the more difficult management codes to assign accurately was Wood Pasture and Parkland (management code WM5). This class covers a group of priority habitats defined by the presence of veteran trees or other elements of old wood pasture. Most sites had been classified during a desktop review of Wood pasture and Parkland for KCC in 2008; however some of these sites appeared to be inaccurate. Landmark historical maps (including 19th to early 20th century mapping) were used to try and establish the likely presence of older/veteran trees. Where possible, these areas were flagged for field survey.

Additional information was added in specific situations by adding a complex code to the classification, for example, areas that corresponded to coastal and floodplain grazing marsh, maritime cliffs and slopes or areas that were post-industrial sites. These all covered various different habitats but, together, described coherent parts of the landscape.

4.3.6 Habitat Boundaries

In some areas, boundaries between habitats had apparently changed or were more accurately represented by OS MasterMap polygon boundaries. The following changes were made where required:

Boundaries lost – Where habitat boundaries no longer existed, and where there was no OS MasterMap boundary, the polygons were merged.

Exceptions to this involved areas that used data from the Environment Agency; in these cases merging was restricted owing to complexity of the combined data.

New habitat boundaries – Boundaries were created where there was an obvious difference in habitat that had not been recorded previously. This may have been due to habitat change, such as the expansion in scrub (figure 4.14), or because previous survey digitisation had omitted the boundary.

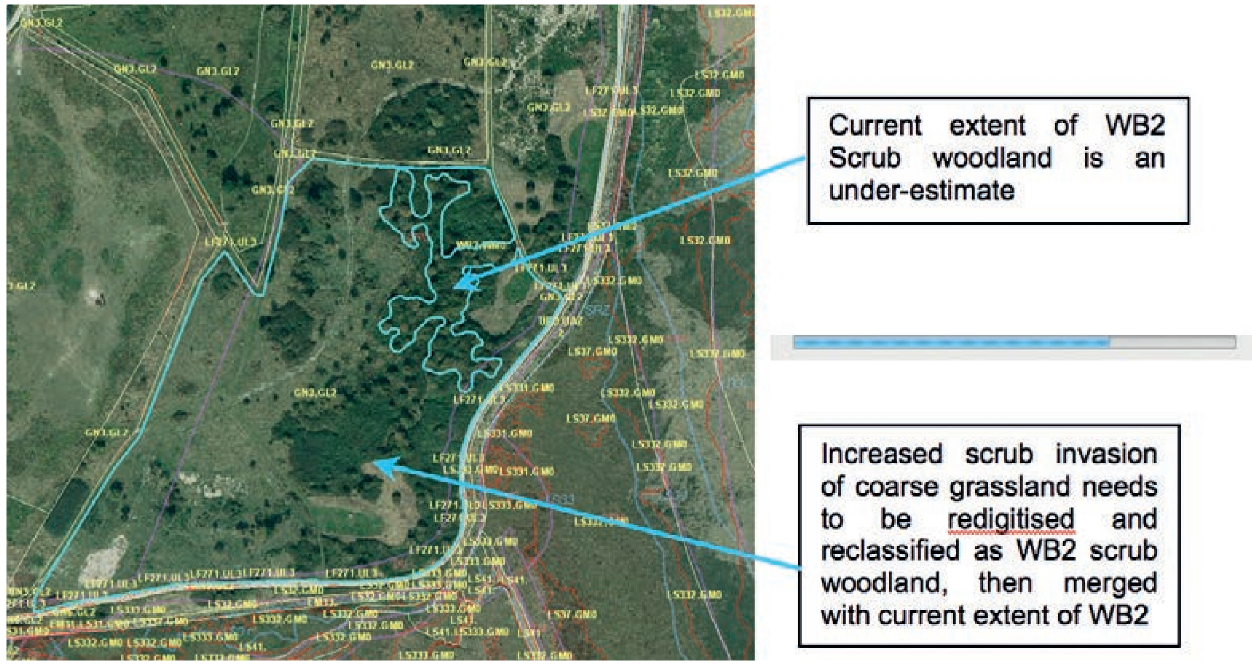

Figure 4.14 An example of scrub expansion and the need for re-digitising a new boundary

Habitat boundaries were digitised at scale 1:500, with newly generated polygons classified using the habitat capture tool. If, as in the example below, the new habitat was an extension of a neighbouring polygon not delineated by OS MasterMap, then the polygons were merged and the new outline and classification checked for accuracy.

Initial data cleaning did not always clear up sliver polygons, created during the combination of OS MasterMap and KHS 2003 data. These were observed as small (sometimes minute) polygons along the edges of current habitat. These were merged with the most appropriate polygons (ones that shared the same OS MasterMap TOID value as the sliver).

4.3.7 Selecting Areas for Field Survey

The aim of the field survey was:

- to identify or confirm areas of UK Biodiversity Action Plan (UK BAP) priority habitat
- to survey areas of priority habitat found in the 1990 survey but not visited in the 2003 survey
- to re-visit areas of semi-improved neutral grassland that had been identified in the 1990 Phase 1 survey but 'lost' in 2003 (mainly areas that had not been recorded as species-rich)
- to identify potential areas of semi- or unimproved grassland in addition to those recorded in the two previous surveys

Selection of areas for field survey was an important part of the API process. Selected polygons were marked by entering a value of '1' in a field called 'Flag' and, where appropriate, a comment on why the area was to be field surveyed was recorded for the future field surveyor.

If re-digitisation of habitats was required, this was undertaken, where possible, during API, since accurate habitat delineation was more difficult in the field.
Not all areas were subject to field survey, with the main exceptions listed below.
1) There was no routine requirement to survey Sites of Special Scientific Interest (SSSIs), except when the aerial photographs suggested that there had been significant change in the habitat cover (for example, an increase or decrease in scrub cover).
2) Areas of priority habitat within Local Wildlife Sites (LWS) were not flagged if they had been surveyed by Kent Wildlife Trust (KWT) in the previous 2 years, unless there was insufficient information to accurately classify the polygons.
3) Sites deemed to be 'dangerous' because of their proximity to anti-social areas, fast roads or other hazards, such as deep water, were omitted from the field survey.
4) Survey of woodland fell outside the remit of the current survey. The exceptions to this were areas of potential wet woodland (UK and Kent BAP priority habitat) or woodland visited en route to survey another area. The latter case was entirely down to the individual surveyor, and the results cover only a very small proportion of the woodland within Kent.
5) Maritime, intertidal and marine habitats had been surveyed in 2006 and 2009 by the Environment Agency and the data incorporated within the current survey. For this reason, most of these areas were not field surveyed.

4.3.8 Priority Habitats

These are areas of greatest conservation interest within the natural and semi-natural habitats in Kent. Priority habitats support important plant and animal communities and fall under both the UK and Kent BAP priority habitat designations. Because of the importance of these sites, all areas of priority habitat were flagged for survey, with the exceptions listed below.

To pick up areas recorded as the equivalent of priority habitat in 1990 but not surveyed in 2003, the previous survey data was queried in ArcGIS. Polygons selected by this method were examined using API to see if there was still potential for the area to have conservation value. Where the habitat appeared not to have undergone significant change from earlier surveys, the polygons were flagged for field survey.

4.3.8.1 Grasslands

Survey limitations in 2003 restricted the amount of grassland that was field surveyed. All semi-improved chalk, acid and species-rich neutral grassland was targeted for field survey, but neutral grassland that had not been recorded as species-rich was not. As a result, many areas of semi-improved neutral grassland were recorded as improved grassland, a net loss compared to that recorded in 1990.

In order to restore these lost grasslands of potential value to wildlife, GIS selections of 1990 data were made. This highlighted area recorded as semi-improved during the earlier survey, but was not field surveyed in 2003. The highlighted sites were then examined by API, using aerial images from the Google Earth to determine any land-use change over time. Extra information from the Phase 1 target notes recorded in 1990, geological information and other external data, such as the Weald Meadow Initiative, were also used. Where the grassland appeared to be unmanaged, it was classified as rank neutral grassland (GN31), not requiring survey. A sub-set of sites that were still likely to support semi-improved grassland communities was identified and flagged for field survey. In addition, information from the 1990 Phase I survey target notes was used to identify other areas of grassland that appeared to have greater ecological potential than that recorded in 2003; these were also flagged for field survey. Some sites had been recorded as potentially unimproved grassland during API in 2003. These were examined as above and a selection flagged for field survey. Some grassland areas, recorded by API as improved grassland (GI0) in 2003 and 1990, had the appearance and texture of semi-improved swards. These areas were further examined using aerial photos from different eras, to check whether they had been subject to intensive management in the recent past. Where it appeared that these sites might contain semi- or unimproved grassland, the polygons were flagged for survey.

4.3.8.2 Wet Woodland

While woodlands in general were not the target of this survey, wet woodland is a UK and Kent BAP Priority habitat and therefore targeted for field survey. Wet woodland is difficult to distinguish from other broadleaved woodland in API, with a few exceptions. Willow carr, depending on its location, has a recognizable appearance, and riverine alder woodland, when not surrounded by woodland of drier ground, can also be distinguished. All wet woodland, or potential wet woodland, over 0.25ha was flagged for field survey. Where wet woodland was below the minimum mappable area within a river, stream system or other water body, it was recorded as a matrix within the water habitat class.

4.3.8.3 Wetlands

Reedbeds form another priority habitat that was detected through API and flagged for field survey. In brackish water areas, there was some possibility of confusion with Bolboshoenus communities. Because of the potentially hazardous nature of the survey work in these localities, not all areas of reedbed were actually visited. Where reedbeds were below the minimum mappable unit, or existed within a ditch system, they were recorded as a matrix within a water habitat class.

4.4 Field Survey

Field survey of selected sites was undertaken in the spring/summer seasons between 2010 and 2012. Three field surveyors were employed for the first season, four in the second (with additional work from a fifth surveyor for part of the season) and one in the third, with additional work from a second surveyor at key sites. The primary aim of the field survey was to validate information recorded during API.

4.4.1 Field Survey Procedures

The standard survey method was to assess the area for general habitat type, and to walk over the site, trying to cover as much of the area as possible. A structured walk, in the shape of a ‘W’ was recommended where possible. In some cases, the surveyors were required to re-digitise the polygon if API had failed to pick up significant variation on the ground. However, boundary determination and digitisation were more difficult in the field, and some of these boundaries, as a consequence, may not follow the true boundaries accurately.

The field surveyors recorded presence and cover of plant species within the habitat using the habitat capture tool. This information enabled them to make an accurate evaluation of the habitat type.

Because of the extent of the area to be field surveyed, and the importance of the field survey data in future planning and conservation projects, both speed and accuracy were required from the field surveyors. To this end, field surveyors were required to record only sufficient botanical species information to confirm the habitat class, with the inclusion of relevant matrices, formation, management and complex codes where appropriate. A full botanical survey was not undertaken. Where sites were of previously unrecorded BAP quality, or had the potential to be a Local Wildlife Site, a greater number of plant species were recorded, together with comments on habitat quality and species-richness.

4.4.2 Field Survey GIS

The use of an all-weather rugged laptop to record habitat data was an advance on the previous survey, where the laptops were more conventional and lacked robustness required for field survey.

Information on the field survey GIS equipment and process has been described in section 4.2.6.

In order for the surveyors to make informed decisions on habitat types, the habitat capture tool contained a list of key indicator species that should be present for specific habitats. These are described in Appendix 3. The exceptions to this were grassland habitats, where a key was developed to record the separate grassland communities. This key is described in the following section.

4.4.3 Grassland Key

In order to standardise the grassland classification for the survey, an identification key was developed (L. Bristow; Appendix 4). This key enabled surveyors to place grassland habitats within the appropriate IHS class, using both positive and negative indicator species, as well as sward structure and other attributes. Training and joint field survey sessions ensured that the surveyors were familiar with the grassland habitat classification system and that there was consistency of classification between the surveyors.

Details of the IHS classes and indicator species were present within the habitat capture tool. Information on equivalent NVC classes was also available to the surveyors.

In order to complete the field survey in the time available, surveyors were asked to follow the standard survey protocol and were specifically instructed not to spend time searching for more species that might promote the grassland to a higher class.

4.4.4 Survey Targets

In the first survey season, there was no formal target set for field survey coverage. However, for the survey seasons 2011 and 2012, a survey target for each field surveyor of 180ha minimum average weekly progress was set (approximately 40ha per day). The figure included allowances for obtaining access permission and survey planning. The amount of actual survey undertaken was dependent on the weather, the nature of the habitats and the distribution and accessibility of the sites.

4.4.5 Access

Access to survey sites was not pre-arranged. Open access or public land allowed for full survey of these areas, where required. On privately owned land, field surveyors made their own arrangements for access by contacting the landowners, where known, or by cold-calling. In some cases, access was not obtained, through lack of information or because access was denied. In these cases, this information was recorded, and as much habitat data as possible was gleaned from binocular survey from Public Rights of Way and other publically accessible areas.

Where there was no access and no view of the site, the API classification was retained, or amended using local information, and a comment included in the survey information.

4.4.6 Other Records

Although the survey was mainly a rapid botanical survey, other records were requested from the field surveyors where possible. Photographs of interesting or important sites or species were taken and their location recorded on a GIS layer. Observations of fauna could be recorded in the field survey comments where the field surveyors were able to positively identify the species. However, as this was not a basic remit of the survey, the coverage for this type of data was not uniform across the survey.

Rare plant species, where observed, were recorded using photographs and comments, and their location noted. If it was possible to take a voucher specimen for confirmation, without damaging the population of plants present, then surveyors were asked to do so, and have the plant identified by the Botanical Society of the British Isles (BSBI) county recorder. A list of rare plant species in Kent from the BSBI was issued to the surveyors, and they were asked to contact the county recorder with information on any rare species observed during the survey.

4.4.7 Identification of Potential Local Wildlife Sites

Kent and Medway have over 457 Local Wildlife Sites (LWS), a designation that indicates an area that is wildlife-rich and has local nature conservation value. They are recognized as important for their contribution to biological diversity and their role in wider ecological networks and are afforded some protection through the National Planning Policy Framework (2012).

The criteria for designation of an area as a LWS were drawn up by the Kent and Medway Biodiversity Partnership (KBP) and site selection is overseen by the KBP steering group. Kent Wildlife Trust manages the LWS system in Kent.

Field surveyors were instructed to record sites that had potential to be listed as LWS. These could be species-rich sites or those that exhibited elements of LWS designation criteria (see Appendix 5). If such a site was identified, a more in-depth survey was undertaken to give a better description of the LWS potential.

4.4.8 Quality Control

Field survey information was checked after the tiles were returned to the office on completion. In some early cases, where the survey protocol had not been followed, field survey data had to be rechecked by another surveyor, to establish the correct habitat classification. This was necessary for only a small proportion of sites visited across the county.

4.4.9 Safety

Safety and welfare of the field surveyors was of prime importance, and a risk assessment document covering all potential situations and their mitigation was issued to, read and signed by the field surveyors. Guidelines and training were given to the surveyors on avoiding potentially unsafe situations. They were instructed not to put themselves at risk of any potential hazards to health and wellbeing.

To ensure that the field surveyors could be located in case of an emergency, and that there was regular contact with them during the day, the automated check-in/check-out Lone Safe system using text messaging was used. However, the effectiveness of this was limited by the phone network coverage. In the second year of survey, surveyors were issued with a second SIM card, so that their phones could use two different networks. The Lone Safe system automatically generated a warning when surveyors failed to check-out, or renew their check-in after a prearranged time. Survey managers responded to any alarm messages from Lone Safe or the surveyors, contacting the surveyors to confirm whether there was a problem and dealing with any issues. In addition, the surveyors' phones could be sent a text message, which returned the GPS location of that phone, which could be mapped in GIS or on Google Earth.

If the surveyors were working after hours, or if they had a problem using Lone safe, a phone buddy system was used.