Biodiversity Key Resources Inventory

Technical Report
E2-024

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R&D Technical Report E2-024

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This report describes the production of key habitat inventories for use within Geographical Information Systems.

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EXECUTIVE SUMMARY

The Environment Agency is committed to improving the extent and quality of habitats to sustainable levels for the benefit of all species. Key to determining whether a habitat is improving either in its extent or quality is knowledge of where that habitat is. Current information on the distribution of key biodiversity resources – particularly habitats, tends to be fragmented and, where available, presented in a variety of formats and media. This situation is being redressed, in part, through steering groups set up under the UK Biodiversity Action Pan.

Historically, inventories have consisted of lists of sites where either different habitats and/or species can be found and have arisen out of a basic requirement to catalogue a given resource. While these have proved useful for a range of management issues, they do not meet our increasing information needs in relation to current (UK Biodiversity Action Plans, Habitats and Birds Directives) and future (Water Framework Directive) drivers. Modern inventories should provide limits of the extent of habitat and species distributions, be based on agreed definitions and be capable of being updated at a known frequency. Once generated such inventories can be held within Geographical Information Systems (GIS), allowing further manipulation of the data. Inventories can be spatially integrated with other data sets such as the location of designated sites, Environment Agency monitoring sites and the location of licensed discharges and abstractions. In this way a wider range of pertinent information can be gathered thus providing answers to questions which to date have been difficult, if not impossible to answer.

This project has focused on generating habitat inventories of specific use to the Environment Agency. This has been driven by looking at those habitats where the Agency has lead responsibility under the UK Biodiversity Action Plan. These include aquifer fed naturally fluctuating water bodies, chalk rivers, coastal saltmarsh, eutrophic standing waters and mudflats. This work has been completed either by collaborating with other interested parties or by independently generating the inventories. Where this has been possible a detailed description of the methods employed has been recorded. The completed inventories are available to Environment Agency staff through the I: drive (national GIS drive).

The use of habitat inventories is important for both strategic purposes (e.g. state of the environment reporting) and operational purposes (e.g. River Basin Management Plans, habitat enhancement schemes and strategic planning). The generation of inventories provides new opportunities for integrating data sets specific to the Environment Agency's activities. This may be of particular benefit when considering the outcome of Agency activity in relation to the 'actual' state of the environment.

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1 Introduction

1.1 What are inventories and how can the Environment Agency use them?

One of the fundamental goals of the Environments Agency's Environmental Vision (Environment Agency, 2000b) is as follows:

"An enhanced environment for wildlife. Wildlife will thrive in urban and rural areas. Habitats will improve in their extent and quality to sustainable levels for the benefit of all species. Everyone will understand the importance of safeguarding biodiversity"

Key to determining whether a habitat is improving either in its extent or quality is knowledge of where that habitat is. This may seem a very obvious statement but for the majority of habitats of interest such information does not exist in a nationally consistent and useable manner. This project seeks to derive this type of information for habitats that are of specific interest to the Agency.

Historically, inventories have consisted of lists of sites where either different habitats and/or species can be found. Inventories have arisen out of a basic requirement to catalogue a given resource. While these have proved useful for a range of environmental management issues, they do not meet our increasing information needs in relation to current and future drivers. Modern inventories should provide limits of the extent of habitat and species distributions, be based on agreed definitions and be capable of being updated at a known frequency. Once generated such inventories can he held within or viewed through Geographical Information Systems (GIS). Such GIS can be used to generate a range of statistics on the habitat and species in question. In addition they provide the opportunity to spatially integrate inventories with other data sets such as designated sites, Environment Agency monitoring sites, licensed discharge and abstractions sites etc. In this way a wider range of pertinent information can be generated and therefore provide answers to questions which to date have been difficult, if not impossible, to answer.

Simplified questions that may be answered with the use of GIS biodiversity inventories include:

- Where is it?
- How much of it is there?
- How much of x is within the boundaries of y?
- How many individuals/hectares of x are within a given distance of y?
- How has the area of x changed since the last survey?
- Where can we locate x to avoid habitat y?
- Which examples would be best targeted for regeneration?
- Has the Agency, through its activities, increased the extent and/or quality of a particular habitat or species?

1.2 The drivers behind inventory creation

It has already been noted that the Agency is committed to improve the extent and quality of habitats within England and Wales. External drivers exist in the form of the UK Biodiversity Action Plan (UK BAP) and the European Directives on Birds and Habitats (79/409/EEC and 92/43/EEC).

1.2.1 UK Biodiversity Action Plan

In response to the signing of the Convention on Biological Diversity at the 1992 Earth Summit in Rio de Janeiro the UK Government published Biodiversity: The UK Action Plan (UKSG, 1995). In 1995 a report was published setting out the principles for delivering the plan during the period 1995-2010. Several volumes of action plans have now been produced covering a total of 391 species and 45 habitats. Over 400 actions in the UK BAP, many of them generic, have been assigned to the Environment Agency. The overall goal of these plans is to conserve and enhance biological diversity within the UK and to contribute to the conservation of global diversity through all appropriate mechanisms. The habitats for which the Agency has lead responsibility are defined below.

- Aquifer-fed naturally fluctuating water bodies
- Chalk rivers
- Coastal saltmarsh
- Eutrophic standing waters
- Mudflats

Key to being able to undertake any actions in relation to these habitats or report on their effectiveness, is knowledge of where the habitats exist. Although fundamental this information is typically lacking. This project has focused on developing inventories of these habitats, but has also considered other habitats in which the Agency has an interest.

1.2.2 European Birds and Habitats Directives

The principal legislation for protecting biodiversity in Europe comes from the European Birds and Habitats Directives. These have resulted in the construction of a network of protected sites for habitats and species which are of outstanding wildlife interest. This is delivered by the designation of Special Protection Areas (SPAs) and Special Areas of Conservation (SACs). The Directives contribute to the convention on biodiversity by requiring Member States to take measures to maintain or restore habitats and species at a favourable conservation status in the Community, giving effect to both site and species protection objectives. Once again knowledge of where specific habitat types are found, in addition to those specifically designated, is crucial to being able to undertake these actions. In some cases the habitats designated as SACs match UK BAP habitat definitions.

The development of the UK BAP, and the requirements of these European Directives, require us to understand the extent and quality of habitat patches outside of the designated statutory sites. Existing inventories only provide a starting point evaluating the current extent of some

habitats, but give no indication of overall quality of the resource, or trends in extent, distribution or quality.

1.3 Past, current and future inventories

Current inventories are stored using a variety of techniques including paper lists, computer based spreadsheets and databases, and within Geographic Information Systems (GIS). The scale at which these inventories are generated also varies both in terms of the scale at which the data have been mapped and the area over which the resource is catalogued. For example, many inventories exist for very specific areas, often to a high level of detail (such as Phase 1 mapping) but these are not generally available as nationally consistent inventories.

Examples of currently available national inventories include the ancient woodland, grassland and lowland heathland inventories. The list of priority habitats currently requiring inventories is given in Table 1. It is clear that there is a need to develop inventories for a much wider range of habitats, some of which have the Agency as the lead partner.

Table 1. List of priority habitats requiring inventories

BAP Broad Habitat	BAP Priority habitats	Lead
Broadleaved, mixed and yew woodland	Upland oak woodland	FC
	Lowland beech woodland	FC
	Upland mixed ashwoods	FC
	Wet woodlands	FC
	Lowland wood pasture and parkland	EN
Coniferous woodland	Native pine wood	FC
Boundary and linear features	Ancient and/or species rich hedgerow	DEFRA
Arable and horticulture	Cereal field margins	DEFRA
Neutral grassland	Lowland meadows	CCW
	Upland hay meadows	DEFRA
	Purple moor grass and rush pastures	CCW
Calcareous grassland	Lowland calcareous grassland	EN
	Upland calcareous grassland	CCW
Acid grassland	Lowland dry acid grassland	EN
Dwarf shrub Heath	Lowland heathland	EN
	Upland heathland	EN
Fen, marsh and swamp	Coastal floodplain grazing marsh	EN
	Fens	EN
	Reedbeds	EN
Bogs	Lowland raised bog	EN
	Blanket bog	SNH
Standing open water and canals	Mesotrophic standing waters	EA
	Eutrophic standing waters	EA
	Aquifer fed naturally fluctuating standing water bodies	EA

Rivers and streams	Chalk rivers	EA
Montane habitats		
Inland rock	Limestone pavement	CA
Built up areas and gardens		
Supralittoral rock	Maritime cliffs and slopes	CCW
Supralittoral sediment	Coastal sand dunes	SNH
	Machair	SNH
	Coastal vegetated shingle	EN
Littoral rock	Littoral and sublittoral chalk	EN
	Sabellaria alveolata reefs	EN
Littoral sediment	Seagrass beds	EHS(NI)
	Coastal saltmarsh	EA
	Mudflats	EA
	Sheltered muddy gravels	
Inshore sublittoral rock	Tidal rapids	EHS(NI)
	Modiolus modiolus	CCW
	Sabellaria spinulosa reefs	EN
Inshore sublittoral sediment	Sublittoral sands and gravels	EN
	Mud habitat in deep water	SNH
	Saline lagoons	EN
	Maerl beds	SNH
	Serpulid reefs	SNH
Offshore shelf rock		
Offshore shelf development		
Continental shelf slope	*Lophelia pertusa* reefs	DEFRA
Oceanic seas		

While it is clear that no common method will be applicable to the development of these diverse inventories, the following ideals should achieved.

- Inventories must be dynamic
- They must be able to have some sort of update capacity to keep up with nature
- Must move on from being static lists
- Must support patch quality assessment
- Provide a requirement to understand habitat patches outside designated areas

Inventories can be based in many media, but a GIS is the most appropriate. Within this environment their range of use is vastly expanded when compared to paper-based or even database inventories. Geographic Information Systems take advantage of the user's natural ability to interpret and distinguish colours, patterns and spatial relationships. Spatial statistics can be easily generated, such as the area of intertidal mudflats within a given SSSI, County or user-defined extent. Repeated surveys can then allow change statistics to be generated, perhaps in response to known habitat improvement schemes. More complex analyses are also possible by integrating inventories with other related data.

This project describes the generation of habitat inventories of specific interest to the Environment Agency. Where this has been successful the inventories have been made available to all Agency staff with access to a GIS. These can be found on the I: drive within the biodiversity folder.

2   Inventory production

The process of inventory production can be split into four key stages. Simply, these can be thought of as defining what the resource is that you want to identify, ensuring that source data are appropriate and available, capturing the data and finally checking the quality of the finished product. While the methods used vary between inventories, for obvious reasons, some of the more generic principles are outlined within this chapter. More detailed information on specific habitats can be found in their associated chapter.

2.1   Defining the resource – Stage 1

It is imperative that any resource being mapped is well defined before cataloguing can take place. Within the UK BAP there are a large number of species listed, many of which have the Agency as lead partner. Defining such a resource provides no problem assuming these species can be identified correctly. This is especially important if more than one person/body is working on the inventory. Replication of the inventory (updating) will require well-documented and available facts about what was initially mapped. Inventories provide a snap shot of resources – the inability to create another snap shot using exactly the same definitions voids the temporal and spatial analysis of change.

2.1.1   Habitat definitions

There are a range of drivers requiring information on habitat extent and quality. The UK BAP has provided a focus for the generation of definitions of priority habitats. One of the primary aims of such work is to be able to map the location of these habitats within a GIS. This brings a new element to habitat definitions in that they need to be 'mappable definitions', placing particular emphasis on defining 'thresholds' between closely related habitats, and defining quantified limits where possible (Burke and Webb 2001).

Outside of this project habitat definitions for BAP priority habitats are being produced within the National Biodiversity Network South West pilot project. These definitions were generated using expert knowledge and following available guidance on formats (EN, 2001a). Local Record Centres in the South West region have each taken responsibility for a selection of priority habitats, and have drafted their definitions. Almost all of the BAP priority habitats are being mapped within the NBN SW pilot, except for those known not to be present in the region (Burke and Webb 2001). A full list of habitats and their definitions is available from the NBN SW pilot project. These definitions were not available for use within this project. The definitions used are defined within each of the habitat specific chapters.

Habitat definitions must be capable of utilising a range of data types (remote sensing, Ordnance Survey, geological and soils data, habitat maps and species data), within a GIS environment, to classify individual land/sea parcels. Methods of defining a parcel include quantifiable parameters ranging from the presence/absence of key species to percentage cover or the total number of individuals. In the case of this project definitions had to be nationally applicable. This therefore required that data were available (both now and in the future, and ideally in the past) for all areas of England and Wales that were to be mapped.   When creating inventories any unavoidable subjective definitions should be well documented for reviews and future use. The definitions must enable a repeatable and acceptable level of

accuracy. In some instances it is useful to attribute text descriptions of the habitat boundaries in the attributes of the inventory as this can provide a useful link between GIS polygons and how they relate to the real environment.

Related to the definition of what constitutes a habitat, is the question of what represents the boundary of that habitat or patch. In some cases the boundary is discrete and obvious, but typically there is a gradual transition between one patch and the next. Decisions on where a boundary can be drawn can depend on a range of issues including the nature and limits of the source data and the final use to which the inventories will be put. An example of the latter is related to the question of habitat degradation and/or restoration. The polygon created could represent not just where the habitat, as defined, is found but also where degraded habitat or habitat suitable for restoration is located. Guidance on how to deal with this issue can be found within the habitat definitions.

Another such contentious issue is that of overlap of habitats. An example might be the occurrence of reedbeds within standing water. Both the reedbeds and the standing water can be represented by discrete polygons but should they be allowed to overlap or should there be a hole in the standing water patch where the reedbed occurs? Again any decision will ultimately depend on the use to which the data will be put. Habitat relationships such as 'edge effect' and 'overlap' are currently being discussed within the SW Pilot from which guidance will soon be available.

2.2   Data Audit and sourcing – Stage 2

Once a habitat definition has been agreed the next stage is to review what, if any, appropriate data exist. This involves conducting a wide-ranging audit of available data from the different potential data sources. These include Local Record Centres (LRCs), the countryside agencies, national data sets and data held by other organisations such as the Forestry Commission.

2.2.1   Data Quality assessment – some pointers

Due to the large number of organisations and individuals collecting biodiversity data and the broad spectrum of their objectives, there is great diversity within the quality, nature and coverage of available data sources. It is therefore important to conduct the following assessments when either producing new data or when using existing data (Burrough and McDonnell, 1998).

- Currency

Are the data contemporary or within an acceptable date range?

Biodiversity data can quickly become out of date due to natural and anthropogenic dynamics. Surveying is a costly and time consuming process and certain inventories are affected more than others. For example an inventory of the location of rivers changes far slower than an inventory of the saltmarsh.

- Completeness

What area do the data cover?

This can range from a single SSSI to whole counties, regions or even countries. How useful is the coverage for the particular requirements, can they support a national inventory?

- Consistency

Map scale?

Do the data represent the resource at an appropriate scale? Are all the data held at the same scale?

Descriptions?

What exactly do the data represent? Are the definitions and descriptions standardised and consistent across the data? Are they repeatable?

Relevance?

Are the data actually relevant?

- Accessibility

Format:

What format are the data held in? This can vary between paper sheets to Excel spreadsheets and Access databases through to spatially referenced geographic data. Can the data be easily transferred between applications?

Copyright:

How can the resulting inventory be used and by whom? Are there restrictions on the use and dissemination of the source data? For example data that has been derived using the Ordnance Survey Service Level Agreement (SLA) is only transferable between organisations with the SLA, unless specific arrangements are agreed.

Cost:

Bearing in mind that updates of data may be required will this be affordable? How much do the data cost – is it a one off payment, a yearly licence fee or loyalty bonus scheme? Data exchange agreements provide a useful source of data, as do collaborative approaches.

- Accuracy and Precision

Density of observations

Does the nature of the monitoring or surveillance programme used to derive the data meet with the user's requirements?

Positional accuracy

Which co-ordinate system has been used in assigning a spatial reference to the data? When using the National Grid Reference (NGR) how many digits have been used? National Grid References in particular are often recorded imprecisely, ranging from an NGR point within a 10km square grid (two figure NGR) to more precise 8 figure NGR. Points can be located precisely (i.e. many figures within and NGR) but can still be inaccurate (i.e. precisely located in the wrong location) and it is important to bear this in mind.

Data Lineage

It is important to know why, when, how and who collected the data.

2.3   Data Capture – Stage 3

This stage of the process can be defined simply as capturing GIS features and assigning them with attributes relevant to each inventory. Standards can be assigned to this process and have been generated as part of the NBN SW Pilot Project (Burke and Webb 2001). The nature of the source data and methods for capturing them are so diverse that it is not possible to prescribe standard methods of data capture.

In some cases inventories will be derived from detailed survey data such as that collected from Phase 1 or NVC surveys. While the source data will contain a high level of detail the coverage may be relatively low. This can be thought of as being a 'bottom up' approach. Alternatively data covering a wider area such as remotely sensed or map based data can be used. Typically these will be less detailed having a lower spatial resolution. This can be referred to as the 'top down' approach. The following sections describe some of the different types of source data available for habitat mapping.

2.3.1   Substrate data

2.3.1.1   Ordnance Survey Basemaps

The Environment Agency maintains a Service Level Agreement with Ordnance Survey (OS) for use of OS basemaps. There are three main scales, offering less detail respectively; 1:10,000, 1:50,000 and 1:250,000:

1:10,000 scale maps provide an effective means of identification and mapping of different habitats. Woodland, sand and mud areas can easily be identified and extracted using appropriate techniques.

1:50,000 scale map features can be digitised directly although they are mostly suitable for large areas of habitats that don't require high levels of detail.

1:250,000 tiles are most useful when mapping large areas such as coastlines. They have not been used within this project for mapping habitats or species although can provide very useful contextual information (such as coastline or infrastructure).

Use of these basemaps provides an invaluable method of relating independently collected spatial data to the "real world" and provide a useful source for digitising (see below). Techniques such as grid conversions can be used effectively and easily on the 1:10,000 maps (see chapter 4) but become less efficient at the 1:50,000 scale (due to the number of colour bands used in image creation).

The new Ordnance Survey Mastermap product aims to replace the Land Line tiles currently available. Mastermap will provide a very useful layer for resource mapping and is available nationally and is likely to be relatively widely used. The product has not yet been assessed for use but is likely to provide significant information. It remains to be seen how the costs involved in purchasing and use will develop.

2.3.1.2 Aerial Photography (AP)

One of the oldest and most well known forms of remote sensing imagery are aerial photographs. Aerial photos may be black and white (panchromatic), colour or colour infrared. Further, they can be stereoscopic (hard-copy 3-D photos, viewed though a lens) or digital, georeferenced for use in GIS. There are often large costs involved in purchasing aerial photography. For feature recognition, aerial photography provides standards against which other systems are judged. Aerial photography can provide the level of detail required to map both linear and area features of a study area. Previous studies have shown that AP is particularly good in mapping a variety of features and habitat types.

2.3.1.3 Compact Airborne Spectrographic Imaging (CASI)

The spatial resolution and multi-spectral capability of CASI data provide significant opportunities for environmental monitoring. This project has used CASI data primarily for manual quality assurance of intertidal mudflat polygons. The coverage of CASI data in England and Wales is currently limited to areas flown for specific projects. Use of CASI data has proved successful in identifying areas of *Phragmites* (reed beds) and intertidal mudflats. Ongoing Agency R&D is assessing the effectiveness of CASI in mapping the extent and quality of coastal habitats such as saltmarsh.

2.3.1.4 Light Detection and Ranging (LIDAR)

LIDAR provides very precise height information and plays an important role in the generation of perspective views to assist with the interpretation of landscape features. Again research is ongoing examining the potential of such data sets for assisting in the identification of particular habitats and hence inventories creation.

2.3.1.5   Other data sets

The following data sets can provide supplementary contextual information during inventory creation:

- British Geological Survey layers; used to limit extents of resources requiring specific conditions
- Centre for Ecology and Hydrology Land Cover Map 2000; can be used to restrict potential coverage of a resource, either by inclusion or exclusion.
- Admiralty charts; height and substrata information.
- Habitat surveys; provide either clues or direct information as to resource location.
- Protected area data sets (e.g. LNR, SSSI); can locate areas and lead to supplementary information sources. Specific information can also be found on the internet, for example local nature reserves or Wildlife Trusts often maintain web sites for particular reserves or protected areas.

2.3.2   Polygons, Polylines, Grids and Point data.

Once spatially referenced, inventory data can be stored in one of the following formats.

2.3.2.1   Polygons

Polygons represent areas as parcels enclosed by specific boundaries with an internal area. Polygon data can be digitised directly from maps while alternative techniques such as grid conversions can be used to separate an image file into unique layers. The amount of processing required varies depending upon the technique used and the scale of the original data. Parcels digitised from 1:10,000 scale maps will contain more detail than the same habitat digitised from 1:50,000 or greater maps. The scale used will ultimately influence the size of the captured data; the more detail captured, the higher the number of nodes within the feature (one node represents a point within the polygon – a perfect square needs a minimum of four nodes to form its four corners, hexagons require six etc, for example). As seen in Figure 2.1, the circle and square are of similar area but the circle has twice the file size, because the greater level of detail required to map a circle.
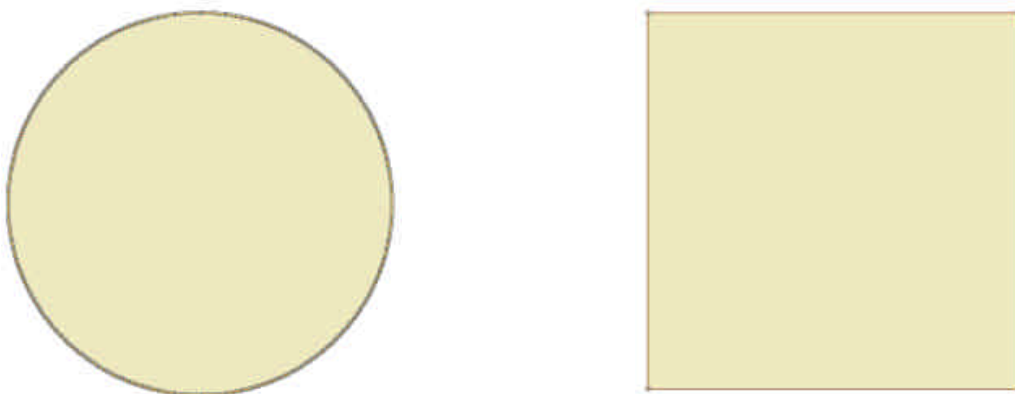

Figure 2.1 Comparison of polygon size: a simple circle with 360 vertices (8kb) and a simple square with 4 vertices (3kb).

The more nodes (and associated presumed accuracy) within your parcel, the larger the resulting polygon file will be, which implications for file storage and efficiency of use.

The numbers of nodes are related to the technique of data capture employed. Grid conversion techniques create more nodes than is practicable with a mouse digitiser – this creates very good detail but the trade off is a large file. Some forethought should be given to this to predict likely problems. Data can be captured using a technique that produces very detailed polygons and then cleaned so that the most important details are kept but small features that add proportionally little to the data set, and take up space, can be deleted. An example of this can be seen in Chapter 4.

2.3.2.2 Points

Points represent features found at discrete locations, such as telephone poles, wells and mountain peaks. Examples of point data can be found in monitoring point locations. Typically species data are held in point format, either located at the location they were found or aggregated to arbitrary areas, such as $1km^2$.

2.3.2.3 Polylines

A polyline is a set of one or more line segments called parts. Each line segment contains 2 or more points (nodes). A river network may easily be represented by polyline data.

2.3.2.4 Grid theme

A grid theme represents a geographic layer where space is partitioned into square cells in a view. Each cell stores a numeric data value that holds information about the geographic layer it represents. An example of data held in a grid would include Digital Elevation Models, where height data are attributed to each grid cell.

2.4 Metadata

At the same time as capturing the data that will represent your inventory within a GIS it is important to consider what additional data you wish to be attributed to them. Defined simply metadata can be described as "data about data". For example origin, size, format and copyright, data owner, date of generation.

Metadata can be effectively stored in a central database such as the Environment Agency's national metadata database. This enables information on a given data set (not necessarily spatial) to be quickly and easily referenced by all who are using the data, or are considering using the data. Due to the increasing amounts of spatial information being generated, the opportunity for querying spatial data sets against one another increases. This therefore requires definition of data sets to ensure compatibility and concordance with licensing agreements. When transferring data metadata should be included which should clearly outline the origins, scales, copyrights and attributes of the data. The same applies when receiving information. The metadata database provides a useful source for finding information from which to generate an inventory as well as locating existing inventories.

At a time when there is an increasing trend towards generating repositories of associated data there is a need to develop standards to ensure compatibility. The National Biodiversity Network has spent considerable time and effort generating metadata standards for such data types, which have been adopted by English Nature. It is recommended that any future work conducted within the Agency conform to these standards (Burke & Webb, 2001).

2.5   Quality assurance (QA) – Stage 4

It is becoming increasingly important to be able to comment on the quality of any data being generated, particularly when considering the use to which some data sets are being put. Described simply, quality assurance enables users to judge how much faith they can put in the data. Arguably, it is just as important and useful to have data of 'known quality', as of 'good quality' (Burke 2001). In relation to the generation of inventories quality assurance should include checks on the metadata, attribute information and the interpretation and accuracy of habitat parcel boundaries. The method of QA employed depends on many factors related to the habitat in question and the method of original data capture. Some of the available methods are outlined below.

2.5.1   Field surveys

Field survey data can be useful to quality assure habitat data that has been derived from remote data such as OS basemaps or aerial photography. Field surveying all of your mapped resource removes the aim of remotely mapping it in the first instance and would add further costs. Therefore a sample of the inventory resource can be selected, using a variety of techniques such as random numbers or grids, and then the random examples surveyed using habitat survey techniques appropriate to the resource. Comparing the results of the two data capture methods gives an indication of the accuracy of the inventory as a whole.

2.5.2   Remote sensing data

Good quality remotely sensed data can be used to QA data. Aerial imagery is useful where clumped or distinctive features are being mapped such as Phragmites reedbeds. CASI imagery has been effectively used in the assessment of the mudflats inventory (chapter 4). A more comprehensive appraisal of the usefulness of different remote sensing techniques for use in feature recognition can be found in R&D report E74.

Many sources of quality assurance data exist on the Internet and with other third party sources such as aerial photography. However it is essential that the provenance of these information sources are investigated. Local nature reserve, record centre or wildlife trust web sites can provide detailed habitat information and sources of contact.

2.6   Update mechanisms

An important consideration when generating habitat inventories is whether and, if so how often, they should be updated. For the vast majority of purposes inventories will be used to help manage the environment and as such they will need to be contemporary. The frequency of and responsibility for updating should be identified as part of any such project. This project has not involved the updating of existing inventories, but the creation of new ones. It

is envisaged that update of these inventories will be possible using the same techniques as employed within this project.

The frequency of update will depend on the perceived rate of change of the habitat and the usual socio-economic pressures. The creation, and hence update, of national habitat inventories is typically expensive and time consuming. One way of reducing the cost of updating an inventory is to only map areas of significant change therefore reducing the time taken to update, plus potentially the costs.

3 Chalk rivers

Description	Rivers fed from chalk aquifers BAP Habitat
Format	Arcview Shapefile (polylines)
Projection	British National Grid
Scale	1:50,000
Coverage	England and Wales
Data source	Environment Agency, Ordnance Survey
Location	I:\ drive Biodiversity folder

3.1   Requirement for chalk rivers inventory

Chalk rivers have a characteristic mid-channel plant community and support a wide range of water loving plants on their low banks. Chalk rivers are fed from ground water aquifers, producing clear water and a generally stable flow regime. These factors support a rich diversity of invertebrate life. Red list species including the otter and crayfish are among the species listed in Annex II of the Habitats Directive which are supported by chalk rivers. Bordering fens and carr woodland are particularly rich in insect life and breeding birds. Threats to chalk rivers include excessive abstraction, physical modification, pollution, catchment land use and fisheries management (UKSG, 1995).

## 3.2   Definition of chalk rivers

Chalk rivers are watercourses dominated by groundwater derived from chalk aquifers. They include streams and rivers that flow over underlying chalk geology types (such as boulder clay) at various points along their length, particularly at the lower reaches.

3.3   Source data

The chalk rivers steering group, through each EA region, supplied an initial list of chalk rivers.   Some of the lists referred to whole rivers, while others referred to discrete stretches, indicated by six figure National Grid References. The Ordnance Survey 1:50,000 raster maps were used as the basis for data capture. Where necessary, rivers were captured from the OS 1:10,000 land plan series if absent from the 1:50,000 series – this was flagged in the attribute table as required.

3.4   Methods

The river network used to map the chalk rivers is the Ordnance Survey 1:50,000 river network, as seen on the 1:50,000 OS digital map series (Fig. 3.1). These maps were loaded behind the AA 1:250,000 river network (to provide attribute information) and digitised as polyline shapefiles in ArcView from the OS basemap. The digitised sections were initially given a name and EA Region as attributes. When digitising, the polyline was kept in the boundary of the river feature shown on the OS maps (Fig. 3.2). When the river was represented as a single line then this line was followed as accurately (centrally) as possible.
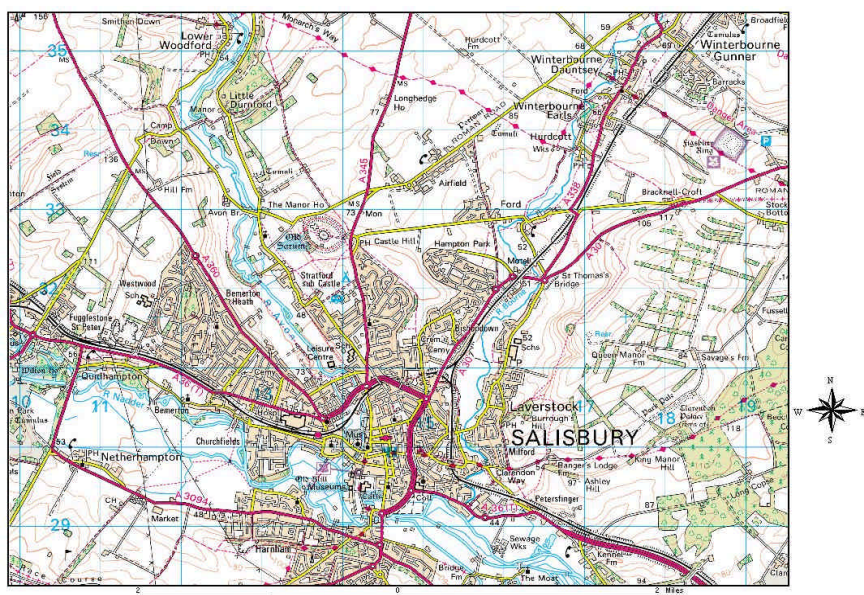
Figure 3.1 Example of information available within an OS 1:50,000 map tile.
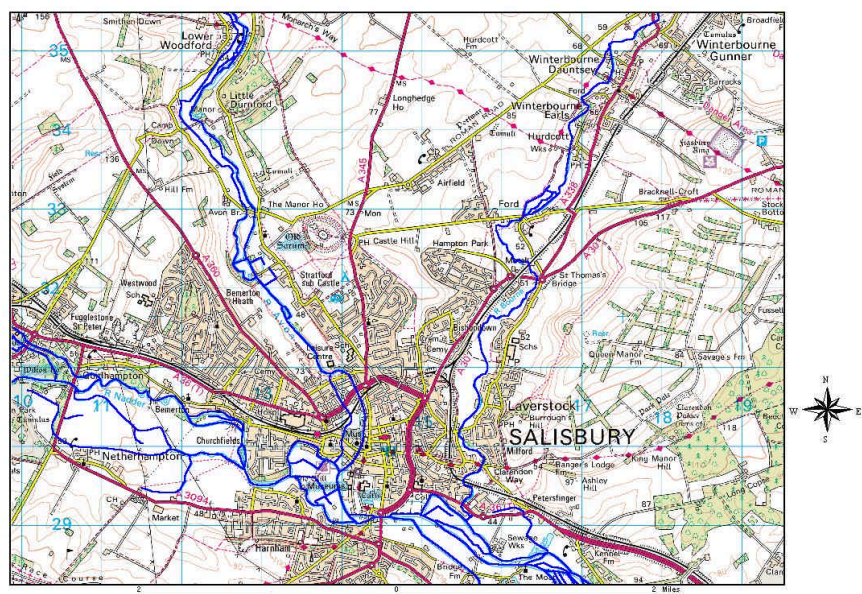
Figure 3.2 Digitised chalk river inventory as derived from OS 1:50,000 map tile.

3.5 Quality Assurance

Despite the inclusion of grid references within the original data, it was still unclear where the start, finish and exact path of some of the chalk rivers lay. It was therefore decided to refer the GIS layers to EA area staff to gain input from expert local knowledge.
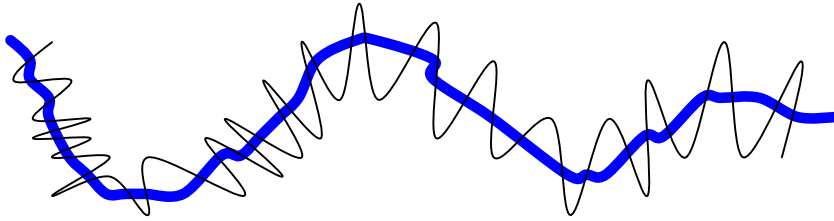
Figure 3.3 Example of deleted section of river.

Thus the chalk river network was broken up into EA areas and printed out on A0 paper at a scale of 1:75,000 or greater and sent to a regional representative. The representative distributed maps to the relevant area offices for quality assurance. Staff were invited to make corrections to the initial network. This involved indicating directly onto the paper maps any sections that were missed out, and river stretches that were incorrectly identified as being a chalk stream.

Instructions were sent out to each regional representative outlining how the first draft chalk rivers layer should be queried. It was requested that:

- Rivers included in the chalk river network that were deemed not to be a chalk river, i.e. superfluous to the chalk river network layer, were crossed out using black ink (Fig. 3.3)
- Any stretches not included in the chalk rivers layer (but present on the OS basemap) should be traced over as above but using red ink. The names of all new rivers were requested.
- The start and end NGRs of all chalk rivers were confirmed, along with any additional chalk rivers that were currently omitted.
- A brief description of the criteria used when deciding whether the Chalk River classification was or was not appropriate.

The paper maps were returned to NCEDS where the corrections made on the paper maps were transferred to the GIS layer.

The response from Regions varied significantly. Whilst some responded swiftly, returning the amended maps promptly and with accurate data, other regions took substantially longer for various reasons.

The most recent version of the chalk rivers habitat (Fig. 3.4) is available nationally through the Environment Agency network. It is hoped that the layer will be further refined through use.

3.6 Future Issues

The introduction of the Ordnance Survey 'Master Map' product will provide a national rivers layer as polygons which will be interpolated linearly (i.e. joined continuously). This will provide a more useful product to base the chalk rivers network on. The attributes associated with this layer are being defined with a view to meeting a range of Agency needs, such as direction of flow for modelling purposes.
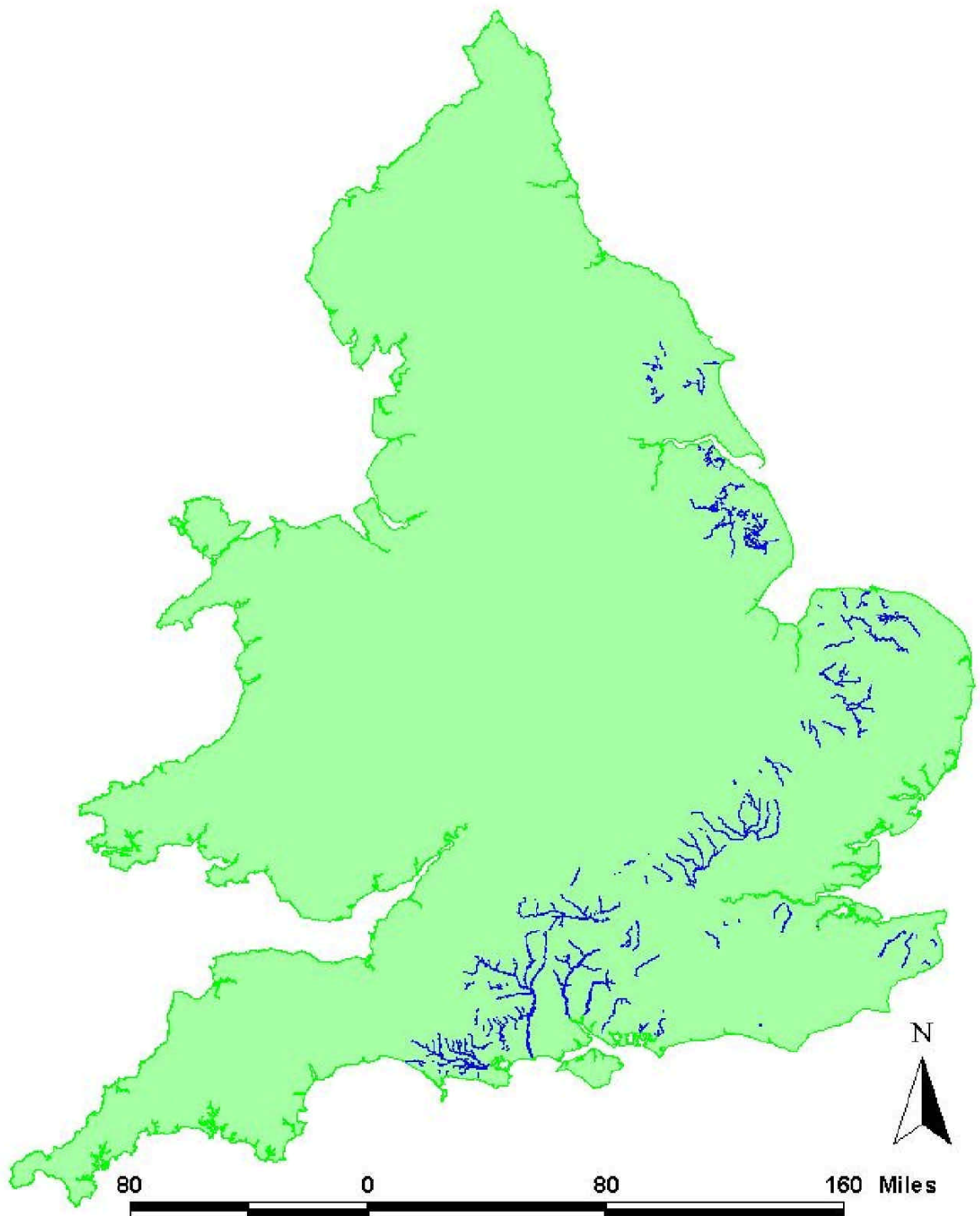
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Figure 3.4 The chalk rivers inventory for England and Wales.

4 Intertidal mudflats

Description	Intertidal Mudflats within England and Wales
Format	Polygons
Projection	British National Grid
Scale	1:10,000
Data Source	OS 1:10K Land Plan series
Location	I:\ Drive Biodiversity folder

4.1   Requirement for intertidal mudflats inventory

Mudflats are identified as a BAP priority habitat with the Agency as lead partner. Like other intertidal areas, mudflats dissipate wave energy thus helping to reduce the erosion of intertidal habitats which protect low lying land. They are characterised by high biological productivity and an abundance of organisms, but low species diversity. They support large numbers of birds, providing feeding and resting areas for internationally important populations of migrant and wintering waterfowl. They are also important nursery areas for some species of flatfish.

One of the principal threats to mudflats is known as "coastal squeeze". This can result from increasing sea levels and the destruction/abandonment of flood defences on one side to the encroachment of man made developments on the landward side. It has been estimated that coastal squeeze will result in the loss of between 8,000 and 10,000 ha of intertidal flats in England between 1993 and 2013. Other known factors effecting the extent of mudflats include the effect of barrage schemes and the introduction of non-native species such as cord grass.

4.2   Definition of intertidal mudflats

The definition of intertidal mudflats, for the purposes of this project, is somewhat driven by the nature of the data upon which it is based. Areas have been identified as mudflat that appear on Ordnance Survey 1:10,000 Land Plan map series labelled as "mud", "sand & mud", "mud & sand" or "mud & shingle", and that lie between the marking for MHW/Mean High Water and MLW/Mean Low Water marks (i.e. intertidal).

4.3   Source data

The mudflat polygons are derived directly from the OS Land Plan maps so the classifications used by OS are very relevant; the intertidal areas on the Land Plan series were originally captured from OS County Series maps. These were originally produced at a scale of 25" to the mile and were created in the 1930's and 40's. This information has been subsequently upgraded as necessary through the OS national seven year cyclic program, usually using aerial photography (OS, 2001), resulting in the current Land Plan data.

Aerial photographs were used in the updating of the Land Plan series (OS, 2001) so it can be assumed that manual interpretation of mud areas was used. It has not been possible to obtain the exact quantifiable parameters that OS used to classify the images but it is expected that analyses such as changes in colour, geographical location, texture and height enabled the intertidal areas to be mapped.

4.4   Methods

The nature of mudflats (i.e. parcels of area) implies polygons as the preferential method of data representation (as opposed to points). A scale of 1:10,000 was chosen due to a balance of detail available (for example clearer distinctions between sand and mud) and the time taken to capture it. This resulted in the base layer for mapping being the Ordnance Survey Land Plan map series (Fig. 4.1).
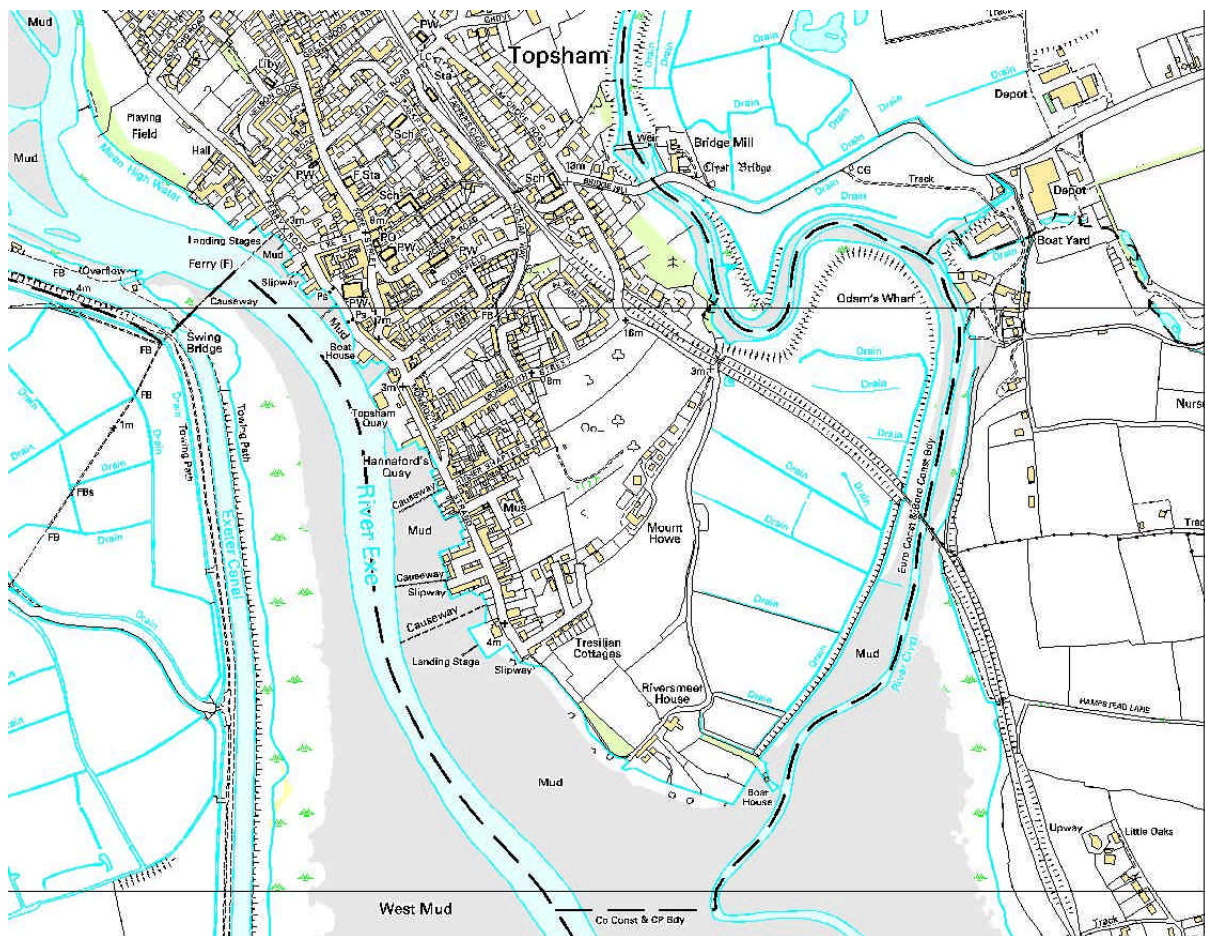
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Figure 4.1 Information available within an OS Land Plan map tile, Northern end of Exe Estuary.

Manual digitising of the edges of the mudflat parcels would have resulted in a very detailed, yet very time consuming method of layer production. A different method was therefore required to extract the required features from the OS map. This was done in ArcView, using grid conversions with ArcView Spatial analyst extension. The grid conversion produces a

grid file from the original georeferenced image file (.tif). This enables any of the colour/feature categories to be selected, and then converted into a separate shapefile.

Figure 4.2 Map showing the different categories available from converting OS Land Plan maps into grids.

As the feature to be extracted in this case was the mud feature, the areas with the feature code 7 (Fig. 4.2) were extracted and converted into a new shapefile, the results of which can be seen in Figure 4.3 below.

A result of adopting this technique is that the polygon is not immediately representative of the mudflat parcels. There are several remnants of the raster techniques used to produce the maps such as grid lines plus voids where label features are present. The shapefile therefore requires the masking of these anomalies and the subsequent joining of the polygon features to form a representative polygon for that mudflat area.

Figure 4.3 Resulting polygon from selecting feature code 7 from the grid conversion.

0.4   0   0.4   0.8 Miles

Figure 4.4 Final polygon representing intertidal mudflats following extraction from map tile and subsequent masking.

While this produced a highly detailed map, the size of the completed shapefile was such that it would have taken an unacceptably long time to load over a network. It was therefore necessary to reduce the size of the file and as such different options were considered. The first of these was to increase the size of the minimal mappable unit to an agreed value. This resulted in the removal of polygons under 0.25 hectares as this represents the minimal mappable unit defined by the National Biodiversity Network (Fig. 4.4 and Fig. 4.5). The removal of areas under 0.25ha reduced the size significantly (from 39MB to 23MB) and a large proportion of the data removed were bow-ties or triangles which did not enhance the data set but rendered it less useable. The mudflat polygons were then unioned into units based upon Urban Waste Water Treatment Directive estuary units. These can be seen within the attributes of the shapefile.
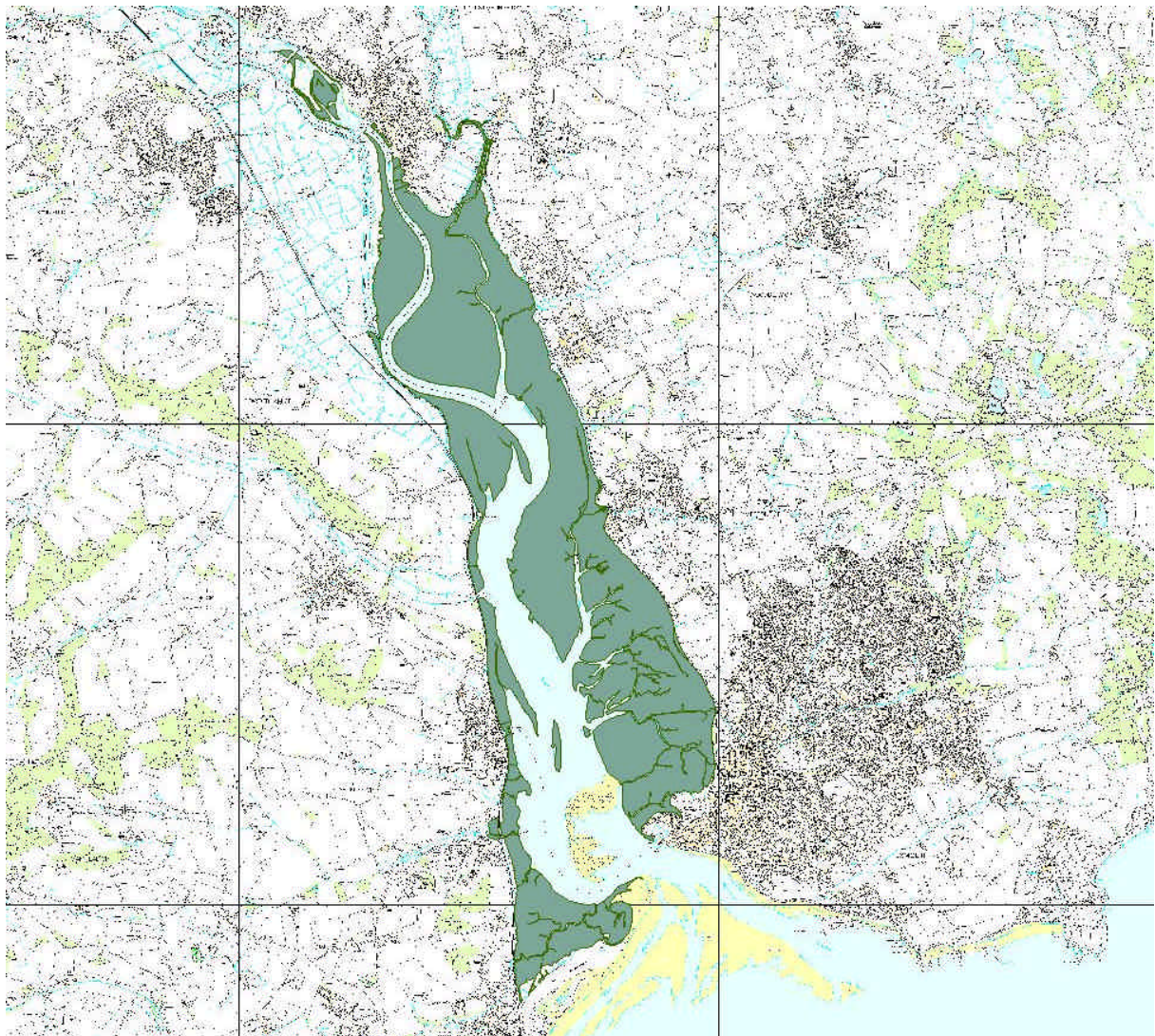
Figure 4.5 Resulting estuarine mudflat polygon derived from the grid conversion technique outlined above.

The national inventory can be seen in Figure 4.6 below (produced from unionising all Land Plan polygons to single units, then amalgamating these into one large national inventory.
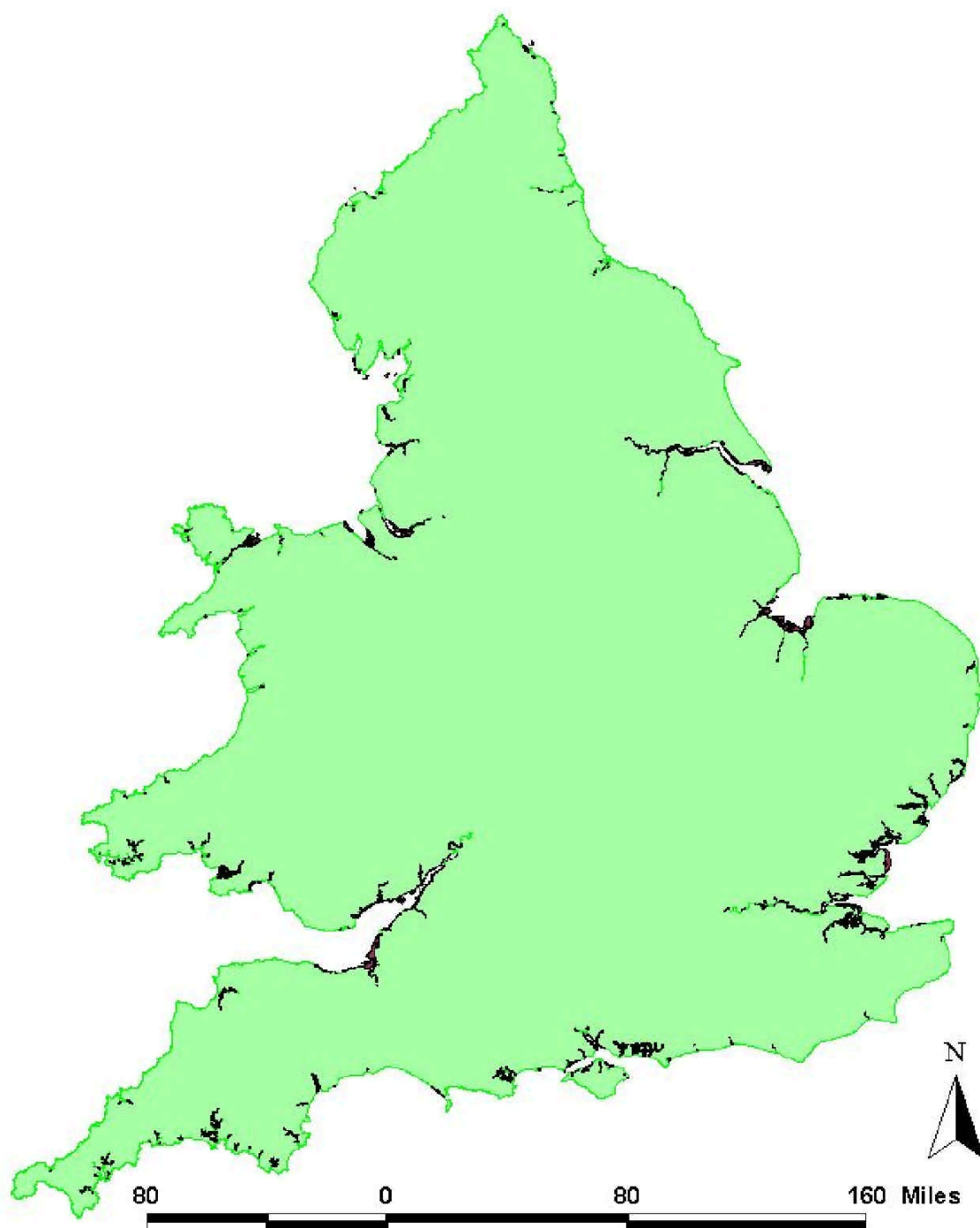
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Figure 4.6 National intertidal mudflats inventory for England and Wales.

4.5   Quality Assurance

One method of assessing the accuracy of the derived habitat inventory is to compare it with another data source of the same area. Two such types of data include aerial photography and the images derived from data collected with a Compact Airborne Spectrographic Imager (CASI). It is possible to compare distributions of recognisable features both in a qualitative and quantitative method.

In this example a sample of the national mudflats imagery has been compared with CASI data. Whilst no quantitative assessment of the accuracy of the mudflat layer has been undertaken it is clear to see that there is excellent correspondence between the two data sets (Fig. 4.7). The limited geographic coverage of existing CASI data has limited the national QA of the mudflat layer. The NBN South West pilot project will be ground-truthing the mudflat layer in a more systematic fashion.

Figure 4.7 Quality assurance using CASI data. Red outline represents overlaid mudflats polygons.

5 Eutrophic Standing Water Bodies Inventory

5.1 Requirement for Eutrophic standing waters inventory.

The BAP Broad Habitat of standing waters and canals is made up of the following BAP Priority Habitats: mesotrophic standing waters, eutrophic standing waters and aquifer fed naturally fluctuating water bodies. All of these have the Environment Agency as the lead partner.

Eutrophic standing waters are naturally nutrient rich and highly productive fresh waters. Planktonic algae and zooplankton are abundant, submerged vegetation is diverse and numerous species of invertebrates are present. Many lowland water bodies in the UK are now artificially enriched with nutrients from urban waste water discharges and agricultural activities. Algae dominate these sites. The main threats to eutrophic standing waters are pollution through sewage discharges, land-use changes, water abstraction, over stocking of fish, and the introduction of non-native plants and animals (Environment Agency, 2000).

## 5.2 Definition of eutrophic standing waters

The initial work undertaken on this inventory as part of this project has been superseded by a larger umbrella project aiming to create a national inventory of all standing waters in the UK and assigning a nutrient status for each standing water through a risk-based protocol. This project ("Development of a GIS based inventory of standing waters for England and Wales, together with a risk based prioritisation protocol - EA R&D Project (P2-239)") is due for completion by end of June 2002. As such, definitions for eutrophic lakes will be derived from the P2-239 project. Currently the project has produced a UK inventory of standing waters by extracting standing waters from Ordnance Survey PANORAMA 1:50k contour data, within which they are identified as individual features. The project has also generated catchment boundaries for each water body, within which risk assessments will be carried out, resulting in a nutrient status/risk classification. This should provide inventories for eutrophic, mesotrophic and oligotrophic standing waters.

However, before the above project was initiated, work had been undertaken within this project to create an inventory based upon a list of eutrophic standing waters provided by the BAP steering group. This list has since been declared redundant and superseded by Project P2-239. Valuable lessons were learnt however during the initial inventory production which are included below for reference.

What follows therefore outlines the initial stages of inventory production under this project, now superseded.

5.3 Source data

The same grid conversion technique was used in layer extraction as described in Chapter 4 (mudflats). The examples below describe the basic procedure required to extract water body features from the Ordnance Survey Land Plan tiles (Fig. 5.1).
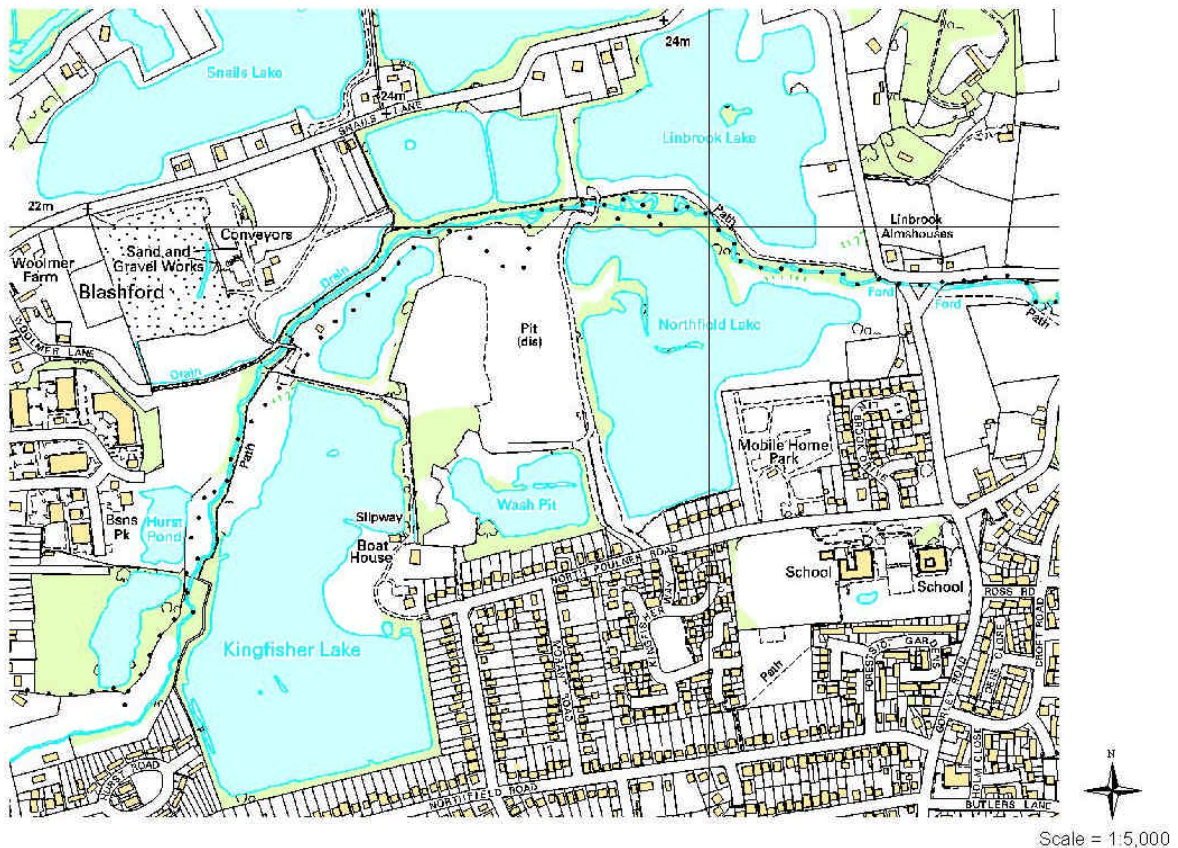
Figure 5.1 Section of Ordnance Survey 1:10,000 raster tile showing location of standing waters.

The Ordnance Survey tiles consist of colour bands, each referring to different feature types within the map. These codes can be used to select appropriate feature types after the image has been converted to grid format, the outcome of which can be seen in Figure 5.2.

The next phase requires the selection of appropriate features from the grid. To represent water features on the OS maps, three colour bands are used (feature codes 2, 8 and 9). Each colour band refers to a different sub-category of water feature. Feature code 2 refers to boundary line polygons (lines surrounding standing waters and rivers), drains and name features (e.g. "drain", "issues", "Spr" and river names). Feature code 8 refers to standing water body polygons (i.e. the area inside the boundary line polygons) and feature code 9 refers to the river stretch polygons (inside the boundary line polygons). Once the appropriate features have been selected, the ArcView Spatial Analyst extension was used to convert selected features to a shapefile.

Figure 5.2 Grid format produced from original .tif file.

The new shapefile contains all features of the colour previously selected, including text features such as river names and the dissecting grid lines. These unnecessary features need to be deleted or masked appropriately if they are not desired within the final shapefile. If all water features are converted to a shapefile from the grid, the results will be as seen in Figure 5.3. The process of cleaning this shapefile has been described already in section 4.4.

It is possible, by virtue of the different colour codes, to select only the standing water or river body polygons and ignore the boundary feature code that contains the drain and river name polygons. However, the boundary polygon also represents the true area of the lake or river and thus exclusion of this feature from the data may provide inaccurate information regarding the water feature.

Figure 5.3 Shapefile produced from converting all water features from grid format.

Figure 5.4 Resulting standing waters polygons after grid conversion and processing.

6 Reedbeds

Description	Reedbeds of *Phragmites* spp.
Format	ArcView Shapefile (polygons)
Projection	British National Grid
Scale	1:10,000
Coverage	England and Wales
Data source	RSPB, OS
Location	I:\Drive Biodiversity folder

6.1   Requirement for reedbeds inventory

Reedbeds are a BAP priority habitat within the BAP broad habitat of fen, marsh and swamp. Reedbeds are one of the most important habitats for birds in the UK. They support a distinctive breeding bird assemblage including six nationally rare Red Data List Birds, and are used as roost sites for several raptor species in winter. They also support Red Data List invertebrates (UKSG, 1995). Reedbeds support critically small populations of species, but often cover small areas themselves. Excessive water abstraction, inappropriate management, predicted sea level rise, eutrophication and pollution by siltation or toxic chemicals are listed as main threats to reedbeds (UKSG 1995).

6.2   Definition of reedbeds within this project

Reedbeds are wetlands dominated by stands of the common reed *Phragmites australis,* wherein the water table is at or near above ground level for most of the year. They tend to incorporate areas of open water and ditches, and small areas of wet grassland and carr woodland may be associated with them.

6.3   Source data

An inventory of reedbed locations and areas within England, Scotland and Wales was provided by a survey conducted by the Royal Society for the Protection of Birds (RSPB) in 1993 (Painter *et al.,* 1995).   The National Grid Reference of each reedbed within the inventory was used to convert the data into a GIS layer by producing a series of points.

6.4   Methods

The following characteristics of reedbeds were gathered from various sources, namely Rodwell (1995), Painter *et al.,* (1995) and UK Biodiversity Group (1995):

- dominated by the common reed *Phragmites australis*;
- support a water level at or above ground level for most of the year;
- contain areas of open water or ditches;
- often associated with open wet grassland and/or carr woodland.

To identify areas of reedbed for mapping as polygons the above characteristics, the RSPB point data and Ordnance Survey 1:10,000 map symbols were combined. The Ordnance Survey symbol for marsh, saltmarsh or reeds (Figure 6.1) was consistently used as a reference point in accordance with Ordnance Survey (2000).

Figure 6.1 OS Land Plan symbols for Marsh, saltmarsh or reeds (OS 2000).

Areas to be digitised as reedbeds were identified by comparing the point based inventory (RSPB) of reedbeds with the map symbols on the OS land plan maps. This presented the obvious problem of where to digitise the polygon boundaries, as no information on the extent of the reedbed was available. In areas identified as homogenous dense reedbed by the OS symbols, the entire area was considered to be reedbed where bounded by either water bodies or other linear features. However, in areas with multiple symbols, but no obvious linear boundaries, a different strategy had to be adopted.

This resulted in a policy of inclusion where it was not possible to identify discrete reedbeds. Consideration was given to the use the reedbed data layer would be put to within the Environment Agency. In this sense the water body containing the reedbed is as important as the actual extent of the reedbed when considering the water quality of the habitat. As a result a decision was taken to digitise the water body containing the reedbed resulting in the polygons displaying habitats that contain reedbed, and not necessarily the exact extent of the reedbed. It was decided that this was suitable for BAP monitoring purposes and that should further, more accurate information be required then that could be gained from satellite images, aerial photographs etc.

The exact extent of reedbed was therefore rarely discernible from the Ordnance Survey 1:10,000 raster tiles (OS 10K tiles). OS 10K tile's cartographic symbols, water body extents (discrete and/or contiguous) and appropriate Sites of Special Scientific Interest (SSSI) and/or National Nature Reserves (NNR) boundaries (SSSI_10K, SSSI_10K_wa, NNR_10K and

NNR_10K_wa shapefiles) were the key boundaries captured as containing reedbeds (Fig. 6.2).

The key disadvantage with using point data, which lack any attributes relating to boundary location, is the ambiguity in perimeter location. Whilst an area field was included in the original data, this proved of limited use when digitising the reedbed boundary. Because of the fragmented nature of some reedbeds it was impossible to determine whether the area field represented the sum of the reedbed fragments or a more general value covering the whole area.

In addition to the difficulties of converting a point based inventory into a series of polygons it became apparent that the original data had, in part, both incorrect and missing NGRs. This resulted in being unable to locate the appropriate area of reedbed or water body.

6.5   Quality Assurance

As with the chalk rivers layer, one method of both resolving the issues highlighted above and quality assuring the data is to provide the data to people with local expert knowledge. In this case that could be Agency, English Nature, or RSPB staff (who originally provided the data). Lists of unmappable reedbeds and the current inventory layer could be sent to the any of these organisations who could obtain more detailed information on the distribution of reedbeds and perform the first stages of quality assuring the data. However, the original RSPB data used to produce the point inventory are no longer available from the RSPB. Coupled with this is the fact that the data on the location of reedbeds were collected in 1993 and the extent/location of some reedbeds are likely to have changed since then.   Therefore it was felt that a new survey of the location of reedbeds was required.

A recent report commissioned by the Environment agency and RSPB to map reedbed communities within Thames Region (Clymer, 2001) has served to highlight the how reedbed coverage has changed since the 1993 RSPB survey. The methodology adopted by Clymer was to use aerial photography for the whole of Thames Region and visually identify areas of reedbeds, recording them as points. Comparison of these data with those generated in this study showed that more reedbeds were identified within Thames region according to Clymer's survey than the 1993 (RSPB) data set. Extrapolated nationally, it becomes apparent that a large proportion of current reedbeds could be absent from the inventory generated in this study from the RSPB inventory.

6.6   Future issues

The inventory therefore stands as an incomplete, non-quality assured, national and historic inventory of reedbeds. Although the inventory generated here could provide a useful starting point, it does not represent a valid national inventory of reedbeds in England and Wales. A new survey is therefore required to provide such a data set, which could be undertaken in a number of ways. One approach would be to harness local knowledge and ask people to submit the locations and perhaps extents of reedbeds in their area. Where possible these experts could return GIS layers containing appropriately attributed polygons – this is the approach being adopted by the NBN SW pilot. The work undertaken by Clymer has shown that it is possible to identify reedbeds within remotely sensed data such as aerial photography.

If these methods were applied across the whole of England and Wales a national inventory could be derived.

Copyright issues:
Please acknowledge Ordnance Survey and the RSPB when using these data.
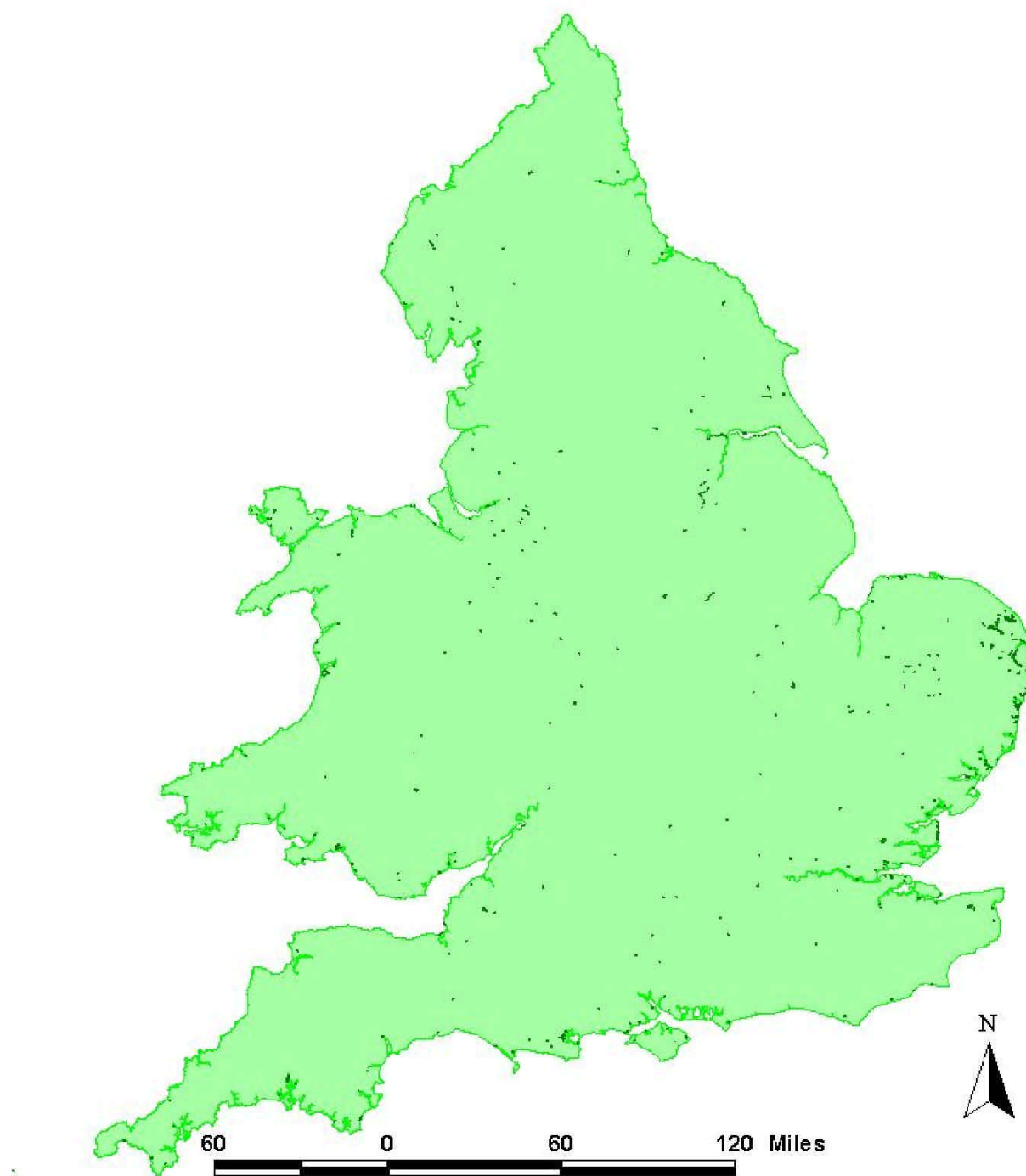
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Figure 6.2 National reedbed inventory for England and Wales.

7 Aquifer Fed Naturally Fluctuating Water Bodies

Description	Aquifer Fed Naturally Fluctuating Water Bodies
Format	Arcview Shapefile (polygons)
Projection	British National Grid
Scale	1:10,000
Coverage	England and Wales
Data source	OS, AFNFWB Steering Group.
Location	I:\Drive Biodiversity folder

7.1 Requirements for an aquifer fed naturally fluctuating water body inventory

The BAP Broad Habitat of standing waters and canals is made up of the following BAP Priority Habitats: mesotrophic standing waters, eutrophic standing waters and aquifer fed naturally fluctuating water bodies. All of these have the Environment Agency as the lead partner.

Aquifer Fed Naturally Fluctuating Water Bodies (AFNFWB) are naturally rare habitats, both in the UK and internationally (UKBG, 1998). A potential overriding threat to this habitat type is climate change, where a long term decrease in rainfall could alter groundwater regimes and may ultimately depress levels in the underlying aquifers to such an extent that stops these bodies filling with water (UKBG, 1998). Water abstraction can upset the delicate hydrological balance of these water bodies, damaging characteristic fauna and flora. High level animal stocking can result in overgrazing and poaching within the draw down zone, but absence of grazing can result in invasion of vegetation (UKBG, 1998).

7.2 Definition of Aquifer Fed Naturally Fluctuating Water Bodies

This habitat refers to water bodies that undergo extreme fluctuation in water level, with periods of complete or almost complete drying out as part of the natural cycle. They have no inflow or outflow streams at the surface, except at times of very high water level. Directly connected to underlying groundwater, they periodically empty and are recharged via swallow holes or smaller openings (EA, 2000). Main threats to AFNFWB can be listed as climate change, water abstraction and eutrophication.

7.3 Source data and methods

The UKBAP steering group provided a national point based inventory of AFNFWBs. The paper document (containing national grid references) was copied into an Excel table, where each record was given a unique ID number. This was converted into DBF format and imported into ArcView. These points were overlaid onto Ordnance Survey 1:10,000 basemaps, and using the name attributes within the list, the relevant water body was identified and then digitised (Fig. 7.1).
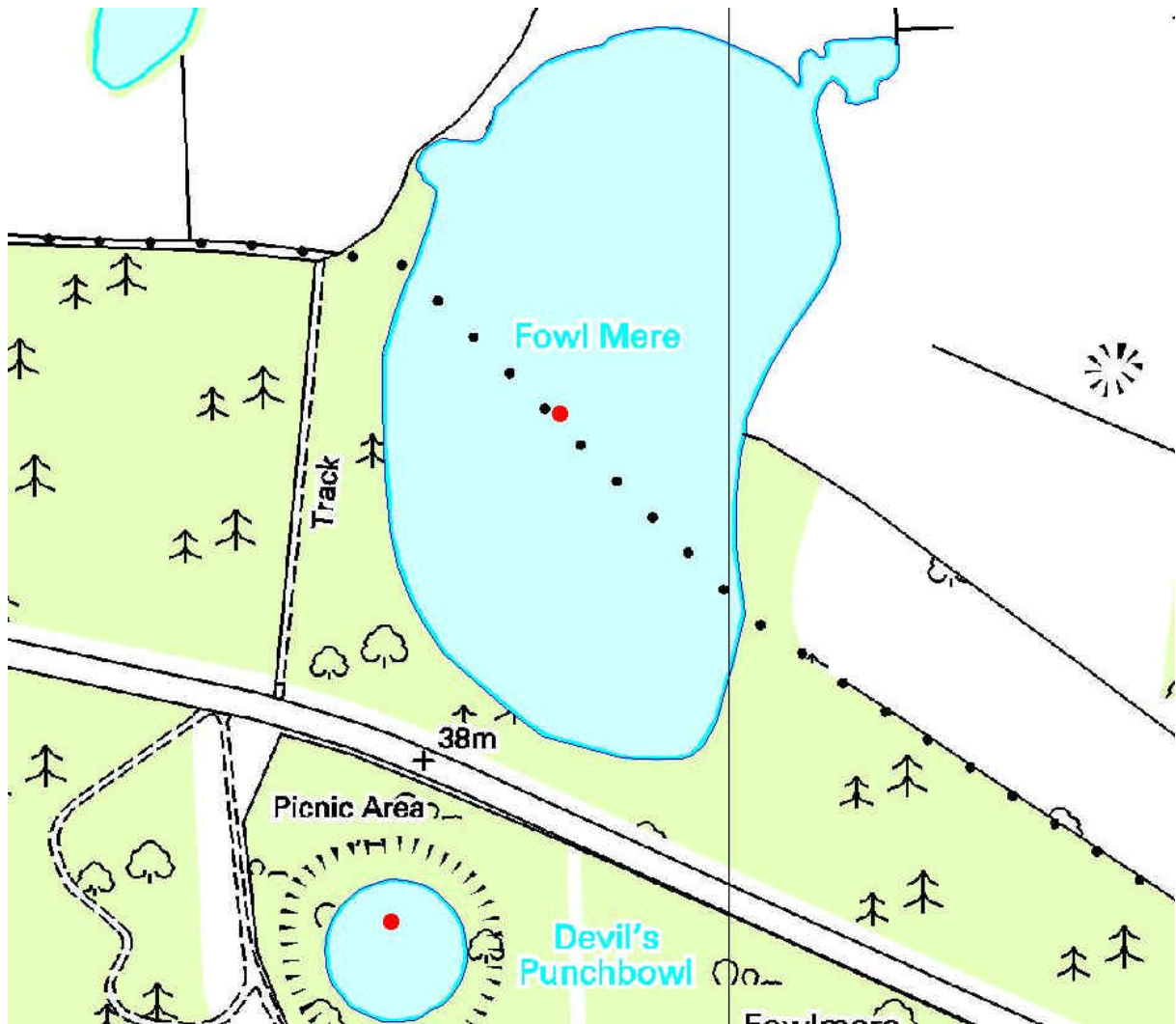
Figure 7.1 Map showing position of AFNFWBs identified by points within the national list (red circle).

Ambiguity during mapping occurred when one point, Foulden Common, was used to locate a series of waterbodies. Further, in the case of Blo'Norton and Theltenham Fen, no distinct water body could be found on the OS map. For these, a non-proportional circle has been recorded instead of a polygon.

Given the low number of AFNFWBs it was felt unnecessary to undertake any rigorous quality assurance of the data.

8   Other habitats of interest

Other habitats inventories specifically investigated within this project are mentioned below. Where inventories were not created successfully it is hoped that the NBN South West Pilot Project will be a source for such inventories in the future.

8.1   Saltmarsh

A preliminary attempt was made to extract saltmarsh data from the ITE Landcover map (1990 coverage) compiled from Landsat TM data. This was abandoned due to saltmarsh coverage within the Landcover image not being comprehensive. Further potential sources of saltmarsh locations include CASI imagery or aerial photography. English Nature and the Environment Agency are jointly funding studies in saltmarsh classification over small areas using remotely sensed imagery but national extrapolation of these techniques would require substantial resources.

8.2   All woodland habitats

The Forestry Commission were able to supply woodland data for Wales. Updates of this dataset and the comparable dataset for England may be currently available. The following woodland categories are mapped within the dataset;

1. Broadleaved
2. Coniferous
3. Coppice
4. Felled
5. Ground prepared
6. Mixed
7. Shrub
8. Young trees

These data may provide the basis for woodland inventories providing further context data are available e.g. water table and/or elevation data.

The welsh dataset is titled **National Inventory of Woodland and Trees, Wales, Ref date 310397** and is available from;

Forest Research,
Woodland Surveys
231 Corstorphine Road
Edinburgh
EH12 7AT   Tel; 0131 314 6122
                         Woodland.surveys@forestry.gov.uk

8.3 Seagrass (*Zostera*)

Investigations concluded that the ephemeral nature of Seagrass characterises it as inappropriately mappable as individual polygons. A point-based inventory of Seagrass locations is likely to fulfil most requirements and may be available from the Steering Group in the future.

8.4 Fens

The national Fens database, FENBASE is held by English Nature and reputedly holds substantial information. A copy of FENBASE was not reviewed during the project.

8.5 Raised bog

No definition available during lifespan of the project. The NBN SW Pilot project will be releasing a relevant definition.

8.6 Blanket Bog

No definition available during lifespan of the project. The NBN SW Pilot project will be releasing a relevant definition.

8.7 Floodplain Grazing Marsh

English Nature maintains a national inventory of floodplain grazing marsh at 1:50,000. This is available on the Environment Agency network in the I:\national\Biodiversity folder.

9 Integrating inventories with other data

9.1 Making use of inventory data

The most obvious use of inventory data, whether it be habitat or species, is to map where a resource can be found. Providing the inventories are then updated in a consistent manner, differences between the two, or more, data sets can be used to highlight where change is occurring in the environment. Examples include increases or decreases in habitat or species distributions. The availability of such data are key to meeting the information needs of the current drivers behind environmental monitoring and assessment, such as the UK Biodiversity Action Plans and the Habitats and Birds Directives.

Resource inventories have a much wider use than described above, particularly when combined with other appropriate data sets.

9.2 Asking the questions

The potential benefits of integrating such data sets span a wide range of organisations, from academia to government departments. The Environment Agency, being no exception, has a range of information needs, or questions, which can potentially be answered in this way. In order to report fully on the Agency's overall input into the UK Biodiversity Action Plan there is a need to determine, across various work programmes, the location of specific work items, and how they contribute to the UKBAP. These work programmes include: Habitats Directive consent reviews, Urban Waste Water Treatment Directive (UWWTD) Water Quality improvement programme, Asset Management Plan – Round 3 (AMP 3), and Water Level Management Plans (WLMPs). Currently, work planned for a specific location frequently uses different names for the site in question. This makes it virtually impossible for anyone without detailed local knowledge to determine the overlap or cumulative impact of the work programmes.

The types of questions that can be answered depend not only on the quality of the available data but the frequency at which they are updated. If we assume that we have access to the location of BAP habitats and species as well as the location of Agency work programmes then it should be possible to ask the following:

"What percentage of BAP habitat X benefits from Environment Agency work programme Y?" or,

At what percentage of Environment Agency work programme X sites does the BAP species Y occur?"

Both of these generic questions assume that Agency work programmes will benefit those areas of the environment that will directly, or indirectly, affect the ecological status of species and or habitats. Provided such data sets exist and are geographically referenced then they can be viewed and analysed within Geographic Information Systems (GIS). Spatial queries can then be used to generate statistics relating the different data to each other. In general, for

polygon data results are more readily extractable through spatial querying, whereas with point data zones of influence/catchments will require generating.

Of significant interest is the question of whether Agency activities are actually benefiting the environment. This is often a difficult question to answer as most of the Agency's activity is related to monitoring programmes looking at the non ecological components of the environment, rather than surveillance programmes considering specific species or habitats. Some useful data do exist, such as the benthic macroinvertebrate data collected under the General Quality Assessment (GQA) programme. The key to being able to measure change in this sense is having data that are of known quality and that are updated at a known frequency.

Currently there are no plans to update any of the biodiversity data generated within this project. If no change can be measured in species or habitat distributions then it is impossible to relate information to Agency activity. Where data do exist, such as for the GQA, we need to be able to relate them back to Agency activity, such as AMP 3. The link between these two data sets is the relationship between rivers (as stretch codes) and their associated AMP schemes. Unfortunately this link has not been developed and therefore such associations can not be made.

9.3   The way forward

From this discussion it is clear that there may be considerable benefit in analysing a range of data sets within a GIS to provide answers to questions that would be difficult, if not impossible, to answer otherwise. This would obviously lead to significant cost savings if it negated the need for new monitoring and surveillance programmes.

Key to the use of such data within a GIS, or the development of a bespoke GIS based system for use across the Agency, is the availability and quality of the underlying data. Typically data are not collected or managed with a view to their inclusion within a GIS. This can be rectified by observing GIS based standards for both data collection and storage.

To answer questions relating to the proportion of a species or habitats distribution that benefits from Agency related activity requires more than just available data of known quality. As was discussed above it may be important to model the anticipated effect of that activity before it can be spatially integrated with species or habitat data. Given the high proportion of Agency activity related to aquatic habitats, particularly rivers, the provision of an appropriately attributed river layer is essential. For modelling, such attributes should include the river's true position and direction of flow. At the time of writing no such layer exists.

Where measures of actual environmental improvement are required, biodiversity data such as the distribution of species and habitats needs to be updated at appropriate intervals. The ability to update these data layers depends upon the method of generation. Where the data are based on a routine monitoring programme then updates are relatively easy to undertake. Typically this is not the case, as is evidenced by the data layers generated within this project. A commitment to the management and updating of these and other layers is required if the full benefit of their use is to be realised.

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11 Appendix 1 – List of Acronyms

AA – Automobile Association
AFNFWB – Aquifer Fed Naturally Fluctuating Water Body
AMP 3 – Asset Management Plan – Round 3
AP – Aerial Photography
BAP – Biodiversity Action Plan
CA – Countryside Agencies
CASI – Compact Airborne Spectrographic Imaging
CCW – Countryside Council for Wales
DEFRA – Department for Environment, Food & Rural Affairs
EA – Environment Agency
EHS(NI) – Environment and Heritage Service – Northern Ireland
EN – English Nature
FC – Forestry Commission
GIS – Geographic Information Systems
ha – Hectare
LIDAR – Light Detection and Ranging
LNR – Local Nature Reserve
LRC – Local Record Centre
MHW – Mean High Water
MLW – Mean Low Water
NBN – National Biodiversity Network
NBN SW – National Biodiversity Network South West (Pilot Project)
NCEDS – National Centre for Environmental Data and Surveillance
NGR – National Grid Reference
NNR – National Nature Reserve
NVC – National Vegetation Classification
OS – Ordnance Survey
QA – Quality Assurance
R&D – Research and Development
RSPB – Royal Society for the Protection of Birds
SAC – Special Area of Conservation
SLA – Service Level Agreement
SNH – Scottish Natural Heritage
SPA – Special Protection Area
SSSI – Site of Special Scientific Interest
UKBAP – United Kingdom Biodiversity Action Plan
UWWTD – Urban Waste Water Treatment Directive
WLMP – Water Level Management Plan