Definition and mapping of open mosaic habitats on previously developed land: Phase 1

Final Report

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EXECUTIVE SUMMARY

Background

Open Mosaic Habitats on Previously Developed Land (OMH) was included in the new list of UKBAP Priority Habitats and species in 2007. OMH Priority Habitat represents a diverse range of sites, largely because of the range of previous land uses associated with the sites, which include coal mining, industry and housing. This habitat is concentrated in, but not confined to, urban and former industrial landscapes.

The biodiversity value of these sites is often underestimated. The habitat supports many species and some habitat types that are a priority for nature conservation, such as pioneer communities and flower-rich grasslands. The areas have been described as important habitats for many UK BAP prority species or Red Data Book/List species.

These habitats are at substantial risk of destruction and serious degradation from a number of factors, including urban development, landfill, unsuitable reclamation, eutrophication, lack of appropriate management and succession. Few previously developed sites have SSSI protection and creation of new sites is limited.

Although there are inventories of previously developed land, these do not distinguish those sites which support the Priority Habitat. A clear definition of this habitat type is essential to enable transparent planning guidance because of the Government's commitment to construction of housing developments on brownfield land. There is therefore a need to identify and map potential sites and to inform survey, assessment and evaluation allowing the compilation of a national inventory of the Priority Habitat. This will help to inform Defra, the devolved administrations, appropriate agencies, NGOs and Local Authorities regarding the conservation management of the Priority Habitat and its associated species. At a local level, this will also enable Planning Authorities to identify brownfield sites which are important for biodiversity when considering development proposals, and to determine any appropriate mitigation measures.

Recommended Approach

The challenge for this project was to agree a robust definition for use in identifying OMH Priority Habitat reliably across the UK. Further development and refinement of the original Priority Habitat definition was required, to encompass the diversity of sites and there was a need to gain consensus from the main stakeholders on this revised definition. Once the definition was agreed, the data and field methods required to identify these habitats and their ecological value were developed.

A consultation was carried out with experts, stakeholders and organisations that hold data of relevance to the identification of OMH Priority Habitat sites. The consultation was conducted in two iterative phases using an email based questionnaire supported by explanatory notes to formulate an approach for the identification and evaluation of OMH Priority Habitat sites. There was an excellent response to both phases of the Consultation within this project, with diverse and detailed views submitted from a wide range of organisations. Underpinning the consultation approach was the view that scientific reports and understanding needed to be combined with as much practical 'on the ground' knowledge as possible to create a pragmatic solution for the identification of OMH Priority Habitat. We have gained consensus from experts, relevant organisations and stakeholders about the definition and how it might be used practically to identify sites and the result is a clear-cut set of defining criteria that can be used to identify whether sites are OMH Priority Habitat.

Taking account of the findings of the consultation, a recommended methodology for both the identification and evaluation of OMH Priority Habitat sites has been developed. These approaches are provided as two annexes to this report. Because the criteria developed required field data and the interpretation of habitat features by individuals with ecological understanding, an automated, purely data-driven site identification method was not possible. The potential use of datasets to identify and screen sites has been demonstrated and this approach is recommended as the next step towards the development of a national inventory of OMH Priority Habitat.

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ADAS PROJECT TEAM

Dr Alison Riding (project leader), Jacqueline Parker (ADAS Associate), Lucy Wilson, Dr Nigel Critchley, Alison Mole, Tatiana Prieto-Lopez, Paul Taylor, Andy Frost, Sonia Brunton, Rosie Whicheloe and Anna Senior.

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1. BACKGROUND

1.1 UKBAP background and Priority Habitat Definition

Open Mosaic Habitats on Previously Developed Land (OMH) was included in the list of UKBAP Priority Habitats and species in 2007. OMH Priority Habitat represents a diverse range of sites, largely because of the range of previous land uses associated with the sites, which include coal mining, industry and housing. This habitat is concentrated in, but not confined to, urban and former industrial landscapes.

The biodiversity value of these sites is often underestimated. The habitat supports many species and some vegetation types that are a priority for nature conservation, such as pioneer communities and flower-rich grasslands. The areas have been described as important habitats for many UK BAP priority species or Red Data Book/List species.

These habitats are at substantial risk of destruction and serious degradation from a number of factors, including urban development, landfill, unsuitable reclamation, eutrophication, lack of appropriate management and succession. Few previously developed sites have been afforded SSSI protection and creation of new sites is limited.

Although there are inventories of previously developed land, these do not distinguish those sites which support the Priority Habitat. A clear definition of this habitat type is essential to enable transparent planning guidance because of the Government's 2008 commitment to construction of 60% of new housing developments on brownfield sites. There is therefore a requirement to identify and map potential sites and to inform survey, assessment and evaluation allowing the compilation of a national inventory of the Priority Habitat.

1.2 Project Objectives

The challenge for this project was to agree a robust definition for use in identifying OMH Priority Habitat reliably across the UK. Further development and refinement of the original Priority Habitat definition was required, to encompass the diversity of sites and there was a need to gain consensus from all stakeholders on this revised definition. Once the definition was agreed, the data and field methods required to identify these habitats and their ecological value were developed.

The objectives of this project were:

- To consult with others in the UK BAP partnership to provide a clear, agreed definition of the UKBAP Priority Habitat type Open Habitat Mosaic on Previously Developed Land to aid 'identification on the ground'.

- To provide a list of species which are associated with this habitat type.

- To provide a list of habitat descriptors (*e.g.* a list of key historical, habitat, vegetation, edaphic and structural features) and an identification key or other form of guidance (*e.g.* a decision flow chart) that can be used to assess and distinguish OMH priority habitat from other habitat types and that enable its ecological significance to be assessed.

- To develop a cost-effective and fit-for-purpose methodology to determine the extent, distribution and quality of land in the UK that falls within the definition as developed.

- To report on the development of the definition, species list and proposed survey and reporting methodology and to provide recommendations for a feasibility study to test the recommended method(s).

1.3 Approach

This report describes the work that was done to prepare the OMH 'Site Identification Guide' and the OMH 'Field Assessment Form' which are provided as separate annexes to this report. It may be useful to read this report in tandem with these two annexes. The Appendices to this report also contain detailed information from the consultation and data review process.

This report is structured into two halves. In the first half the way that the definition has been established and the form the consultation has taken is described. In the second half of the report, the practical aspects of the definition for OMH Priority Habitat sites are developed further.

Underpinning the consultation approach was the view that scientific reports and understanding needed to be combined with as much practical 'on the ground' knowledge as possible to create a pragmatic solution for the identification of OMH Priority Habitat. We have gained consensus from experts, relevant organisations and stakeholders about the definition and how it might be used practically to identify sites and the result is a clear-cut set of defining criteria that can be used to identify whether sites are OMH Priority Habitat. This work was the basis of the OMH Site Identification Guide and is described in **Section 2** 'Consultation' and **Section 3** 'Approach for Identification of OMH Priority Habitat Sites'.

This report also describes the basis for a field evaluation approach which could assist with the prioritisation of sites. There is a need at a UK level not only to identify and map OMH Priority Habitat sites but also to determine the condition and conservation value of individual sites. This will help to inform Defra, the devolved administrations, appropriate agencies, NGOs and Local Authorities regarding the conservation management of the Priority Habitat and its associated species. At a local level, this will also enable Planning Authorities to identify brownfield sites which are important for biodiversity when considering development proposals, and to determine any appropriate mitigation measures. The 'OMH Field Assessment Form' has been developed as an excel spreadsheet to provide a protocol for collecting standardised information on individual sites, which could be used subsequently in a comparative analysis of their quality. The spreadsheet is provided as a standalone annex to this

report and is described in **Section 4** 'Approach for Evaluation of OMH Priority Habitat Sites'.

Because the criteria developed required field data and the interpretation of habitat features by individuals with ecological understanding, an automated, purely data-driven site identification method was not possible. The potential use of datasets to identify and then screen sites is described in **Section 5** 'Testing of Remote Assessment Approach for OMH Priority Habitat Sites'. Within **Section 6** 'Testing of Field Approach' testing of the OMH Site Identification Guide and the OMH Field Assessment Form at a number of sites is described.

Within **Section 7**, a brief summary of recommendations is provided.

2. CONSULTATION

2.1 Introduction

The successful development and uptake of a UK wide approach to the assessment and mapping of OMH Priority Habitat sites requires the involvement of experts, practitioners and those with a policy interest in the habitat to formulate a fit-for-purpose habitat definition and methodology for an inventory. Looking ahead, it was also considered important for the project to begin building support for the mapping of the habitat amongst stakeholders who will have an important role in influencing its protection and management.

Three stakeholder groups were identified for consultation during the project. The groups were:

- Expert advisors

- Data Providers

- Other stakeholders requiring an understanding of the OMH Priority Habitat

The work with expert advisers formed the main focus of consultation during the project and was conducted in two iterative phases using an email based questionnaire supported by explanatory notes.

2.2 Expert advisors

Composition of this group was decided by discussion with the Project Steering Group. The group of expert advisors encompassed members of the UK Biodiversity Partnership who were able to assist in developing the habitat definition and tools for the ecological assessment of sites and included individuals from member organisations of the Urban Inter-agency Working Group (NE, CCW, EHSNI, SNH), the JNCC, NGOs (*e.g.* Buglife, Butterfly Conservation) as well as amateur and professional experts and academics. The group also included representatives from organisations with a policy interest, such as the Homes & Communities Agency, the UK-MAB Urban Forum and the Land Restoration Trust.

2.3 Data providers

There are a number of organisations who hold data which might be of use in identifying OMH Priority Habitat sites. The organisations responsible for each potential dataset were identified (for example British Geological Survey for the Mines & Quarries data). Where ADAS was not already fully familiar with the dataset, a suitable representative was identified with expert knowledge of it. These representatives were contacted by telephone to establish the nature, availability and potential suitability of the dataset. A full review of the datasets available is given in Appendix 1, and their use in screening potential OMH Priority Habitat sites described in Section 5.

2.4 Other stakeholders requiring an understanding of the OMH Priority Habitat

In order to build support for the mapping and appropriate management of the habitat, key stakeholders who could positively influence its protection and management were identified in consultation with the Steering Group. Information was sent to them to update them on the project.

2.5 Phase 1 Consultation

The first phase of the consultation explored the basis for, and features required to define the presence of OMH Priority Habitat.

2.5.1 Purpose and Format of Phase 1 Consultation

The first phase of the consultation worked with the group of expert advisors to:

- identify existing methods of identifying OMH Priority Habitat

- identify records of field surveys of potential OMH Priority Habitat

- inform the review of data sources to achieve successful mapping of the habitat;

- identify potential defining features of OMH Priority Habitat and their characteristics and explore with experts how these could be identified and used to define the presence of OMH Priority Habitats.

A Phase 1 consultation questionnaire was produced and distributed to consultees (for a copy of the Phase 1 consultation questionnaire, please see Appendix 3).

The main focus of the questionnaire was to establish the range and characteristics of defining features of the habitat and how they could be used within a decision tool to define the habitat. A review of a range of scientific literature and reports was used to identify the initial set of potential defining habitat features, their characteristics and how they might be measured. A series of questions were used to collate experts' scientific and field based knowledge to assess the importance of the defining habitat features and their likely practical applicability as part of a site identification tool. Views were sought on whether there were other defining features that could be used in defining the presence of the habitat.

2.5.2   Consultees and response rate

Potential consultees were sought from a range of organisations. A few organisations declined to participate, for a variety of reasons, ranging from lack of time, to the subject area being peripheral to the policy interest of their organisation. Of the 26 organisations who agreed to participate, 21 provided responses (Appendix 2). In some cases, a range of expertise was available in a particular organisation (*e.g.* Defra and Natural England) and multiple individual responses were provided. In many other cases, the respondent had consulted with colleagues within their organisation when putting together their organisations response.

2.5.3 Phase 1 Evaluation of Responses

The responses to the Phase 1 questionnaire were evaluated by the project team and a summary of findings discussed with the Steering Group. The findings were used to develop a draft OMH Priority Habitat definition and site identification approach (see Appendix 4 for collated responses).

2.6 Phase 2 Consultation

This second phase of consultation with the experts was needed to test the draft OMH Priority Habitat definition and site identification approach, specifically to provide further views on an approach to the assessment of the ecological significance of sites.

A Phase 2 consultation questionnaire was produced and distributed to consultees (for a copy of the Phase 2 consultation questionnaire, please see Appendix 6).

2.6.1 Phase 2 Consultees

A list of the 18 individuals who provided responses to the Phase 2 consultation is provided in Appendix 5.

2.6.2 Phase 2 Evaluation of Responses

Responses to the Phase 2 Consultation were reviewed and any issues or challenges raised by individuals or organisations were discussed on a case by case basis initially by the project team and then in discussion with the Steering Group. Collated consultation responses are included in Appendix 7.

Modifications were made to the proposed OMH Site Identification Guide. These included tightening up the criteria to make it less inclusive, changing the phrase 'habitat' to describe particular plant communities, improving and clarifying the description of the underlying substrate/ bare ground, providing guidance on what was meant by 'unvegetated bare substrate' and clarifying how to evaluate the presence of pools of standing water compared to bare ground.

Following the Phase 2 consultation, the project team and Steering Group concluded that a list of indicator species was required within the approach; however, there was insufficient information from the consultation responses to formulate such a list. Plant species to be included were typically those tolerant of stress and possibly also disturbance, and but not common ruderal species tolerant of high nutrient availability. A species list was therefore developed on the basis of these criteria by the Project team and Steering Group.

2.7 Conclusions

There was an excellent response to both phases of the Consultation within this project, with diverse and detailed views submitted from experts in a wide range of organisations.

3. APPROACH FOR IDENTIFICATION OF OMH PRIORITY HABITAT SITES

3.1 Criteria for recognition of the habitat

Identification of OMH Priority Habitat sites requires a clear-cut set of criteria or defining features. Initially, six defining criteria were derived from the existing Priority Habitat description (Maddock, 2008). These were:

1) previous physical disturbance to the site / post-industrial substrates;

2) open habitat;

3) size of site;

4) mosaic of habitat features (site structure);

5) characteristic species assemblages;

6) UK BAP Priority Species.

Comments were sought on these defining criteria in the Phase 1 consultation and on the basis of the expert opinion provided, five draft criteria were adopted. The main alteration was to exclude the presence of BAP Priority Species as a strict criterion for defining the habitat. This was done because the consensus view was that the habitat features alone should be sufficient for a site to qualify as OMH Priority Habitat, but the presence of any Priority Species would add to its conservation importance.

These five draft criteria were included in the Phase 2 consultation to ensure there was consensus on their use, and following comments received from consultees and the Project Steering Group, were subject to further minor modification.

3.2 Definition of OMH Priority Habitat

The definition for OMH Priority Habitat sites is summarised in Table 1 and in the Annex to this report (OMH Site Identification Guide).

Included with the final criteria is a set of explanatory notes to clarify each one, again taking account of comments received during the consultations. These explanatory

notes provide guidance, but will not be able to cover all potential scenarios and an element of expert judgement will therefore be needed in their application. Users of the criteria will need to have the ecological expertise necessary to recognise plant communities and the key component species.

3.3 Characteristic plant species

A list of 64 plant species that are known to occur in OMH Priority Habitat (Table 2) was compiled (D. Goode, pers. comm.) and agreed by the Project Steering Group. The list represents the type of species that are characteristic of the habitat and is only intended as a guide to assist identification of the habitat in the field. Further development of species lists is recommended to assist with the identification and evaluation of OMH Priority Habitat. Typically, OMH Priority Habitat is expected to contain some of these species, or at least a suite of species with similar traits. This includes several non-native species which, although of limited conservation value per se, are typical of OMH Priority Habitat and which are an important food source for invertebrates.

Species' expected occurrence in three major UK regions (Southern England/Wales, Northern England, Scotland) were also included to provide three broad regional lists. However, sites on particular substrates or in restricted geographic areas tend to have their own characteristic suite of species. An example of such a list has been produced by CCW for colliery sites in south Wales (included in the OMH Field Assessment Form spreadsheet).

Table 1 Criteria for identification of OMH Priority Habitat sites.

	Criterion and Explanatory Notes	Data sources
Criterion 1.	**The site is at least 0.25 ha in size.**	Land use databases, Calculations in GIS
1.1	*The minimum size refers to the potential OMH habitat, which might be a part of a larger site containing other habitats such as woodland or developed land.*	
Criterion 2.	**Known history of disturbance at the site or evidence that soil has been removed or severely modified by previous use(s) of the site. Extraneous materials/substrates such as industrial spoil may have been added.**	Land use databases
2.1	*Disturbance refers to that resulting from major historical industrial use or development.*	
2.2	*Extraneous materials refer to extensive additions of spoil rather than incidental dumping of litter, broken glass etc.*	
2.3	*There might be evidence of heavy metal contamination but extensive stands of Calaminarian grasslands are specifically excluded as that is a distinct Priority Habitat.*	
Criterion 3.	**The site contains some vegetation. This will comprise early successional communities consisting mainly of stress tolerant species (e.g. indicative of low nutrient status or drought). Early successional communities are composed of a) annuals *or* b) mosses/liverworts *or* c) lichens *or* d) ruderals *or* e) inundation species *or* f) open grassland *or* g) flower-rich grassland *or* h) heathland.**	Aerial Photography; Field Survey

Criterion and Explanatory Notes	Data sources

3.1   *Brief descriptions of the early successional communities:*

a) Annual communities are those comprised mainly of stress-tolerant ruderals, which are short in stature and suited to low nutrient availability. Typical examples would be Arenaria serpyllifolia, Centaurium erythrea, Linum catharticum *or* Trifolium arvense.

b) Moss/liverwort communities can contain both acrocarpous (usually unbranched, tufted) and pleurocarpous (usually branched, carpeted) mosses and are usually relatively open and less luxuriant than in more mature habitats, often with bare ground present in a fine-grained mosaic. They can occur in discrete patches or interspersed in other communities such as open grassland or heathland. Common species are usually present such as the mosses Brachythecium rutabulum, Dicranum scoparium *or* Hypnum cupressiforme *and the liverworts* Lophocolea heterophylla *or* Ptilidium ciliare.

c) Lichen communities are likely to occur in extensive patches or interspersed with other communities such as open grassland or heathland. Species with a range of growth forms might be present, for example foliose (leaf-like), crustose (crust) or fruticose (shrubby and branched).

d) Ruderal communities are those composed mainly of taller annuals, biennials or short-lived perennials and typical of slightly more nutrient rich, or less disturbed conditions than the annual communities. Typical examples would be Daucus carota, Linaria vulgaris, Medicago

lupulina *or* Reseda luteola*.*

e) Inundation communities are comprised of species suited to periodic, often seasonal flooding. Vegetation is usually interspersed with bare areas of mud which can have a caked surface during dry periods and can result in annuals establishing. Typical species would be Alopecurus geniculatus*,* Juncus bufonius, Persicaria maculosa *or* Ranunculus flammula.

f) Open grassland is comprised mainly of perennial, stress-tolerant species of short stature with patches of bare ground at very fine-grained scale and often with a significant number of annual species or lichens in the sward. Typical species would be Festuca ovina, Hypochaeris radicata, Pilosella officinarum *or* Rumex acetosella.

g) Flower-rich grassland is a more typical, mature community with fewer gaps and characterised by more robust mesotrophic forbs such as Centaurea nigra, Lotus corniculatus, Ranunculus acris *or* Trifolium pratense.

h) Heathland communities are composed mainly of dwarf shrubs, often interspersed or in mosaics with graminoids, bryophytes or lichens. On OMH Priority Habitat they tend to have a more open structure with less plant litter and other organic matter build up on the substrate than in more typical heathlands. Typical species include Calluna vulgaris, Deschampsia flexuosa, Festuca ovina *or* Nardus stricta.

3.2   Examples *of species that characterise the early successional communities of OMH in*

Criterion and Explanatory Notes	Data sources

specified geographic regions are shown in the generic species list. The list demonstrates the type of species that can be expected to be present. It is not exhaustive and none are confined solely to OMH habitats. Some of these species might be present but if so, will occur with others typical of early successional communities.

3.3   *Other plant species associated with the particular edaphic conditions might also be present, for example ericaceous species on acidic sites. Species composition will also vary with geographic location and site age.*

3.4   *Other communities or habitats might also be present e.g. scrub, reedswamp, open water but early successional communities should comprise the majority of the area.*

Criterion 4. **The site contains unvegetated, loose bare substrate and pools may be present.**	Aerial Photography; Field Survey

4.1   *Loose bare substrate is intended to distinguish substrate potentially colonisable by plants from large expanses of sealed surface (concrete, tarmac, etc) where vegetation could only establish if it is broken up or heavily weathered.*

4.2   *Bare substrate can occur at a range of spatial scales, from unvegetated patches easily seen from a distance, to small, open spaces between individual plants within a community. On some substrates, for example coal spoil, the patches of bare ground may be 10cm across or less. A site with a wide variety of patch sizes could also qualify.*

4.3   *Bare substrate also implies absence of organic matter accumulation.*

	Criterion and Explanatory Notes	Data sources
Criterion 5.	**The site shows spatial variation, forming a mosaic of one or more of the early successional communities plus bare substrate, within 0.25 ha.**	Aerial Photography; Field Survey
5.1	*A mosaic is defined as an area where a range of contiguous plant community types occur in transition with one another, usually with ecotone habitat gradients and often at a small scale.*	
5.2	*Continuous blocks of a closed plant community greater than 0.25 ha would be classified as a habitat other than OMH, although those containing very fine-grained mosaics might qualify.*	

Table 2 Generic plant species that are characteristic of OMH Priority Habitat.

	Southern England / Wales	Northern England	Scotland
Artemisia absinthium*	X		
Artemisia verlotiorum*	X		
Artemisia vulgaris*	X	X	X
Aster novi-belgii*	X	X	X
Blackstonia perfoliata	X	x	
Centaurea nigra	X	X	X
Centaurium erythraea	X	X	
Cerastium fontanum	X	X	X
Cichorium intybus*	X	X	X
Conium maculatum*	X	X	X
Conyza canadensis*	X		
Conyza sumatrensis*	X		
Crepis biennis	X	x	
Crepis capillaris	X	X	X
Dactylorhiza praetermissa	X	X	
Daucus carota ssp. sativus*	X	X	
Deschampsia flexuosa		x	X

	Southern Wales	England /	Northern England	Scotland
Diplotaxis tenuifolia*	X			
Echium vulgare	X		X	X
Equisetum arvense	X		X	X
Erigeron acer	X		x	
Euphrasia spp.			x	X
Galega officinalis*	X			
Hieracium sabaudum	X		x	
Hypericum perforatum	X		X	X
Hypochaeris radicata	X		X	X
Juncus inflexus	X		X	X
Lepidium ruderale*	X			
Linaria repens*	X		X	
Linaria purpurea*	X		X	
Linaria vulgaris	X		X	X
Linum catharticum	X		X	X
Lotus glaber	X			
Matricaria matricarioides	X		X	X
Medicago sativa	X			
Medicago lupulina	X		X	X

	Southern Wales	England /	Northern England	Scotland
Melilotus altissimus*	X		X	
Melilotus officinalis*	X		X	
Nardus stricta			x	X
Odontites vernus	X		X	X
Oenothera spp.*	X		X	
Ophrys apifera	X		X	
Picris echioides*	X		x	
Picris hieracioides	X		x	
Pilosella praealta*	X			
Plantago lanceolata	X		X	X
Reseda lutea	X		X	X
Reseda luteola*	X		X	X
Saponaria officinalis*	X		X	X
Silene vulgaris	X		X	X
Tragopogon pratensis	X		X	X
Trifolium arvense	X		X	X
Trifolium campestre	X		X	X
Trifolium dubium	X		X	X
Trifolium hybridum*	X		X	X

	Southern Wales	England /	Northern England	Scotland
Trifolium medium	X		X	X
Trifolium pratense	X		X	X
Trisetum flavescens	X		X	X
Tussilago farfara	X		X	X
Senecio squalidus*	X		X	X
Verbascum nigrum	X			
Vicia cracca	X		X	X
Vicia hirsuta	X		X	X
Vicia tetrasperma	X			

*introduced species of lower biodiversity value but still characteristic of OMH Priority Habitat sites.

4. APPROACH FOR EVALUATION OF OMH PRIORITY HABITAT SITES

4.1 Introduction

There is a need at a UK level not only to identify and map OMH Priority Habitat sites but also to determine the relative conservation value of individual sites. This will help to inform Defra, the devolved administrations, appropriate agencies, NGOs and Local Authorities regarding the conservation management of the Priority Habitat and its associated species. At a local level, this will also enable Planning Authorities to identify brownfield sites which are important for biodiversity when considering development proposals and to determine any appropriate mitigation measures. We have, therefore, developed a protocol for collecting standardised information on individual sites, which could be used subsequently in a comparative analysis of their quality.

4.2 Overview of existing approaches

A number of organisations have developed field assessment methods of relevance for determining the condition and conservation value of brownfield sites. These were reviewed to determine their suitability for assessing the ecological significance of OMH Priority Habitat sites. Although some of these methods were not aimed specifically at OMH Priority Habitat they were included in the review because the approaches are particularly relevant to OMH Priority Habitat. The methods reviewed included two aimed specifically at invertebrate interest (Roberts et al., 2006; Butterfly Conservation, undated).

A wide range of attributes was specified in the four assessment methods targeted mainly at brownfield or OMH sites although none was common to all four methods (Table 3). Some attributes had numerous categories specified; for example there were 23 separate habitat categories in the brownfield assessment method used by the Northumberland Wildlife Trust and partners (Sixsmith et al., 2009). There was, however, close correspondence of the specified attributes with those identified and subsequently agreed in the Phase 2 consultation and they were therefore included in the provisional assessment method for OMH.

Table 3 Existing field assessment methods of relevance to OMH assessment.

Organisation	Location of sites	Type of site	Type of survey	Quality Assessment	Reference
Northumberland Wildlife Trust & partners (NWT)	Newcastle upon Tyne, North Tyneside & SE Northumberland	Brownfield	Extended Phase 1	'Traffic-light' scoring system developed to assign priority scores to brownfield sites with the aim of assessing conservation interest	Sixsmith et al. (2009)
Buglife	Thames Gateway (Kent, London & Essex)	Brownfield invertebrate habitat	Bespoke habitat assessment	Sites were assigned low, medium or high ratings based on their quality for invertebrates	Roberts et al. (2006)
CCW	South Wales valleys (Glamorgan & Monmouthshire)	Coal spoil	Conservation assessment	'Traffic-light' botanical assessment tool derived that allows classification of sites as having low, moderate or high conservation interest	Miller et al. (2007)
Butterfly Conservation (BC)	North-east England	Dingy Skipper habitat	Bespoke habitat condition survey		Butterfly Conservation
JNCC	UK-wide	Designated sites (various habitats)	Common Standards Monitoring	Seven categories of habitat condition ranging from "favourable maintained" to "destroyed".	http://www.jncc.gov.uk/page-2199

The JNCC guidance for Common Standards Monitoring provides advice on sampling procedures for a range of habitats on designated sites. The most suitable method for open habitats is a structured walk of the site with 10-20 stops to provide a quick assessment of the variation within the site. Attributes are recorded at each stopping point and overall for the site at the end of the survey. The data collected at each stopping point are not intended to have rigorous statistical value but serve as guidance for the overall site assessment. This method is recommended, for example, in the case of lowland heathland (JNCC, 2009) and was the sampling approach adopted here for the provisional assessment method for OMH Priority Habitat.

Some of the existing methods used a ranking system to determine the relative value of different sites in the sample and this might be a suitable approach when the objective is to prioritise local resources. However, due to regional variation in OMH Priority Habitat sites and local objectives, it would not be feasible to compare or rank sites at a national level. It was therefore agreed with the project Steering Group that the scope of this project would be limited to designing the field survey method to produce information in a format suitable for interpretation by local users.

Table 4 Attributes specified in existing assessment methods. Organisations refer to those in Table 3.

Attribute	Buglife	BC	CCW	NWT	JNCC*
Activities / management	✓	✓			✓
Bare ground	✓	✓	✓		✓
Connectivity				✓	
Invertebrate diversity	✓				
Lichen diversity			✓		
Low nutrient status			✓		
Negative / invasive plant species	✓			✓	✓
pH variation			✓		
Plant diversity / abundance	✓				✓
Plant species	✓	✓	✓		✓
Rabbit activity		✓			
Rare / Priority / protected species (various taxa)				✓	
Seed resource		✓			
Substrate	✓				✓
Topographic complexity			✓		
Vegetation height		✓			
Vegetation types / habitats	✓	✓		✓	✓
Wet areas	✓			✓	✓

*dependent on habitat being assessed

4.3 Provisional site assessment approach

Building on the findings of the review of methods a provisional approach for assessing the conservation value of OMH Priority Habitat sites was designed and tested. The approach used four stages:

1) identification of potential OMH Priority Habitat sites from remote assessment,

2) collation of any previous background data,

3) confirmation in the field of OMH Priority Habitat status and

4) collection of field data on site attributes.

Previous background data that might be available and relevant to the assessment included site origin, age and the presence of any species of conservation importance, such as UK or Local BAP Priority Species, Red Data or nationally scarce species.

The field survey method followed that recommended by JNCC for Common Standards Monitoring on Lowland Heathland, as described above.

Attributes to be recorded at each stopping point and for the site as a whole were:

- percentage cover of OMH communities,

- presence of other communities or habitats;

- evidence of environmental stress and bare substrate; and

- the presence of physical variation, habitat mosaic and negative indicators

- Additionally the following attributes were also recorded:

- Cover / abundance of characteristic plant species.

- current use,

- landscape context and

- evidence of fragmentation of OMH Priority Habitat.

A set of standard recording forms was produced together with detailed guidance notes and instructions for field surveyors to support the recording of these attributes.

The OMH Field Assessment Form is provided as an annex to this report.

5. TESTING OF REMOTE ASSESSMENT APPROACH FOR OMH PRIORITY HABITAT SITES

5.1 Introduction

Remote assessment in this context is a means of locating brownfield sites using national datasets, and subsequently gaining knowledge of a site's characteristics prior to field visit using aerial photography. The overall aim of the remote assessment is to determine whether or not a site should be visited for ground survey. The approach only excludes sites from ground survey if it can be ascertained from the aerial photography that one or more of the criteria defining OMH Priority Habitat are not met.

5.2 Methods

5.2.1 Identification of test regions

Three regions were chosen to test the approach for remote assessment of sites. Regions were chosen to maximise geographic variation, whilst focusing on areas that already have good quality survey data for sites that may fit the OMH Priority Habitat definition. This enabled the assessment of whether any important sites were missed using this approach. Such survey data were not used to identify OMH Priority Habitat sites in the first instance, because the definition had not yet been developed.

Potential sites were assessed remotely in:

- Tyneside region: North Tyneside; South Tyneside & Blyth Valley UAs;

- South Wales region: Rhondda, Cynon, Taff UAs; and

- The Thames Gateway region: Thurrock UA.

Prior surveys in each of these areas have been carried out by other organisations with the aim of classifying sites as having low, moderate or high conservation importance and are therefore useful test sites for comparison (see Table 3 in Section 4 for a summary of methods used. A range of sites had been surveyed in each area.

The 'Brownfield Biodiversity Report' (Sixsmith, 2009) presents the results of a project

carried out by a number of partners including Blyth Valley District Council, Newcastle City Council, North Tyneside Council, Wansbeck Council, Natural England, Northumberland Wildlife Trust, Groundwork Northumberland and Butterfly Conservation. The aim of the project was to gain a better understanding of brownfield and its biodiversity in South East Northumberland, North Tyneside and Newcastle. It provided an understanding of the species composition of 22 brownfield sites across the region, and made an assessment of the biodiversity value of these sites.

The 'All of a Buzz in the Thames Gateway' project (Roberts et al, 2006) is the most extensive and detailed assessment of the biodiversity value of brownfield sites to date. The Thames Gateway is known to support a high diversity of invertebrates, including at least eight UK BAP priority species. Some of the aims of the project within the study area were to (i) evaluate the invertebrate resource with particular reference to brownfield habitats; (ii) identify key assemblages and species associated with brownfield habitats; (iii) list and map all sites that would fit the broad category of 'brownfield' and assess each one for its likely importance to invertebrates and (iv) evaluate the relative importance of different land uses for providing supporting habitats. The study identified a total of 520 brownfield sites, of which 41% were estimated to be of 'high' quality for invertebrates.

Miller et al (2007) carried out an NVC-type survey of coal spoil sites in South Wales on behalf of Countryside Council for Wales. The aims were to carry out detailed mapping of coal spoil habitats on 15 sites, and to develop a simple methodology for assessing these habitats for their conservation interest. Coal waste sites were examined in the County Boroughs of Caerphilly, Merthyr Tydfil, Rhondda Cynon Taff and Torfaen. A 'traffic-light' botanical assessment tool was derived, which allows a preliminary assessment of sites into those of low, medium and high conservation interest respectively by workers with some ecological expertise but without the need for detailed NVC or lower plant identification skills.

5.3 Data

National databases of previously developed sites with spatial information (grid references or boundaries) were used to identify potential OMH Priority Habitat sites in the test regions. The attributes of the datasets that were used for the remote

assessment are detailed in Table 5. Further details of these datasets can be found in Appendix 1. As the National Land Use Database of Previously Developed Land only has England coverage, Phase 1 habitat data for Wales was used as an alternative. Use of alternative datasets for different regions doesn't impact on the robustness or consistency of the approach as the datasets are used to screen out sites that are not potential OMH rather than to identify sites that are definitely OMH.

Table 5 Datasets used for testing the remote assessment approach and their useful attribute data

Dataset	Spatial representation	Attributes used for assessment
National Land Use Database of Previously Developed Land (NLUD-PDL)	Points (coordinates)	Land Type (vacant or derelict) Area (ha)
Environment Agency Historic Landfill Sites	Polygons	Last input (date) Type of waste
British Geological Survey's Mines & Quarries	Points	Pit status (ceased, dormant or historic) Site type (open pit /surface workings or open pit and underground)
Countryside Council for Wales' national Phase 1	Polygons	Habitat type (mine, quarry, spoil, tip, bare or ephemeral)

5.4 Remote assessment

Datasets were converted to GIS format where necessary (NLUD-PDL) and overlaid onto geo-referenced aerial photography (AP) for the test. The AP used was Microsoft Virtual Earth, which is freely available as an integrated feature in ArcGIS 9.3.1. The

advantage of using Virtual Earth is that it can be brought into the ArcGIS desktop and is correctly georeferenced. As some of the Google Earth AP is more recent than Virtual Earth, cross checks were made with Google Earth photography. Better results will come from use of AP taken during the Spring/Summer months when the vegetation is more obvious.

As a first step, sites in the national databases were excluded from consideration if they were <0.25ha in area. Site area is present as an attribute field in NLUD, and can be calculated from the polygons for Historic landfill and Phase 1. There is no site area information in the mines & quarries dataset, therefore an estimate was made from the AP. Where it was evident from the AP that only part of the site was potential OMH, this area only was estimated using GIS tools.

For potential sites that met the minimum area criterion, the underlying AP was inspected in relation to each of the other OMH Priority Habitat definition criteria. Sites were excluded from further consideration if they were (i) recently developed; (ii) landscaped; (iii) lacked any vegetation; (iv) were completely covered with late successional vegetation such as woodland, scrub or homogenous grassland or were under agricultural use. The apparent absence of a mosaic was not used as an excluding factor, since the mosaic cannot necessarily be seen from AP.

Boundaries of sites that remained potential OMH following AP inspection were either digitised to OS MasterMap linework or a copy made of the relevant site polygon, whichever was most appropriate, using the AP as a guide to the site extent. If the potential OMH habitat covered only part of the site a site boundary polygon was captured using freehand digitising. Site (or OMH) boundaries that were to be surveyed as part of the testing process were overlaid onto the AP (including road and place name labels) with a reference grid and exported as JPEGs at 300 dpi. These maps were printed and used during field survey of sites. Edits were made to the boundaries following field survey.

5.5 Results

5.5.1 Numbers of potential OMH Priority Habitat sites

A total of 47 potential sites were identified in Tyneside, 34 in Thurrock and 42 in South Wales. The numbers of sites inspected by remote assessment and the numbers classified as potential OMH Priority Habitat by Unitary Authority and dataset are shown in Table 6. Maps of potential OMH Priority Habitat sites in each region are shown in Figures 1, 2 and 3.

Table 6 Numbers (and %) of potential OMH Priority Habitat sites identified from the total number of sites in the dataset for each test region.

	Dataset			
UA area	NLUD-PDL	Historic Landfill	Mines & Quarries	Phase 1
North Tyneside	1/8 (12.5%)	12/71 (17%)	0/21 (0%)	~
South Tyneside	8/26 (31%)	6/46 (13%)	4/10 (40%)	~
Blyth Valley	7/11 (64%)	11/22 (50%)	1/16 (6%)	~
Thurrock	4/19 (21%)	30/102 (29%)	37/174 (21%)	~
Rhondda, Cynon, Taff	~	11/89 (12%)	39/142 (27%)	37/446 (8%)
TOTAL	20/64 (31%)	70/330 (21%)	81/363 (22%)	37/446 (8%)

None of the potential sites were represented in both NLUD and Historic Landfill. One site, in Thurrock, was represented in both NLUD and Mines & Quarries datasets. Three sites were identifiable from both Historic Landfill and Mines & Quarries in Tyneside; 15 in Thurrock and two in Wales. There were six instances of potential sites in Wales that were identified in both the Historic Landfill and Phase 1 data, and two sites that were represented in all three datasets used.
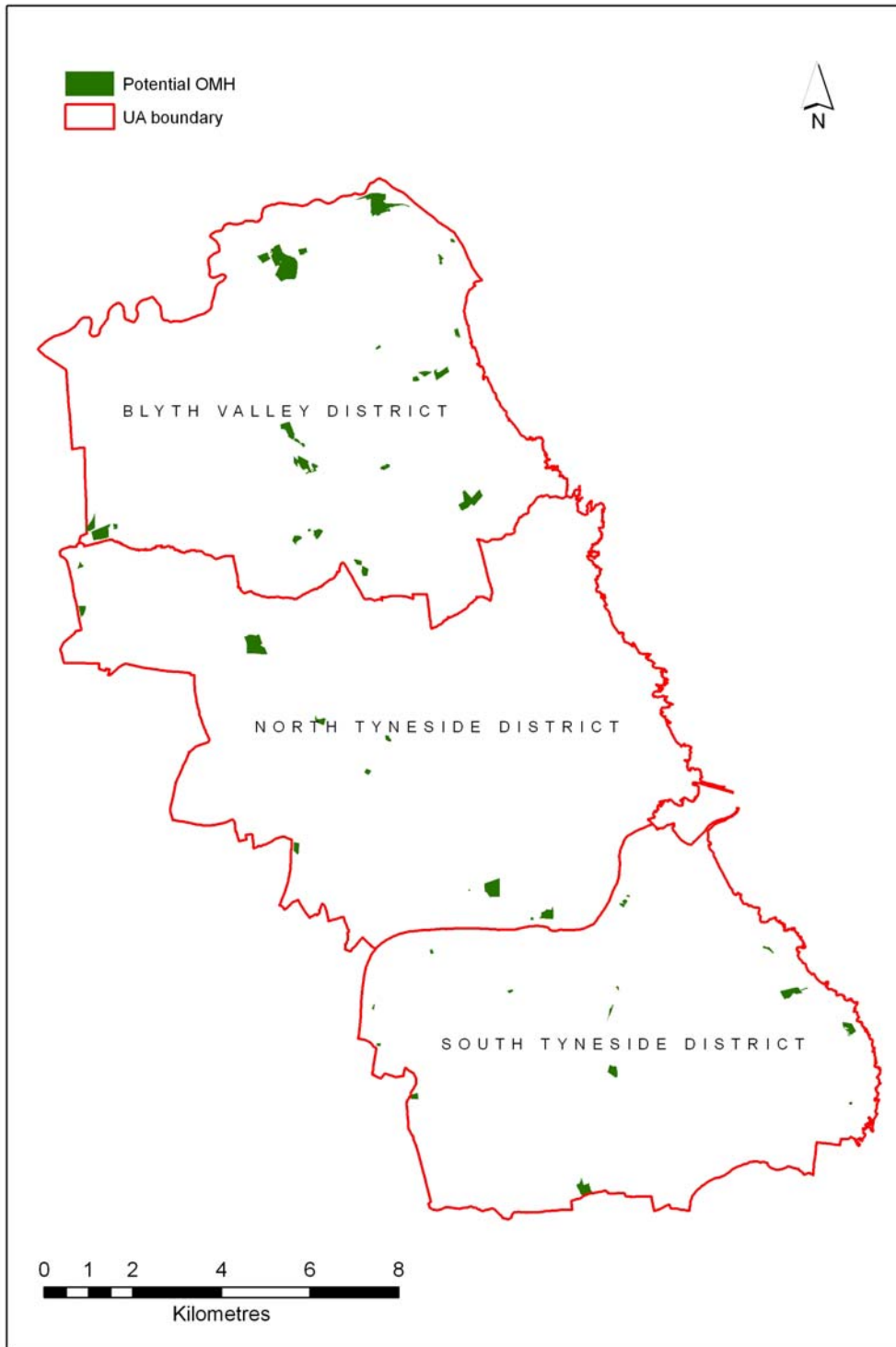
Figure 1. Potential OMH Priority Habitat sites in the Tyneside region
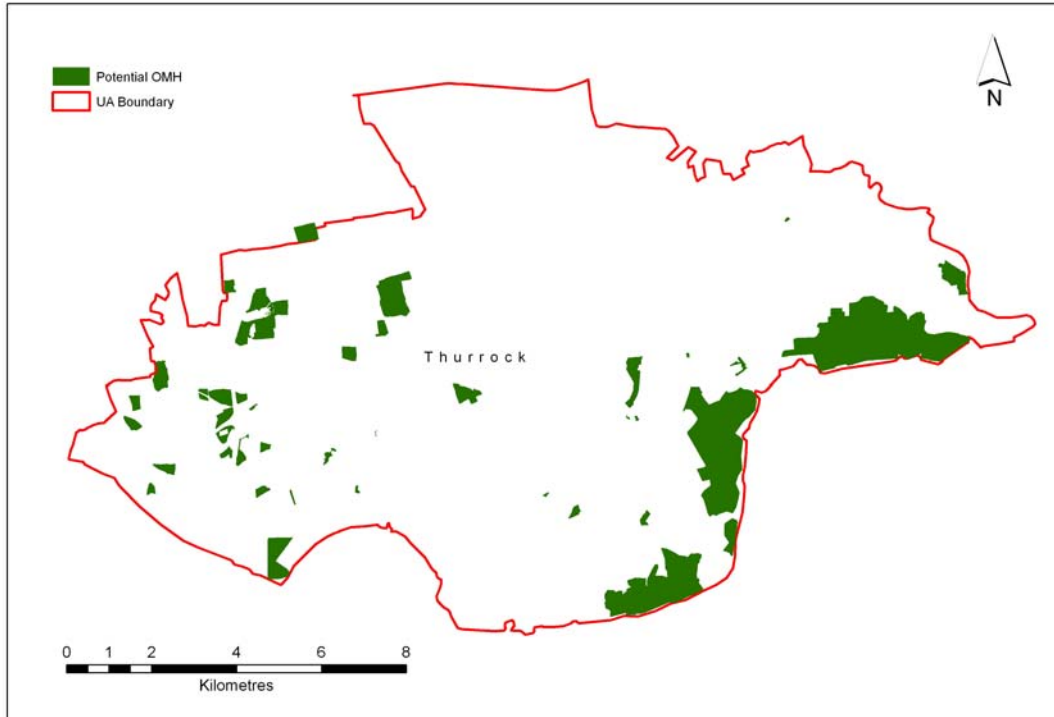
Figure 2. Potential OMH Priority Habitat sites in Thurrock (Thames Gateway)
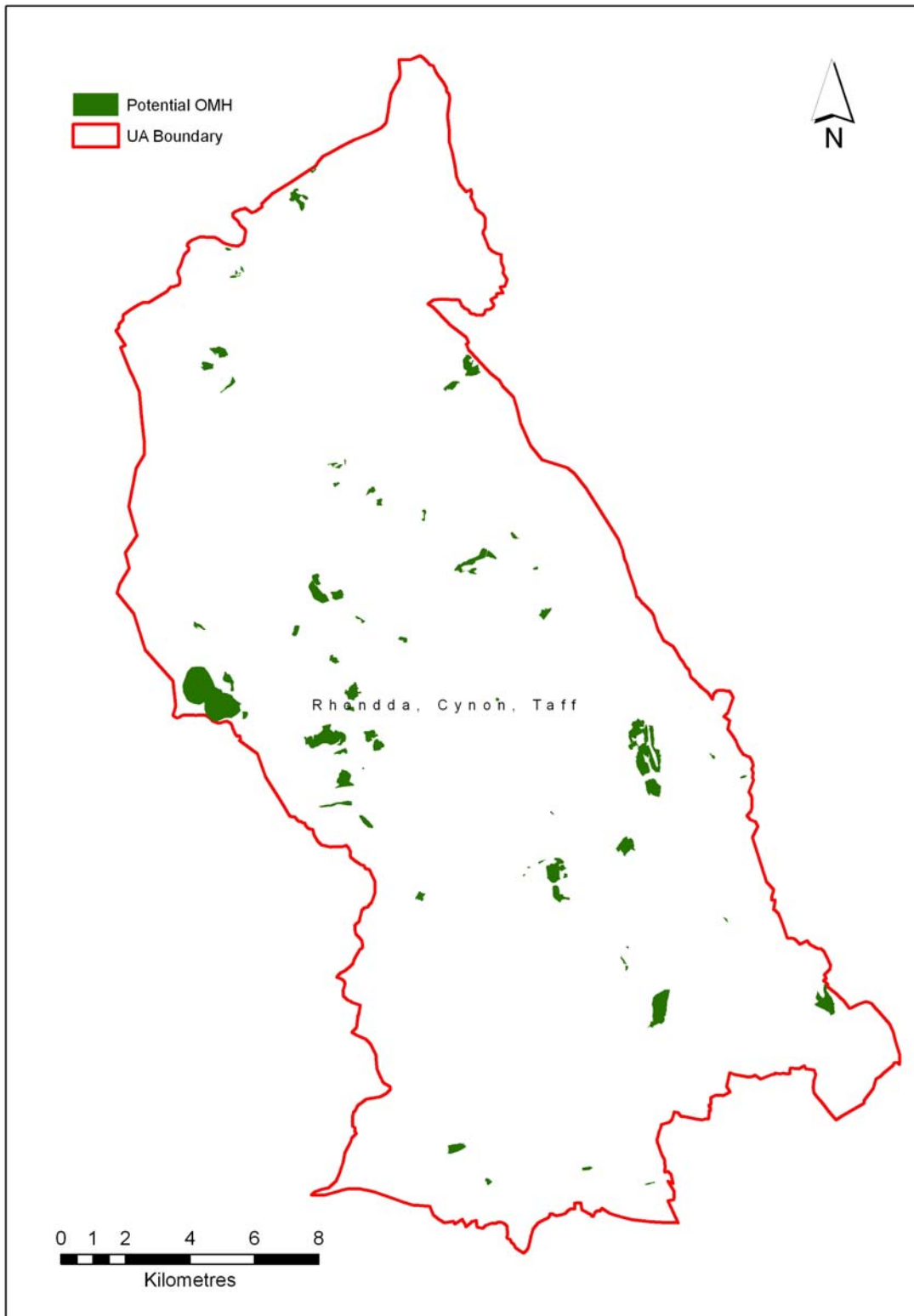
Figure 3. Potential OMH Priority Habitat sites in Rhondda, Cynon, Taff (South Wales)

5.5.2 Identification of surveyed sites

Remote assessment of sites was able to screen out sites that would not satisfy the OMH Priority Habitat criteria. However, where there were known sites likely to be similar in nature to the OMH Priority Habitat, some were not identifiable within the datasets used – with only two thirds of the known sites seen. This may have been due to sites not being recorded in national datasets. Further investigation, possibly using datasets from Local Authorities or e.g. Wildlife Trusts may be required to identify all potential sites within an area.

Of the 11 sites surveyed by Northumberland Wildlife Trust in North Tyneside and Blyth Valley, 7 (64%) were identified as potential OMH through remote assessment. Of the 33 sites surveyed by Buglife in Thurrock, 12 (36%) were identified as potential OMH Priority Habitat through remote assessment. 15 of the 33 were not represented in any of the national datasets, and six were present in the national datasets but were excluded following inspection using AP. Of the five sites surveyed by CCW in Rhondda, Cynon & Taff, three were identified as potential OMH through remote assessment.

5.6 Conclusions

The proposed method provides a simple, effective means of identifying and potentially screening out sites prior to field survey, thus reducing survey effort and cost. By using a combination of the available national datasets, many potential sites can be identified at a Unitary Authority/ county level. It was however evident that some potential OMH Priority Habitat sites were not represented in any of the national datasets used. The number of potential sites missed could be reduced by investigation of local datasets (*e.g.* from local authorities or from the National Biodiversity Network), and potentially by scanning the aerial photography for extra sites.

Overall, 31% of NLUD-PDL sites; 21% of Historic Landfill sites; 22% of Mines & Quarries sites and 8% of Phase 1 sites were considered potential OMH Priority Habitat in the test regions. Instances of potential sites being represented in more than one dataset were few, the most being in both the Historic Landfill and the Mines & Quarries datasets in Thurrock. The number of sites classified as potential OMH

Priority Habitat varied between 13 and 42 per Unitary Authority. The three test regions varied substantially in the density of previously developed sites and the type of industry. There were no particular interpretation issues specific to the type of site, although it was more difficult to define the boundary of the potential OMH Priority Habitat for large coal mine sites or ex-landfill sites.

It is apparent that the quality and recentness of the aerial photography will be key to obtaining the best results from the remote assessment phase. Some of the Virtual Earth photography was old compared with Google Earth, and major changes can occur in relatively short spaces of time (*e.g.* development; landscaping). It will therefore be important to use the most recent photography available at the best resolution possible. Poor quality photography can also lead to interpretation issues, for example the assessor could miss the presence of small patches of vegetation between concrete. There are also likely to be differences in interpretation between assessors. It is possible that the use of colour infrared photography (CIR) may help to pick out small patches of vegetation; more easily identify heterogeneity (*i.e.* mosaics) and stressed vegetation. However, use of CIR would bring an additional cost which might not be justified given the fact that the remote assessment can only screen for potential sites which would still need a field visit. An example of CIR photography is provided in Figure 4.

Figure 4. Example of colour infrared photography in an urban area. Nutrient rich grassland has most reflectance, and therefore has most colour. Nutrient stressed vegetation will be duller and more patchy at certain times of the year.

6. TESTING OF FIELD APPROACH

6.1 Methods

The provisional field approach was tested on six sites in three distinct geographic locations, being North East England, South Wales and the Thames Gateway. The aim of the exercise was to follow through the site identification process from the remote assessment method (described in Section 5), to test the utility of the field method and to identify any outstanding difficulties or issues relating to identification of OMH Priority Habitat and the collection of data to assess the conservation value of sites.

A shortlist of sites was first drawn up, referring to previous survey data. Sites were selected to cover a range of origins and with potential for OMH Priority Habitat to be present, with a strong likelihood that the site was still intact (*i.e.* not developed) and relative ease of access. The potential for OMH Priority Habitat being present was checked from aerial photography and site boundaries drawn using OS Mastermap (as described in Section 5). From this, the final set of test sites was selected (Table 7). Former uses of the sites were colliery, industrial waste, quarrying and landfill. Due to time restrictions, it was not possible to cover the entire area of some sites. The results should not therefore be taken as a definitive description or evaluation of the sites chosen, as they were only intended to be used as a test bed for the site evaluation method.

During the consultation phase it was evident that, due to the variation between sites in different geographic regions and with different origins, regional lists of characteristic species would be highly desirable in order to assist identification of OMH Priority Habitat. Regional lists could be used in addition to, or instead of, a generic list. Therefore, at the sites in South Wales, an additional list of species characteristic of South Wales colliery sites was also tested. This list was one used by Wildlife Trusts in South Wales.

Field tests were carried out by four ecologists, each of whom surveyed 1 or 2 sites during the first half of August 2009.

6.2 Results

6.2.1 Test sites

Of the six sites surveyed, only three satisfied all five criteria and therefore qualified as OMH Priority Habitat (Table 7). One site (Gelli Tip) was judged not to have met the Priority Habitat definition because there was no bare ground present, apart from on well-worn tracks. Two other sites (Howdon Tip and Georgetown Tip) failed because the areas of mosaic comprising open communities with bare ground were smaller than the agreed threshold of 0.25 ha. Howdon Tip comprised mainly flower-rich grassland and rank grassland with small areas less than 0.1 ha in size of mosaic formed from bare ground along with OMH communities. Georgetown Tip comprised mainly acid grassland and bracken with only small areas of bare ground where slippage had occurred.

OMH Priority Habitat was present in a single block at Bates Colliery and Kingsnorth Spoil Heap but fragmented into distinct areas at Swanscombe Marsh & Point. The connectivity of test sites to other habitats was very variable. The North East England sites were in urban locations but connected to other habitats such as parkland and other brownfield sites. In contrast, the South Wales sites were in rural locations, adjacent to farmland and forestry. Kingsnorth was adjacent to farmland and Swanscombe Marsh & Point to coastal marshes.

Each of the eight OMH communities was recorded on at least one of the six sites. Annuals, mosses-liverworts and ruderals were recorded at all sites, albeit at low cover on some. Heathland, open grassland, mosses/liverworts and flower-rich grassland were judged to occupy at least 50% of one or other site. Scrub was the most commonly occurring additional habitat. Acid or calcareous conditions were noted at all sites and low nutrient status or drought conditions at three sites each. All sites showed some form of physical variation and seven different substrates were recorded. Mosaics, where present, occurred at multiple spatial scales, although some surveyors found this difficult to assess. Invasive plant species were the only negative indicators but occurred at all but one site.

In total, 25 of the 64 species on the generic list were recorded at one or more of the test sites. Plantago lanceolata, Trifolium pratense, Blackstonia perfoliata and

Cerastium fontanum were the species recorded most commonly. Of these, B. perfoliata is characteristic of annual communities and the remainder of mesotrophic (flower-rich) grassland. Of the 85 local indicator species for South Wales colliery sites, only eight and two were recorded respectively from Gelli and Georgetown Tips (Table 9). Most of those recorded were common and widespread heathland and grassland species.

Information on the characteristics of each site captured using the OMH Field Assessment Form is given in Table 8.

Table 7. Summary descriptions of test sites.

Site	Location	Area (ha)	Origin	>0.25ha	Disturbance	Early succession	Bare substrate	Mosaic	Current use
Howdon Tip	NE England		Council tip	✓	✓	✓	✓	–	Formal open access.
Bates Colliery	NE England		Colliery	✓	✓	✓	✓	✓	Informal open access.
Swanscombe Marsh & Point	Thames Gateway		Quarrying, chalk extraction, cement manufacture & landfill	✓	✓	✓	✓	✓	Accessible greenspace; mostly unmanaged.
Kingsnorth Spoil Heap	Thames Gateway		Unspecified industrial spoil	✓	✓	✓	✓	✓	Minor fly tipping.
Gelli Tip	S Wales		Colliery	✓	✓	✓	–	–	Informal open access; sheep grazing.
Georgetown Tip	S Wales		Colliery	✓	✓	✓	✓	–	

Table 8 Summary of results from test sites.

a) Attributes

Attribute			Site HT	BC	SM	KS	GT	GN
Vegetation	**OMH communities**	Annuals	<1	1	20	10	<1	5
		Mosses / liverworts	<1	2	1	2	50	50
		Lichens			1	<1	5	15
		Ruderals	<1	1	5	5	<1	<1
		Inundation species	<1					
		Open grassland	<1	60	50	50		80
		Flower-rich grassland	50	40				
		Heathland					95	
	Additional communities / habitats	Scrub	<1	2	3	15	10	
		Woodland						
		Rank grassland	40	2				
		Improved grassland						
		Open water			4	<1		
		Swamp / fen				<1		
		Other	10			<1		10
	Conditions indicated	Low nutrient status	5	65				80
		High pH	<1	5	30			
		Low pH				3	95	80
		Seasonal drought		65	30	1		
		High moisture	10			2		
		Brackish / saline						
		Heavy metal						
		Other soil contamination						
Physical variation		Topography			✓		✓	
		Substrate		✓	✓	✓		
		Aspect					✓	

Attribute		Site	HT	BC	SM	KS	GT	GN
		Wetness	✓			✓		
Bare substrate	**Type**	Clay	20	20				
		Coal		1			<1	<1
		Rubble			40			
		Brick			3			
		Gravel & sand			60	70		
		Concrete			2			
		Tarmac				10		
	Colour	Pale	20	20	ND	70		
		Intermediate			ND	ND		
		Dark		1	ND	ND	<1	<1
	Particle size	Large			ND			
		Intermediate		1	ND	25	<1	<1
		Small	20	20	ND	70		
Mosaic scale		<0.1m	✓	✓				
		0.1-1m	✓	✓				
		1-5m		✓	✓			
		>5m		✓	✓	✓		
Negative indicators		Invasive plant species	✓		✓	✓	✓	✓
		Topsoil dumping						
		Other						

HT = Howdon Tip, BC = Bates Colliery, SM = Swanscombe Marsh & Point, KS = Kingsnorth Spoil Heap, GT = Gelli Tip, GN = Georgetown Tip. Data are % cover estimates or presence (✓) of the attribute for the whole site; ND = no data recorded. Some data estimated retrospectively to take account of surveyor comments. Results should not be taken as a definitive evaluation of individual sites (see text).

b) Characteristic OMH species recorded on the DAFOR scale at test sites

	HT	BC	SM	KS	GT	GN
Blackstonia perfoliata	O	A		A		
Centaurea nigra	O					
Centaurium erythraea		A		A		
Cerastium fontanum	R				F	A
Crepis capillaris	O	R				
Deschampsia flexuosa				A		
Equisetum arvense	F					

	HT	BC	SM	KS	GT	GN
Euphrasia spp.						R
Hypericum perforatum				A		
Hypochaeris radicata	R				A	
Linaria vulgaris	R		R			
Linum catharticum		R				
Lotus glaber				O		
Medicago lupulina	R	A				
Melilotus altissimus	O					
Melilotus officinalis			O			
Nardus stricta					O	F
Odontites vernus	R					
Picris echioides				O		
Plantago lanceolata	A	A	O		O	
Reseda lutea			R			
Reseda luteola			R			
Trifolium medium	O	R				
Trifolium pratense	A	A	O		R	
Vicia cracca	O					

Table 9. Species recorded from the local list for South Wales colliery sites.

	GG	GN
Calluna vulgaris	A	
Deschampsia flexuosa	A	
Festuca ovina	A	D
Filago vulgaris	R	
Pilosella officinarum agg.	A	A
Rumex acetosa	O	
Trifolium striatum	R	
Vaccinium myrtillus	A	

6.2.2 Assessment method

Overall, the assessment method worked satisfactorily although surveyors made suggestions for clarifying some of the instructions and some minor procedural changes. A minimum level of expertise is required to interpret the criteria correctly and in particular to recognise some of the less common and exotic plant species in the OMH indicator list (within the OMH Site Identification Guide). Field ecologists using the site assessment method could be guided by photographs to aid their interpretation.

The most problematic issue in deciding whether an area meets the definition of OMH is the spatial scale at which the mosaic, and particularly bare ground, must occur. The agreed definition is that the mosaic should occur within 0.25ha but it is not possible to be definitive about how much of that area should be occupied by bare ground and early successional communities. This is partly because there can be a mixture of sizes of diffferent 'patches' of the mosaic across the site. There is also a temporal component, as pioneer communities undergo succession to more closed vegetation, resulting in a mosaic of communities at different stages of succession. Ultimately, the vegetation development might be so advanced that the site is similar to a different habitat, as in the example of Gelli Tip, which more resembled upland dwarf shrub heath. Therefore, there will always be an element of subjectivity in deciding on marginal cases, which should become less problematic as experience is gained by the assessor.

The generic list of species and regional lists, such as the South Wales colliery sites example (Table 9), will also act as an aid to deciding on marginal cases. The generic list includes several non-native species that might not in themselves be of biodiversity value. However, this list is intended primarily to assist the identification of OMH, rather than the evaluation of individual sites. Evaluation of individual sites will need to take wider community descriptions into account. A list of 50 plant species beneficial to invertebrates in the Thames region has also been compiled by Buglife and Livingroofs.org, and this and similar lists could provide additional information for evaluating individual sites (contained within OMH Field Assessment Form). The generic

list also includes some difficult groups, which require a relatively high level of botanical expertise to identify. However, since the list is intended only as a guide and also includes familiar species, it can still be used by ecologists with varying levels of expertise.

Amendments made to the method following the field tests were:

- In discussion with the Steering Group, further guidance on bare ground was added to the OMH Priority Habitat Definition. This change allows for inclusion of sites like Gelli Tip as OMH Priority Habitat.

- Field sampling procedure simplified and speeded up by spacing stops so that each covers a homogenous area, rather than having equidistant spacing between stops. This reduces redundant information recorded by multiple stops within homogeneous areas.

- Brief community descriptions and incidental records of BAP species to be made in the target notes.

- Various minor amendments made to clarify the guidance notes and to make recording in the field easier.

- One suggestion made was that recording particle size and colour might be unnecessary as they could usually be deduced from the substrate type. However, even minor variation in size and colour is important for different invertebrate species and these attributes were retained in the method.

7. RECOMMENDATIONS

7.1 Site Identification and Evaluation

The recommended methodologies for identification and evaluation of OMH Priority Habitat sites are provided in the two annexes to this report: OMH Site Identification Guide and OMH Field Assessment Form. Included are explanatory notes for the criteria along with guidance notes.

The definition of OMH Priority Habitat presented here serves as a guideline for identifying the habitat. Currently there is no comprehensive dataset on OMH Priority Habitat across the UK so both identification and assessment of sites will require a degree of subjective, expert judgement to be applied. As more information on OMH Priority Habitat becomes available, it should be possible to tighten up the definition further and provide targets for each attribute in order to standardise site assessment further.

The development of regional plant species lists and those specific to particular substrates will also be important and is recommended. However, as with other habitat types, an element of judgement will always need to be applied, especially in borderline cases. Sites containing habitat mosaics are especially difficult to classify and this is exacerbated in the case of OMH Priority Habitat where there is a requirement for bare ground to be present in the mosaic. However, the current definition and assessment guidelines proved to be workable in practice and were refined following field testing.

7.2 Identifying and screening sites by remote assessment

The work presented here has shown that there are datasets available that can assist with the identification and screening of potential OMH sites. Some recommendations for the remote assessment part of the method include:

1. Use the most up-to-date aerial photography (which is available to Defra), as sites can undergo rapid change.

2. Experiment with supplementing colour aerial photography (AP) with infra-

red where available, as this may assist in interpretation of whether there is presence (or absence) of vegetation.

3. Undertake quality control checks in AP interpretation as the process is fairly subjective, and there may be differences in interpretation between assessors.

4. Ensure assessors undertake sufficient training in the interpretation of AP for brownfield sites that have been subject to field assessment.

5. Consider using more stringent exclusion criteria during remote assessment, for example, some evidence of the presence of a mosaic. Three of the six sites that underwent field assessment did not meet the OMH requirements due to the lack of a mosaic or the area of the mosaic falling under the 0.25ha threshold. Field survey effort could be reduced if this could be picked up at the remote assessment stage; however this would increase the risk of OMH habitat being missed. The best way to address this might be through refinement of the AP interpretation method whilst carrying out the national inventory. For example, start off by using the current suggested exclusion criteria, and then re-visit the AP for sites that were considered not to have met the Priority Habitat definition due to the absence of a mosaic following field assessment. This will help train the interpretation of the mosaic from the AP. If presence or absence of a mosaic can be consistently identified from the AP, the exclusion criteria can then be made more stringent. This is likely to be an iterative process that will improve as the inventory progresses.

7.3 Production of a national inventory of OMH Priority Habitat Sites

The approach developed in this project for identifying OMH Priority Habitat Sites could be rolled out to develop a national inventory. The steps that would have to be taken to do this would be as follows:

1. Carry out the remote site identification procedure using all available datasets at a regional/ county/ UA level.

2. Contact key individuals at the regional/ local level to obtain local datasets containing additional potential OMH Priority Habitat sites.

3. Screen out any sites that do not fulfil the criteria for OMH Priority Habitat using the remote assessment approach described in Section 5.

4. Create a database of potential OMH sites that need to be visited for an ecological survey using the OMH Site Identification Guide.

5. Either at the same time as the ecological survey for site identification, or at a later date carry out a further assessment of the conservation value of the site using the OMH Field Assessment form.

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