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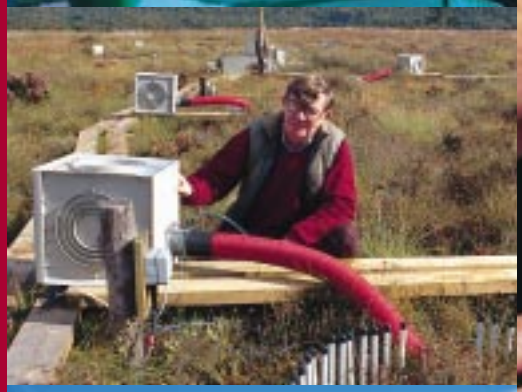

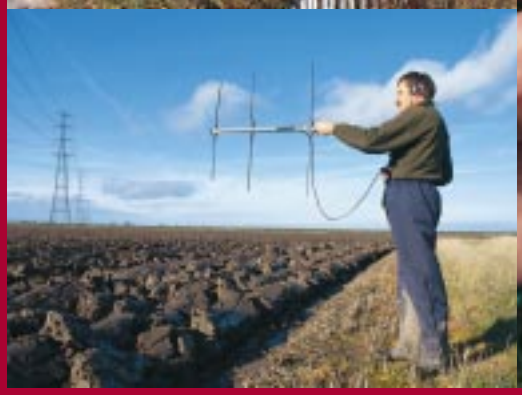

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Review of the coverage of urban habitats and species within the UK Biodiversity Action Plan

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Summary

There is a growing awareness of the nature conservation value of urban habitats and the importance of these to local people for educational, recreational, cultural, health and spiritual reasons. However, despite this and increasing threats to such habitats (eg from residential, commercial and infrastructure related developments), urban habitats and species have received little attention in the UK Biodiversity Action Plan (UKBAP) process.

To address this issue, English Nature commissioned this independent review of the treatment of characteristic urban habitats and species in the UKBAP. The aim of the study is to improve their representation by identifying the most obvious and significant omissions. In particular, the study has involved a review of available literature and data on urban nature conservation in the UK, development of a typology for urban habitats, identification of Species of Conservation Concern (SoCCs) associated with urban habitats, an assessment of the treatment of urban species in Local Biodiversity Actions Plans (LBAPs), and identification of potential new UKBAP Priority Habitats and Priority Species associated with urban habitats. The key conclusions from the study are:

- The overall number of Priority UKBAP Species associated with urban habitats has been previously underestimated, although the dependence of some well known Priority Species on urban areas has been overestimated.

- The majority of urban habitats are of moderate or high overall conservation importance, often in terms of both biodiversity and social value. The most important in biodiversity terms are probably some post-industrial sites (with important and often relatively rare vegetation communities and associated invertebrate assemblages). These habitats are particularly threatened and few new sites are being created that can replace such habitats. Some ponds and other still waters (and associated lichen and bryophyte communities), tall grasslands, gardens and urban commons are also of significant biodiversity value, but such habitats are generally less threatened.

- Some habitats stand out as being of particularly high value to people, but most importantly, all urban wildlife has value, because it is where people are and, therefore, where people are most able to experience it. All urban sites which support accessible, visible wildlife should be given higher conservation priority than is currently often the case.

- LBAPs appear to be addressing urban conservation needs through Habitat Action Plans for the Built-up Areas and Gardens Broad Habitat Type, rather than through specific actions for species. In many cases these actions may be adequate. However, some specific actions for particular species may be overlooked. And there may be a particular problem for species associated with urban habitats that fall within the Inland Rock Broad Habitat type (which includes post-industrial habitats, many of which are likely to be of high conservation value).

- Few characteristically urban species that are not currently Priority Species merit an increase to Priority status, at least on existing information and known population trends. The species with the strongest cases for revised listing as Priority Species, are house sparrow and starling, which have both clearly undergone rapid declines in urban and suburban areas. As Priority species they would benefit from concerted

actions that could be drawn together under Species Action Plans, and these would also benefit other similar species in urban areas. Priority status should also be considered for the micro-moth *Nemophora fasciella*, which appears to be declining as a consequence of direct conflicts between its ecological requirements and human desires for tidiness.

- This study supports the recognition of a "Rock Outcrops and Mine Spoil Rich in Heavy Metals" Priority Habitat (which includes the EU Habitats Directive listed Calaminarian grasslands), as previously proposed by JNCC. However, this habitat is relatively narrowly defined and we consider that there is a strong case for the separate recognition of a group of habitats under a combined category of "Post-industrial sites of High Ecological Quality" as a Priority Habitat (irrespective of whether they are in an urban setting). These habitats are both ecologically valuable and are threatened.

- No other habitat clearly meets the criteria for UKBAP Priority status at the current time. However, we suggest that further research and subsequent consideration should be given to urban commons (ie demolition sites with more fertile and/or wetter substrates), urban rock habitats (ie walls, roofs, paths, cemeteries and churchyards), gardens, and urban scrub.

- Conservation efforts should not solely focus on Priority Habitats and Priority Species, but should also aim to maintain all remaining semi-natural habitats in urban landscapes and strive to enhance their ecological quality and connectivity.

- A general conclusion from this study is that further information is required to enable more reliable assessments of the biodiversity value of many urban habitats, especially with regard to their importance for fungi, lichens, lower plants and many invertebrate groups. In particular much more information is required on the distribution of many species and the extent to which they rely on habitats that are characteristic of urban areas and created by industrial or other human activities.

- Further monitoring is also required of many urban habitats to establish population trends within urban areas, as many current schemes omit these or under-represent them. Monitoring and surveillance is also urgently required of broader ecological changes and process in many urban habitats to better understand their importance and conservation management needs.

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1. Introduction

1.1 Background

There is a growing awareness of the importance of many urban habitats, such as gardens, parks and some post industrial sites, for biodiversity conservation (eg Ansell and others 2001; Baines 1986; Cannon 1999; Gaston and others 2004; Gilbert 1992; Good 2000; Kendle & Forbes 1997; Mabey 1973; Owen 1991). For example, some habitats and species communities appear to be largely restricted to urban or post-industrial landscapes. And some species are concentrated in urban habitats in the UK (eg black redstart) or have important but declining populations in such areas (eg house sparrow and *Populus nigra*). Furthermore, the social, cultural, educational and health values of such remaining habitats and associated wildlife are being increasingly recognised (Greenwood 1999; Sukopp 2004; Turner and others 2004).

At the same time, there is concern over the extent and condition of remaining urban habitats of conservation value. According to the *Biodiversity Strategy for England* (Defra 2002), the main concerns for biodiversity associated with urbanisation and developments are:

- "Pressure on high-value land for development and other land uses leads to the potential for conflict with biodiversity objectives
- Urban green spaces often consist of highly-managed largely artificial landscapes used for many competing interests and maintained using methods not always sympathetic to biodiversity
- The population density of urban areas leaves little space for natural processes to operate effectively
- A common perception that nature is not of or for towns and cities, and thus an unwanted intrusion
- Gardening practices can be the source of introduced species with the capacity to cause damage to native habitats and species. Pets can have adverse impacts on wildlife in certain circumstances."

Despite this, urban habitats and species have received little attention in the UK Biodiversity Action Plan (UKBAP) process (see Box 1.1. for background). As a result there is some concern that no UKBAP Priority Habitats have yet been identified within the UKBAP "Built up areas and gardens" Broad Habitat category. And important urban species may also be under-represented within the UKBAP list of Priority Species. The importance of urban habitats for those species that are Priority listed is also overlooked in many cases.

In contrast, many Local Biodiversity Action Plans (LBAPs) give a high priority to conservation measures for a variety of urban habitats and associated species. This often reflects the high proportion of urban land within many LBAPs, but also the perceived importance of conserving species that are familiar to and valued by local people. Although only about 10% of England is urbanised, some 90% of the population lives in urban areas (Defra 2002), and thus most contact between people and nature is likely to be with urban species in urban habitats. There is, therefore, an important need to integrate urban conservation priorities with wider biodiversity priorities, and hence a need to review and expand the treatment of urban habitats and species within the UKBAP process.

Box 1.1. The UK Biodiversity Action Plan process

The Earth Summit was held in Rio de Janeiro in 1992, in response to increasing concern over the rates of biodiversity loss and degradation that were being observed across the world. This led to the development of Agenda 21 (a package of measures to promote sustainable development) and the Convention on Biodiversity (CBD).

The Biodiversity Convention was ratified by the UK Government in June 1994. However, even before this, the Government had committed itself to produce a consultative national action plan, *Biodiversity: the UK action plan* (Anonymous 1994) based on the principles of the Biodiversity Convention. The overall goal of the plan was "To conserve and enhance biodiversity within the UK and to contribute to the conservation of global biodiversity through all appropriate mechanisms".

The plan stated that this is to be achieved through the conservation and, where practicable, enhancement of:

- the overall populations and natural ranges of native species and the quality and range of wildlife habitats and ecosystems;
- internationally important and threatened species, habitats and ecosystems;
- species, habitats and natural and managed ecosystems that are characteristic of local areas;
- the biodiversity of natural and semi-natural habitats where this has been diminished over recent decades.

At the same time as the UKBAP was produced, a consortium of NGOs (the 'Challenge Group') produced Biodiversity Challenge: an agenda for conservation in the UK (Anonymous 1993). This put forward targets for over 530 threatened species and 16 habitats as a proposed approach for a biodiversity conservation strategy.

Following the publication of the UKBAP, the UK Steering Group was formed to develop a detailed programme of action to meet the plan objectives. The group published its conclusions and recommendations in 1995 in *Biodiversity: the UK Steering Group Report* in two volumes (UKSG 1995a, b). The programme contained the following key components:

- the development of Habitat Action Plan (HAPs) and Species Actions Plans (SAPs) with targets for some of the most threatened and declining species and habitats. These national action plans now form the basis for long-term strategic biodiversity conservation in the UK;
- the establishment of an effective system for handling the necessary biological data at the local and national levels so that the status of biodiversity can be assessed and progress can be monitored;
- the promotion of increased public awareness of the importance of biodiversity, and the broadening of public involvement and
- the promotion of Local Biodiversity Action Plans as a means of implementing the national plan.

The last two elements are essentially concerned with involving the wider community in biodiversity issues rather than keeping it confined to traditional nature conservation interests. By adopting such a broad-based approach, a wide range of bodies (including landowners, managers and businesses) can become involved in biodiversity-related issues through the establishment of partnerships.

The Government Response (Anonymous 1996) largely endorsed the UK Steering Group Report. Subsequently a framework of groups, coordinated by the UK Biodiversity Group (UKBG), was established to drive the process forward. And four Country Groups (England, Northern Ireland, Scotland and Wales) were formed to oversee implementation of the individual action plans, raise public awareness, encourage implementation at the local level and promote environmental education. Other groups were formed to support the UKBG including the UK Local Issues Advisory Group (which, together with the Local Agenda 21 Steering Group, guided the production of Local Biodiversity Action Plans), a Targets Group (which coordinated the development of Habitat and Species Action Plans), a Research Group and an Information Group

As part of the development of the UK BAP, lists were produced of Priority Habitats and Priority Species requiring conservation actions (see Box 1.2 and Chapters 4 and 5 for criteria).

The intention is that all Priority Habitats and Priority Species should be the subject of conservation action through the development of Habitat Actions Plans (HAPs) and Species Actions Plans (SAPs).

By October 1999, and following a review of priority habitats and species in 1998/99, the UKBG completed

the publication of six tranches of SAPs and HAPs, (UKBG 1998a, b, c, 1999a, b, c, 2000). When added to those already published in the Steering Group report, the total number of published plans amounts to 391 SAPs and 45 HAPs. Lead partner organisations or agencies were also appointed for the plans and many of the actions identified in these Action Plans implemented, including feasibility studies and implementation of habitat restoration schemes, the establishment of species and habitat data gathering, dissemination and monitoring programmes, research studies and numerous educational, training and publicity initiatives.

The first round of reporting on the published SAPs and HAPs was undertaken by the lead partners and agencies during 1999, which resulted in the UKBG's report on progress, *Sustaining the Variety of Life: 5 years of the UK Biodiversity Action Plan* (UKBG 2001). This report, known as the Millennium Biodiversity Report, reviewed progress with the UKBAP and made recommendations for the future.

The recommendations from the report were accepted by government and a new UK BAP structure was implemented in late 2002. The UK Biodiversity Partnership, comprising all involved in the UK BAP, replaced the UK Biodiversity Group. A UK Biodiversity Partnership Standing Committee was established to manage the business of the UK Biodiversity Partnership. It is assisted in this role by two advisory groups the Biodiversity Research Advisory Group (BRAG) and the Biodiversity Reporting and Information Group (BRIG).

The overall purpose of the BRAG is to provide advice to the community of biodiversity research funding bodies, research users and research institutions about biodiversity research priorities and co-ordination in the UK.

Amongst other tasks, BRIG will maintain the relevance of the UK lists of HAPs and SAPs taking account of developing information and policy and the needs of the Country Biodiversity Groups. In particular its Species & Habitats Review Working Group is co-ordinating the review of HAPs and SAPs, which is currently being carried out in 2005.

To take account of recent devolution within the UK and to implement the UKBAP within England, the England Biodiversity Strategy Group (EBSG) was formed and in 2002 published *Working with the grain of nature – a biodiversity strategy for England* (Defra 2002), known as the England Biodiversity Strategy (EBS). Although the EBS is a government strategy, it has been prepared in partnership with a wide range of public, voluntary and private sector stakeholders. The strategy outlines a number of actions that will be taken by government and its partners across all the main socio-economic sectors. The EBS is the principal means by which the Government will comply with its duties under Section 74 of the Countryside and Rights of Way Act 2000 (CROW Act). These are:

- to have regard to the purpose of the conservation of biological diversity in the exercise of the Government's functions; and
- to take, or promote the taking by others, of steps to further the conservation of the habitats and species which together are of principal importance for the conservation of biodiversity.

A key success within the UKBAP process has been its uptake by a wide range of stakeholders. Importantly, biodiversity conservation considerations are now increasingly taken being taken into account in the development of governmental policy across all departments and socio-economic sectors, and as a result BAP priorities and objectives are becoming of increasing importance. There has also been widespread engagement in the BAP process by many business (eg through the preparation of corporate BAPs) and local communities (through local BAPs).

1.2 Aims and scope of the review

The purpose of this study is to "Improve the representation of urban areas within the UKBAP and the England Biodiversity Strategy (EBS) processes. It is intended to address the more obvious and significant omissions of characteristically urban habitats and associated species within the UKBAP". It is anticipated that the study will help inform the UKBAP review, and in particular the review of Priority Habitats and Species being undertaken in 2005 (see Box 1.1).

Specifically this reports aims to:

1. Describe the main habitat types that are characteristic of urban areas and previously developed land, and assess their biodiversity value.
2. Review the representation of urban habitats and associated species within LBAPs in England.
3. Identify UKBAP Species of Conservation Concern (see Box 1.2 for background) and species groups that have a primary or subsidiary association with urban habitats, and review the habitat requirements of those with a primary association with urban habitats.
4. Identify UKBAP Species of Conservation Concern of urban habitats that may qualify as UKBAP Priority Species.
5. Identify potential urban UKBAP Priority Habitats.
6. Identify the need and scope for further work to develop a comprehensive classification system for urban habitats, and priorities for research and monitoring of urban habitats and associated species.

1.3 Methods and sources of information

Identification of literature sources and preparation of bibliography

This review has primarily been undertaken as a desk study of existing data and literature sources. The first part of the project therefore included the identification and collation of relevant scientific references on ecology and conservation of urban habitats and species in the United Kingdom. There is an extensive body of literature on urban ecology in various habitats worldwide (eg Sukopp 1990, 2003, 2004, Turner and others 2004), but it has been beyond the scope of this review to examine this thoroughly. Instead we have focussed on collating key references that are of relevance to the aims of this study (eg relating to urban habitats types, species that are primarily found in urban areas and their status and their habitat requirements).

The bibliography has been compiled by firstly identifying relevant references from some standard texts and reviews of urban ecology (eg Ash 1991; Bornkamm and others 1982b; Dawe 1990; Gilbert 1991; Kendle & Forbes 1997; Wheater 1999). This has been added to by checking the contents of the scientific journals that have most frequently included papers on urban ecology and urban nature conservation and related subjects, including *Urban Ecology*, *Urban Wildlife Magazine*, *Urban Wildlife News*, *British Wildlife*, *The Journal of Ecology*, *Journal of Applied Ecology, London Naturalist* and the *British Journal of Entomology and Natural History*. English Nature's Urban Wildlife Bibliography and Urban Wildlife Abstracts were also searched.

Further computer based online searches were also carried out using the English Nature WildLink reference database, Synergy journal website and Incarta bibliographic database website. These database searches were carried out using selected key words to identify potentially relevant references. The search terms were references containing in the title, keywords or abstract:

- Urban or garden or industrial,

AND

- Biodiversity or ecology or nature conservation or classification or wildlife.

The database derived lists of references containing these combinations of key words were then screened by checking each reference's title and abstract. Standard reference citation details were then extracted from each literature source that was considered to be relevant to this study. These were then entered into an Adept Scientific EndNote 6 library database.

Box. 1.2. The Species of Conservation Concern (SoCC) list: its history and criteria

The UK Database for Ranking Biodiversity (BURD) was developed at the start of the UKBAP process to inform the Biodiversity Steering Group about priorities for the development of Species Action Plans (SAPs). In the autumn of 1995, information from BURD was then used to compile three lists under the UKBAP. The Long List (1250 species) consisted of species selected according to five criteria using the best available information, but it was acknowledged that this list was incomplete. The Middle List consisted of 300 species that were considered to be globally threatened or rapidly declining in the UK. All these species were earmarked for the production of SAPs. The Short List, consisted of 116 species, extracted from the Middle List, for which SAPs had been produced. These are now referred to as the Tranche 1 Action Plan species.

In 1997 the UK Biodiversity Group commissioned a review of the Middle List, which resulted in a final Middle List of 450 species for which SAPs have now been produced. The review also recommended that all species selected by the Long List criteria should now be referred to as Species of Conservations Concern (SoCCs) and that from these, all species that qualify under the Short and Middle List criteria should be referred to as Priority Species (in practice these are also often referred to as UKBAP species). It was also decided to update, expand and rename the BURD as the SoCC database.

Subsequently work has been carried out to attempt to complete the list of qualifying SoCCs, using slightly amended Long List criteria. Species now qualify as SoCCs if they are any one of the following:

- Globally threatened according to IUCN
- Of international importance in the UK (ie with >25% of their world population, and/or range, in the UK)
- Nationally threatened (ie listed in UK Red Data Books or the equivalent)
- Declining at >1% per annum
- Localised (ie occur in 15 or less 10-km squares in the UK, if terrestrial, or 55 10-km squares if marine)
- Species listed in the EU Birds or Habitats Directives, the Bern, Bonn or CITES Conventions, or under the Wildlife and Countryside Act 1981 and the Wildlife Order (Northern Ireland) 1985.

Species which qualify for one or both of the following categories should be considered as Priority Species:

- Species which are globally threatened;
- Species which are rapidly declining in the UK, ie by more than 50% in the last 25 years.

The current list of SoCCs was obtained from http://www.ukbap.org.uk/Library/SOCC6.XLS

1.3.1 Bibliography checking and consultations

The draft bibliography was then circulated to individual experts and organisations that have or are known to be conducting research into urban ecology and urban nature conservation, and national nature conservation organisations (see Appendix 1). These were identified from recent papers in the draft bibliography and consultations with English Nature and DEFRA staff. Each consultee was invited to check that all their relevant research outputs are identified and listed correctly, and to provide information on missing references if they desired.

1.3.2 Terminology

A glossary of frequently used terms is provided in Appendix 2.

Plant species are only referred to in this report using their scientific names, to avoid confusion over possible alternative English names. Plant taxonomy and nomenclature follows that used in Stace (1997) for vascular plants, Smith (2004) for mosses, Paton (1999) for liverworts. A list of National Vegetation Classification (NVC) communities (Rodwell 1991a, b, 1992, 1995, 2000) referred to in this report is provided in Appendix 3.

The scientific names used for lichens and invertebrates are as listed in the JNCC list of SoCCs. Other animals are referred to using their common English name and are listed together with their scientific name in Appendix 4.

2. Urban habitat types

2.1 The classification of urban habitats in the UKBAP

An initial UKBAP Broad Habitat classification for the whole of the UK was published in the *UK Steering Group Report* (UKSG 1995a, b). This identified an urban Broad Habitat type and further identified four categories of site under this heading. Two of these (remnants of ancient natural systems and pre-industrial rural landscapes) typically represented encapsulated countryside and include habitat types which are at least as characteristic of rural areas as they are of urban areas. The remaining two were managed green spaces (including public parks and private gardens) and 'naturally seeded areas', including a range of post-industrial and previously developed land.

However, it was recognised that there were gaps in the Broad Habitat classification and the UKBG recommended that these and some of the ambiguity in the habitat descriptions should be revisited. The freshwater and terrestrial components of the classification was therefore re-examined by a JNCC led working group, and a revised classification published in the second volume of the UKBAP Tranche Two Action Plans (UKBG 1998b).

The revised classification took into account the original basis for the selection of Broad Habitat types, namely that (i) there should be a limited number of habitat types and (ii) the definitions should be simple and easily understood by a broad range of people. Jackson (2000) states that it also concluded that the UKBAP Broad Habitat classification should aim to provide:

- a comprehensive framework for surveillance of the UK countryside and surrounding seas which is compatible with other widely-used habitat and land-cover classifications, particularly Phase 1 and the Countryside Survey 2000:

- a means of setting priority habitats in context and a system for identifying gaps and emerging new priorities in the list of priority habitats; and

- a means of characterising patterns and mosaics upon which wide-ranging species are dependent.

The working group used the following six criteria to re-examine the UK Broad Habitat Classification:

- Comprehensive - All of the habitat types of the UK should be described within the classification.

- Exclusive - The habitat types should be discrete to ensure that there is a "once-only fit" in the classification for each habitat encountered in the field.

- Structured - The classification should provide a framework for organising and presenting the priority habitats that are the focus of action plans.

- Nested - Priority habitats should fit into only one Broad Habitat type.

- Measurable - Broad Habitats should be easily recognisable, have a measurable surface area and physical or biological features that are clearly characterised and wherever possible can be selected from existing systems for data collection.

- Consistent - There should be consistency in the division of the Broad Habitats. The classification should not sub-divide some ecological units more finely that others.

The revised Broad Habitat classification redefined the urban type to "Built-up areas and gardens". According to Jackson (2000) this Broad Habitat type "***covers urban and rural settlements, farm buildings, caravan parks and other man-made built structures such as industrial estates, retail parks, waste and derelict ground, urban parkland and urban transport infrastructure. It also includes domestic gardens and allotments. This type does not include amenity grassland which should be included in the 'Improved grassland' Broad Habitat type.***"

This Broad Habitat classification of "Built-up Areas and Gardens" excludes many post-industrial sites, which are often thought of as being typical urban habitats. Many of these now fall within the UK BAP "Inland Rock" Broad Habitat Category. This Broad Habitat type covers "both natural and artificial exposed rock surfaces which are greater than 0.25ha, such as inland cliffs, caves, and screes and limestone pavements, as well as various forms of excavations and waste tips such as quarries and quarry waste" (Jackson 2000). A number of vegetation types associated with rock habitats fall within this Broad Habitat type, including calaminarian grasslands, which are found on soils which have levels of heavy metals, such as lead, chromium and copper, that are toxic to most plant species. These "Inland Rock" habitats may be urban or rural: the distinction is not necessarily relevant eg in canals which traverse such boundaries (Greenwood 2005).

However, this classification of urban habitats is not straightforward. Despite the intention for UKBAP Broad Habitats to be exclusive there is in practice a great deal of overlap in the occurrence of urban habitats across Broad Habitat types. For example, it is not clear whether small woodlands or rows of trees within gardens and parks or along roads should be considered as "Broadleaved, Mixed and Yew Woodland" or "Built Up Areas and Gardens. Similarly, it is not clear whether ponds within gardens should be treated as "Standing Water and Canals" or Built-up Areas and Gardens".

2.2 The main habitat types characteristic of urban and previously-developed land

2.2.1 Factors determining habitat types

Descriptions of British urban habitats in recent decades have taken two main forms. Gilbert (1991) groups the habitats largely by origin eg railways, city parks, cemeteries. Shimwell (1983) classifies by vegetation type eg ruderal weed communities, scrub vegetation.
The differences are more of emphasis than content, but the latter approach has been taken and adapted here because all existing Habitat Action Plans (HAPs) are habitat-based, and it allows closer linkage to the ecology of sites. Adaptation is necessary because the last two decades have accumulated more knowledge of animals and plants in urban areas. Existing urban LBAPs (eg London and Bristol), use a combination of both approaches.
Key studies of urban vegetation ecology (Ash 1991; Bornkamm and others 1982a; Gilbert 1991; Miles & Walton 1993; Shimwell 1983) indicate that communities tend to be determined by:

- edaphic conditions (ie physical, chemical and biological conditions) - especially soil characteristics and water supply;
- propagule supply (ie the supply of seeds or vegetative parts of plants that are capable of giving rise to new individuals);
- management, or its lack; and
- history.

However, in urban areas, with often high levels of disturbance, history can be particularly important, so that Gilbert's and Shimwell's two forms of description coincide in, for example, many post-industrial sites.

Because of the frequency of disturbance, localised supply of propagules and sometimes changes in management, urban habitats are often fragmentary, form intimate mosaics (Rodwell 2000) and have many gradations between types. For this and other reasons the vegetation rarely fits well into National Vegetation Classification (Rodwell 1991a, b, 1992, 1995, 2000) categories. Some urban habitats are naturally short-lived and there are identifiable successions, eg those on demolition sites (Bradshaw 2003; Gilbert 1991). There are high numbers of non-native species established in urban areas; an effect of urbanisation is usually to decrease native species and increase non-natives (Paton 1999; Preston and others 2002a; Preston and others 2002b). While many are cosmopolitan species, it is possible that some may become established that are declining in their native habitats, and merit conservation here. Populations of many of these species can rapidly change in extent. For all

these reasons the description of urban habitats is challenging and can only take in the main types.

Whilst it is possible to define urban habitats by vegetation types, these may be of little relevance for animal groups such as mammals, birds, amphibians, reptiles and many invertebrates, for whom physical cover and food resources, for example, may far outweigh the value of a particular NVC stand type. Some invertebrates, in particular, especially the aculeate Hymenoptera (bees and wasps) form highly mobile "meta-populations" in urban areas and these use a range of habitat types within a site, and also a large number of sites within a geographically confined area. Within this framework, no single habitat or site is particularly more important than another. The nature of many sites is such that they will come and go, with bare sites becoming sparsely-vegetated and passing through a succession of stages until overtaken by woodland. Thus, the preservation of a number of inter-connected sites, with a mosaic of habitats will often be of greater importance than the individual considerations of any component habitat type. This allows meta-populations to migrate and colonise sites, and the larger the complex of sites the more robust the entire population will be. However, this is not always the case and there are species whose mobility is more limited; the persistence of their populations will therefore depend to a far greater extent on habitat stability.

In addition to this, whilst individual invertebrate species can, in some cases, be assigned to a habitat category, the overall invertebrate communities cannot. The robber fly *Machimus atricapillus*, for example, hunts Diptera and other flying insects in grassland, yet has a requirement for scrub, or at least an isolated bush, which it can use as a vantage point from which to launch its aerial attacks. The bee wolf (*Philanthus triangulum*) has an absolute requirement for level ground in order to excavate its metre deep nest burrow but is more usually associated with gardens and parkland where it hunts bees at flowers. Most solitary bees, in fact, have a requirement for bare ground, level or sloping, in which to excavate nest burrows but they also need pollen, nectar or both, which may only be available in a quite different habitat type some great distance away from the nesting area – even on another site. Solitary wasps that nest in sand cliffs will have prey requirements that are not satisfied by Inland Rock habitats – usually they will predate weevils, aphids or some other specialist group associated with scrub and/or woodland.

A summary of the biodiversity value of urban habitats is provided in Table 2.6 below, and the habitat requirements of some urban species (SoCCs that are primarily associated with urban habitats) are discussed in Section 2.4 and Table 2.5.

2.2.2 Major habitat types of urban areas

The main types of habitat that occur within urban areas are described below, and summarised in Table 2.1. This does not include encapsulated countryside and other habitats that are more characteristic of rural landscapes. Nor does the classification include buildings (and other artificial non-vegetated habitats), although these may be of high importance to some species, such as many bats and some birds.

The habitat categories are primarily based on vegetation types and follow Shimwell, but sub-categories have been revised by us for this project. Correspondence with UKBAP Broad Habitats is with respect to the occurrence of the habitat type within an urban or built up

environment. Approximate equivalent habitat types as defined by Gilbert (1991), the Phase 1 typology (JNCC 1993) and the National Vegetation Classification (NVC) are also given in

Table 2.1 Urban habitat types and their relationship with UK BAP Broad Habitats, and other equivalent habitat types as defined by Gilbert (Gilbert 1991), Phase 1 survey (JNCC 1993) definitions and the NVC (Rodwell 1991a, b, 1992, 1995, 2000).

Habitat type in urban areas	Broad Habitat	Gilbert type	Phase 1 types	NVC Types
1. Pioneer communities of hard surfaces, dominated by cryptogams and lythophytes. Unmanaged.				
1.1 Lichen-dominated communities of exposed hard surfaces (eg rock, concrete), water deficient, nutrients very low.	Inland rock	No equivalent	Wall, Rock	No equivalent
1.2 Bryophyte-dominated communities on hard surfaces with some degree of shade or shelter and/or adequate water supply, nutrients very low.	Inland rock	No equivalent	Wall, Rock	No equivalent
1.3 Fragmentary stands of ferns and flowering plants on wall mortar, on ledges, in crevices etc. Water and nutrients low.	Inland Rock	Gardens	Wall, Rock	OV39, OV41, OV42
2. Aquatic communities of fresh waters, composed mostly of perennial, obligate hydrophytes. Management little or none.				
2.1 Eutrophic still waters, mainly ponds, with communities of free-floating species.	Standing waters and canals	Rivers, canals, ponds, lakes, reservoirs and water mains	Open Water: Standing Water	A1, A2, A5, A15
2.2 Still water bodies of a range of sizes (ponds, lakes, mill dams) with communities of floating and submerged aquatics.	Standing waters and canals	Rivers, canals, ponds, lakes, reservoirs and water mains	Open Water: Standing Water	A7, A8, A9, A10, A12, A15, A16
2.3 Bryophyte communities of canal walls, river walls, bridge supports etc. in slow-flowing waters.	Rivers and streams if in channel, or Inland rock	Rivers, canals, ponds, lakes, reservoirs and water mains	Open Water: Running Water	No equivalent
3. Ruderal communities.				
3.1 Nutrients and water abundant, neutral pH: formerly common around sewage works and similar places, but reduced by changes in sewage treatment. Dominated by annuals.	Built-up areas and gardens, when in urban areas	No equivalents	Swamp: Margin/Inundation Communities	No equivalents
3.2 Nutrients and water adequate, circum-neutral pH: typical of gardens and allotments but widespread. Dominated by annuals.	Built-up areas and gardens, when in urban areas	Allotments	No equivalent	Many communities depending on soil type, trampling, water - OV7, OV8, OV9, OV10, OV11, OV12, OV13, OV14, OV15, OV18, OV19, OV21, OV22.

Habitat type in urban areas		Broad Habitat	Gilbert type	Phase 1 types	NVC Types
3.3	Nutrients and often water limited, range of pH. The starting-point of post-industrial land and demolition site successions and includes a wide range of communities.	Inland rock	Urban Commons, Industrial Areas, Railways	No equivalents	No equivalents
4.	**Emergent, tall (>100cm) swamp communities of a variety of water margins and places where water stands, at least at wet periods.**				
4.1	*Phragmites australis* marshes, usually where water/substrate has slightly raised base status.	Fen, marsh and swamp	Rivers, canals, ponds, etc.	Swamp: Single-species Dominant Swamp	S4, S26
4.2	*Typha latifolia* marshes, usually on eutrophic sites	Fen, marsh and swamp	Rivers, canals, ponds, etc.	Swamp: Single-species Dominant Swamp	S12
4.3	Tall *Carex* marshes, usually *C. acutiformis* but occasionally *C. riparia*.	Fen, marsh and swamp	Rivers, canals, ponds, etc.	Swamp: Single-species Dominant Swamp	S6, S7
4.4	*Impatiens glandulifera* communities, usually on banks of flowing waters, but increasingly spreading from there into adjacent habitats.	Fen, marsh and swamp	Rivers, canals, ponds, etc.	Swamp: Single-species Dominant Swamp	No equivalent
4.5	*Sparganium erectum* marshes, where water levels are high all year.	Fen, marsh and swamp	Rivers, canals, ponds, etc.	Swamp: Single-species Dominant Swamp	S14
4.6	*Phalaris arundinacea* tall-herb marsh, often with *Epilobium hirsutum*, *Urtica dioica*, in winter-wet sites.	Fen, marsh and swamp	Rivers, canals, ponds, etc.	Swamp: Single-species Dominant Swamp	S28
4.7	Mixed tall marsh, incorporating any of the above species but often with abundant *Epilobium hirsutum*. Especially found on uneven sites.	Fen, marsh and swamp	Rivers, canals, ponds, etc.	Swamp: Tall Fen Vegetation	No equivalent
5.	**Low-growing (<70cm) swamp and marsh communities on damp ground.**				
5.1	Dominated by *Juncus* spp. Permanently wet soils.	Neutral grassland	Urban commons, Industrial areas, etc.	Wet Overlay for Grassland, Swamp: Margin/Inundation Communities	MG10

Habitat type in urban areas		Broad Habitat	Gilbert type	Phase 1 types	NVC Types
5.2	Grassy marshes, usually *Alopecurus geniculatus, Agrostis stolonifera or Glyceria fluitans*, on land with fluctuating water levels but dry for part of year.	Neutral grassland	Urban commons, Industrial areas, etc.	Wet Overlay for Grassland, Swamp: Margin/Inundation Communities	S22, MG11, MG13
5.3	Broad-leaved perennials, usually on the banks of water bodies with fluctuating levels.	Standing waters and canals / Rivers and streams / Fen, marsh and swamp	Rivers, canals, ponds, lakes, reservoirs and water mains	Swamp: Margin/Inundation Communities	S23, OV28, OV29, OV30, OV31, OV33
6.	**Tall grass and tall herb communities.**				
6.1	Communities dominated by tall, tussock-forming grasses.	Neutral grassland but also Built-up areas and gardens	Urban Commons, Industrial Areas, Railways, etc.	Grassland: Neutral Semi-improved but poor fit.	MG1, on base-enriched sites MG12
6.2	Communities with similar grasses but high content of patch-forming herbs.	Neutral grassland but also Built-up areas and gardens	Urban Commons, Industrial Areas, Railways, etc.	Grassland: Neutral Semi-improved but poor fit.	MG1, MG2, MG9, OV23,OV24, OV25, OV26, OV27, M27 but many examples have poor fit to the NVC.
7.	**Low grass and grass-herb communities.**				
7.1	Grasslands dominated by *Lolium perenne* and *Poa* spp. with/without *Trifolium repens*. On fertile soils and dependant on regular mowing. Broad habitat type: Improved grassland	Improved grassland	City Parks, Roads	Grassland: Improved/Re-seeded	MG7, with various open habitat communities especially OV21, OV22.
7.2	Grasslands with predominately fine-leaved species and many herbs on a variety of low-fertility substrates where nutrient stress, and sometimes water stress, restrict growth. Normally unmanaged.	Inland rock	Industrial areas, Railways	Grassland: Acidic Unimproved, Neutral Unimproved and Calcareous Unimproved, but not what is normally meant by these categories.	No real equivalents, but some similarities to MG9, CG10, U1, U2, OV37.
7.3	Recent "habitat creation" wild flower grasslands, usually created on former amenity grassland.	Depends on context, target habitats and outcome	No equivalents	No equivalents	No equivalents

Habitat type in urban areas		Broad Habitat	Gilbert type	Phase 1 types	NVC Types
8.	**Scrub vegetation.**				
8.1	*Ulex europaeus* and *Cytisus scoparius* thickets, on acid soils.	Broadleaved, mixed and yew woodland if >0.25 ha	Urban commons, Woodland	Scrub: Dense/Continuous	W23
8.2	Mixtures of *Buddleja, Salix cinerea, Salix caprea* and *Betula pendula* on infertile substrates.	Built up areas and gardens, when in urban areas	Industrial Areas, Railways, Woodland	Scrub: Dense/Continuous	No equivalent
8.3	On more fertile sites, eg brick rubble, mixtures of a wide range of species.	Built up areas and gardens, when in urban areas	Urban commons, Woodland	Scrub: Dense/Continuous	W21 but poor fit.
8.4	On damp sites, *Salix, Alnus* and *Populus* spp.	Broadleaved, mixed and yew woodland if > 0.25 ha	Urban commons	Scrub: Dense/Continuous with wet overlay	W6
8.5	Recently-planted habitat creation woodlands, very variable in composition.	Broadleaved, mixed and yew woodland / Coniferous woodland if > 0.25 ha	No equivalent	Scrub	No equivalent
9.	**Woodlands (Closed canopy woodlands >5m tall, and open "urban savannah").**				
9.1	Urban savannah - scattered trees, avenues and clumps in mown grassland.	Built up areas and gardens	City parks	Parkland and scattered trees	No equivalent
9.2	Copses of large trees in some parks built to mimic country estates. Variable composition and usually species-poor grassy ground flora and no understorey.	Built-up areas and gardens / Broad-leaved, mixed and yew woodland	City parks	Parkland and scattered trees, Woodland: Mixed Plantation, Broadleaved Plantation or Coniferous Plantation.	No equivalent
9.3	Brick rubble sites of 40 years old or more, with unlikely mixtures, mixed understorey and ground flora of shade-tolerant herbs and grasses.	Built-up areas and gardens / Broad-leaved, mixed and yew woodland	Urban commons, Woodland.	Woodland: Broadleaved Semi-natural but not the normal meaning.	No equivalent

Habitat type in urban areas	Broad Habitat	Gilbert type	Phase 1 types	NVC Types
9.4 Older woodland habitat creation sites; understorey is often lacking, ground flora of shade-tolerant herbs and grasses, but woodland species may colonise or be introduced.	Broadleaved, mixed and yew woodland / Coniferous woodland	Woodland	Woodland: Mixed or Broadleaved Plantation	No equivalent
10. Gardens and allotments.	Built up areas and gardens	Gardens	Not included	No equivalents

1. Pioneer communities of hard surfaces, dominated by cryptograms and lythophytes. Unmanaged.

Subgroups

1.1 Lichen-dominated communities of exposed hard surfaces (eg rock, concrete), water deficient, nutrients very low. Precise communities vary with substrate pH, propagule supply and other factors eg *Xanthoria* and *Candelariella* spp. dominate on concrete and other alkaline surfaces. Long-established examples can be very rich in species and include rarities eg Roman walls, Colchester (Earland-Bennett 1994, Jarvis &Woodhouse 1994).

1.2 Bryophyte-dominated communities on hard surfaces with some degree of shade or shelter and/or adequate water supply, nutrients very low. Precise communities vary with substrate pH, propagule supply and other factors eg *Bryum argentium* and *Ceratodon purpureus* are typical of neutral/acid surfaces, *Funaria hygrometrica* and *Leptobryum pyriforme* of alkaline examples.

1.3 Fragmentary stands of ferns and flowering plants on wall mortar, on ledges, in crevices etc., mostly lythophytes such as *Asplenium adiantum-nigrum* and *Cymbalaria muralis*. Water and nutrients low. In many areas these may provide the only habitat for certain ferns, including rarer species such as *Osmunda regalis* (Lancaster castle) and *Adiantum capillaris-veneris* (former railway station, Wirral) (Woodell & Rossiter 1959, Eric Greenwood pers. comm.)

Since the Clean Air Acts started control of air pollution, lichens have gradually spread into the centre of urban areas, initially on calcareous substrates but increasingly on a wider range (Seaward 1982, Gilbert 2001). Gilbert found several species new to Britain in urban gardens (Gilbert 2001), all inconspicuous saxicolous species growing on brick rubble and similar substrates. Some unusual bryophytes have been found in urban situations eg *Pseudocrossidium hornschuchianum* in Sheffield (Gaston, Smith, Thompson & Warren 2004). But although there are such occasional records of rare lichens and bryophytes in these urban habitats, our overall knowledge of them is insufficient to establish which species are primarily associated with them. And a similar lack of knowledge applies to lichens and bryophytes in the other urban habitats discussed in this report.

Associated fauna

There are rather few invertebrates that are associated with the pioneer vegetation of inland rock habitats and most species that are associated with this habitat will fall into one of four categories.

There will be opportunist predators such as the spider *Salticus scenicus* and the ground beetles *Harpalus obscurus*.

Several are insects that have a nest requirement for hard sand cliffs. Examples include the wasps *Cerceris quadricincta* and *Odynerus spinipes* and the bee *Andrena flavipes*.
Other species nest on level ground in sand – examples being *Lasioglossum leucopum* and *L. pauperatum* and the bee wolf (*Philanthus triangulum*).

Other species will be specific predators and parasites. The nomad bee *Nomada fucata* is a specific cleptoparasite of *Andrena flavipes* whilst the Dotted Bee Fly *(Bombylius discolor*) may also parasitise the same host. *Nomada ferruginata* is a cleptoparasite of *Andrena humilis* – another species that requires exposed sand in which to nest.

2. Aquatic communities of fresh waters, composed mostly of perennial, obligate hydrophytes. Management little or none

Subgroups

2.1 Eutrophic still waters, mainly ponds, with communities of free-floating species, commonly *Lemna* spp. and *Elodea* spp.

2.2 Still water bodies of a range of sizes (ponds, lakes, mill dams) with communities of floating and submerged aquatics, often including *Potamogeton* spp.. These waters are usually lower in nutrients than 2.1, and have generally low pollution.

2.3 Seepages of water in hard rock habitats, damp flushes at the base of cliffs and damp rock of canal walls, river walls, bridge supports etc. in slow-flowing waters. These habitats may take the form of small pools, just a few centimetres wide, or may create permanently damp areas where extremely slow-flowing water covers the rock surface and allows for the development of bryophyte communities eg C*onocephalum conicum, Pellia epiphylla, Marchantia polymorpha.* In deeper water eg canal locks, the bryophytes are mainly *Brachythecium rivulare and Fontinalis antipyretica*).

Fast-flowing waters are usually absent in urban areas, while some canals develop still water floras.

Ponds of High Ecological Quality have recently been proposed under the UK BAP as a Priority Habitat. However, few urban ponds will qualify as the majority are small, eutrophic and often contain exotic fish (which reduce their value for invertebrates) and exotic plants, eg Australian swamp stonecrop *Crassula helmsii*.

Associated fauna

There is evidence from some studies of the local importance of ponds to amphibians especially common frog and smooth newt, and also of their importance to people's experience of wildlife in urban areas (Good 2000, Ansell, Baker & Harris 2001, Urbio 2002). Although such species are common and widespread, and occur in many non-urban habitats, their urban populations are of considerable importance. And some ponds also hold populations of the rarer great crested newt, a UKBAP Priority Species.

There are few invertebrate communities of wetland habitats that are restricted to urban areas and general wetland invertebrate communities may be equally well represented on post-industrial sites if human erosion of these sites, especially the marginal vegetation, is minimal.

However, the pools, mosses and liverworts etc of water seepages, flushes and damp walls may sometimes be important micro-habitats for invertebrates. The organic deposits associated with them support an array of saproxylic microbes that will in turn provide a biotope suitable for colonisation by invertebrates that will include craneflies and soldier flies

in particular (eg, soldier fly *Oxyna pygmaea* in limestone quarries in West Midlands) as well as several ground beetles (*Bembidion* species and others).

Canals and ditches may hold populations of water vole (a UKBAP Priority Species).

3. Ruderal communities

The early colonisation of new sites by higher plants. Management none.

Subgroups

3.1 Nutrients and water abundant, neutral pH: formerly common around sewage works and similar places, but reduced by changes in sewage treatment. Dominated by annuals such as *Atriplex prostrata, Chenopodium rubrum, Polygonum spp.* Such plants provide abundant food resources for seed-eating birds. For example, Beddington Sewage Farm in south London, is well known for its large resident population of tree sparrows, which have survived despite substantial declines in the species' rural population in the UK (Gregory and others 2003).

3.2 Nutrients and water adequate, circum-neutral pH: typical of gardens and allotments but widespread. Dominated by annuals such as *Chenopodium album, Senecio vulgaris, Veronica spp.,* but with regional variations influenced by soil type eg *Urtica urens* on light soils.

Again such plants provide abundant seed resources for birds, though in this case for more typical garden birds such as house sparrows, greenfinch, chaffinch and goldfinch. The tall and dense vegetation can also provide good cover for ground foraging invertebrate–feeding species such as dunnock, blackbird and song thrush, invertebrate food sources and damp ground conditions which help maintain the availability of soil invertebrates such as snails, slugs and earthworms.

3.3 Nutrients and often water limited, range of pH. This is the starting-point of post-industrial land and demolition site successions and includes a wide range of communities selected by particular combinations of edaphic conditions and propagule supply. As a result, each site is subtly different, although there are some patterns. In general, the higher the nutrient stress, the more perennials in the colonising vegetation. Industrial wastes with very low nutrients start with species such as *Agrostis capillaris, Holcus lanatus* (acid) or *Agrostis stolonifera, Tussilago farfara* (alkaline). More fertile brick rubble additionally supports annuals such as *Senecio squalidus, Sinapis arvensis and Tripleurospermum inodorum*. Tree seedlings may be present as initial colonisers, especially *Salix cinerea, S. caprea, Buddleja davidii and Betula pendula/pubescens.* Local propagule supply influences colonisation eg *Artemisia vulgaris* and *Reseda lutea* are common on Sheffield brick rubble, *Foeniculum vulgare* locally distinctive around Birkenhead docks (Ash 1991, Gilbert 1989, 1992).

Associated fauna

Ruderal plant communities support a huge number of invertebrates where these are in warm, sunny positions, on a well-drained relatively friable substrate and rich in areas of bare ground

(eg, Harvey, 2000). Invertebrate biodiversity will reflect floral diversity but the experience of many field workers seems to be that it would be unusual for two sites to support the exactly the same invertebrate fauna. Subtle variations, many not yet apparent to present knowledge, mean that most sites will generate differing species lists unless they are very close and more or less identical. Certainly there are differences between the recorded invertebrate fauna of post-industrial ruderal sites in East London (unpublished surveys by Colin Plant) and Coventry (unpublished surveys by Steven Falk) and there are differences again between these and some sites that were surveyed in Sheffield as various Notes and Communications in the journal *The Sorby* Record indicate. Consequently, invertebrates using these sites are defined here by their broader groupings rather than by individual species.

Species associated with this habitat will include those that nest in small patches of bare ground such as a wide range of solitary bees, especially those belonging to genera *Lasioglossum* and *Andrena*. Many other bee and solitary wasp genera will also be represented on the better sites. Sites that have a significant community structure of bees and wasps will have a significantly raised Cleptoparasitic load (ie the percentage of the aculeate species that are cleptoparasites (or parasitoids) on other host aculeates) – defined in Wcislo (1987).

Specialists such as the blue carpenter bee (*Ceratina cyanea*) nest in the stems of drought-stressed brambles only where these grow prostrate across the ground. Other specialists will be attracted to specific plants (such as the yellow-faced bee *Hylaeus signatus*, which is attracted to the flowers of *Reseda luteola* or beetles of the genus *Mordellistena* that all have different plant requirements).

Species that have specific foodplant requirements as larvae or specific food requirements as adults (usually pollen and nectar) are dominated by weevils (Apionidae and Curculionidae) leaf beetles (Chrysomelidae) and moths (Lepidoptera). There are a great many examples in all three groups.

Predatory species on the ground are dominated by ground beetles (Carabidae) and in the air by flies (Diptera – eg, *Gymnosoma nitens*). Spiders are also important, and may include species in the genus *Zodarion*, all of which are extremely rare.

4. Emergent, tall (>100cm) swamp communities of a variety of water margins and places where water stands, at least at wet periods.

Often dominated by one or two species. Most stands are small or fragmentary, but larger examples can occur in urban areas (St. Helens WAG 1986). Management little or none. Fertility medium to high, but water supply is dominant edaphic feature.

Subgroups

Classified by dominant species, of which the commonest are:

4.1 *Phragmites australis* marshes, usually where water/substrate has slightly raised base status. Often with *Urtica dioica, Epilobium hirsutum.*

4.2 *Typha latifolia* marshes, usually on eutrophic sites

4.3 Tall *Carex* marshes, usually *C. acutiformis* but occasionally *C. riparia*. Habitat preferences unclear; *C. acutiformis* may prefer higher calcium than *C. riparia*, but propagule supply and founder effect are probably important.

4.4 *Impatiens glandulifera* communities, usually on banks of flowing waters, but increasingly spreading from there into adjacent habitats.

4.5 *Sparganium erectum* marshes, where water levels are high all year.

4.6 *Phalaris arundinacea* tall-herb marsh, often with *Epilobium hirsutum*, *Urtica dioica*, in winter-wet sites.

4.7 Mixed tall marsh, incorporating any of the above species but often with abundant *Epilobium hirsutum*. Especially found on uneven sites.

Associated fauna

There are few invertebrate communities of wetland habitats that are restricted to urban areas and general wetland invertebrate communities may be equally well represented on post-industrial sites if human erosion of these sites, especially the marginal vegetation, is minimal. These habitats are of particular importance for amphibians, and occasionally grass snakes.

5. Low-growing (<70cm) swamp and marsh communities on damp ground, extremely widespread on any ill-drained or compacted area of amenity grassland, verges, neglected land, etc..

Management usually little or none, although sometimes grazed. Fertility probably medium, but water supply is the dominant edaphic feature.

Subgroups

Variable in composition, but main types include:

5.1 Dominated by *Juncus* spp., especially *J. effusus, J. inflexus, J. conglomeratus and J. articulatus.* Occasionally *Carex* spp. may be abundant eg *C. hirta, C. nigra,* or marsh grasses such as *Alopecurus geniculatus.* Permanently wet soils.

5.2 Grassy marshes, usually *Alopecurus geniculatus, Agrostis stolonifera or Glyceria fluitans*, on land with fluctuating water levels but dry for part of year.

5.3 Broad-leaved perennials, usually on the banks of water bodies with fluctuating levels. *Polygonum amphibium* often abundant, also commonly *Apium nodiflorum, Veronica beccabunga.*

Associated fauna

Associated invertebrate fauna will be dominated by phytophagous species, especially those that feed on pollen, nectar or both such as hoverflies (Syrphidae). Examples would especially include species of *Cheilosia* and *Chrysogaster*.

6. Tall grass and tall herb communities.

Fertile, reasonably well-drained soils, circum-neutral pH.

Management none, except "accidental" fires. The characteristic community of demolition sites after 4-6 years, but also common on neglected land. Develops eventually on low-nutrient substrates, but only after long periods to build soil fertility eg 30 years for railway land, 100+ years on alkaline industrial waste (Hilary Ash pers. obs.). Extremely variable in amount and type of herbs, depending on age (older brick rubble examples tend to be more grassy than younger ones), propagule supply, frequency of fires (fire favours *Chamerion angustifolium*) and history (neglected land eg former agricultural land quickly becomes grassy, allotments retain more herbs).

Subgroups

6.1 Communities dominated by tall, tussock-forming grasses, typically *Dactylis glomerata, Arrhenatherum elatius* or (usually on high base status sites) *Festuca arundinacea*. Often with *Heracleum sphondylium*.

6.2 Communities with similar grasses but high content of patch-forming herbs, both native and non-native eg *Chamerion angustifolium, Aster x salignus group, Solidago canadensis/gigantea*.

This group varies considerably between urban areas (Gilbert 1989,1992) eg *Eupatorium cannabinum* is abundant in Manchester and St. Helens, while Sheffield sites support *Chrysanthemum parthenium, Tanacetum vulgare, Saponaria officinalis* and *Galega officinalis*. Occasionally *Pteridium aquilinum* may form part of this community.

Associated fauna

These are likely to have very high invertebrate interest though Archer and Burn (1995) show that large sites are necessary to support the most diverse assemblages. Habitat quality indicators will include a large number of species of leaf beetles (Chrysomelidae) and weevils (Apionidae and Curculionidae) in particular as well as aculeate Hymenoptera and Lepidoptera. In sites where the substrate is dominated by PFA a unique fauna may develop but some uncommon species, such as the Chalk Carpet moth (*Scotopteryx bipunctaria*) tend to be restricted to geologically calcareous sites rather than those with an artificially raised pH. Spider communities may include *Cheiracanthium erraticum*, *Neriene peltata*, *Pardosa prativaga*, *Philodromus cespitum*, *Pisaura mirabilis* and many others. Wherever *Lotus corniculatus* is present there may be the beetles *Eutrichapion loti*, *Perapion marchicum*, *Perapion violaceum*, *Protapion trifolii*, *Bruchus loti*, *Bembidion properans*, *Calathus melanocephalus* and *Agapanthia villosoviridescens* amongst others. In the south-east, *Mordellistena acuticollis* is expected on *Artemisia vulgaris* and *Mordellistena pseudoparvula* on unknown foodplants.

The high densities of invertebrates and dense cover can provide suitable conditions for some invertebrate-predators such as grass snake, slow worm and common shrew. And amphibians may be abundant if there are suitable breeding ponds or ditches in the vicinity. The abundant seed sources can support high densities of small mammals, such as field vole and house

mouse, which, as well as invertebrates, may in turn support predators such as kestrel, weasel, stoat and fox.

7. Low grass and grass-herb communities.

Subgroups

Three very different groups.

7.1 Grasslands dominated by *Lolium perenne* and *Poa* spp. with/without *Trifolium repens*, and some finer-leaved grasses and prostrate herbs such as *Prunella vulgaris.* Mostly on fertile soils and dependant on regular mowing. Typical of playing fields, road verges and amenity grassland in all its forms. Usually with small patches of damp/trampling-resistant/disturbed communities. If mowing ceases, quickly becomes tall tussock-grass (6.1) as on unmown motorway banks.

These can occupy half the greenspace in urban areas (St. Helens WAG 1986).

While most examples are of low floristic diversity, long-established examples and those on low-nutrient substrates may have more varied and sometimes important floras. For example, the North Lawn at the medieval Speke Hall, Liverpool, on acidic, free-draining soil, is effectively a mown grass heath containing *Agrostis capillaris, Calluna vulgaris, Danthonia decumbens, Luzula campestris, Polytrichum juniperinum* and *Peltigera spp*. (E.Greenwood pers.comm.). Older examples may support waxcaps (*Hygrocybe* spp.) of conservation interest. Road verges and lawns on former sand dune areas in the Wirral and Lancashire support a number of dune species, especially annuals, such as *Erophila verna, Cerastium diffusum* and *Erodium cicutarium*, and occasional rarities such as *Erophila glabrescens* and *Cerastium semidecandrum* (E.Greenwood pers. comm.). Such examples, while a small part of the total habitat, may be locally significant for biodiversity.

7.2 Grasslands with predominately fine-leaved species (*Festuca* and *Agrostis* spp.) and many herbs on a variety of low-fertility substrates where nutrient stress, extreme pH or other toxicities, and sometimes water stress, restrict growth. Normally unmanaged.

This includes the varied grasslands of post-industrial sites, with peculiar floras depending on the substrate and propagule supply (Ash, Gemmell & Bradshaw 1994), and often high value to invertebrates (eg Harvey 2000, Urban Nature Magazine 1996, Urban Wildlife News 1999). The herb content often includes orchid species, especially *Ophrys apifera, Gymnadenia conopsea* and *Dactylorhiza* spp., and these sites are particularly appreciated by members of the public. The flora and fauna often includes other species some way from their "natural" habitats eg *Salix repens ssp. argentea* and coastal lichen *Cladonia rangiformis* on S. Lancashire and Cheshire waste sites. It is possible to recognise a "Leblanc flora" on highly calcareous chemical waste, that is very open, low-growing and rich in small flowers such as *Centaurium erythraea*, *Pilosella officinalis* and *Linum catharticum*), a "Pulverised Fuel Ash (PFA) flora" (rich in *Trifolium* spp. and *Dactylorhiza* spp.) and a “colliery waste flora” (acidic shales dominated by *Agrostis capillaris* with early colonisation by *Betula* spp.)(Ash, Gemmell & Bradshaw 1994, Bradshaw 1999, Shaw 1992, 1994), but

because of the chances of colonisation, especially over long distances, there are few constant species and many varying ones.

Some examples of the Annex I type 6130 Calaminarian grasslands of the *Violetalia calaminariae*, found on heavy metal mine wastes, occur in urban areas, where they fit into this habitat type. They are characterised by open grassland (*Festuca ovina*, *Agrostis capillaris*) with *Minuartia verna*, *Thymus praecox* and other small herbs. Some substrates have few constraints to rising soil fertility, eg PFA, which after initial leaching is restricted largely by shortage of nitrogen, a shortage which is remedied by legumes. On these the floristically-rich grassland stage may last only 2-3 decades before becoming (usually) scrub. On more hostile materials, eg those with extreme pH such as Leblanc waste, blast furnace slag, or colliery spoil, this stage of the succession can last for a century or more. The most valuable sites are often these with very slow successions, as a greater number of plant and animal species have time to colonise, and they were formed when the general landscape was richer in species than is the case at present (Harvey 2000, Ash, Gemmell & Bradshaw 1994). There is often industrial history interest to these sites.

7.3 Recent wild flower grasslands, often created on former amenity grassland or as part of site restoration or landscaping schemes associated with new developments. These include "habitat creation" grasslands, which aim to mimic a certain semi-natural type, and "creative conservation" grasslands, where a suitable starting point is created after which the emphasis is on allowing natural processes to proceed. Both types usually result in a matrix of fine-leaved grass with high content of herbs such as *Leucanthemum vulgare, Daucus carota and Centaurea nigra*. Often initially sown with cornfield annuals (*Papaver spp., Chrysanthemum segetum, Centaurea cyanus, Agrostemma githago)* which fade out after a few years but return if the site is disturbed. Some degree of management is necessary, usually an annual mowing. Currently only occupying small areas, but significant in certain localities eg Knowsley on Merseyside, Wolverhampton (Luscombe and Scott 2004). Good examples are developing invertebrate interest (Ash & O'Boyle 2000, 2002, Ash & McGaw 2004).

Associated fauna

Although playing fields and other *Lolium* dominated grasslands (Habitat Type 7.1 above) are of low botanical interest, their high fertility can support abundant soil invertebrate populations (eg of earthworms and tipulid larvae). They, therefore, often provide important foraging areas for some invertebrate-feeding birds, such as blackbird, jackdaw, song thrush and starling; and the latter two are declining in urban areas, possibly as a result of declining invertebrate food supplies. In winter they may support large flocks of such species as well as winter migrants such as redwing and fieldfare, and can provide suitable roosting sites for gulls. Urban badger populations (such as in Bristol) also regularly use these and other grasslands as feeding areas. Surface-dwelling invertebrates of grasslands will be limited by the variety of the flora and will inevitably comprise mostly generalist phytophagous species in species-poor grasslands.

Longer-established and less fertile areas, such as Habitat Type 7.2, may develop more complex and richer communities of predatory species and, ultimately, parasitic insects. And although further studies are required of such habitats, it does appear that many are of high importance for invertebrate conservation. For example, a general indication of the value of

brownfield sites for beetles is given by Eyre et al (2004), who investigated the distribution of ground, rove and phytophagous beetle assemblages on 78 post-industrial and urban sites throughout England between 1991 and 2001. A total of 182 records of 46 nationally rare and scarce species (16 ground, 10 rove and 20 phytophagous species) were generated. A number of these species are more usually associated with other, more 'natural' habitats such as riverine sediments, sandy heaths and chalk grassland and it was concluded that Brownfield sites provide habitat conditions similar to more natural habitats and may help maintain populations of some rare and scarce species. The results indicate that brownfield sites are important habitats for beetles and there is evidence that the situation is similar for other invertebrate groups.

Recent work has also shown the significance of post-industrial sites with species-rich grassland (and ruderal habitats of Type 3 above) for butterflies. For example, the Hampshire Wildlife Trust commissioned a survey of post-industrial sites in Hampshire during 2003. On the 75 sites surveyed, about half were found to support key species of *Lepidoptera* and in these a total of 61 key species of *Lepidoptera* were discovered to be present. These included 4 Red Data Book species and 6 UKBAP Priority Species. The majority of key sites were formal mineral workings. In all, a total of 806 species of *Lepidoptera* were recorded, representing nearly 50% of the county total. The surveyed sites included dismantled railways (3 sites), a disused car parks, a disused cress beds, disused industrial/residential areas (5), landfill sites (3), mineral extraction workings (17) and spoil dumps (2).

Habitats with nutrient-poor grassland (Type 7.2) can also support high densities of reptiles, especially where there is a mosaic of sparse vegetation cover, areas of bare soil or rock (and scrub; see below), such as found on some old quarries, brick pits, and other post-industrial or developed sites. The most typical species of these habitats are common lizard and slow worm, but grass snakes may occur less commonly, and in some less urban post-industrial areas adder and sand lizard may rarely occur.

Invertebrate colonisation of habitat creation areas (Type 7.3) needs time, and the little available data show current assemblages are dominated by generalist species. However, whilst interactive community structures comprising the full suite of hosts and parasites, prey and predators, will develop with the habitat these new areas can have a profound importance as sources of nectar and pollen for aculeate Hymenoptera, in particular if they contain appropriate plant species.

Where Landlife have sown cornfield annuals in quantity, including Kirby and in the cropping fields, some seed-eating birds have benefited, including declining farmland species, such as the linnet (Richard Scott per. comm.). This is contributing to the targets for arable weeds and for farmland birds in the North Merseyside LBAP. Other BAPs could benefit from suitably designed creation sites, including in those urban areas where biodiversity is currently low. A footnote to this section is the small but growing number of "green roofs", which have alongside their other benefits the capacity to increase biodiversity. An example is those designed to replace habitat lost to development eg roofs for black redstart in London (Urbio 2002).

8. Scrub vegetation.

On most open sites, fertile or infertile, some scrub seedlings appear at the earliest stage of colonisation, but do not dominate the vegetation until after a grassland stage. While small-

seeded species such as *Salix, Buddleja* and *Betula* can spread by wind, they can only colonise at early stages in the succession when there is still bare ground. Larger-seeded species, which can penetrate the grass mat, can colonise later, but suitable parent plants are often highly-localised. A variable mixture of native and non-native species is usual, with marked founder effect, but some main types can be recognised (eg Hodge & Harmer 1996, Gilbert 1991). Usually deficient in shade-tolerant ground layer species, possibly because of lack of propagules. Usually there is no management, apart from fire in *Ulex/Cytisus* stands.

8.1 *Ulex europaeus* and *Cytisus scoparius* thickets, on acid soils.

8.2 Mixtures of *Buddleja, Salix cinerea, Salix caprea* and *Betula pendula/pubescens* on infertile substrates.

8.3 On more fertile sites, eg brick rubble, mixtures of a wide range of species, including the species in 8.2, plus *Crataegus monogyna, Sambucus nigra, Rubus fruticosus* (often cultivars of which the most widespread is *R.armeniacus* (Newton & Randall 2004)), *Sorbus aucuparia, Cotoneaster* spp. and young *Fraxinus excelsior, Acer pseudoplatanus,* etc.

8.4 On damp sites, *Salix, Alnus* and *Populus* spp., sometimes planted eg *Salix cinerea, S. caprea, S. fragilis, S. viminalis, S. x sericans, Alnus glutinosa, Populus* hybrids.

8.5 Recently-planted habitat creation woodlands, very variable in composition but usually trying to reflect the "local" woodlands or recognised woodland types. Found on reclaimed sites where hard end uses are not envisaged, especially landfill, and in small amounts on many landscaping schemes.

Associated fauna

Ulex europaeus and *Cytisus scoparius* thickets will support a characteristic fauna that is independent of the wider geographical setting. Micro-moths such as *Cydia ulicetana* (= *succedana*) can be expected as can other host-plant specific invertebrates such as the moths *Agonopterix nervosa, Scythris grandipennis, Oncocera genistella*, and the beetles *Apion atratulum, Apion scutellare, Sitona regensteinensis* and *Hypera venusta* (on gorse) and the moths *Trifurcula immundella, Phyllonorycter scopariella, Mirificarma mulinella* and beetles *Anarsia spartiella, Bruchidius villosus*, and *Hylastinus obscurus* on broom.

Buddleia is a favoured nectar source for many common butterflies and bees. But it supports almost no invertebrates of high conservation importance and can in fact be damaging to overall invertebrate interest if it becomes dominant to the detriment of semi-natural vegetation. Nevertheless, both *Salix* and *Betula* scrub support a huge number of species that are also associated with woodland habitats.

Scrub habitats can provide important nesting habitats for many urban bird species, such as blackbird, song thrush, dunnock and robin, especially where they provide dense or tall cover. They may also hold less common urban species such as blackcap, garden warbler, willow warbler and tree sparrow.

Berry producing species, such as *Crataegus monogyna, Sambucus nigra, Rubus fruticosus*, *Sorbus aucuparia, Cotoneaster* spp. provide important food resources for resident and winter

migrant populations of blackbird, song thrush, starling, fieldfare and redwing, and some small mammals. During eruptive years, waxwings may winter in Britain in significant numbers and then rely heavily on urban and suburban berry producing.

9. Woodlands

Closed canopy woodlands (>5m tall) and open "urban savannah".

Mostly found in parks and similar areas, except in urban areas with persistent economic problems where the brick rubble and post-industrial successions may manage to reach woodland (Gilbert 1989, 1992, Hodge & Harmer 1996) before redevelopment occurs. Usually fragmentary and often unmanaged except for perceived safety, with the exception of the New Towns and their successors.

Subgroups

9.1 Urban savannah - scattered trees, avenues and clumps in mown grassland, typical of amenity grassland, parks and verges. Often small ornamental species eg *Prunus cvs, Malus cvs, Sorbus cvs* but may include large trees such as *Acer pseudoplatanus, Platanus x hispanica, Tilia x vulgaris*.

9.2 Copses of large trees in some parks eg Birkenhead Park, built to mimic country estates. Variable composition, but often include *Fagus sylvatica, Quercus spp., Acer pseudoplatanus, Aesculus hippocastanum*. Usually species-poor grassy ground flora (eg *Holcus lanatus, Dactylis glomerata*) and no understorey. These are typically impoverished habitats in terms of their invertebrate assemblages.

9.3 Brick rubble and post-industrial sites of 40 years old or more, with unlikely mixtures (Gilbert 1989) of *Fraxinus excelsior, Acer pseudoplatanus, Sambucus nigra, Laburnum anagyroides, Malus domestica, Cotoneaster spp.*, etc, depending on the seed sources available. Sites of lower soil fertility (often post-industrial) may remain dominated by *Betula* and *Salix* spp. growing to tree height. Understorey equally mixed but stands may be even-aged with little understorey. Limited ground flora of shade-tolerant herbs and grasses (eg *Tussilago farfara, Holcus lanatus)* although woodland species may gradually colonise (*Silene dioica*) or be planted (*Hyacinthoides* spp., usually the hybrid *H. non-scripta x hispanica*).

9.4 Older habitat creation sites; few habitat creation woodlands have yet reached this stage. Exceptions are some of the early reclamation schemes for derelict land eg Woodshaw Colliery Tip, Wigan, planted with a mixture of species which would tolerate the shale (*Alnus glutinosa, Betula pendula, Pinus nigra),* and large numbers of small sites in new towns such as Runcorn and Milton Keynes. The latter vary in composition but often include quick-growing species such as *Populus* and *Salix*. An understorey is often lacking. The ground flora typically consists of general shade-tolerant herbs and grasses, but woodland species may colonise or be introduced.

Associated fauna

Invertebrate interest in these areas will be limited to species that are restricted to particular tree species. Urban noteworthies include the hoverfly *Brachyopa insensilis* whose larvae feed in sap runs on trunks of horse chestnut and sycamore, but there are few other invertebrates of

relevance. The larval stages of many aphidiphagous hoverflies will form a significant predator group in tree canopies whilst moths may also form a sizeable part of the invertebrate community (Plant 1993). The invertebrate fauna will, however, inevitably be restricted by the alien origins of many plant species (including trees) and by the young age of the habitat with its concomitant lack of microhabitat features.

In general, the bird community of urban parkland and small woodlots is a considerably less rich version of that found in woodlands. It typically lacks species associated with the interior of large woodlands, and is dominated by ubiquitous generalist species, such as chaffinch, blue tit, great tit, woodpigeon and blackbird.

Nevertheless, mature trees provide important nesting sites for many larger urban species of bird, including woodpigeon, collared dove, sparrowhawk, carrion crow, mistle thrush. Old trees with cavities or dead wood may also provide nesting sites for blue and great tits, tawny owl, starling, kestrel and woodpeckers. Without such trees, the bird community of urban areas would be less diverse, although some species have adapted to using nest boxes in place of natural cavities.

10. Gardens and allotments.

An intimate mosaic of pioneer communities, grassland, horticulture, tall herb and scrub with frequent small ponds. Individually small, but often occurring in large semi-continuous tracts. Management variable in space and time.

Lawns bear some similarities to semi-natural grasslands, consisting largely of native species (Thompson et al 2004, Gaston et al 2004). *Agrostis capillaris, Festuca rubra* and *Lolium perenne* dominate, with herbs resistant to mowing such as *Bellis perennis, Ranunculus repens* and *Trifolium repens.* Larger lawns tend to be richer in species (Thompson et al 2004, Good 2000), and old lawns can include unusual species such as *Spiranthes spiralis* (Perring 1956) and *Hygrocybe* spp. (see section 7.1). A list of the 20 most common taxa found in private gardens in Sheffield are listed in Table 2.2. However, gardens vary considerably and collectively, contain very high numbers of species of trees, shrubs, grasses and herbs, with about two-thirds being non-native species (Thompson et al 2003). Many are maintained at very low frequencies by gardeners, and change with gardening fashions. A few species relatively uncommon outside the urban areas find a refuge in gardens eg *Mecanopsis cambrica, Geranium sanguineum.*

Allotments support large ruderal floras among the cultivated areas eg *Capsella bursa-pastoris*, *Poa annua, Stellaria media, Veronica hederifolia, V. persica,* and areas of aggressive perennial weeds such ass *Elytrigia repens* and *Aegopodium podagraria*. They also often include areas of long grass, tall herb and hedge, with the occasional pond.

Table 2.2. The 20 most frequent taxa in 120 1-m^2 quadrats in 60 private gardens in Sheffield UK (Thompson and others 2003)

Species	Status	No. of records
Epilobium montanum	Native	34
Taraxacum officinale agg.	Native	32
Geum urbanum	Native	18
Aquilegia vulgaris	Native	18
Festuca rubra	Native	18
Ranunculus repens	Native	18
Cardamine hirsuta	Native	16
Elytrigia repens	Native	16
Primula vulgaris	Native	16
Holcus lanatus	Native	15
Rubus fruticosus	Native	15
Alchemilla mollis	Alien	13
Fraxinus excelsior	Native	13
Poa trivialis	Native	13
Digitalis purpurea	Native	12
Geranium robertianum	Native	12
Crocosmia x *crocosmiiflora*	Alien	11
Epilobium ciliatum	Alien	11
Hedera helix	Native	11
Meconopsis cambrica	Native	11

Associated fauna

The intimate mosaic of habitat types that make up gardens can support a high diversity of associated fauna (eg Ansell and others 2001; Gaston and others 2004; Good 2000; Owen 1991), which is of undoubted value to people's experience of wildlife (eg Baines 2000). However, species richness and the wildlife value of gardens varies greatly. Gardens are of greatest value when they form interconnected areas dominated by large and mature gardens, but with other habitats such as parkland, scrub, ruderal or grassy areas, woodlots and allotments, nearby to increase habitat diversity. Plant (1993 and pers. obs.) showed to a limited extent that moths (Lepidoptera) may act as indicators of human socio-economic habitats. The fauna in economically deprived urban areas included a smaller range of species and lacked components which have a requirement for mature trees, other plants or habitats. For example, the scarce tissue moth (*Rheumaptera cervinalis*) whose caterpillar feed on *Berberis* is mainly found in urban areas where the gardens are large and well-established.

Thus, whilst gardens will support an immense population of invertebrates the species composition will vary immensely depending on the size, geography and management of the site. Neat and tidy plots that are regularly treated with pesticides will have minimal interest,

but neglected patches, even if small such as those actively encouraged by those who favour "butterfly gardening" may support a wide array of species. Stinging nettles, popularly retained for the caterpillars of some butterflies also support larvae of plusiine and arctiine moths, plant bugs, froghoppers, leaf mining flies and an array of predatory and parasitic species (Davis 1983). Thistles will also support an equally diverse, yet totally different fauna (Redfern 1983).

Gardens can be of importance to a variety of vertebrates. As mentioned above, ponds can support locally important populations of amphibians, and garden ponds can be useful in this respect (Ansell and others 2001; Good 2000). Surveys conducted by BTO Garden BirdWatch participants in 2003 (http://www.bto.org/gbw/index.htm) found that common frogs were present in up to 93% of suburban gardens (86% in rural and 90% urban) and common toads were present in 55% of rural gardens, (32% of suburban and 35% of urban).

Ecologically 'good quality' gardens with areas of rough grass and undisturbed ground (eg compost heaps) and adequate cover may also hold grass snakes and slow worms, although these are becoming less common. The BTO survey found that slow worms were present in 14% of rural gardens and grass snakes in 13% of rural gardens, but both were much less common in suburban and urban gardens. However, it should be borne in mind that these surveys were not conducted on randomly selected gardens, but by those with an interest in birds, thus they are likely to over-represent gardens that are to some extent managed for wildlife.

The breeding and wintering bird communities of gardens have been well described and monitored over many years in the UK by the British Trust for Ornithology through its Garden BirdWatch Scheme (Cannon 1998; Toms 2003), and the Garden Bird Feeding Survey (Glue 1982) and other research studies. This research has shown that gardens are likely to hold high proportions of the national breeding populations of many species (Gregory & Baillie 1998). Furthermore, a recent questionnaire survey of households undertaking the BTO Garden BirdWatch also revealed that the urban populations of several common gardens birds is likely to have been considerably underestimated in the past, irrespective of the survey's likely bias towards bird friendly gardeners (Bland & Greenwood 2004).

Gardens are also of considerable importance for many species in winter. This is in part due to widespread bird feeding, which is estimated to occur at 75% of households at some time during the year (Cowie & Hinsley 1988).

The BTO surveys indicate that a high diversity of birds use gardens, but there is a fairly constant set of frequently encountered species (Table 2.3). The most commonly occurring are robin, blackbird, blue tit and greenfinch (which occur in all gardens) followed by dunnock, song thrush, great tit, starling, house sparrow and chaffinch (>95%). However, some species, although recorded at a relatively high proportion of sites, are only observed in a low proportion of weeks (eg sparrowhawk, pied wagtail, wren, redwing, long-tailed tit, rook and siskin) indicating that these species are widespread but infrequent visitors to gardens.

The long-term BTO data also reveal many species have shown significant changes in abundance in gardens between 1970 and 2000, with about half of 41 analysed species datasets indicating an increase in use of gardens (Chamberlain and others, in press). Many of these increases may reflect a response to greater food availability, because the number of feeding stations has increased over time. However, other species, especially the house

sparrow and starling have shown significant decreases; the house sparrow probably declining as a result of a decrease in small invertebrate food that is required by nestlings (Summers-Smith 1999).

Table 2.3. The 20 most frequently encountered birds in UK gardens according to BTO Garden Bird Feeding Surveys (Chamberlain and others, in press)

The table presents occurrence per site (number of sites where a species was recorded at least once as a percentage of the total) and per week where a given species was recorded at garden feeding stations between the winters of 1970/71 and 2000/01.

Species	% Site occurrence	% week occurrence
Blue tit	100	95.3
Robin	100	87.8
Blackbird	100	84.9
Greenfinch	100	68.8
Great tit	99.8	81.1
Dunnock	99.6	81.7
Chaffinch	99.3	75.1
House sparrow	99.1	87.0
Starling	98.7	77.7
Song thrush	97.4	32.2
Coal tit	94.8	49.4
Collared dove	91.9	57.2
Wren	88.2	13.0
Pied wagtail	83.0	9.7
Magpie	82.3	30.9
Redwing	75.8	1.7
Siskin	69.2	7.6
Wood pigeon	67.2	15.8
Rook	65.1	6.0
Goldfinch	64.4	5.0

Gardens may also be used by a wide variety of mammals, with the Garden Mammals Survey in 1998/99 (as reported in Ansell and others 2001) revealing that five species or groups occurred in more than half of surveyed gardens: mice (78%), grey squirrel (78%), hedgehog (70%), fox (68%) and bats (63%). Although the survey could not reliably distinguish between some similar species, it is likely that the most commonly encountered bats were the pipistrelle species, but brown long-eared bat, serotine, Daubenton's bat and noctule are also likely to frequently occur. The survey also revealed that the occurrence of mammals varies greatly between gardens depending on their size, location in relation to other habitats and way that they are managed.

2.3 The biodiversity importance of characteristic urban habitats

Further consideration of urban habitats in this report is now restricted to habitats that are characteristic of urban areas. These include all habitats that fall within the Built-up Areas and Gardens Broad Habitat, and also ponds, tall grasslands, ruderal communities, scrub and small woodlands within urban environments and post-industrial Inland Rock habitats and grasslands.

2.3.1 Importance for UKBAP Species of Conservation Concern

The use of Inland Rock and Built-up Areas and Gardens Broad habitats types by UKBAP Species of Conservation Concern (SoCCs) is summarised in Table 2.4 below. The list of SoCCs was taken from the UK BAP website library (http://www.ukbap.org.uk/librarysearchresults.aspx?ID=529) on 24 January 2005 (see Box 1.2 for further information on the SoCC list). The table lists all species that we consider to have a primary or secondary association with Inland Rock and Built-up Areas and Gardens, based on our reviews of the literature, own professional experience and consultations with taxa experts and urban ecologists. In preparing the list we have also taken into consideration the assessments made of habitat associations between UKBAP Priority Species (ie priority SoCCs) and "Natural rock exposures and built environments" in the English Nature publication *Biodiversity: making the links* (Simonson & Thomas 1999). For some species we do not agree with Simonson and Thomas that they have primary or secondary associations with the stated habitat, in which case these are listed in Table 2.4 and reasons are given in the text below for our differing assessments.

To a large extent it is difficult to evaluate the associations between many invertebrate species and urban, brownfield and post-industrial habitats, because we are only just beginning to find out which species, and in particular which rare species, are found on these sites. And as more studies are carried out it is becoming increasingly clear that almost any post-industrial site of any size is likely to hold an assemblage of rare and scarce invertebrate species (Eyre and others 2002, 2004). For instance, *Axinotarsus pulicarius*, a nationally Endangered beetle (Red Data Book category 1) beetle, was found by chance at an East London site in 2004, the first British record for 80 years (Mick Eyre, personal communication) and the micro moth *Tinagma balteolella* – a species until now known only from coastal sand dunes at Deal, Kent – was discovered at a site less than a kilometre away during the same year by Colin Plant (Plant 2004).

Table 2.4 UKBAP Species of Conservation Concern associated with Built-up Areas and Gardens and post-industrial Inland Rock habitats

Key: P = Primary association (a habitat which is of principle or sole importance for the species); S = Secondary association (a habitat that holds a significant proportion of the species, ie c. > 10% of population / range, but is not of principle importance). Codes in brackets indicate assessments made in Simonson and Thomas (1993). x indicates species considered by Simonson and Thomas to be of "less importance to the species". Priority = UKBAP Priority Species.

Species group / species	Common name	Post-industrial Inland Rock	Built-up Areas & Gardens	UK BAP status
Fungi				
Tulostoma niveum	White stalkball	(P)		Priority
Lichens				
Belonia calcicola	Lichen	S (x)		Priority
Calicium corynellum	Lichen		P (x)	Priority
Lecanactis hemisphaerica	Churchyard lecanactis		P (x)	Priority
Mosses and liverworts				
Barbula glauca	Glaucous beard-moss	P		Priority
Brachythecium appleyardiae	Appleyard`s feather-moss		(P)	Priority
Cephaloziella nicholsonii	Greater copperwort	P (x)		Priority
Desmatodon cernuus	Flamingo moss	P (x)	(x)	Priority
Ditrichum cornubicum	Cornish path-moss	P (x)		Priority
Ditrichum plumbicola	Lead-moss	P (x)		Priority
Marsupella profunda	Western rustwort	P (x)		Priority
Petallophyllum ralfsi	Petalwort	S		Priority
Tortula freibergii	Freiberg`s screw-moss	P		Priority
Higher plants				
Agrostemma githago	Corncockle		S	
Centaurea cyanus	Cornflower		S	Priority
Cerastium nigrescens	Shetland mouse-ear	S		Priority
Epipactis leptochila var. dunensis	Narrow-lipped helleborine	S		
Epipactis palustris	Marsh helleborine	S		
Epipactis phyllanthes	Green-flowered helleborine	S		
Epipactis youngiana	Young`s Helleborine	P (x)		Priority
Fumaria occidentalis	Western ramping-fumitory		S (S)	Priority
Funaria purpurea	Purple ramping-fumitory		S	Priority
Ophrys apifera	Bee orchid	S		

Species group / species	Common name	Post-industrial Inland Rock	Built-up Areas & Gardens	UK BAP status
Senecio cambrensis	Welsh groundsel		P	
Sisymbrium irio	London rocket		P	
Thlaspi perfoliatum	Perfoliate penny-cress	P	(?)	Priority
Insects				
Acrolepiopsis assectella	Leek moth		S	
Adelphocoris seticornis	A plant bug		?	
Alysson lunicornis	A solitary wasp		S	
Amblytylus delicatus	A plant bug		S	
Andrena florea	A solitary bee	S		
Apion lemoroi	A beetle	?	?	
Arachnospila wesmaeli	A solitary wasp		S	
Argogorytes fargei	A solitary wasp		S	
Argyresthia trifasciata	A micro moth		P	
Axinotarsus pulicarius	A beetle		S	
Bombus humilis	Carder bumblebee		S	Priority
Bombylius discolor	Dotted bee-fly	S (x)		Priority
Bruchela rufipes	A beetle		S	
Calliphora uralensis	A flesh fly		S	
Calophasia lunula	Toadflax brocade[*1]		S	Priority
Celastrina argiolus	Holly blue butterfly		S	
Ceratina cyanea	Blue carpenter bee		S	
Cerceris quadricincta	Solitary wasp	P		Priority
Cerceris quinquefasciata	Solitary wasp		S	Priority
Cheilosia cynocephala	A hoverfly	S		
Chorthippus vagans	Heath grasshopper	S		
Cicones undatus	A beetle		S	
Cupido minimus	Small blue	S		
Dolichovespula media	Median wasp		S	
Dorycera graminum	Picture-winged fly		S	Priority
Dyschirius obscurus	A beetle	S		Priority
Erynnis tages	Dingy skipper	S		Qualifies as a Priority[*2]
Pyrgus malvae	Grizzled Skipper	S		Not SoCC, Qualifies as Priority sp.[*2]
Gymnosoma nitens	A parasitic fly	S	P	
Harpalus obscurus	Ground beetle	(P)		Priority
Hecatera dysodea	Small ranunculus		S	

Species group / species	Common name	Post-industrial Inland Rock	Built-up Areas & Gardens	UK BAP status
Hedychrum niemelai	A ruby-tailed wasp		S	
Helina concolor	A fly	S		
Homoneura interstincta	A fly		S	
Hylaeus cornutus	A yellow-faced bee		S	
Hypena rostralis	Buttoned snout		S (S)	Priority
Lasioglossum brevicorne	A solitary bee		S	
Lasioglossum leucopum	A solitary bee	S	S	
Lasioglossum pauperatum	A solitary bee	S	S	
Lucanus cervus	Stag beetle		S (P)	Priority
Myopites inulaedyssentericae	A fly		S	
Myrmica specioides	An ant		S	
Nemophora fasciella	A micro moth		P	Not SoCC, Qualifies as Priority sp[*3]
Nomada ferruginata	Cuckoo bee	P		Priority
Nysson interruptus	A solitary wasp		S	
Philanthus triangulum	Bee wolf	S		
Polystichus connexus	A ground beetle		S	
Scotopteryx bipunctaria	Chalk carpet	S (S)		Priority
Solenopsis fugax	An ant		S	
Sphecodes niger	A cuckoo bee	S		
Sphecodes reticulatus	A cuckoo bee	S		
Sphecodes scabricollis	A cuckoo bee	S		
Stictopleurus abutilon	A ground bug		P	
Stictopleurus punctatonervosus	A ground bug		P	
Stratiomys longicornis	A soldier fly		S	
Tinagma balteolella	A micro moth[* 4]		S	
Trichocera maculipennis	A winter gnat	S		
Tyta luctuosa	Four-spotted Moth		S	Priority
Zodion notatum	A parasitic fly		S	
Other invertebrates to add, which are not current SoCC species				
Insects				
Campiglossa malaris	A picture-winged fly		S	Qualify as SoCC
Mordellistena pseudoparvula	A tumbling flower beetle		S	Qualify as SoCC

Species group / species	Common name	Post-industrial Inland Rock	Built-up Areas & Gardens	UK BAP status
Olibrus flavicornis	A beetle		S	Qualify as SoCC
Spiders				
Zodarion fuscum	A spider		P	Qualify as SoCC
Zodarion italicum	A spider		P	Qualify as SoCC
Zodarion rubidum	A spider		P	Qualify as SoCC
Amphibians				
Bufo bufo	Common toad		S	
Rana temporaria	Common frog		S	
Triturus cristatus	Great crested (warty) newt	S	S	Priority
Triturus vulgaris	Smooth newt		S	
Birds				
Accipiter nisus	Sparrowhawk		S	
Bombycilla garrulus	Waxwing		S	
Carduelis cannabina	Linnet		S	Priority
Carduelis carduelis	Goldfinch		S	
Carduelis chloris	Greenfinch		S	
Carduelis spinus	Siskin		S	
Charadrius dubius	Little Ringed Plover	S		
Columba palumbus	Woodpigeon		S	
Corvus corone	Carrion / hooded crow		S	
Corvus monedula	Jackdaw		S	
Delichon urbica	House martin		P	
Hirundo rustica	Swallow		S	
Larus argentatus	Herring gull		S	
Larus fuscus	Lesser black-backed gull		S	
Larus ridibundus	Black-headed gull		S	
Motacilla alba	White/pied wagtail		S	
Muscicapa striata	Spotted flycatcher		S	Priority
Paridae	Coal tit		S	
Paridae	Blue tit		S	
Paridae	Great tit		S	
Passer domesticus	House sparrow		P	Not SoCC, Qualifies as Priority sp.[*5]
Passer monatus	Tree sparrow		S	Priority

Species group / species	Common name	Post-industrial Inland Rock	Built-up Areas & Gardens	UK BAP status
Phoenicurus ochruros	Black redstart	P	S	
Pica pica	Magpie		S	
Prunella modularis	Dunnock		S	
Riparia riparia	Sand martin	S		
Sturnus vulgaris	Starling		P	Qualifies as Priority sp.[*5]
Streptopelia decaocto	Eurasian collared dove		S	
Troglodytes troglodytes	Wren		S	
Turdus merula	Common blackbird		S	
Turdus philomelos	Song thrush		S (P)	Priority
Turdus viscivorus	Mistle thrush		S	
Mammals				
Pipistrellus pipistrellus[1]	Pipistrelle bat		S (P)	Priority

Notes
1: *Calophasia lunula* is typically a species of south-coast shingle beaches, but has recently started to thrive on post-industrial sites in London where it feeds to a large extent on the alien purple-flowering toadflax rather than on the native yellow-flowering species. 2: This species has declined significantly in recent years (Asher and others 2001), and is amongst a number of species that Butterfly Conservation are proposing for Priority status (John Davis, Butterfly Conservation pers. com.). 3: *Nemophora fasciella* feeds in the fallen leaves and flowes of *Ballota nigra* on the ground beneath the plant for much of the year. The plant is characteristic of path edges etc in urban areas and is vulnerable as a consequence of path-sweeping and other cleaning operations. 4: *Tinagma balteolella* has recently been found breeding on post-industrial urban sites in East London (see Plant 2004). Until recently it was confined to the sand dunes at Deal in East Kent. 5: This species has declined by more than 50% in the last 25 years (Crick and others 2004; Eaton and others 2004; Gregory and others 2003).

In a few cases we consider that Simonson and Thomas have over-estimated the association between the species listed and their respective habitats. In particular, this was the case for the following species.

Tulostoma niveum grows in only one site in UK, in Scotland, on large boulders in a limestone scree. This is not a post-industrial habitat.

Harpalus obscurus (Priority Species) is an inhabitant of inland chalk and limestone surfaces, not represented in coastal areas. A summer-breeding species whose biology appears to be otherwise unknown.

[1] It was recently discovered that there are actually two species of pipistrelle bat formerly grouped together as *Pipistrellus pipistrellus*. The soprano pipistrelle (*Pipistrellus pygmaeus*) is now recognised as a separate species to the common pipistrelle (*P. pipistrellus*). It can only be reliably told apart from the Common Pipistrelle by its echolocation call which is on 55 kHz rather than 45kHz. A third pipistrelle, (*P. nathusii*) is also now known to breed in England and Northern Ireland, but has been little studied.

Lucanus cervus, the stag beetle, is a saproxylic species, whose larvae develop over a period of many years in damp, subterranean timber such as dead tree roots. The literature contains occasional references to urban compost heaps as breeding sites but these all relate to a single erroneous observation, slavishly copied without checking. Older gardens with dead tree roots (eg those with old orchards) often support stag beetles, but the appearance that they are concentrated in such habitats is the result of biased observations. In fact they more commonly occur in woodlands with abundant deadwood, but are more rarely observed in such habitats. Thus, although gardens and some other urban habitats (such as parkland rich in old trees) can support important populations of stag beetles, it is not strictly speaking an urban species.

We consider that Song thrush has a secondary association, rather than primary association with Built-up Areas and Gardens, because a large part of its population is associated with rural habitats, eg farmland, scrubland, heaths and woodlands. In a study of large scale habitat use by birds in the UK, Gregory and Baillie (1998) found that habitats associated with human habitation hold about 23% of the British population of song thrush, and only 13% were in urban and suburban settings. Nevertheless, it is recognised that urban habitats hold a large proportion of the UK population of this UKBAP Priority Species. The use of urban areas by the species may also be increasing, particularly in eastern England, with urban areas becoming of greater importance as habitat refuges (Mason 2000). The management of parks, gardens and other 'green space' may therefore have an important impact on their populations. This would also benefit the starling, which can be considered to be primarily associated with Built-up Areas and Gardens. Virtually half of the British population is associated with human habitation, with 29% in suburban areas alone (Gregory & Baillie 1998).

Although urban habitats and associated buildings are of undoubted significance to both pipistrelle bat species, they are in fact widespread and common in many other habitats, including open woodland and farmland; and are therefore best not treated as urban habitat dependent species.

Overall, this assessment reveals that 123 SoCCs (or species qualifying as such) have a primary or secondary association with Built-up areas and Gardens and Inland Rock, as defined by the UK Broad Habitat Types. Of these 35 are Priority Species, of which two have a primary association with Built-up Areas and Gardens, and 16 have a secondary association. Eleven have a primary association with Inland Rock and seven have a secondary association.

In contrast *Biodiversity: making the links* (Simonson & Thomas 1999) considered that only nine Priority Species have a primary or secondary association with "natural rock exposures and built environments". Of these, four have a primary association with built environments, and two have a secondary association. Two have a primary association with natural rock exposures and one has a secondary association. Exact comparison of these lists and totals is not easy because slightly different habitat types are examined in each study. Nevertheless, it is apparent that the assessment in *Biodiversity: making the links* probably significantly underestimated the number of Priority Species with an association with urban habitats.

However, most of the assessments here should be treated with caution as many SoCCs, especially amongst the fungi, lower plants and invertebrates, are poorly known. Although some species may only be known from a few urban locations and may hence appear to have a strong association with such habitats, it is possible that further studies could reveal that they are more widespread than currently thought. Unfortunately, to date in-depth studies of the

distribution of lower plants and invertebrates of urban and post-industrial habitats are relatively scarce.

2.4 The habitat requirements of UKBAP Species of Conservation Concern that have a primary association with urban habitats

A summary of the habitat requirements of those SoCCs that have a primary association with urban habitats (ie those of that fall within the Built-up Areas and Gardens Broad Habitat, and also ponds, tall grasslands, ruderal communities, scrub and small woodlands within urban environments and post-industrial Inland Rock habitats and grasslands) is presented below in Table 2.5. This draws on many of the standard texts on urban ecology, but also a wide range of specific autecological studies, the most important of which are listed below.

Table 2.5 The habitat requirements of UKBAP Species of Conservation Concern with primary associations with Built-up Areas and Gardens and post-industrial Inland Rock habitats

Habitats used: Habitat type in urban areas: PC = Pioneer communities of hard surfaces; AC = Aquatic communities of fresh waters; RC = Ruderal communities; ET = Emergent, tall (>100cm) swamp communities; LM = Low-growing (<70cm) swamp and marsh communities; TG = Tall grass and tall herb communities; LG = Low grass and grass-herb communities; S = Scrub; W = Woodland, G = Gardens and allotments. Numbers indicate subgroups where of particular importance (see Table 2.1).

Substrate type (brackets give examples): Fine (clays, loams, silts); Coarse (sands, most demolition waste); Stony (quarry waste, colliery waste, etc.); Walls.

Substrate pH: Acid: i.e. <6; Neutral: i.e. 6-7.5; Alkaline: i.e. >7.5.

Nutrient status: Toxic (heavy metal mine wastes); Low (most industrial wastes including quarry); Medium (demolition sites and many soils); High (nutrient-enriched sites such as sewage works).

Water supply: Deficient (sands and most industrial wastes); Adequate (most soils); Seasonally flooded (pond edges, compacted areas); abundant / aquatic (standing and flowing water).

References

Plants: (Grime and others 1988; Grime & Lloyd 1973; Paton 1999; Smith 2004). Invertebrates: (Ball 1986; Bratton 1990, 1991; Falk 1991a,b; Harvey 1999; Hyman & Parsons 1992, 1994; Kirby 1992; Parsons1993; Plant & Harvey 1997; Shirt 1987; Wallis 1991). Birds: (Cramp 1977-93; Kirby and others 2000; Summers-Smith 1963).

Plants

Species group / species	Common name	Habitats used	Substrate type	Substrate pH	Nutrients	Water	Notes
Lichens							
Calicium corynellum	Lichen	PC1.1	walls	acid	low	adequate	
Lecanactis hemisphaerica	Churchyard Lecanactis	PC1.1	walls	alkaline	low	deficient	
Mosses and liverworts							
Barbula glauca	Glaucous Beard-Moss	PC1.2	stony	alkaline	low	deficient	
Cephaloziella nicholsonii	Greater copperwort	PC1.2	coarse, stony, walls	acid	toxic (copper)	deficient	
Desmatodon cernuus	Flamingo moss	PC1.2	stony	alkaline	low	deficient	
Ditrichum cornubicum	Cornish Path-Moss	PC1.2	stony	acid	toxic (copper)	deficient	
Ditrichum plumbicola	Lead-moss	PC1.2, RC3.3	stony	acid	toxic (lead)	deficient	

Species group / species	Common name	Habitats used	Substrate type	Substrate pH	Nutrients	Water	Notes
Marsupella profunda	Western Rustwort	PC1.2	coarse	acid	low	deficient	
Tortula freibergii	Freiberg`s screw-moss	PC1.2	walls, especially along Bridgewater Canal	acid	low	deficient	
Higher plants							
Epipactis youngiana	Young`s Helleborine	W on mine spoil	stony	acid	low	adequate	
Senecio cambrensis	Welsh Groundsel	RC3.3, LG7.2	coarse	neutral	low	deficient to adequate	
Sisymbrium irio	London Rocket	RC3.3,LG7.2	coarse, walls	neutral	low	deficient to adequate	
Thlaspi perfoliatum	Perfoliate Penny-Cress	RC3.3	stony, walls	alkaline	low	deficient	

Animals

Species group / species	Common name	Habitats used	Substrate type	Water	Food resources	Breeding site	Notes
Insects							
Alysson lunicornis	solitary wasp	RC	Fine	Deficient	froghoppers (Cicadellidae & Delphacidae)	bare clay ground in full sun – level or sloping	
Amblytylus delicatus	a plant bug	RC/TG/LG	-	Deficient	cudweeds	unclear	
Arachnospila wesmaeli	solitary wasp	RC/TG in combination	Coarse	Deficient	spiders	sand or PFA in full sun	
Argogorytes fargei	solitary wasp	RC/TG in combination	Fine/coarse	Deficient	froghoppers (Phiilaenus)	clay, gravel or sand in full sun	
Argyresthia trifasciata	a micro moth	G	-	-	Cupressaceae	mines leaves of Cupressaceae	
Cerceris quadricincta	Solitary wasp	RC/TG in combination	Fine/coarse	Deficient	Curculionid weevils	clay or sand in full sun	
Gymnosoma nitens	a parasitic fly	RC	-	Deficient	parasitic on Hemiptera	open, sparsely vegetated sites where the host is found	

Species group / species	Common name	Habitats used	Substrate type	Water	Food resources	Breeding site	Notes
Harpalus obscurus	Ground beetle	PC	Stony (Chalk & limestone)	Deficient	predatory on other insects	on the ground/in crevices?	Alkaline substrate
Nemophora fasciella	a micro moth	RC/LG	coarse/stony		*Ballota nigra*	in seeds then in litter om groud below plant	Vulnerable to "tidying" (removal of accumulated litter along paths etc).
Nomada ferruginata	Cuckoo bee	RC/TG/LG	Fine	Deficient	cleptoparasite of solitary bee Andrena humilis	Host nests in sand; parasite follows host	
Stictopleurus abutilon	a ground bug	RC	-	Deficient	predatory on other insects	sparsely-vegetated bare ground/grassland etc	
Stictopleurus punctatonervosus	a ground bug	RC	-	Deficient	predatory on other insects	sparsely-vegetated bare ground/grassland etc	
Others to add, which are not current SoCC species							
Spiders							
Zodarion fuscum	spider	RC	Stony	-	insects	silk retreat constructed under objects (stones etc)	
Zodarion italicum	spider	RC	Stony	-	insects	silk retreat constructed under objects (stones etc)	
Zodarion rubidum	spider	RC	Stony	-	insects	silk retreat constructed under objects (stones etc)	
Birds							
Delichon urbica	House Martin	Houses / air space			Exclusively aerial feeder on small insect food	Eaves of buildings and needs source of mud for nest	
Passer domesticus	House Sparrow	RC, LG, S, G			Small inverts and seeds. Bird table food.	Normally in cavities in buildings	Declining, probably due to inadequate food resources

Species group / species	Common name	Habitats used	Substrate type	Water	Food resources	Breeding site	Notes
Phoenicurus ochruros	Black Redstart	RC1.3, LG			Small ground-surface invertebrates	Cavities in derelict buildings	
Sturnus vulgaris	Starling	LM5.2, LG7.1, G			Mainly soil-invertebrates, also fruit in autumn. Bird table food.	Normally in cavities in buildings and tree holes.	Declining, probably due to inadequate food resources

It is important to take into consideration the limitations of such a simplified analysis of habitat requirements. Many species can occupy more than one habitat type and habitat requirements will depend on specific circumstances affecting the species at a particular location. In particular a species' requirements may vary depending on the landscape and habitat types that it is within. And there may also be multiple solutions to providing a species' needs. For such reasons a mosaic of habitat types is often of greatest importance rather than the presence of any one habitat type and set of features, and this will be a limiting factor for most invertebrate communities in particular. Ideal sites for many species will also be edge habitats, those difficult to define zones between bare areas and grassland, and between open areas and scrub/woodland and so on, and for which the physical limits in each direction will vary considerably.

2.4.1 Overall evaluation of the biodiversity importance of urban habitats

There are a number of considerations that should be taken into account when evaluating the ecological importance of habitats, especially the reasons for the evaluation. In many cases evaluations are carried out to inform priority setting, and in particular to guide the selection of protected areas. An overall set of principles for protected area selection is given by Ratcliffe (1977), which have been widely accepted and are applicable to this study. Ratcliffe suggests that priority should, for pragmatic reasons, be given to sites and features that:

1. Are intrinsically most fragile and sensitive to human impact;
2. Have already lost ground through human impact;
3. Are predictably most vulnerable to further damage and loss through a combination of (1) above and probable expansion of impacts;
4. Would represent the greatest loss to nature conservation if they were damaged or destroyed;
5. Would be the most difficult to restore or re-create if they were damaged or destroyed.

A variety of approaches and criteria have been developed for evaluating habitats that take these principles into account (Spellerberg 1992; Usher 1986). To be defendable evaluation criteria should also be objective, explicit, based on widely accepted ecological science principles and the best available data, and ideally, quantifiable. Although, no standard set of criteria have emerged for this purpose, one set that have been particularly frequently used are those developed by Ratcliffe (1977). These were first used in the Nature Conservation Review to identify sites of high conservation value, which later formed the basis of the SSSI series. Although now over 25 years old, these have been widely adopted in the UK and have been adapted for a variety of purposes including the evaluation of habitats as a whole.

The Ratcliffe criteria relating to diversity, rarity and naturalness have been used in this study as a basis for the evaluation of the ecological importance of urban habitats. However, additional criteria have also been used to take into account each habitat's importance for European threatened habitats (ie listed in EU Habitats Directive Annex 1), importance for UKBAP SoCCs (see Table 2.4) and overall uniqueness (eg in terms of biophysical characteristics and species assemblages).

However, nature conservation in urban areas has differed from traditional approaches to conservation in several respects. Less emphasis has often been placed on rare or threatened

species or habitats, and because of the proximity of urban habitats to people more weight is given to the values and benefits of urban wildlife to local people (Goode 1989). Evaluation criteria therefore typically include social criteria as well as those of intrinsic biological interest. A second set of criteria have, therefore, been applied to take into account each habitat's educational, scientific and amenity value (ie its intrinsic appeal and recreational use by people).

For example, tall grass and herb communities are favoured play areas for children. Examples with good populations of grasshoppers, snails and other invertebrates can be of interest to children and adults, as well as providing excellent teaching resources. Flower-rich habitats are commonly considered to be of high aesthetic appeal, both in terms of their colour and variety, and in terms of the larger insects that they attract (such as hoverflies, bumblebees and butterflies).

Ponds are always of great interest, especially to children. But the presence of water is widely valued aesthetically and these habitats have high intrinsic appeal.

Post-industrial sites offer examples of primary successions, which are very rare, especially in the lowlands, and of great research and educational value. Habitat creation sites can allow the study of colonisation of a new habitat by plants and animals. Both these are of particular relevance as climate change alters patterns of distribution.

Lastly, criteria relating to the degree of threat to each habitat are considered, with explicit consideration of recent or predicted rates of loss, predicted rates of degradation of the habitat (eg through inadequate management), fragility of the habitat (as used by Ratcliffe), and the irreplacability of the habitat (ie the practical difficulty in replacing the habitat if destroyed). Further details of the application of the criteria to the evaluation of habitats is provided in Appendix 5.

An evaluation of the habitats that are characteristic of urban areas in relation to these criteria is provided in Table 2.6 below and summarised in Table 2.7.

Table 2.6 An overall evaluation of the biodiversity importance of the main types of habitat that are characteristic of urban areas in the UK.

Key: H = high, M= medium, L= low, ? a severe lack of data makes an assessment almost impossible
a. Ecological Value

Habitat type in urban areas	1. Importance for EU threatened habitats	2. Importance for Spp of Conservation Concern	3. Diversity	4. Rarity	5. Naturalness	6. Uniqueness
1. Pioneer communities of hard surfaces, dominated by cryptograms and lythophytes. Unmanaged.						
1.1 Lichen-dominated communities of exposed hard surfaces (eg rock, concrete), water deficient, nutrients very low.	?L: none known	?M: some reports of uncommon spp.	?M: lack of data	?M: lack of data	M-H: natural succession on a variety of substrates	?L. probably similar communities in many places,
1.2 Bryophyte-dominated communities on hard surfaces with some degree of shade or shelter and/or adequate water supply, nutrients very low.	?L: none known	?M: some reports of uncommon spp.	?M: lack of data	?L: lack of data	M-H: natural succession on a variety of substrates	?L: probably similar communities in many places;
1.3 Fragmentary stands of ferns and flowering plants on wall mortar, on ledges, in crevices etc. Water and nutrients low.	L	L	L	L	M-H: natural succession on a variety of substrates	L: similar communities in many places
2. Aquatic communities of fresh waters, composed mostly of perennial, obligate hydrophytes. Management little or none.						
Ponds in Built-up Areas and Gardens: ie classes 2.1 Eutrophic still waters, mainly ponds, with communities of free-floating species; and 2.2 Still water bodies of a range of sizes with communities of floating and submerged aquatics.	L	M: locally important to amphibians	H: many small water bodies with a variety of edaphic conditions	L or M: depending on spp. present	L-M: garden ponds highly managed, old mill dams little management	L: except for a few larger and older water bodies
3. Ruderal communities.						
3.1 Nutrients and water abundant, neutral pH: formerly common around sewage works and similar places, but reduced by changes in sewage treatment. Dominated by annuals.	L	M: valuable seed resources for some seed-eating birds	L	L	M: natural colonisation on highly altered substrate	L

Habitat type in urban areas	1. Importance for EU threatened habitats	2. Importance for Spp of Conservation Concern	3. Diversity	4. Rarity	5. Naturalness	6. Uniqueness
3.2 Nutrients and water adequate, circum-neutral pH: typical of gardens and allotments but widespread. Dominated by annuals.	L	M: valuable seed resources for some seed-eating birds	M: wide variety of edaphic conditions and propagule supply	L	L-M: examples of species adapted to continual disturbance	L
3.3 Nutrients and often water limited, range of pH. The starting-point of post-industrial land and demolition site successions and includes a wide range of communities.	L:	M: some evidence of early colonisation by unusual lower plants	M: wide range of initial edaphic conditions and propagule supply	L to M: depends on colonising spp.	M: natural succession on unnatural substrates	L to H depending on substrate
6. Tall grass and tall herb communities.						
6.1 Communities dominated by tall, tussock-forming grasses.	L	L-M, especially useful to small mammals and their predators eg owls	L	L: a very common habitat in urban areas,	M- H: natural succession on a variety of substrates	L
6.2 Communities with similar grasses but high content of patch-forming herbs.	L	L-M : especially useful to small mammals and their predators	M	L: a very common habitat in urban areas	M-H: natural succession on a variety of substrates, influenced by propagule supply	L
7. Low grass and grass-herb communities.						
7.1 Grasslands dominated by *Lolium perenne* and *Poa* spp. with/without *Trifolium repens*. Mostly on fertile soils and dependant on regular mowing. Broad habitat type: Improved grassland	L	L-M: good foraging habitat for some invert-feeding birds	L	L: extremely abundant in urban areas	L	L
7.2 Grasslands with predominately fine-leaved species and many herbs on a variety of low-fertility substrates where nutrient stress, and sometimes water stress, restrict growth. Normally unmanaged.	M: may include some Annex I type 6130 Calaminarian grasslands of the *Violetalia calaminariae* [NB. Inland Rock Broad Habitat, but some sites are urban, see Appendix 7.]	H: especially important for invertebrates, but also some reptiles, birds and plants	H: both within and between sites, with varied edaphic conditions including pH and nutrient level extremes.	H: increasingly rare as sites being lost eg to reclamation and development, and few new ones created. Plus general eutrophication.	M: long-standing natural successions on unnatural substrates	H: while general types can be recognised, combination of substrate and colonisation patterns make many sites unique.
7.3 Recent "habitat creation" wild flower grasslands, usually created on former amenity grassland.	L	L : but evidence that unusual invertebrates are starting to colonise	L: tend to similar species mixes	M but more being created annually.	L	L

Habitat type in urban areas	1. Importance for EU threatened habitats	2. Importance for Spp of Conservation Concern	3. Diversity	4. Rarity	5. Naturalness	6. Uniqueness
8. Scrub vegetation.						
8.2 Mixtures of *Buddleja, Salix cinerea, Salix caprea* and *Betula pendula* on infertile substrates.	L	?L: invertebrate use, eg good nectar sources	M: depends on substrate and topographical diversity	L: reasonably common in areas where land is unused for a decade or more	M: natural colonisation on unnatural substrates	M: much variation between sites due to vagaries of colonisation
8.3 On more fertile sites, eg brick rubble, mixtures of a wide range of species.	L	?L: invertebrate and bird use?	M: depends on substrate and propagule supply	L: reasonably common in areas where land is unused for a decade or more	M: natural colonisation on unnatural substrates	M: much variation between sites due to vagaries of colonisation
9. Woodlands (Closed canopy woodlands >5m tall, and open "urban savannah").						
9.1 Urban savannah - scattered trees, avenues and clumps in mown grassland.	L	L	L	L	L	L
9.2 Copses of large trees in some parks built to mimic country estates. Variable composition and usually species-poor grassy ground flora and no understorey.	L	L	L: usually very species-poor	L	L	L
9.3 Brick rubble and post-industrial sites of 40 years old or more, with unlikely mixtures, mixed understorey and ground flora of shade-tolerant herbs and grasses.	L	?L: invertebrate and bird use?	M: depends on substrate and propagule supply	M: few urban areas leave land unused for long enough	M: long-running natural succession on unnatural substrate	M: much variation between sites due to vagaries of colonisation
10. Gardens and allotments.	L	L-M: extremely variable some unusual species of lower plants and invertebrates, locally important to amphibians, wide variety of birds and important populations of some Priority Species	M: variable, many different management practices and planting support very high diversity, but many exotic species	L	L: dominated by non-native species and intensively managed, but some contain semi-natural elements, especially those tolerant of high disturbance	L

b. Social value and threat status

	Social value		Threat status			
Habitat type in urban areas	**1. Educational & scientific importance**	**2. Amenity value (recreational use)**	**1. Rate of loss**	**2. Rate of degradation**	**3. Fragility**	**4. Irreplaceability**
1. Pioneer communities of hard surfaces, dominated by cryptograms and lythophytes. Unmanaged.						
1.1 Lichen-dominated communities of exposed hard surfaces (eg rock, concrete), water deficient, nutrients very low.	H: needs scientific study, good for education	L: usually overlooked	L: although occasional problems with cleaning of buildings etc.	L or M: vulnerable to eutrophication	H: easily destroyed by being overlooked	L; will probably reform given the right conditions
1.2 Bryophyte-dominated communities on hard surfaces with some degree of shade or shelter and/or adequate water supply, nutrients very low.	H: needs scientific study	L: usually overlooked	L: occasional problems with cleaning of buildings, etc.	L or M: vulnerable to eutrophication	H: easily destroyed by being overlooked.	L; will probably reform given the right conditions
1.3 Fragmentary stands of ferns and flowering plants on wall mortar, on ledges, in crevices etc. Water and nutrients low.	M: educational opportunity	L: usually overlooked unless large extent	L: loss when walls are re-pointed	L or M: vulnerable to tidyness	H: easily destroyed by being overlooked	L; will reform given the right conditions
2. Aquatic communities of fresh waters, composed mostly of perennial, obligate hydrophytes. Management little or none.						
Ponds in Built-up Areas and Gardens: ie classes 2.1 Eutrophic still waters, mainly ponds, with communities of free-floating species; and 2.2 Still water bodies of a range of sizes with communities of floating and submerged aquatics.	H: excellent for education and study	H: people are attracted to water, especially still water	?M: high turnover of small ponds	M or H: eutrophication a problem, sometimes other pollution. Older examples such as abandoned dams suffer neglect	M or H: easily damaged by pollution, drainage, etc.	L or M; larger water bodies may be difficult to recreate.
3. Ruderal communities.						
3.1 Nutrients and water abundant, neutral pH: formerly common around sewage works and similar places, but reduced by changes in sewage treatment. Dominated by annuals.	L	L	M: changes in sewage treatment have reduced extent, but small patches are common	L: accumulated nutrients slow to disperse	L	L; will colonise most places that nutrients accumulate

	Social value		Threat status			
Habitat type in urban areas	**1. Educational & scientific importance**	**2. Amenity value (recreational use)**	**1. Rate of loss**	**2. Rate of degradation**	**3. Fragility**	**4. Irreplaceability**
3.2 Nutrients and water adequate, circum-neutral pH: typical of gardens and allotments but widespread. Dominated by annuals.	L	L	M: high removal as weeds, but very good at recolonising	L	L	L
3.3 Nutrients and often water limited, range of pH. The starting-point of post-industrial land and demolition site successions and includes a wide range of communities.	H: good for research and education on colonisation and succession	L or M: ones with attractive flowery communities are appreciated	H: usually destroyed by redevelopment or reclamation	H: often reseeded or otherwise adapted.	L	L or M ; depending on substrate, very low fertility examples from wastes are getting fewer
6. Tall grass and tall herb communities.						
6.1 Communities dominated by tall, tussock-forming grasses.	L	L or M as dog-walking areas, etc.	M: largely to redevelopment, reclamation or becoming managed eg by mowing	L: stable habitat that slowly becomes scrub	L: very robust community	L; easily reforms on soils of moderate to high fertility
6.2 Communities with similar grasses but high content of patch-forming herbs.	M : scientific study	M: often visually attractive	M: largely to redevelopment, reclamation or becoming managed eg by mowing	L: stable habitat that slowly becomes scrub	L: very robust community	L; reforms on soils of moderate fertility providing propagule supply is available.
7. Low grass and grass-herb communities.						
7.1 Grasslands dominated by *Lolium perenne* and *Poa* spp. with/without *Trifolium repens.* On fertile soils and dependant on regular mowing.	L	H: main sports pitch and amenity grassland community	L	L	L	L
7.2 Grasslands with predominately fine-leaved species and many herbs on a variety of low-fertility substrates where nutrient stress, and sometimes water stress, restrict growth. Normally unmanaged.	H: good for study of colonisation and succession,	H, or L if safety problems from previous use restrict access	H: mostly to reclamation and redevelopment	H: lack of management eventually leads to succession to less valuable communities	M: excessive trampling can cause damage to thin swards	H; many of the industries which created the wastes are gone, and modern waste disposal rules prevent new ones forming.

	Social value		Threat status			
Habitat type in urban areas	**1. Educational & scientific importance**	**2. Amenity value (recreational use)**	**1. Rate of loss**	**2. Rate of degradation**	**3. Fragility**	**4. Irreplaceability**
7.3 Recent "habitat creation" wild flower grasslands, usually created on former amenity grassland.	H: good for education and study of colonisation	H: attractive communities	L: but dependant on fashions in open space management	L: but depend on suitable management	M excessive trampling can be harmful	L
8. Scrub vegetation.						
8.2 Mixtures of *Buddleja, Salix cinerea, Salix caprea* and *Betula pendula* on infertile substrates.	M: good for education	H or L if safety problems from previous use	H: mainly to redevelopment	L: no management needed	H: robust community	M; few sites left un-used long enough in many urban areas
8.3 On more fertile sites, eg brick rubble, mixtures of a wide range of species.	M: good for education	M	H: mainly to redevelopment	L: no management needed	H: robust community	M; few sites left unused long enough in many urban areas
9. Woodlands (Closed canopy woodlands >5m tall, and open "urban savannah").						
9.1 Urban savannah - scattered trees, avenues and clumps in mown grassland.	L	H: valued for amenity	L	M: often lack of replacement trees	L	L
9.2 Copses of large trees in some parks built to mimic country estates. Variable composition and usually species-poor grassy ground flora and no understorey.	L	H: valued for amenity	L	M often lack of replacement trees	L: can be damaged by excessive trampling	M; takes time to grow replacements
9.3 Brick rubble sites of 40 years old or more, with unlikely mixtures, mixed understorey and ground flora of shade-tolerant herbs and grasses.	H: good for study of succession and colonisation	H: appreciated for amenity	H: mainly to redevelopment	L	L: can be damaged by excessive trampling	M; time needed to grow replacements
10. Gardens and allotments.	H: education can start here	H: the principal point of contact with the natural world for most people	L: sometimes M where large gardens and allotments taken for development	L	M: change in owner can mean change in management	L

Table 2.7 Summary of the evaluation of the biodiversity importance of the main types of habitat that are characteristic of urban areas in the UK

Overall score codes: L = Low; L/M = Low/Moderate; M = Moderate; M/H Moderate/High; H = High.

Habitat type in urban areas	1. Biodiversity value	2. Social value	3. Threat status
1. Pioneer communities of hard surfaces, dominated by cryptograms and lythophytes. Unmanaged.			
1.1 Lichen-dominated communities of exposed hard surfaces (eg rock, concrete), water deficient, nutrients very low.	M	M	M
1.2 Bryophyte-dominated communities on hard surfaces with some degree of shade or shelter and/or adequate water supply, nutrients very low.	M	M	M
1.3 Fragmentary stands of ferns and flowering plants on wall mortar, on ledges, in crevices etc. Water and nutrients low.	L	L	M
2. Aquatic communities of fresh waters, composed mostly of perennial, obligate hydrophytes. Management little or none.			
Ponds in Built-up Areas and Gardens: ie classes 2.1 Eutrophic still waters, mainly ponds, with communities of free-floating species; and 2.2 Still water bodies of a range of sizes with communities of floating and submerged aquatics.	M	H	M/H
3. Ruderal communities.			
3.1 Nutrients and water abundant, neutral pH: formerly common around sewage works and similar places, but reduced by changes in sewage treatment. Dominated by annuals.	L	L	L?
3.2 Nutrients and water adequate, circum-neutral pH: typical of gardens and allotments but widespread. Dominated by annuals.	L	L	L
3.3 Nutrients and often water limited, range of pH. The starting-point of post-industrial land and demolition site successions and includes a wide range of communities.	M	M	M/H
6. Tall grass and tall herb communities.			
6.1 Communities dominated by tall, tussock-forming grasses.	L	M	L
6.2 Communities with similar grasses but high content of patch-forming herbs.	L/M	L/M	L
7. Low grass and grass-herb communities.			
7.1 Grasslands dominated by *Lolium perenne* and *Poa* spp. with/without *Trifolium repens*. On fertile soils and dependant on regular mowing.	L	M	L
7.2 Grasslands with predominately fine-leaved species and many herbs on a variety of low-fertility substrates where nutrient stress, and sometimes water stress, restrict growth. Normally unmanaged.	H	M/H	H

Habitat type in urban areas	1. Biodiversity value	2. Social value	3. Threat status
7.3 Recent "habitat creation" wild flower grasslands, usually created on former amenity grassland.	L (but potentially M)	H	L
8. Scrub vegetation.			
8.2 Mixtures of *Buddleja, Salix cinerea, Salix caprea* and *Betula pendula* on infertile substrates.	M	M	M
8.3 On more fertile sites, eg brick rubble, mixtures of a wide range of species.	M	M	M
9. Woodlands (Closed canopy woodlands >5m tall, and open "urban savannah").			
9.1 Urban savannah - scattered trees, avenues and clumps in mown grassland.	L	M	L
9.2 Copses of large trees in some parks built to mimic country estates. Variable composition and usually species-poor grassy ground flora and no understorey.	L	M	L
9.3 Brick rubble sites of 40 years old or more, with unlikely mixtures, mixed understorey and ground flora of shade-tolerant herbs and grasses.	M	H	M
10. Gardens and allotments.	L-M	H	L

This evaluation reveals that the majority of urban habitat types are of moderate or high overall conservation importance, often in terms of both biodiversity and social value (as defined by our criteria). Only a few habitats are of generally low importance and these are typically the more artificial and fertile or intensively managed habitats, which are generally common and widespread and under little threat.

Some habitats stand out as being of particularly high amenity and social value, including ponds, wildflower rich grasslands (whether artificially recreated or naturally colonised on a variety of nutrient poor substrates), established woodlots and gardens. Of these most are of low or moderate biodiversity value (though gardens vary considerably and some may be of high value) and most are not greatly threatened by loss or degradation. However, many of the herb-rich low fertility and unmanaged grasslands (Type 7.2), as often associated with post-industrial sites, are threatened. Such habitats are often considered to be of low value and unsightly and receive little conservation protection or management. As a result many are lost to land reclamation for residential or industrial estates etc, and without management many are prone to degradation through natural succession to scrub (eg Bradshaw 1999; Gilbert 1991; Shaw 1994). Furthermore, few new sites are being created that can replace such habitats. Further discussion of the threats to these habitats is presented in Section 5.2 below.

3. The representation of urban habitats and associated species within Local Biodiversity Action Plans

LBAPS work on the basis of partnership to identify local priorities and to determine the contribution they can make to the delivery of the national SAP and HAP targets. Often, but not always, LBAPs conform to county boundaries.

One of the aims of this study is to review the coverage of urban habitats and species in LBAPs, because many of these have implicitly recognised the limitations of the treatment of

urban habitats and associated species in the UKBAP to date. Many LBAPs also focus on urban areas and the amenity value of urban habitats. Some have, therefore, given a high priority to actions that address urban habitat types and species that are not necessarily listed as UKBAP Priority Species. As a result a considerable amount of thinking and consultations have been undertaken in LBAPs with regard to urban habitats and species, that are of value to this study. Although it has not been possible here to review the rationale and selection process for the treatment of urban habitats and species in each LBAP in detail, we have attempted to identify those habitats and species that are characteristic of urban areas that have been the focus of LBAPs to date.

This has been carried out by a review of the LBAPs listed on the UKBAP website (www.ukbap.org). Analysis of the website firstly revealed that 41 LBAPs have action plans for Built-up Areas and Gardens (see Appendix 6 for a list) despite this being a Broad Habitat type rather than a Priority Habitat type. This amounts to 23 % of the total of 179 LBAPs that have been produced to date. And this indicates that such habitats are being given a relatively high priority, above that which might be expected from the national UKBAP.
However, only seven Action Plans have been prepared for Inland Rock habitats (listed in Appendix 6), which suggests that the importance of some forms of this Broad Habitat type are being overlooked.

Table 3.1 Coverage of UKBAP Species of Conservation Concern primarily associated with Built-up Areas and Gardens and post-industrial Inland Rock habitats in Local Biodiversity Action Plans

Totals numbers of LBAPs (as listed on the UKBAP website on 31/1/05): LBAPs addressing Inland Rock = 7; LBAPS addressing Built-up Areas & Gardens = 41; Total number of LBAPs (analysed for Priority Species only) = 179. Numbers indicate the number of LBAPs where action plans have been prepared for the species. The analysis also includes those species that are listed as being primarily associated with natural rock exposures and built environments in *Biodiversity: making the links* (Simonson & Thomas 1999), but not by this study (see Section 2.3). These species are indicated in parentheses.

Species group / species	Common name	LBAPs addressing Inland Rock	LBAPS addressing Built-up Areas & Gardens	All LBAPs / Priority Species only
Fungi				
(Tulostoma niveum)	White Stalkball	0	0	0
Lichens				
Calicium corynellum	Lichen	0	0	0
Lecanactis hemisphaerica	Churchyard Lecanactis	0	0	1
Mosses and liverworts				
Barbula glauca	Glaucous Beard-Moss	0	0	0
(Brachythecium appleyardiae)	Appleyard`s feather-moss	0	0	1
Cephaloziella nicholsonii	Greater copperwort	0	0	1
Desmatodon cernuus	Flamingo moss	0	0	1
Ditrichum cornubicum	Cornish Path-Moss	0	0	1

Species group / species	Common name	LBAPs addressing Inland Rock	LBAPS addressing Built-up Areas & Gardens	All LBAPs / Priority Species only
Ditrichum plumbicola	Lead-moss	1	1	3
Marsupella profunda	Western Rustwort	1	1	1[2]
Tortula freibergii	Freiberg`s screw-moss	0	0	0
Higher plants				
Epipactis youngiana	Young`s Helleborine	0	0	2
Senecio cambrensis	Welsh Groundsel	0	0	-
Sisymbrium irio	London Rocket	0	0	-
Thlaspi perfoliatum	Perfoliate Penny-Cress	0	0	1
Insects				
Adelphocoris seticornis	a plant bug	0	0	-
Apion lemoroi	a beetle	0	0	-
Argyresthia trifasciata	a micro moth	0	0	-
Cerceris quadricincta	solitary wasp	0	0	0
Gymnosoma nitens	a parasitic fly	0	0	-
(Harpalus obscurus)	ground beetle	0	0	0
(Lucanus cervus)	stag beetle	0	8	16
Nemophora fasciella	a micro moth	0	0	-
Nomada ferruginata	cuckoo bee	0	0	0
Stictopleurus abutilon	a ground bug	0	0	-
Stictopleurus punctatonervosus	a ground bug	0	0	-
Others to add, which are not current SoCC species				
Spiders				
Zodarion fuscum	a spider	0	0	-
Zodarion italicum	a spider	0	0	-
Zodarion rubidum	a spider	0	0	-
Birds				
Delichon urbica	House Martin	0	3	-
Passer domesticus	House Sparrow	0	5	-
Phoenicurus ochruros	Black Redstart	0	2	-
Sturnus vulgaris	Starling	0	2	-
(Turdus philomelos)	Song Thrush	4	18	51
Mammals				
Pipistrellus pipistrellus	(Pipistrelle Bat)	4	18	68

The analysis of the treatment of individual SoCCs that we, or Simonson and Thomas (1999), considered to be primarily associated with urban habitats indicates that few have been

[2] A listing for Stirling LBAP is assumed to be erroneous.

specifically addressed through the preparation of SAPs within LBAPs. The main exceptions to this include some Priority Species that have been listed in *Biodiversity: making the Links* (Simonson & Thomas 1999); in particular pipistrelle bat, song thrush and stag beetle. However, our re-evaluation of habitat use by these species suggests that these species are not particularly characteristic of urban areas and only have a secondary association with the habitat (see Section 2.3 above). Most other Priority Species that we do consider to be primarily associated with urban habitats appear to have been the subject of few or no LBAP SAPs. This is of some concern as it suggests that necessary conservation measures for these species may be being overlooked. However, the low number of SAPs may be partly due to their restricted distributions (eg *Marsupella profunda*), and one should remember that actions for species may be achieved through actions for habitats as a whole and for other species with similar habitat requirements.

It has not been within the scope of this study to analyse the treatment of all species that we consider to be primarily associated with urban habitats across all 179 LBAPs. Instead we have examined their treatment in all LBAPs that address Built-up Areas and Gardens and Inland Rock Broad Habitat types. This indicates that some of these species have indeed been addressed in LBAPs, including house sparrow (which is not listed as a SoCC or in *Biodiversity: making the Links*), but most have not. Again this is of some concern, but to be expected as many of these species were not considered to be primarily associated with these habitats by Simonson and Thomas (1999). Further actions should therefore be taken to address the conservation requirements of these species in urban areas, although in some cases further surveys and research may be required to confirm their status, habitat use and conservation needs.

In the course of examining the LBAPs that address Built-up Areas and Gardens a note was made of other local priority species or groups with a secondary association with these habitats that were the subject of SAPs. Amongst the 41 of these, the most commonly listed as being the subject of SAPs were bats (11), *Populus nigra* (9), hedgehog (6), swift (4), common toad (3) and slow worm (3).

4. UKBAP Species of conservation concern of urban habitats that may qualify as UKBAP Priority Species

One of the aims of this study is to identify UKBAP SoCCs of urban habitats that may qualify as UKBAP Priority Species. We have therefore compared the UK population status of the SoCCs with a primary association with urban habitats, as listed in Table 2.4, with the criteria for SoCCs and Priority Species status (see Box 1.2).

Table 4.1 below summarises the status of species that are primarily associated with urban habitats, but are not currently UKBAP Priority Species. This indicates that of all the SoCCs that are not already Priority Species, and that we consider to have a primary association with urban habitats, only three, the house sparrow, starling and the micro-moth *Nemophora fasciella* appear to qualify as Priority Species.

Both the house sparrow and starling clearly meet the criteria for Priority status as a result of recent well documented rapid declines (of over 50% in their UK breeding populations over 25 years), as a result of which they have been placed on the UK Red List (Gregory and others 2002).

Conservation measures for the house sparrow and starling may provide additional benefits for the invertebrate fauna of gardens, other insect predators (eg house martin and swift) and soil-invertebrate feeders (eg song thrush and blackbird). Furthermore, the house sparrow in particular could play the role of an urban and suburban flagship species. About 60% of its UK population occurs in towns, villages and rural gardens (Crick and others 2002) and populations in urban and suburban areas have declined by about 60% (Robinson and others, in press). The cause of the decline is uncertain, but it is thought to be at least in part due to a decline in small insects in gardens (Summers-Smith 1999). It is also a well known species and its declines have been the subject of considerable media interest.

Priority status should also be considered for the micro-moth *Nemophora fasciella,* which is a declining species as a consequence of direct conflicts between its ecological requirements and human desires for tidiness. After initial feeding on the seeds of the host plant – *Ballota nigra* (black horehound) – the caterpillar feeds on flower and leaf remains on the ground beneath the plant. The moth is more or less restricted to the south-east of England, especially the London Area, where it is a characteristic species of disturbed habitats. Adult moths may lay all their eggs on a single plant, so that whilst many plants at a given location will not support the species the few that do may support very large numbers. This extreme localisation of populations within a site clearly also adds to the vulnerability of the species.

Future consideration may also need to be given to the house martin, as this has shown a decline of some 33% between 1974 and 1999, and has consequently been added to the Amber list of Birds of Conservation Concern (Gregory and others 2003). There is also concern over swift populations, because these have declined in the UK by some 30% between 1994-2002 (Crick and others 2004), but the species is not currently Amber listed (Gregory and others 2002). The black redstart is also Amber listed by Gregory and others, but as a result of its small population size (maximum UK population of 77 pairs) and although its population trends are uncertain, it is not thought to have declined significantly.

Table 4.1 Current non-Priority UKBAP Species of Conservation Concern that are primarily associated with Built-up Areas and Gardens and post-industrial Inland Rock habitats.

Species that qualify for UKBAP Priority Species status are indicated in bold
Key. IUCN Status: LC = Least concern, V = vulnerable, NT = Near Threatened

Species group / species	Common name	IUCN Global Threat status	Reference	UK Rate of decline	Reference
Higher plants					
Senecio cambrensis	Welsh Groundsel	LC	www.redlist.org	Stable	Preston and others 2002
Sisymbrium irio	London Rocket	LC	www.redlist.org	Stable	Preston and others 2002
Insects					
Argyresthia trifasciata	a micro moth	LC		Increasing	Plant and others 2000
Gymnosoma nitens	a parasitic fly	LC		Stable	Plant and others 1996

Species group / species	Common name	IUCN Global Threat status	Reference	UK Rate of decline	Reference
Nemophora fasciella	**a micro moth**	LC		decreasing	Plant, C. W. unpublished data
Stictopleurus abutilon	a ground bug	LC		Increasing	Harvey 2004
Stictopleurus punctatonervosus	a ground bug	LC		Increasing	Harvey 2004
Others to add, which are not current SoCC species					
Spiders					
Zodarion fuscum[1]*	a spider	LC		Unknown	
Zodarion italicum[1]*	a spider	LC		Unknown	
*Zodarion rubidum[*1]*	a spider	LC		Unknown	
Birds					
Delichon urbica	House Martin	LC	(BirdLife International 2004)	Possible moderate decline	www.bto.org.uk
Passer domesticus[*1]	**House Sparrow**	**LC**		**>50% Decline**	**(Gregory and others 2003)**
Phoenicurus ochruros	Black Redstart	LC		Uncertain	
Sturnus vulgaris	**Starling**	**LC**		**>50% Decline**	**(Gregory and others 2003)**

Notes: *1 These species are not currently listed on the JNCC SoCC list.

It has not been possible within the scope of this study to systematically review the possible Priority status of the many SoCC species that have secondary associations with urban habitats. But some species that have come to our attention during the study that may also qualify as Priority Species could include the following, and further studies of their status may be warranted.

Lichens:

- *Peltigera rufescens* (associated with lime waste, PFA)
- *Cladonia pocillum* (associated with calcareous wastes)
- *Diploschistes muscorum* (associated with PFA)

Higher plants:

- *Ophrys apifera* - bee orchid
- Dactylorhiza - swarms of hybrid marsh orchids

- Possibly *Anacamptis pyramidalis* (pyramidal orchid) and *Gymnadenia conopsea* (fragrant orchid)
- *Osmunda regalis* - royal fern
- *Populus nigra ssp. betulifolia*, native black poplar (especially in Gt. Manchester and parts of Merseyside). Manchester poplars are now accepted as native black poplar and are suffering from the lethal disease poplar scab, which has in the last two years killed about 3000 of Manchester's 5-7000 black poplars.
- Existing Cheshire LBAP sp: Equisetum x trachyodon Mackay's horsetail, one of whose two major colonies is urban, the other coastal.

Invertebrates:

No invertebrates have come to our attention during this assessment process as likely candidates for addition to the UKBAP Priority list. However, a more thorough review of invertebrates listed as UKBAP SoCCS is underway in both England and Scotland.

5. Potential urban UKBAP Priority Habitats

The aim of this part of the study is to identify those habitats in the Built-up Areas and Gardens Broad Habitat category that it would be appropriate to recognise as Priority Habitats. Strictly speaking, this should exclude consideration of post-industrial habitats. However, such habitats are often of high nature conservation value and often found in urban situations and, for completeness, are therefore included in this review of habitat types.

5.1 Recently proposed additions to the UKBAP Priority Habitat list

In December 1998 the UK Biodiversity Targets Group agreed that JNCC should undertake a review to identify significant gaps in the BAP Priority Habitats series. This has been carried out by JNCC's Habitats Advice team using essentially the same criteria as those used by the UK Steering Group in 1995 for the identification of key (now referred to as Priority) habitats (as described in Box 5.1).

As a result of this review, proposals for seven new priority habitat types were presented to the UK Targets Group in February 2001 (paper UKTG-01-P03). The Group approved proposals for two of these types, Lowland Mixed Deciduous Woodland and Upland Birchwoods, and referred these to the Country Biodiversity Groups for comment. Subsequently, further consultation and analysis of the remaining five proposed types has been undertaken. Following amendments to definitions and names in some cases, it was considered that four of these types met the criteria for Priority Habitat status (Oligotrophic Lakes, Ponds of High Ecological Quality, Active Shingle Rivers and Montane Heaths). Of these only Ponds of High Ecological Value may normally occur in an urban landscape, but this habitat is not characteristic of urban areas and is, therefore, not considered further in this report.

It was also recognised that some post-industrial habitats that are often associated with urban areas (although within the Inland Rock Broad Habitat Type), are clearly of high biodiversity importance, in particular examples which support assemblages of rare invertebrates, bryophytes or lichens. The most important sites tend to be relatively old, or include workings which were started several decades ago. Their important flora and fauna may be relics of

colonisation from adjacent more natural habitats, such as heathland, which have subsequently been destroyed. Such sites are often subject to threats such as landfill, restoration for arable, industrial or housing use, or inappropriate conservation after-use. However, JNCC considered that there are considerable difficulties in defining these types satisfactorily while excluding the many examples which are of low conservation interest (Ian Strachan, pers. comm.). This problem is exacerbated by the lack of a national habitat classification for urban and related habitats although the Urban Inter-agency Working Group is proposing to address this.

Box 5.1. Criteria being used for the review of UKBAP Priority Habitats

Priority Habitats are defined in the UKBAP as:

1. Habitats for which the UK has international obligations

Particular attention has been given to those habitats listed on Annex I of the Habitats Directive which are not covered by existing priority habitats, notably certain freshwater and montane types. However, inclusion on Annex I was not considered to be sufficient justification on its own for UKBAP Priority Habitat status. Certain Annex I habitats are very rare in the UK and are considered to be protected adequately by the SAC network. Others are more widespread but are not considered to be sufficiently at risk to merit the preparation of HAPs at the present time.

2. Habitats at risk, such as those with a high rate of decline especially over the last 20 years, or which are rare

It is considered essential that any new priority type should meet this criterion, although in many cases it has proved difficult to quantify. Decline or threat in terms of habitat quality rather than extent is often the critical issue.

3. Areas, particularly marine areas, which may be functionally critical (essential for organisms inhabiting wider ecosystems)

This criterion is difficult to assess satisfactorily and is of varying relevance to the habitats proposed. It is particularly important for some freshwater types.

4. Areas important for BAP Priority Species

This criterion has been interpreted widely to include not just UKBAP Priority Species but also other species considered to be important in a national or international context, eg Red Data Book species and species listed on Annex II of the Habitats Directive. It is generally agreed that priority status should only be considered for a particular habitat if the production of a HAP would bring benefits additional to those of the action plans for associated species.

Following consultation, a number of additional principles have been applied in assessing or developing new proposals.

i. For any habitat to qualify as a priority type, there needs to be a demonstrable conservation benefit from having a HAP.

ii. The series of Priority Habitats should be a sub-set of semi-natural vegetation types for which co-ordinated conservation action across the UK is required, rather than a comprehensive list of habitats.

iii. Habitat definitions should be clear, mutually exclusive, and where possible defined in terms of existing vegetation classifications (eg NVC and Phase I). New priority types should generally fit within a single broad habitat.

iv. Priority types should be mappable and should have measurable quantitative or qualitative attributes for monitoring purposes.

v. Priority habitats should be defined at a broadly consistent hierarchical level.

However, JNCC concluded that the case for treating habitats occurring on substrates rich in heavy metals as a Priority Habitat (as originally suggested by Plantlife and by the JNCC Lowland Grassland Lead Coordination Network) is more straightforward and acceptable. Mine spoil rich in heavy metals and other unusual minerals is an important habitat for Calaminarian grasslands (EU Habitats Directive Annex 1) and related vegetation, in which

certain species or races of vascular plants, lichens and bryophytes occur which are specifically adapted to these conditions. These include four BAP priority species of bryophytes and a range of other rare species. The vegetation is sparse and open due to the toxicity and low nutrient status of the substrate. At most sites the metalliferous outcrops which would have been the natural habitat for these species have been quarried away but the mine spoil still provides suitable habitat.

The proposed priority habitat includes a large proportion of the total UK resource of the Annex I type Calaminarian grasslands, of which only a relatively low proportion occurs within SACs. Many sites supporting this habitat are under considerable threat from restoration or rehabilitation.

However, the heavy-metal rich examples exclude most of the important invertebrate habitats encompassed by the original proposal, and JNCC recommend that, if the more narrowly defined habitat described above is approved as a new priority type, further work should be undertaken to consider these other types.

The JNCC proposal was subsequently revised and provisionally named 'Rock outcrops and mine spoil rich in heavy metals'. Full details of the proposal, which was originally put forward by the Lowland Grasslands Lead Co-ordination Network and by Plantlife, are given in the standard format in Appendix 7.

5.2 Proposals from this study

Based on the assessment of the biodiversity value of the habitat types as distinguished in this study and the threats to them (see Tables 2.4, 2.6 and 2.7) we consider that few of the habitat types would qualify as Priority Habitats types according to the criteria and other factors being considered by the UK Biodiversity Targets Group (see Box 5.1).

However, there is a strong argument for including a group of habitats under a combined category of "Post-industrial sites of High Ecological Quality" as a Priority Habitat (whether in an urban setting or not). As described further below (using the standard JNCC Habitat Review headings) the habitat qualifies on most of the criteria listed above.

Although it is not easily definable or mappable according to existing vegetation classifications (eg NVC and Phase I), we consider that these methodological limitations should be secondary considerations. The difficulties in defining and mapping the habitat is due to limitations in the NVC and Phase 1 definitions, and is not a justifiable reason for ignoring the conservation of a highly valuable and threatened habitat. Furthermore, these are limitations that can be overcome with some further study, which Priority status might help facilitate. There are also existing examples of Priority Habitats that cannot equally be easily mapped or defined, or placed in one Broad Habitat Type (such as the proposed Rock Outcrops and Mine Spoil Rich in Heavy Metals Priority Habitat, which in many industrial areas would be better regarded as a habitat of Built-up Areas and Gardens).

The Proposed Priority Habitat for Ponds of High Ecological Quality also sets a precedent for defining habitats by associated fauna, and not just mappable NVC types.

The proposed Priority Habitat for Post-Industrial Sites of High Ecological Value could be taken to include habitats developed on heavy-metal mine spoil (under the proposed Rock

Outcrops and Mine Spoil Rich in Heavy Metals Priority Habitat), which exhibit many similarities of vegetation type, but these owe their character to particular toxins and include semi-natural counterparts eg serpentine soils, so are best treated separately. These habitats, including the Calaminarian grasslands (see Appendix 7), would exist as a type in the absence of man, whereas the post-industrial sites as defined in this proposal are all on man-made substrates.

Other habitats that we considered as possible Priority Habitats included the following types, but we do not propose these as Priority Habitats at present, often for lack of information.

- Urban Commons, ie demolition sites with more fertile and/or wetter substrates (including Habitat Types 3,3, 5.1, 5.2, 6.1, 6.2, 8.1, 8.3, 8.4 9.3 in Section 2.1). There is currently a lack of evidence that these have valuable invertebrate faunas compared with the post-industrial sites, though some uncommon lower plants have been found. Succession is much faster than on post-industrial sites, where it is not stopped by re-development or landscape treatment. However, further information is required to confirm this conclusion.
- Urban Rock ie walls, roofs, paths, cemeteries, churchyards (including Habitat Types 1.1, 1.2 and 1.3 in Section 2.1). These are fragmentary habitats that are difficult to conserve and map. However, they are possibly important for lichens, bryophytes and associated invertebrates (eg, relatively common moths such as *Cryphia domestica* – whose larvae feed on mosses and lichens on hard surfaces, may thrive on some roofs – though there is no specific data to confirm this). The invertebrates in these habitats are poorly known and should be studied further.
- Gardens, of high amenity value and of local importance to amphibians and invertebrates. Some evidence of importance for Priority bird species and bats, and some unusual lower plants occur, but more study is needed. High quality types could be defined, but it is difficult to see how Priority Habitat status would help biodiversity in this habitat.
- Urban Scrub - possibly important to invertebrate and bird communities, but further information is required.
- Habitat creation and creative conservation sites, which may be supporting significant biodiversity, but there is a need for much more information on their development.

As discussed previously, it is often the mix and continuity of habitats in the urban landscape that is of most importance to many species, rather than specific habitat types. Therefore, we also strongly recommend that a high priority is given to maintaining, and where possible, enhancing all remaining areas of semi-natural habitat in urban areas, rather than focussing solely on Priority Habitats and Priority Species. The need to conserve all such habitats should be taken into account through conservations actions (such as LBAPs) and in planning decisions. For example, many invertebrates, reptiles and amphibians would benefit from greater connectivity of semi-natural habitats, such as through railway embankments, green verges and environmentally friendly drainage systems (Bray & Gent 1997).

5.2.1 Proposal for Post-industrial Sites of High Ecological Quality as a Priority Habitat

Corresponding Habitats

Habitat types 3.3, 7.2, 8.1 and 8.2 as described in Chapter 2 and Table 2.1. BAP broad habitat: Inland rock.

Phase 1: Quarry, Spoil, Mine, Ephemeral/short perennial, Bare Ground.

NVC: Poor fit to described communities, a factor which has led to these sites being decried (Frith 2003). May have some similarities to OV21, OV22, OV28 and other open ground communities.

Other: poor fit to Shimwell, but includes 3B and artificial-substrate equivalents of 7A.

Description

As with ponds, it is necessary to differentiate high quality example from lesser ones. High quality ones will usually be "unmanaged flower-rich grasslands with sparsely-vegetated areas developed over many years on [edaphically-] poor substrates" (Harvey 2000, referring to the East Thames Corridor, but it applies to all types). It includes some very early pioneer communities on skeletal substrates, but most will be established open grasslands with many herbs, areas of bare ground, and often a little scrub, which can persist for decades on substrates whose edaphic conditions severely limit plant growth. Examples are substrates with extreme pH, whether alkaline (eg chemical wastes) or acid (eg colliery spoils), deficient in nitrogen (PFA), or available phosphate (highly calcareous Leblanc waste, blast furnace slag and calcareous quarry spoil), or water-deficient (dry gravel and sand pits).

All the above are primary successions, and as such unusual in the British landscape, especially the lowlands. This proposed category does not include demolition sites, where the substrate is usually a mixture of soil, brick rubble, concrete rubble and mortar, and noticeably more fertile with a different, largely secondary, succession (Gilbert's urban commons). It is not intended to include sites where the substrate was not significantly altered eg woods coppiced for ironworks fuel.

Invertebrate faunas on post-industrial sites can be species-rich and include many uncommon species (Eyre and others 2002, 2004). Between 12 and 15% of all nationally-rare and nationally-scarce insects are recorded from brownfield sites, which will include many post-industrial examples (Gibson 1998; Jones 2002). For example, Harvey (2000) recorded two UKBAP Priority bumble bees (*Bombus sylvarum*, *B.humilis*) and a rare parasitic fly *Gymnosoma nitens* on post-industrial sands and gravels in the East Thames corridor, whilst the rhopalid ground bugs *Stictopleurus abutilon* and *S. punctatonervosus* appear to be characteristic of such sites.

Plant assemblages are unusual, selected by propagule supply as well as site conditions (Ash, Gemmell & Bradshaw 1994 for several waste types, Shaw 1994 on PFA). These often include species declining in the wider countryside such as *Ophrys apifera*, *Gymnadenia conopsea* (alkaline wastes), *Epipactis youngiana* (acid waste), *Osmunda regalis* (acid sandstone quarries), *Peltigera rufescens* (lime waste, PFA), *Cladonia pocillum* (calcareous wastes), *Diploschistes muscorum* (PFA) and a BAP Priority lichen, *Petalophyllum ralfsii* (PFA).

Some sites are important for birds that are primarily associated with urban habitats, eg black redstart, as well as more widespread, but UKBAP Priority species, including song thrush, skylark, linnet and reed bunting.

Other BAP Priority Species use such sites for part or all of their life cycle eg great crested newt, and water vole (Stoke-on-Trent: Colin Hayes pers. comm), whilst such habitats can hold high densities of more widespread SoCCs, including common frog, common toad, common lizard, grass snake and slow worm.

Criteria for selecting sites of high ecological quality would include:

- Presence of UKBAP Priority Species (ie all globally threatened species and rapidly declining species; see Box 1.2).
- Presence of a significant population of any Red Data Book or Red Data List species.
- Presence of important populations of any UKBAP SoCC.
- Presence of a rich or rare assemblage of any species group.
- Particularly rich and/or large examples of habitats typical of the substrate concerned.
- Sites with particularly high value to the local population because of their wildlife.
- Sites with particularly high value to scientific study because of historical records.
- Sites which are good examples of primary succession.

Geographic distribution

Very widely distributed but concentrated in certain urban and former industrial areas. Many sites are urban, including ones originally urban-fringe which have now been surrounded by development. The Priority Habitat covers all post-industrial sites, whether urban or rural.

Reasons for recommendation

Habitats for which the UK has international obligations

None (Calaminarian grasslands would fall under the proposed Rock Outcrops and Mine Spoil Rich in Heavy Metals Priority Habitat)

Habitats at risk

Sites supporting this habitat are often considered to be of low value, unsightly and sometimes hazardous. They are under considerable threat from landfill, industrial use and housing, which is often targeted towards "brownfield" sites. Many are reclaimed as greenspace for wildlife or recreation, often at great expense. Such reclamation is often misinformed and influenced heavily by visual appearance, and usually involves the importation of fertile soils, landscaping and planting of grasses, herbs and trees, which is generally disastrous to the existing wildlife interest.

Although a few have been given statutory protection as SSSIs eg Nob End Leblanc Tip, Bolton, or LNRs eg Pelsall North Common, Walsall (Urban Wildlife News 1991), most have

little protection as Local Wildlife Sites or none at all. The best examples were usually created some decades ago by industries that are now defunct (Leblanc, blast furnace slag), or spoil disposal methods that are no longer used (Solvay), and few would now be allowed by planning conditions to stay untreated long enough to acquire a valuable flora or fauna. They are therefore effectively irreplaceable. At the time of their creation/abandonment, the general landscape was much richer in species to provide a propagule supply, and some sites were urban fringe rather than truly urban. Time also allows more chance for long-distance colonists to arrive, especially plants.

Many sites have been lost eg all the Widnes and most of the St. Helens Leblanc heaps, most of Wigan's colliery tips, five out of six London Sites of Metropolitan Importance (*Urban Wildlife News 1997*). Remaining ones are now changing into scrub and/or tall tussock grassland and in desperate need of suitable management (eg Nob End SSSI). Suitable management in these cases may involve re-starting the succession by removing the organic layer in sections to reveal the underlying waste or substrate (Kirby 1992; Shaw 1994 and H. Ash in Urban Wildlife News 1994). The stage of this succession most valuable to biodiversity is the open, flower-rich grassland which persists without management for decades, but eventually accumulates sufficient nutrients for dense grassland and/or scrub to develop.

Habitats which are functionally critical

These habitats are vital to many invertebrate species which require bare ground for basking/nesting and nectar sources for adult feeding, especially aculeate Hymneoptera and Coleoptera.

Such habitats are increasingly rare in the general landscape, as eutrophication has become marked (Preston and others 2002a). They may be particularly valuable as the climate changes, being sufficiently open to allow colonisation by suitably adapted species.

Habitats important for key species

These post-industrial habitats can be exceptionally important for invertebrate communities, with very rich faunas and large numbers of rare species (Eyre and others 2002, 2004). Typically these include thermophilic sabulicolous and lapidicolous species, notably of Hymenoptera and Coleoptera, but also including other taxonomic groups with requirements for bare substrate, sandy burrowing or nesting sites, and nectar sources (Falk 2000). This fauna includes a high proportion of Red Data Book, Nationally Scarce and some UKBAP Priority species.

Conservation gain

The conservation of this habitat is a very complex and neglected issue which requires action by many parties. A HAP would provide an incentive and justification to do so. Pleas for the protection of these sites have been issued for decades (eg Greenwood & Gemmell 1978; Kelcey 1997; Landlife 1991; Shaw 1994; Teagle 1978, 1995).

The fauna and flora of these sites are important in their own right and make a significant contribution to the urban areas where they occur. Their conservation can on occasion be combined with development (eg Canvey Island, Urbio 2004). It can also where suitable be

combined with amenity treatment of part of the site to improve the visual effect for local residents (eg Colliers Moss, St. Helens, Groundwork Trust). People need green spaces in urban areas (Urban Wildlife News 1994), and in many urban areas a significant proportion of greenspace is post-industrial. Most of these sites are robust and can be used for recreation and education (Table 2.6 this report, Bradshaw 2003), providing a valuable resource in many urban areas where access to other wildlife areas is difficult.

6. Conclusions and recommendations

6.1 Urban habitat types and their biodiversity importance

This study has developed a simple habitat typology, primarily based on substrate characteristics and associated vegetation types. And although there are some limitations with the applicability of this to mobile fauna, such as birds and many invertebrates, it has provided a workable framework for assessing the biodiversity importance of urban habitats.

The assessment firstly considered the extent to which urban habitats are used by UKBAP Species of Conservation Concern (SoCCs). Overall, this assessment revealed that 123 SoCCs (or species qualifying as such) have a primary or secondary association with Built-up Areas and Gardens and Inland Rock, as defined by the UK Broad Habitat Types. Of these 35 are Priority Species, of which two have a primary association with Built-up Areas and Gardens, and 16 have a secondary association. Eleven have a primary association with Inland Rock and seven have a secondary association.

In contrast *Biodiversity: making the links* (Simonson & Thomas 1999) considered that only nine Priority Species have a primary or secondary association with "natural rock exposures and built environments". This strongly indicates that previous assessments of the use of urban habitats by English Nature in *Biodiversity: making the links* probably significantly underestimated the importance of urban habitats to a variety of Priority Species.

However, most of the individual assessments of habitat use should be treated with caution as many SoCCs, especially amongst the fungi, lower plants and invertebrates, are poorly known.

The assessment of use by SoCCs was taken into account in a general evaluation of the biodiversity importance of each urban habitat type, using a range of criteria to assess (in semi-quantitative terms) biodiversity value, amenity value and threat status. This broad evaluation suggested that the majority of urban habitat types are of moderate or high overall conservation importance, often in terms of both biodiversity and social value. Perhaps the most important in biodiversity terms (eg associated SoCCs, rarity, diversity, naturalness and fragility) are a range of post-industrial sites (with important and often relatively unique vegetation communities and associated invertebrate assemblages). These habitats are particularly threatened as a result of land reclamation for residential or industrial estates etc, and without management are prone to degradation through natural succession to scrub (Gilbert 1989, Ash 1999, Greenwood 1999). Furthermore, few new sites are being created that can replace such habitats.

Some ponds and other still waters (and associated lichen and bryophyte communities), tall grasslands, gardens and the urban commons are also of significant biodiversity value, but such habitats are generally less threatened.

Some habitats also stand out as being of particularly high value to people (eg in terms of their aesthetic appeal and cultural values, or in terms of their value for education, research and recreation). These are a somewhat different suite of habitats which includes some post-industrial sites, some urban commons, some tall grasslands, many still waters, some areas of scrub and woodland – and of course, gardens. But most importantly, all urban wildlife has value, because it has one very important characteristic – it is where people are and where people may be able to experience it. If the 80-90% of the population of the UK that lives in urban areas is going to have any concern for wildlife and its future, they need to experience it for themselves, not just on a TV screen. Any site in the urban area which supports accessible, visible wildlife ought to have a higher value than is currently placed on it from narrow purely scientific biodiversity assessments, and consequently should be given higher priority in Development Plans and monetary evaluations. This conclusion applies to encapsulated countryside and urbanised coasts as well as the habitats dealt with in this report.

6.2 The representation of urban habitats and associated species within LBAPS

This study included a review of the extent to which urban habitats and their associated species have been addressed through the preparation of Species Action Plans (SAPs) within Local Biodiversity Action Plans (LBAPs). This firstly revealed that 23 % (ie 41) of the total of 179 LBAPs have action plans for some part of the Built-up Areas and Gardens despite being a Broad Habitat type rather than a Priority Habitat type. This strongly suggests that such habitats are being given a relatively high priority, above that which might be expected from the national UKBAP. However, in contrast few plans addressed Inland Rock habitats, which seems to indicate that the importance of some forms of this Broad Habitat type (such as post-industrial sites) are being overlooked.

Our analysis of the treatment of individual UKBAP Priority Species revealed that few that are primarily associated with urban habitats have been specifically addressed through the preparation of SAPs within LBAPs. The main exceptions to this include some Priority Species that have been listed in *Biodiversity: making the Links* (Simonson & Thomas 1999); in particular pipistrelle bat, song thrush and stag beetle. Most of the other characteristic urban species, that from this study we now consider should be Priority Species (but were not listed in *Biodiversity: making the Links*), have been the subject of few or no LBAP SAPs. This is of some concern as it suggests that necessary conservation measures for these species may be missed.

Examination of the treatment of other SoCCs with a primary association with urban habitats, showed that, amongst the LBAPs that address Built-up Areas and Gardens and Inland Rock Broad Habitat types, few species have been the subject of SAPs. Again this is of some concern, but to be expected as many of these species have not until now been considered to be primarily associated with these habitats.

In conclusion this study has shown that many LBAPs appear to be addressing urban conservation needs through Action Plans for the Built-up Areas and Gardens Broad Habitat Type, rather than through specific actions for species (ie through a SAP). In many cases these actions may be adequate. However, some specific actions for particular species may be overlooked. And there may be a particular problem for species associated with urban habitats that fall within the Inland Rock Broad Habitat type. And this type includes post-industrial habitats, many of which are likely to be of high conservation value.

This strongly suggests that further measures should be taken to encourage the production of HAPs for Inland Rock habitats and SAPs for Priority Species that are primarily associated with urban habitats according to the results of this study. However, the problem could probably be better dealt with by the recognition of Priority Habitat status for Rock Outcrops and Mine Spoil Rich in Heavy Metals, and Post-industrial Sites of High Ecological Quality (see 6.4 below).

6.3 UKBAP Species of Conservation Concern of urban habitats that may qualify as UKBAP Priority Species

This study has found that only three characteristically urban species that are not currently Priority Species merit an increase to Priority status, at least on existing information and known population trends. The species with the strongest cases for revised listing as Priority Species are house sparrow and starling. Both qualify as Priority Species because of recent well documented rapid population declines (of over 50% in their UK breeding populations over 25 years), as a result of which they have been placed on the UK Red List (Gregory and others 2002). As Priority Species they may benefit from concerted actions that could be drawn together under SAPs, which might also benefit a range of other urban species. The house sparrow may also be a particularly effective flagship species for urban and garden nature conservation.

Priority status should also be considered for the micro-moth *Nemophora fasciella,* which appears to be declining as a consequence of direct conflicts between its ecological requirements and human desires for tidiness.

6.4 Potential urban UKBAP Priority Habitats

This study supports the previous proposal by JNCC to the UKBAP Targets Group for the recognition of a "Rock Outcrops and Mine Spoil Rich in Heavy Metals" Priority Habitat (which includes the EU Habitats Directive listed Calaminarian grasslands). However, this habitat is relatively narrowly defined. Although it would help conserve some post-industrial sites, it would, as recognised by the Targets Group, not deliver conservation actions that are required for a range of other post-industrial sites, such as those that hold important associated invertebrate communities.

We therefore consider that there is a strong case for the recognition of a group of habitats under a combined category of "Post-industrial Sites of High Ecological Quality" as a Priority Habitat. This habitat type meets the key criteria for Priority Habitats, because it is both ecologically valuable and threatened. This Priority Habitat would be in addition to the JNCC proposal for Rock Outcrops and Mine Spoil Rich in Heavy Metals, which exhibit many similarities in vegetation type, but these owe their character to particular toxins and include semi-natural counterparts. Whereas the post-industrial sites, as defined in this proposal, are all on man-made substrates and are therefore best treated separately.

No other habitat clearly meets the criteria for UKBAP Priority status at the current time. However, we suggest that further research and subsequent consideration should be given to urban commons (ie demolition sites with more fertile / wetter substrates), urban rock habitats (ie walls, roofs, paths, cemeteries and churchyards), gardens and urban scrub.

6.5 Recommendations for further research and monitoring

A general conclusion from this study is that much more information is required to enable more reliable assessments of the biodiversity value of many urban habitats, especially with regard to their importance for fungi, lichens, lower plants and many invertebrate groups. In particular much more information is required on the distribution of many species and the extent to which they rely on habitats that are characteristic of urban areas and created by industrial or other human activities.

It is therefore suggested that priority areas for research should include:

- The distribution of fungi, lichens, bryophytes and the characterisation of invertebrate assemblages in the various categories of urban habitats and their reliance on these.
- Studies on gardens and their value for biodiversity – the Sheffield BUGS study needs replicating elsewhere to see how typical it is.
- Research into the biodiversity value of urban commons (demolition sites, railway lines, etc.) especially regarding the later stages of scrub and woodland, including the characterisation of invertebrate assemblages.
- Identification of species and characterisation of species assemblages of high conservation importance on post-industrial sites, examination of their habitat requirements and appropriate management methods for these sites.
- Studies on habitat creation and creative conservation sites, to evaluate the developing communities, including invertebrate assemblages, and their role in increasing biodiversity, especially in areas of low existing biodiversity.

We also conclude that further monitoring is required of many urban habitats to establish population trends within urban areas, as many current schemes omit these or under-represent them. Monitoring and surveillance is also urgently required of broader ecological changes and process in many urban habitats, in order to better understand their importance and conservation management needs. It is therefore suggested that priority areas for monitoring should include:

- Improved monitoring of inadequately surveyed groups, including fungi, lichens, lower plants, most invertebrate groups, amphibians and reptiles.
- Coverage of urban habitats where there these are omitted or under-represented in existing national monitoring schemes.
- Monitoring of post-industrial sites so that appropriate management can be started as necessary. Given that the most valuable plant and invertebrate communities occur in the protracted open-grassland stage, it is valuable to biodiversity to retain them in this stage, but further information is needed on the extent to which management measures are effective in achieving this.
- Monitoring of urban habitat creation sites to assess their effectiveness and value in biodiversity terms, as opposed to amenity terms.

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Urban Wildlife News (1994). All change in Bebington Vol 11: no3,p10
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Urbio (2002) High-rise habitats. Issue 3, pp 12-13
Urbio (2004). Brown jewels. Issue 5: p8.

Appendices

Appendix 1. List of consultees

Bat Conservation Trust
British Lichen Society
British Mycological Society
British Trust for Ornithology
BugLife
Butterfly Conservation
CCW
Centre for Ecology and Hydrology
DEFRA
Dr Ian Rotherham, Sheffield Hallam University
Dr Jon Sadler, University of Birmingham
English Nature
Environment and Heritage Service (NI)
Eric Greenwood
Federation of Biological Recorders
George Barker
Herpetological Conservation Trust
JNCC
Kevin Gaston & Ken Thompson – BUGs project, University of Sheffield
LandLife
Mammal Society
Martin Wigginton
Mick Eyre, Entomological Monitoring Services
National Federation for Biological Recording
Oliver Gilbert
Peter Shepherd, Baker Shepherd Gillespie
PlantLife
Pond Conservation Trust
Professor Tony Bradshaw
Professor John Handley, University of Manchester
RSPB
SNH
Steven Falk, Warwickshire Museum
UK MAB Urban Forum
Wildlife Trusts

Appendix 2. Glossary and acronyms

Birds Directive	EU Council Directive 79/409/EEC on the Conservation of Wild Birds
CROW Act	Countryside and Rights of Way Act 2000
Crytophyte	A perennial plant with renewal buds below ground or water level
cSAC	Candidate Special Area of Conservation
Defra	Department for the Environment, Food & Rural Affairs
EA	Environment Agency
Edaphic	Pertaining to or influenced by the nature of the soil
EN	English Nature
EU	European Union
Habitats Directive	EU Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora
HAP	Habitat Action Plan
Hydrophyte	A plant adapted to live in water or in very wet conditions, and or requiring wet conditions for optimal growth.
Lapidicolous	Living under or among stones
LBAPs	Local Biodiversity Action Plan (see Box 1.1)
Liythophyte	A plant growing under or amongst stones
NVC	National Vegetation Classification
PFA	Pulverised Fuel Ash
Priority Habitat	Habitats identified as being a priority in the UK BAP (see www.ukbap.org.uk), see Box 5.1.
Priority Species	Species identified as being a priority in the UK BAP (see www.ukbap.org.uk) because they are globally threatened and/or rapidly declining in the UK (see Box 1.2)
Ruderal	A plant characteristic of open, disturbed conditions, often resulting from human activity.
Sabulicolous	Living in sand
SAC	Special Area of Conservation, designated under the EU Habitats Directive (EU Council Directive 92/43/EEC on the conservation of natural habitats of wild fauna and flora).
SAP	Species Action Plan
Saxicolous	Living in or growing amongst rocks
Semi-natural	Plant associations often created by direct or indirect effects of man.
SoCC	Species of Conservation Concern (see Box 1.2)
SPA	Special Protection Area, designated under the EU Wild Birds Directive (*Council Directive 79/409/EEC on the conservation of wild birds*).
Species of Conservation Concern	Species listed as being of conservation concern in the UK BAP (see Box 1.2).
SSSI	Site of Special Scientific Interest
Thermophilic	A species that thrives in warm conditions
UKBAP	The UK Biodiversity Action Plan (see Box 1.1). Although no single document exists that is called the UK BAP, this terms is widely used to refer to the total programme of actions identified as part of implementation of the UK Biodiversity Strategy (see www.ukbap.org.uk).

Appendix 3. National Vegetation Classification (NVC) communities (Rodwell 1991a, b, 1992, 1995, 2000) referred to in this report

Nvc types cited in urban habitat descriptions

Where descriptions were drawn up to refer to semi-natural rural habitats, the fit between these and urban habitat types is usually poor.

W6 *Alnus glutinosa-Urtica dioica* woodland
W21 *Crataegus monogyna-Hedera helix* scrub
W23 *Ulex europeaus-Rubus fruticosus* agg. scrub

M27 *Filipendula ulmaria-Angelica sylvestris* mire

MG1 *Arrhenatherum elatius* grassland
MG2 *Arrhenatherum elatius-Filpendula ulmaria* tall-herb grassland
MG7 *Lolium perenne* leys and related grasslands
MG9 *Holcus lanatus-Deschampsia cespitosa* grassland
MG10 *Holcus lanatus-Juncus effusus* rush pasture
MG11 *Festuca rubra-Agrostis stolonifera-Potentilla anserina grassland*
MG12 *Festuca arundinacea* grassland
MG13 *Agrostis stolonifera-Alopecurus geniculatus* grassland
CG10 *Festuca ovina-Agrostis capillaris-Thymus praecox* grassland
U1 *Festuca ovina-Agrostis capillaris-Rumex acetosella* grassland
U2 *Deschampsia flexuosa* grassland

A1 *Lemna gibba* community
A2 *Lemna minor* community
A5 *Ceratophyllum demersum* community
A7 *Nymphaea alba* community
A8 *Nuphar lutea* community
A9 *Potamogeton natans* community
A10 *Polygonum amphibium* community
A12 *Potamogeton pectinatus* community
A15 *Elodea canadensis* community
A16 *Callitriche stagnalis* community
S4 *Phragmites australis* swamp
S6 *Carex riparia* swamp
S7 *Carex acutiformis* swamp
S12 *Typha latifolia* swamp
S14 *Sparganium erectum* swamp
S22 *Glyceria fluitans* swamp
S23 Other water margin vegetation
S26 *Phragmites australis-Urtica dioica* tall-herb fen
S28 *Phalaris arundinacea* tall-herb fen

OV7 *Veronica persica-Veronica polita* community
OV8 *Veronica persica-Alopecurus myosuroides* community
OV9 *Matricaria perforata-Stellaria media* community
OV10 *Poa annua-Senecio vulgaris* community
OV11 *Poa annua-Stachys arvensis* community
OV12 *Poa annua-Myosotis arvensis* community
OV13 *Stellaria media-Capsella bursa-pastoris* community
OV14 *Urtica urens-Lamium amplexicaule* community
OV15 *Anagellis arvensis-Veronica persica* community
OV18 *Polygonum aviculare-Chamomilla suavolens* community
OV19 *Poa annua-Matricaria perforata* community
OV21 *Poa annua-Plantago major* community
OV22 *Poa annua-Taraxacum officinale* community
OV23 *Lolium perenne-Dactylis glomerata* community
OV24 *Urtica dioica-Galium aparine* community
OV25 *Urtica dioica-Cirsium arvense* community
OV26 *Epilobium hirsutum* community
OV27 *Epilobium angustifolium* community
OV28 *Agrostis stolonifera-Ranunculus repens* community
OV29 *Alopecurus geniculatus-Rorippa palustris* community
OV30 *Bidens tripartita-Polygonum amphibium* community
OV31 *Rorippa palustris-Filaginella uliginosa* community
OV33 *Polygonum lapathifolium-Poa annua* community
OV39 *Asplenium trichomanes-Asplenium ruta-muraria* community
OV41 *Parietaria diffusa* community
OV42 *Cymbalaria muralis* community

Appendix 4. Scientific names of vertebrates referred to in this report.

Amphibians

Common frog *Rana temporaria*
Common toad *Bufo bufo*
Great crested (Warty) newt *Triturus cristatus*
Palmate newt *Triturus helveticus*
Smooth newt *Triturus vulgaris*

Reptiles

Adder *Vipera berus*
Common (Viviparous) lizard *Lacerta vivipara*
Grass snake *Natrix natrix*
Sand lizard *Lacerta agilis*
Slow worm *Anguis fragilis*

Birds

Taken from *The British List* as published by British Ornithologists Union on their website

Black redstart *Phoenicurus ochruros*
Blackbird *Turdus merula*
Blackcap *Sylvia atricapilla*
Black-headed Gull *Larus ridibundus*
Blue tit *Parus caeruleus*
Brambling *Fringilla montifringilla*
Bullfinch *Pyrrhula pyrrhula*
Carrion crow *Corvus corone*
Chaffinch *Fringilla coelebs*
Coal tit *Parus ater*
Dunnock (Hedge Accentor) *Prunella modularis*
Eurasian collared dove *Streptopelia decaocto*
European (European goldfinch) *Carduelis carduelis*
Fieldfare *Turdus pilaris*
Garden Warbler *Sylvia borin*
Goldcrest *Regulus regulus*
Great spotted woodpecker *Dendrocopos major*
Great tit *Parus major*
Greenfinch (European greenfinch) *Carduelis chloris*
House martin *Delichon urbica*
House sparrow *Passer domesticus*
Jacdaw (Eurasian jackdaw) *Corvus monedula*
Jay (Eurasian jay) *Garrulus glandarius*
Kestrel *Falco tinnunculus*
Lapwing (northern lapwing) *Vanellus vanellus*
Lesser black-backed gull *Larus fuscus*
Linnet *Carduelis cannabina*
Little Ringed Plover (Little Plover) *Charadrius dubius*
Long-tailed tit *Aegithalos caudatus*
Magpie (Black-billed magpie) *Pica pica*
Marsh tit *Parus palustris*
Mistle thrush *Turdus viscivorus*
Redwing *Turdus iliacus*
Reed Bunting *Emberiza schoeniclus*
Robin (European robin) *Erithacus rubecula*
Rook *Corvus frugilegus*
Sand martin *Riparia riparia*
Siskin (Eurasian siskin) *Carduelis spinus*
Sky lark *Alauda arvensis*
Song thrush *Turdus philomelos*
Sparrowhawk *Accipter nisus*
Spotted flycatcher *Muscicapa striata*
Starling *Sturnus vulgaris*
Swallow (Barn swallow) *Hirundo rustica*
Swift *Apus apus*
Tawny owl *Strix aluco*
Tree sparrow (Eurasian Tree Sparrow) *Passer montanus*
Waxwing (Bohemian waxwing) *Bombycilla garrulus*
White / Pied wagtail *Motacilla alba*
Willow warbler *Phylloscopus trochilus*
Wood pigeon *Columba palumbus*
Wren (Winter wren) *Troglodytes troglodytes*
Yellowhammer *Emberiza citrinella*

Mammals

Badger *Meles meles*
Barbastelle bat *Barbastella barbastellus*
Brown long-eared bat *Plecotus auritus*
Common shrew *Sorex araneus*
Daubenton's bat *Myotis daubentoni*
Fox *Vulpes vulpes*
Hedgehog *Erinaceus europaeus*

House mouse *Mus muculus*
Noctule *Nyctalus noctula*
Pipistrelle *Pipistrellus pipistrellus* (as listed in the UKBAP, but it was recently discovered that this comprises two species in the UK: the soprano pipistrelle (*Pipistrellus pygmaeus*) is now recognised as a separate species to the common pipistrelle (*P. pipistrellus*). A third pipistrelle, (*P. nathusii*) is also now known to breed in England and Northern Ireland.
Rabbit *Oryctolagus cuniculus*
Serotine bat *Eptesicus serotinus*
Short-tailed vole (Field vole) *Microtus agrestis*
Stoat *Mustela erminea*
Water vole *Arvicola terrestris*
Weasel *Mustela nivalis*

Appendix 5. Criteria used for the evaluation of habitats

Criteria	Application
Ecological value	
1. Importance for EU threatened habitats	Habitats that include types that are listed in Annex 1 of the EU Habitats Directive will be of high value.
2. Importance for UKBAP species of conservation concern	Habitats that include large numbers of species that are UK BAP Species of Conservation Concern will be of high value, particularly if a high proportion of these are Priority Species, or are considered to be threatened in the UK (and accordingly listed in a UK Red Data book or equivalent) or threatened in Europe (and accordingly listed in Annex II of the Habitats Directive or Annex 1 of the Birds Directive). Habitats that hold a high proportion of the UK population of a Priority Species, UK threatened species or European threatened species will be of particularly high value.
3. Diversity	Habitats that exhibit a high level of structural, bio-physical and species diversity or richness (ie the number of species present) will typically be of high value. However, consideration will also be given to some habitats of naturally low diversity, such as some plant communities associated with heavy metal rich soils or highly acidic conditions. Low diversity may be of value in these circumstances as the species that are present are often uniquely associated with such habitats and therefore contribute to species diversity at larger scales (eg national scales).
4. Rarity	Habitats that are rare will be of particular value, especially if naturally so. Note: The presence of rare species is taken into account Criterion 2 above.
5. Naturalness	Habitats that are least modified and are dominated by native species will have a high value, as they are more likely to have intact ecosystems and associated plant and animal communities, often including rare species as such habitats tend to be relatively rare. They also have high scientific value and often aesthetic appeal. However, consideration will be given to artificial habitats that exhibit natural ecosystem processes or mimic natural biophysical characteristics. For example, some post-industrial sites may provide habitats that are analagous to some natural geological features, or are undergoing natural succession although on un-natural substrates.
6. Uniqueness	Habitats that have unique biophysical properties and associated vegetation and species assemblages will be of particular value, especially if are relatively natural (see above) .
Social value	
1. Educational & scientific importance	Habitats that are of particular value for educational purposes because they are accessible and safe and have, for example, abundant and visible wildlife or particular properties that can be used to demonstrate ecological concepts will be of high value. A high value will also be given to habitats that are especially important for scientific research, eg because they have unusual properties or are particularly suited to study.
2. Amenity value (recreational use)	A high value will be given to habitats that are popular and used frequently or valued by people for cultural, recreational, health and spiritual reasons, and therefore fulfil an important amenity value. Such habitats are typically intrinsically appealing and safe to visit.
Threat status	
1. Rate of loss	A high conservation priority will be given to habitats that are undergoing a rapid or long term decline in extent. Consideration will also be given to habitats that are likely to be lost as a result of known developments or predicted land-use changes.
2. Rate of degradation	A high conservation priority will be given to habitats that are undergoing a rapid or long term decline quality, eg as a result of inadequate or inappropriate management, pollution, disturbance, or other environmental changes.
3. Fragility	A high priority will be given to habitats that are especially vulnerable or sensitive to anthropogenic change, or natural changes (such as succession) that need to be managed if their biodievsrity values are to be maintained.
4. Irreplaceability	Habitats that cannot be easily and quickly replaced (in terms of bio-physical properties, ecosystem processes and species communities) will be of high priority.

Appendix 6. Local Biodiversity Action Plans that address the "Built-up Areas and Gardens" and "Inland Rock" Broad Habitat type

Source: UKBAP website (http://www.ukbap.org.uk/UKPlans.aspx?ID=62), accessed 26 January 2004

Built-up areas and gardens

A 50 Year Vision for the Wildlife and Natural Habitats of Hertfordshire
A Biodiversity Action Plan for Northamptonshire
Ayrshire
Bedfordshire and Luton
Bexley Biodiversity Action Plan
Biodiversity Action Plan for the Lee Valley Regional Park
Biodiversity Action Plan for Worcestershire
Biodiversity in the East Riding of Yorkshire
Birmingham and Black Country
Brent Biodiversity Action Plan
Bromley Local BAP
Cambridgeshire Biodiversity Action Plan
Clackmannanshire Biodiversity Partnership
Dacorum Borough Nature Conservation Strategy
East Lothian Biodiversity
Eastleigh Borough Biodiversity Action Plan
Edinburgh Biodiversity Partnership
Glasgow City Biodiversity Action Plan
Hambleton BAP
Hounslow Local BAP
Hull Local Biodiversity Action Plan
Lewisham Local BAP
London Borough of Merton Biodiversity Action Plan
North East Scotland Biodiversity Partnership
North Tyneside
Oxfordshire's Habitat Action Plans
Rotherham Local Biodiversity Action Plan
Shropshire Biodiversity Action Plan
Southwark Local BAP
Stirling Council Area Biodiversity Action Plan
Stockport's Action Plan for Nature
Tayside Biodiversity Action Plan
Teignbridge BAP
The National Forest
Torfaen LBAP
Waltham Forest Biodiversity Action Plan
Warwickshire, Coventry and Solihull Local Biodiversity Action Plan
Wiltshire Biodiversity Action Plan
Wokingham District
Working for Wildlife; the Northumberland Biodiversity Action Plan
Your Wildlife. The Newcastle Biodiversity Action Plan

Inland Rock

A Biodiversity Action Plan for Bolton
Action for Wildlife: The Dartmoor Biodiversity Action Plan
Lowland Derbyshire Biodiversity Action Plan

Rotherham Local Biodiversity Action Plan
Stirling Council Area Biodiversity Action Plan
Teignbridge BAP
Telford and Wrekin

Appendix 7. A revised proposal for 'rock outcrops and mine spoil rich in heavy metals' as a UKBAP Priority Habitat

Habitat Name: Rock outcrops and mine spoil rich in heavy metals

Corresponding Habitats

BAP broad habitat:	Inland rock
Phase 1:	I1.2 Scree; I2.2 Spoil
NVC:	OV37 and other undescribed types
Annex I:	6130 Calaminarian grasslands of the *Violetalia calaminariae*

Description

Includes a range of semi-natural and anthropogenic sparsely vegetated habitats on substrates characterised by high levels of heavy metals such as lead, chromium and copper, or other unusual minerals. These are associated with outcrops of serpentine and river gravels rich in heavy metals, as well as with artificial mine workings and spoil heaps. Seral succession is slowed or arrested by the toxicity of the substrate. Open-structured plant communities, sometimes known as 'Calaminarian grasslands', typically occur, composed of ruderal/metallophyte species of lichens, bryophytes and vascular plants, such as spring sandwort *Minuartia verna*, alpine pennycress *Thlaspi arvense*, and genetically adapted races of species such as thrift *Armeria maritima* and bladder campion *Silene maritima*. Notable species include *Epipactis youngiana*, *Asplenium septentrionale* and *Ditrichum plumbicola.* In northern parts of the UK there are local populations of boreal species which characterise these habitat conditions in Scandinavia, such as Scottish sandwort *Arenaria norvegica* and the endemic Shetland mouse-ear *Cerastium nigrescens*.

In most sites the metalliferous outcrops which would have been the natural habitat for these species have been quarried away but the mine spoil still provides suitable habitat.

Geographic Distribution

Natural occurrences are restricted to serpentine exposures and scree in scattered parts of the Scottish Highlands and Islands and other upland areas, and on river deposits. Anthropogenic stands are more common but still local, in certain urban and post-industrial areas, especially in the north and west.

Reasons for Recommendation

Habitats for which the UK has international obligations

This habitat includes the total UK resource of the Annex I type 6130 Calaminarian grasslands of the *Violetalia calaminariae*.

Habitats at risk

Sites supporting this habitat are often considered to be of low value, unsightly, and sometimes hazardous. The toxic nature of the soils means that successional changes are slow but a greater threat is the rehabilitation of derelict land, often with grant aid from the EC and Government. Such restoration is often misinformed, usually involving landscaping, levelling topography, spreading topsoil and planting grasses, herbs and trees, all of which are usually very damaging to the intrinsic wildlife interest.

Habitats which are functionally critical

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Habitats important for key species

Plants of heavy metal spoil include the following BAP species: Cornish path moss *Ditrichum cornubicum*, lead path moss *Ditrichum plumbicola*, western rustwort *Marsupella profunda* (also listed on Annex II of the Habitats Directive), the liverwort *Cephaloziella nicholsonii*, and Young's helleborine *Epipactis youngiana.*

Conservation Gain

The conservation of this habitat is a very complex and neglected issue which requires a strategic approach involving many parties. A HAP would provide an excellent mechanism for taking this forward.

SUGGESTED LEAD AGENCY	NAME OF PROPOSER/ORGANISATION
English Nature or Countryside Council for Wales	Martin Harper (Plantlife); Richard Jefferson (EN) & David Stevens (CCW) for the Lowland Grassland LCN.

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Top left: Using a home-made moth trap.
Peter Wakely/English Nature 17,396
Middle left: Co_2 experiment at Roudsea Wood and Mosses NNR, Lancashire.
Peter Wakely/English Nature 21,792
Bottom left: Radio tracking a hare on Pawlett Hams, Somerset.
Paul Glendell/English Nature 23,020
Main: Identifying moths caught in a moth trap at Ham Wall NNR, Somerset.
Paul Glendell/English Nature 24,888