

Introduction to brownfields

Brownfields can be havens for wildlife, supporting some of the UK's most threatened species, while often being the last 'wild space' in urban areas for local communities. The value of brownfields is slowly being recognised with two of the top five most biodiverse sites in the UK being brownfields. However, despite a greater understanding of the important of brownfields, they continue to be prioritised for development threatening the future of some of our most special wildlife.

What are brownfields?

Brownfields are any piece of land which has been altered by human activity. These can be extremely varied, including anything from former industrial estates to quarries, spoil heaps to disused railway lines or landfill sites to disused airfields. Brownfields are now listed as a Priority habitat on Section 41 of the Natural Environment and Rural Communities Act 2006 (NERC Act) under the name of 'Open mosaic habitat on previously developed land'. A set of criteria has been established to distinguish wildlife-rich habitat from brownfield sites of negligible wildlife value, such as homogenous areas dominated by hardstanding (See Buglife's 'Identifying open mosaic habitat' sheet for further information). Sites supporting open mosaic habitat on previously disturbed land must have a history of disturbance with soil being removed, modified or extraneous materials added. In addition the site must show some spatial variation, forming a mosaic of more than one early successional habitat including unvegetated bare areas.

The importance of brownfields for invertebrates

Wildlife-rich brownfields develop as a result of periodic disturbance and abandonment, combined with low nutrient soils, and in many cases introduced substrates such as chalk, sandy dredgings or industrial materials such as blast furnace

Brownfield biodiversity figures

- At least 12-15% of nationally rare and scarce invertebrates are recorded on UK brownfields (Gibson 1992). This is likely to be a significant underestimate.
- Over 30 UK BAP species are strongly associated with brownfields.
- On Thames Estuary brownfields alone, 100 Red Data Book and 400 Nationally scarce species have been recorded.
- At least 40 invertebrate species are largely or wholly confined to brownfields.



Former mineral extraction site with dry and wet habitat mosaic © Clare Dinham



Ruderal-rich brownfield habitat mosaic © Steven Falk

slag or Pulverised Fuel Ash (PFA). This leads to variation across a site in terms of topography, soil type, hydrology and pH. This diversity of environmental conditions leads to a mosaic of habitats and microhabitats developing in close proximity, including unusual combinations which are uncommon in the wider landscape.

Many invertebrates require at least two habitats in close proximity during their lifecycle, which is increasingly rare in the managed countryside but can often be found on a single high quality brownfield site. This diversity of habitats in close proximity mean that a single site can also support rich assemblages of specialists of multiple habitat types alongside generalists. The sheer diversity of habitat types that can be supported within complex mosaics, such as heathland, herbrich grassland, lichen heath, ruderal vegetation, scrub, rough grassland, sparsely vegetated ground ephemeral or permanent pools and reedbed, means no two brownfields are the same and they do not fit well into traditional Natural Vegetation Classification (NVC) communities.

The degradation of the wider countryside due to agricultural improvement and development pressures, makes brownfields increasingly important for biodiversity and ecological networks. Many brownfield habitats mimic natural and seminatural habitats such as chalk grassland, heathland or coastal wetlands which have been progressively lost. They provide refuges and linkages between more traditional habitats, allowing movement across the landscape. As habitats become increasingly fragmented and isolated, brownfields present the opportunity to maintain habitat stepping stones and improve connectivity, highlighting the importance of retaining a network of high quality sites and not just a few high profile sites in isolation.

Thin, drought stressed and nutrient poor soils which are often contaminated prevent usually dominant species from taking over and slows vegetational succession. As a result wildliferich brownfields are often dominated by nectar-rich ruderal herbs in a mosaic with bare ground. Bare ground develops a warm microclimate in sunny weather and enables invertebrates to warm up quickly, while also helping incubate

Examples of UK Priority invertebrates strongly associated with brownfields • Saltmarsh shortspur

- Dingy skipper (*Erynnis* tages
- Grayling (Hipparchia semele)
- Shrill carder bee (Bombus sylvarum)
- Brown-banded carder bee (Bombus humilis)
- Distinguished jumping spider (Sitticus distinguendus)
- Five-banded weevil wasp (Cerceris quinquefasciata)
- Four-banded weevil wasp (Cerceris quadricincta)

- Saltmarsh shortspur beetle (Anisodactylus poeciloides)
- Streaked bombardier beetle (Brachinus sclopeta)
- Phoenix fly (Dorycera graminum)
- Black-headed mason wasp (Odynerus melanocephalus)
- Horehound longhorn moth (Nemophora fasciella)
- Horrid ground weaver spider (Nothophantes horridus)

eggs which are laid nearby (Key 2000). Warm bare areas enable brownfield sites to support species that are at the northern limits of their range in the UK, providing basking sites which allow species to persist in otherwise inhospitable regions. This may become increasingly important in response to climate change, with brownfield sites offering stepping stones of suitable habitat to aid movement across the landscape and offer new opportunities for wildlife when their distributions shift in response to change.

The varied nature of brownfields often means bare ground can be found with a range of substrates, aspects, compaction and slope angle found across a site, providing appropriate conditions for a wide range of invertebrates (Falk 1995, Key 2000). Novel combinations of substrates in unusual locations can lead to unique invertebrate assemblages developing. For example sandy river dredgings and blast furnace slag. Brownfields can also provide new opportunities for species well outside of their normal range, such as active mineral





Successional and topographical mosaic © Clare Dinham

extraction sites or flooded former sand and gravel pits which can support assemblages normally associated with coastal habitats, or with PFA habitats which can host assemblages normally associated with inland dune systems (Bodsworth et al. 2005).

Introduced substrates are often extremely low in organic material or can take many years to break down, further slowing succession. They then provide a strong bare ground resource for many years. Different substrates develop their own characteristic vegetation communities due to variation in pH, drainage and nutrient status, which can increase the potential biodiversity that a site can support. Different substrates offer their own benefits for invertebrates directly, for example rubble provides sheltering opportunities and microclimate variation, sandy materials offer surfaces for burrowing and ground-nesting species, while calcareous aggregates develop chalk grassland communities.

Brownfields can support an exceptional diversity of flowering plants, both native and exotic, leading to a very strong nectar and pollen resource (Bodsworth et al. 2005). This benefits both plant-specific feeders and generalists, with a larger variety of plant species and prolonged nectar and pollen resource leading to an increase in invertebrate biodiversity where there is a varied vegetation structure (Kirby 1992, Falk 1995). The abundance of nectar and pollen-rich plants is a stark contrast to the highly managed countryside which has suffered from significant losses of wildflowers, making brownfields effectively a refuge for some invertebrates.

Brownfields often remain unmanaged after many years of abandonment, which provides a continuity of forage and allows species which overwinter in various parts of plants to complete their lifecycles undisturbed. This lack of management leads to important resources such as dead wood accumulating and hollow stems being left in situ, benefiting a diverse range of species.

Sites with a history of cyclical disturbance across a wide area can often demonstrate a range of successional stages

in a complex mosaic. Different invertebrate assemblages can be associated with specific successional stages. By supporting a complex mosaic of ages, from bare ground with early successional habitats through to mature, dense scrub, a wider range of species can be supported.

Disturbance can lead to significant variation in topography across a site, altering hydrology and drainage conditions. Where material is piled up, warm free-draining mounds or bunds can be created which are ideal for early successional habitats. Scrapes, hollows or depressions can create localised warm microclimates where there is bare ground. Conversely, scrapes, hollows or depressions can form shallow ephemeral pools, inundation grassland or permanently wet areas. In some instances sites support a complex mosaic of these free-draining, sparsely vegetated mounds and diverse wetland features which caters for many different assemblages.

Threats to brownfields

Despite a growing acknowledgement of the biodiversity value of wildlife-rich brownfields, brownfields are still widely considered as a priority for development by many local authorities. Where areas of habitat are retained and managed as mitigation, plans are rarely appropriate to the sites invertebrate interest, leading to heavy losses. Many of these sites are also never subject to proper invertebrate survey, making the task of designing truly meaningful mitigation impossible. Simply, if you don't know what species or assemblages a site supports, you cannot confidently design functional mitigation. Full invertebrate surveys are essential on high quality brownfield sites, with this information used to identify key habitat features to be retained, as part of a suite of mitigation and compensation options to protect biodiversity. It is also important the phasing of larger developments is carefully considered, to ensure that invertebrates have sufficient time to colonise newly created mitigation or compensation areas, before existing habitat is destroyed.

The 'greening' of brownfields is a growing issue, with brownfields



Habitat mosaic in former sand pit © Jamie Robins



Diverse forage including both native and exotic species © Jamie Robins

inappropriately restored or remediated for use as public open space. This can involve adding nutrient rich topsoil and seeding with grass species, alongside tree planting and the introduction of intense management such as grass cutting. Such methods are not compatible with brownfield ecology and inevitably leads to the loss of rare and scarce species. Even a single annual cut in autumn or winter may lead to the loss of invertebrate species which overwinter in dead stems and seedheads (Harvey 2000).

Where less intrusive management is put in place on brownfields, simple tidying up and introducing broadscale management can reduce a site's value for invertebrates. Actions such as removing substrates, planting strategies or cutting large swathes of a site actively reduce the finescale habitat mosaic that is key to brownfield biodiversity.

Some sites will require management to prevent site succession to scrub or woodland and the loss of open habitats, the management of brownfields differs from traditional conservation management. Traditional management often involves broad techniques being applied to large compartments, however, the nature of complex vegetation mosaics makes blanket management over extensive areas inappropriate. In fact rigid management schemes often implemented in conservation of natural and semi-natural habitats are best avoided, with management ideally undertaken in a relatively reactionary manner based on rotational disturbance in response to site monitoring during the early years of management being introduced. Through assessing the results of monitoring management actions, a potentially useful rotation can then be identified. For more information on management of brownfield see the management guidance sheets and case studies.

Scrub invading early successional habitats © Clare Dinham

The implications of habitat loss

The loss of brownfields through development or inappropriate management or restoration, is causing the habitat resource to be increasingly fragmented and isolated. In the Thames Gateway area for example, over half of nearly 200 wildlife-rich brownfields were lost in only a six-year period (Robins et al., 2013). Such losses are surely not sustainable and threatens the future of a large number of Red Data Book and Priority species, which rely heavily on brownfield sites.

Many invertebrate populations live in metapopulations, which are essentially occasionally linked isolated populations. In metapopulations there are many sites, with populations regularly disappearing from sites but reappearing on others through occasional colonisation events. As more and more areas of suitable habitat are lost, extinctions of sites continue but there are fewer sources of colonists, with sites becoming more isolated. Over time this can lead to local extinction events, particularly with scarce species that are poor dispersers.

A number of scarce species are only found on a handful of individual brownfields. Species such as this are at serious risk of being lost from the UK fauna completely should a single inappropriate development take place on their habitat.

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Development on former wildlife-rich brownfield site © Steven Falk

