Thick-legged Hoverfly
© Joshua Clarke

Recognising the contribution that open mosaic habitat sites can make to biodiversity in the Inner Forth

Across the UK both the abundance and distribution of invertebrate species has declined and continues to do so. A main driver of this decline is habitat loss and their subsequent fragmentation. The latest Bugs Matter report has found that the abundance of insects sampled by citizen scientists in Scotland reduced by a worrying 40% between 2004 and 2022. There are a wide variety of ecologically diverse habitats such as species rich grasslands, native woodland, lowland raised bog, freshwater lochs, rivers and wetlands scattered across the Inner Forth region that act as islands for struggling species. Surprising to many, open mosaic habitats, often found on vacant and derelict old industrial sites provide some of the most important areas for nature in Scotland. These sites are seemingly hidden jewels in the vast landscape that makes up Stirling, Clackmannanshire, Falkirk and Fife.

Often the reason for this is the mosaic of habitats found in a relatively small area, supporting many different types of invertebrates, from grassland to rocky outcrops, sands, gravels, hollows, and open bare ground. Open Mosaic Habitat on Previously Developed Land (OMH) can be extremely diverse, supporting a wide range of terrestrial and aquatic habitats. This diversity has made them increasingly important within ecological networks for rare and scarce invertebrates as well as lichens, plants, birds, reptiles and amphibians of conservation concern. Many nationally-rare and nationally-scarce insects have been recorded from OMH sites. Often the habitats found on old industrial sites can be of high value to invertebrates as they are often lacking in the wider countryside. Due to the natural process of succession, OMH has a limited life-span, depending on the nature of the site and local climate, as scrub and woodland will eventually take over. Habitats at these sites can be conserved, enhanced and created through appropriate management. It may come as a surprise to realise that these sites can be significant for the conservation of species, in particular for pollinators (Hart, A. *pers comm.*)

There is widespread concern over the status of pollinators, as many insect groups including bees, butterflies, moths and hoverflies have declined dramatically in the UK and globally both in their abundance and diversity (Biesmeijer *et al*., 2006; Potts *et al*., 2010). With regards to bees in the UK, despite a few species expanding their ranges, the majority are suffering declines. For example, three of the UK'S 25 species of bumblebee have gone extinct, with a further eight suffering major range contractions (Goulson *et al*., 2008).

Interestingly, several of the most threatened species of solitary bee have associations with early successional habitats found on OMH sites. In August 2022, funded by the Inner Forth Legacy Fund, a group of entomologists from Buglife, together with volunteers and staff from our partner organisations surveyed sites previously identified as supporting OMH habitats (Currie and Burgess, 2013) in the Inner Forth looking for solitary bees often associated within brownfield sites. Despite it being late in the season, they discovered a wide diversity of solitary bees at sites in Stirling, Alloa, Fallin and Bo'ness, including: Heather Colletes (*Colletes succinctus*), Orange-legged Furrow Bee (*Halictus rubicundus*), Bronze Furrow Bee (*Halictus tumulorum*), Common Furrow Bee (*Lasioglossum calceatum*), White-footed Furrow Bee (*Lasioglossum leucopus*), Patchwork Leafcutter Bee (*Megachile centuncularis*), Willoughby's Leafcutter Bee (*Megachile willughbiella*), Geoffroy's Blood Bee (*Sphecodes geoffrellus*) and the Box-headed Blood Bee (*Sphecodes monilicornis*).

Box 1: Solitary Bees associated with Brownfield sites, quarries and sand pits in Scotland

Sandpit Mining Bee (*Andrena barbilabris*)

Grey-banded Mining Bee (*Andrena denticulata*)

Buffish Mining Bee (*Andrena nigroaenea*)

Small Sallow Mining Bee (*Andrena praecox*)

Wilke's Mining Bee (*Andrena wilkella*)

Red-shanked Carder Bee (*Bombus ruderarius*)

Tufted Furrow Bee (*Lasioglossum nitidiusculum*)

Rufous-footed Furrow Bee (*Lasioglossum rufitarse*)

Willughby's Leafcutter Bee (*Megachile willughbiella*)

Sandpit BloodBee (*Sphecodes pellucidus*)

Female Patchwork
Leafcutter Bee
© Natalie Stevenson

OMH sites and solitary bees

Many species of solitary bee have a strong association with OMH sites (see Box 1). For example, Willoughby's Leafcutter Bee (*Megachile willughbiella*) is often associated with brownfield sites and in habitats with bellflowers (*Campanula* species), Bird's-foot Trefoils (*Lotus* species), thistles (*Cirsium* species) and brambles (*Rubus* species). Wilke's Mining Bee (*Andrena wilkella*) has a strong association with unimproved grasslands and can be found in a variety of legume-rich habitats. It forages from various plants but prefers legumes such as Bird's-foot Trefoil and vetches (*Vicia* species) that are typically found in early successional habitats. Early successional habitats in naturally regenerating quarries and sand pits, provide a major nectar and pollen source, and also foraging habitat for predatory wasps. The presence of some of these species of solitary bee on a site can indicate the presence of important habitats that are ecologically rich.

OMH sites and butterflies

Wildlife-rich brownfield sites also provide important habitat for many declining butterfly species. The bare ground and varied topography often associated with brownfields can produce warm microclimates and basking spots that are ideal for these heat-loving species. Brownfields can also support a rich and varied ruderal wildflower resource for adult butterflies during the flight season and crucially, the foodplants required by the larvae of many scarce species are often found in abundance.

Brownfields can mimic many of the traditional habitats used by rare butterflies which have declined in the countryside. For example, quarries, as well as industrial spoil such as blast furnace slag, develop habitat that strongly mimics traditional grasslands. Whereas larval foodplants for butterflies may be sparse in poorly managed grasslands, many brownfields such as quarries can support plentiful amounts. The creation of new habitats from industrial activity, such as spoil heaps, provide new opportunities for these species, allowing them to colonise new areas. Some species are becoming increasingly reliant on brownfield sites to provide appropriate habitat at the landscape-scale, alongside natural and semi-natural habitats.

Butterflies exist in metapopulations, which are groups of small but linked populations using patches of suitable habitat scattered across the landscape. Cycles of extinction are balanced by re-colonisation from nearby sites, allowing their survival across the landscape. Where there is a large loss of suitable habitat, remnant sites become fragmented and their populations isolated.

Brownfield sites in the Inner Forth have the potential to act as habitat stepping-stones within the wider landscape, providing both breeding sites and aiding movement across the landscape.

Female Common Blue Butterfly
(*Polyommatus icarus*)
© Claire Pumfrey

How can we maximise opportunities for invertebrate biodiversity in OMH sites?

There are enormous opportunities for creating important habitats such as lowland heathland, species-rich grassland and maintaining OMH. Working with nature and not against it or forcing it, can 'guide' the regeneration to a desired outcome with management, e.g. scrub control, control of invasive species, some land-forming etc. Natural regeneration is a valuable restoration tool which can produce habitats of higher biodiversity value than more intensive methods.

Biodiversity delivery can be built into all stages of operation at industrial sites. By just leaving undisturbed areas of a site, things will often colonise on their own. Habitat does not need to be permanent, indeed it is often the more temporary habitats found in quarries such as disturbed pools that support the rarest species of invertebrates.

Although an absence of management is often a key factor in the high biodiversity of brownfields, management will eventually be necessary to maintain the early successional habitats. Methods to enhance brownfield habitats include scrub clearance, increased deliberate disturbance, the creation of scrapes, bee/butterfly banks and providing wildflower rich areas.

Scrapes can be created at a small-scale using hand tools or with machinery, by removing topsoil to a depth of around 20cm. The edges should be left as gentle rounded angles to diversify aspect and microclimate. They are ideally created on flat ground, or by cutting out wedges on south-facing slopes to create a bare wall fronted by a plateau.

Combining sunny, south-facing bee/butterfly banks with adjacent scrapes can create an ideal habitat mosaic with sheltered, sunny microclimates alongside forage and food plants. Small banks can be created using hand tools, but ideally larger banks can be created using machinery such as an excavator.

Finally, creating wildflower-rich areas can improve the nectar resource for foraging bees and butterflies, particularly where there are only limited nectar sources of a target species. Wildflower enhancement should target low nutrient areas which are less likely to be dominated by coarse grasses.

The Inner Forth Habitat Network Concept Maps (East) and (West) show existing and potential areas for the five key habitat types that were identified during a 2019 pilot engagement process. The User Guide describes how to locate where the conservation, restoration and management of an existing habitat is the priority for the coherence of the habitat network, and where the Opportunity Network is located i.e. places to strengthen the habitat network. These maps identify important grassland and OMH areas for conservation and management within the Inner Forth, as well as sites which represent opportunities to expand the connected network of sites used by many solitary bees and butterflies.


Fallin Bing at Fallin, Stirlingshire in flower
© Claire Pumfrey

These maps include the important OMH sites visited by Buglife in 2022 and have a good association with other concept maps, such as Buglife's B-Lines. The B-Lines are a series of 'insect pathways' running through the Inner Forth, along which, our local authorities (Stirling, Falkirk, Clackmannanshire and Fife), are restoring and creating wildflower-rich habitat stepping-stones. B-Lines link existing wildlife areas and habitat patches together, creating a network, that will weave across the landscape. This will provide large areas of new habitat benefiting bees and butterflies – but also a host of other wildlife.

There is scope for future work in the Central Belt to study and protect OMH sites. The National Planning Framework 4 mentions the importance of assessing vacant and derelict sites for their biodiversity value but there remains a risk that important OMH sites will be prioritised for development and lost from the network. Previous assessments of the amount and distribution of vacant and derelict land in the Central Belt were made a decade ago and it would be worthwhile repeating these assessments across the CSGN and Inner Forth area.

Some of the sites visited as part of this project, and others across the Inner Forth, could also benefit from scrub clearance and disturbance to ensure they maintain their open mixed mosaic characteristics.

Species monitoring in the Inner Forth is really important as so many invertebrates are under-recorded. The challenge can be that some species require specialist knowledge to identify them, including some requiring microscopic identification. These skills are held by a few experts and whenever possible we should look to share knowledge and inspire a future generation of recorders. Solitary bees are a great example, ensuring public and third sector staff and communities have access to training at all levels – from beginner to expert – will be essential to ensure skills remain within the Inner Forth to monitor the unique species and habitats found in this area.

Buglife looks forwards to continued work in the Inner Forth, with our partner organisations, as we all work to deliver Nature Networks like B-Lines, and protect important sites for Scottish pollinators.

- Biesmeijer, J. C, Roberts, S. P. M, Reemer, M., Ohlemuller, R., Edwards, M., Peeters, T., Schaffers, A. P., Potts, S. G., Kleukers, R., Thomas, C. D., Settele, J. and Kunin, W. E. (2006). Parallel declines in pollinators and insect-pollinated plants in Britain and the Netherlands. Science 313, 351–354.
- Currie, N and Burgess, S (2013) An assessment of invertebrate biodiversity at four brownfield sites in the Inner Forth area Final-An-assessment-of-invertebrate-biodiverity-on-four-brownfield-sites-in-the-Inner-Forth-Area.pdf (buglife.org.uk)
- Currie, N and Burgess, S (2013) Identifying open mosaic habitat on vacant and derelict land in the Inner Forth area Final-Identifying-open-mosaic-habitat-on-vacant-and-derelict-land-in-the-Inner-Forth-area_0.pdf (buglife.org.uk)
- Goulson, D., Lye, G. C. and Darvill, B. (2008). Decline and conservation of bumblebees. Annual Review of Entomology 53, 191-208.
- Hart, A. *personal communication*
- Potts, S. G., Biesmeijer, J. C., Kremen, C., Neumann, P., Schweiger, O. and Kunin, W. E. (2010). Global pollinator declines: trends, impacts and drivers. Trends in Ecology & Evolution 25, 345–353.
- Inner Forth Habitat Network Concept Maps (East) and (West) InnerForthHabitatNetworkConceptUserGuideandEastWestMaps_March2019.pdf (innerforthlandscape.co.uk)

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