Brownfield mosaics in the built environment: designing UGI to conserve invertebrates

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Sustainability Research Institute (SRI)

The Sustainability Research Institute (SRI) is UEL's centre of excellence for environmental research and development. We collaborate with industry, government, public agencies and charities to enable changes in physical infrastructure and social capital that benefits the environment, promotes sustainable living and creates a carbon neutral society.

Welcome to the SRI

Established in 2001, the SRI was one of the first dedicated sustainability research institutes in the UK and we have since built an excellent international reputation by applying our ground breaking research and development in the real world.

Our work focuses on a range of emerging research fields and pressing urban and rural sustainability challenges and is centred on three key themes:

- Green infrastructure – spanning areas such peatland ecology and conservation, the design and monitoring of urban green infrastructure and invertebrate conservation
- Resource Management – encompassing materials engineering, energy efficiency and the circular economy.
- Sustainable Living – covering adaptive governance and community engagement and asset management.

The SRI is a prime example of UEL's tradition of cross-disciplinary knowledge transfer. Working with partners across the UK and around the world, our work addresses the critical issues for creating more resilient urban and rural communities. Our results orientated innovation expertise, state of art test sites and facilities, and cross sectoral networks allows us to punch far above our weight.

Professor Darryl Newport – Director – Sustainability Research Institute

TURAS

Connecting Nature

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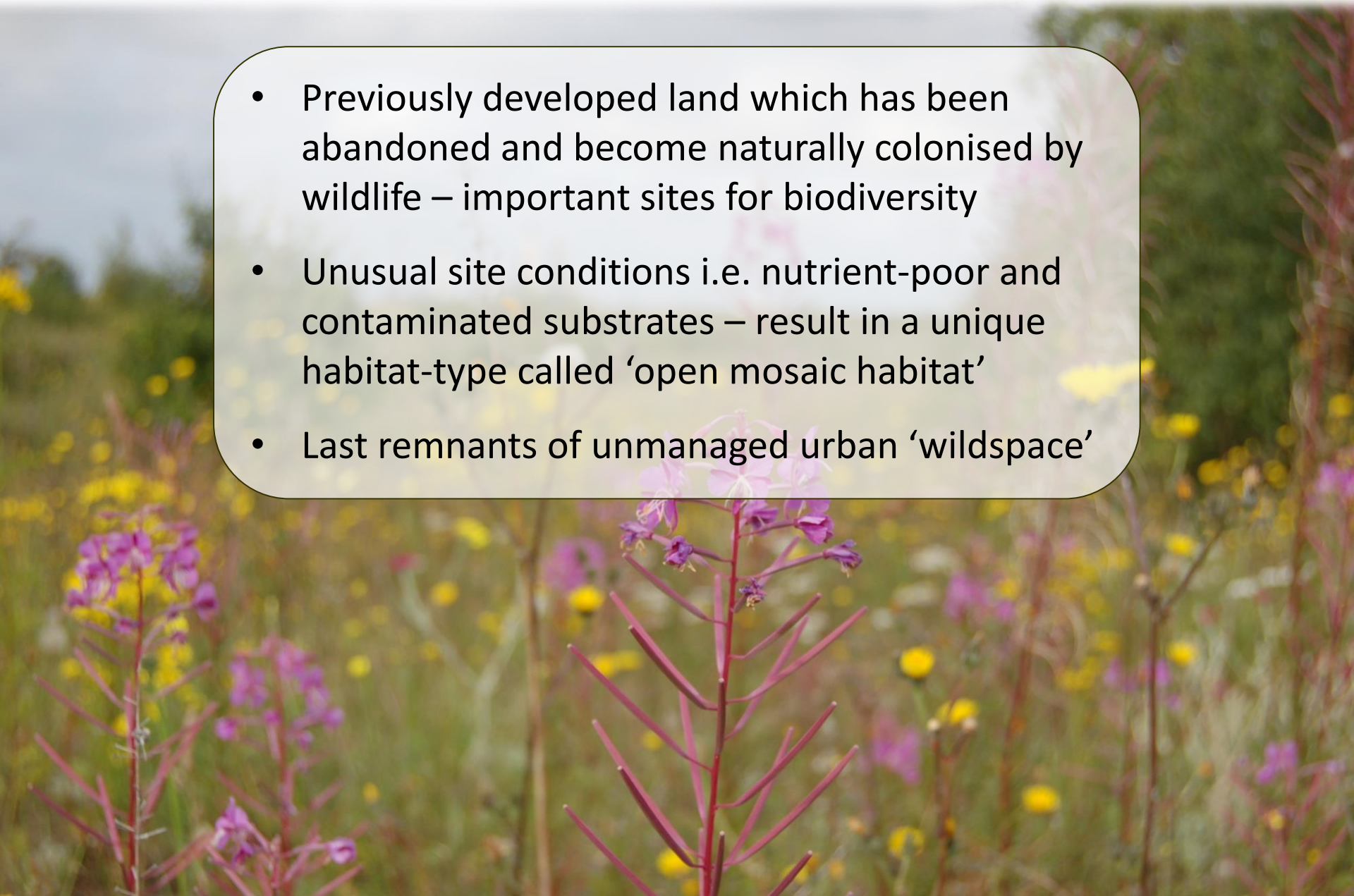
Why brownfields?

Wasteland

Brownfield sites – urban wildspace



- Previously developed land which has been abandoned and become naturally colonised by wildlife – important sites for biodiversity
- Unusual site conditions i.e. nutrient-poor and contaminated substrates – result in a unique habitat-type called ‘open mosaic habitat’
- Last remnants of unmanaged urban ‘wildspace’

Brownfield value – mosaics and analogues

Key features:

Mosaic of habitats on varied, nutrient-poor substrates

Structural diversity – mounds, tussocks, bare areas, tall and short vegetation

Flower-rich habitats – nectar and pollen

Scrub & tall plants - shelter

Bare & sparsely vegetated ground – nesting and basking

Wetland habitat – for species with an aquatic stage

Analogue for (semi)natural habitats

In 2007 ‘OMHPDL’ was designated a UK BAP habitat principally for its importance for invertebrates

Brownfield pressures

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Press release

New measures to unlock brownfield land for thousands of homes

From: Department for Communities and Local Government and The Rt Hon Gavin Barwell
Part of: Planning system
Published: 3 April 2017

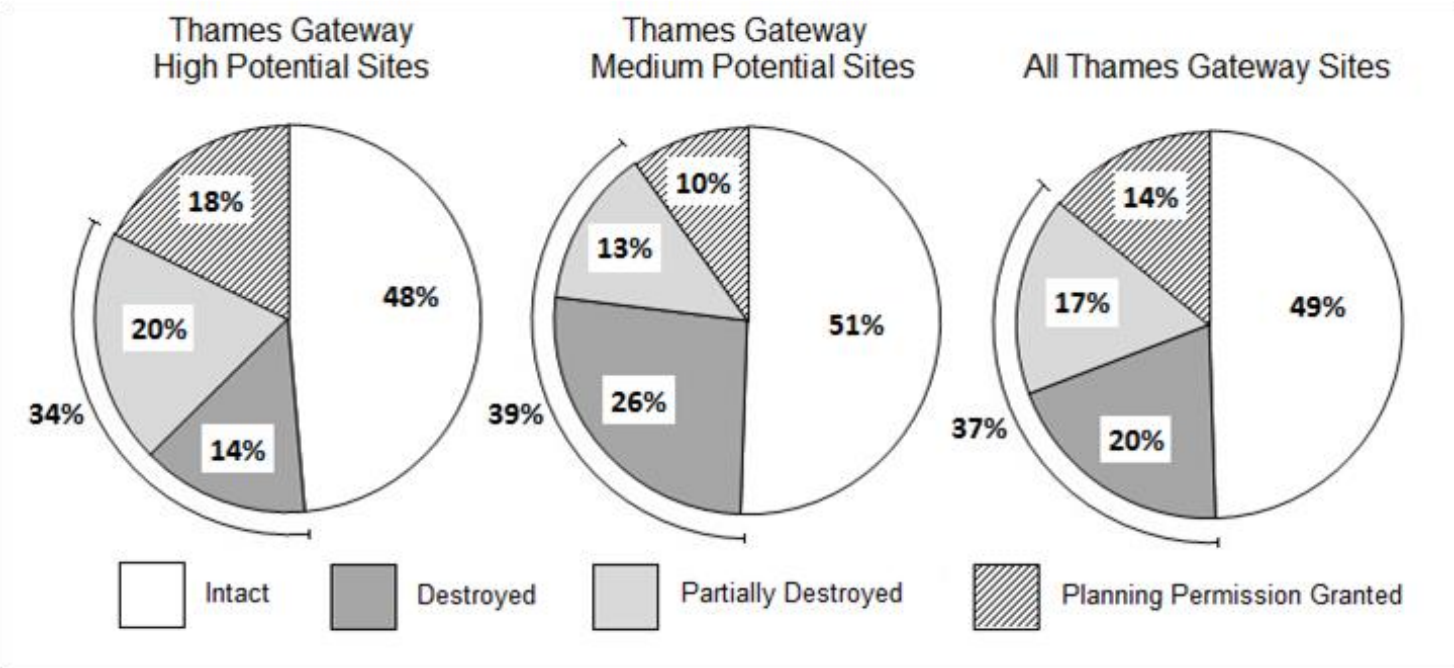
Councils will have new tools to speed up development of derelict and underused land for new homes.

Councils will have new tools to speed up development of derelict and underused land for new homes, Housing and Planning Minister Gavin Barwell confirmed today (3 April 2017).

Local authorities across the country will now have to produce and maintain up-to-date, publicly available registers of brownfield sites available for housing locally.

The new registers will help housebuilders identify suitable brownfield sites quickly, promising to unlock land for thousands of new homes

The state of East Thames Corridor brownfields in 2012



- 37% of wildlife-rich brownfields destroyed or partially destroyed
- 51% either destroyed or have an outstanding planning permission

Robins, J. & Henshall, S. (2012) The state of brownfields in the Thames Gateway. The Essex Naturalist Journal. 29: 77-88.

Bugs are in trouble

- Almost a third of all bees and wasps are under threat
- Half of our 27 bumblebee species declining
- Two thirds of our moths show long-term declines
- Over 70% of butterflies are declining significantly
- Bugs really need our help, and we need bugs!


Kevin Frayer via Getty Images

My research - creating bespoke green infrastructure solutions to compensate for brownfield loss

Brownfield mitigation – challenges

‘Blandscaping’ – generic approach to urban green space design driven by ‘manicured’ aesthetic and long tradition of intensive management practices

‘Off-the-shelf’ industry standard green roofs – lightweight and low-cost systems designed primarily for stormwater management

Developers assume green space will deliver biodiversity benefits, but biodiversity needs to be an intrinsic element of the design

Taking inspiration from nature

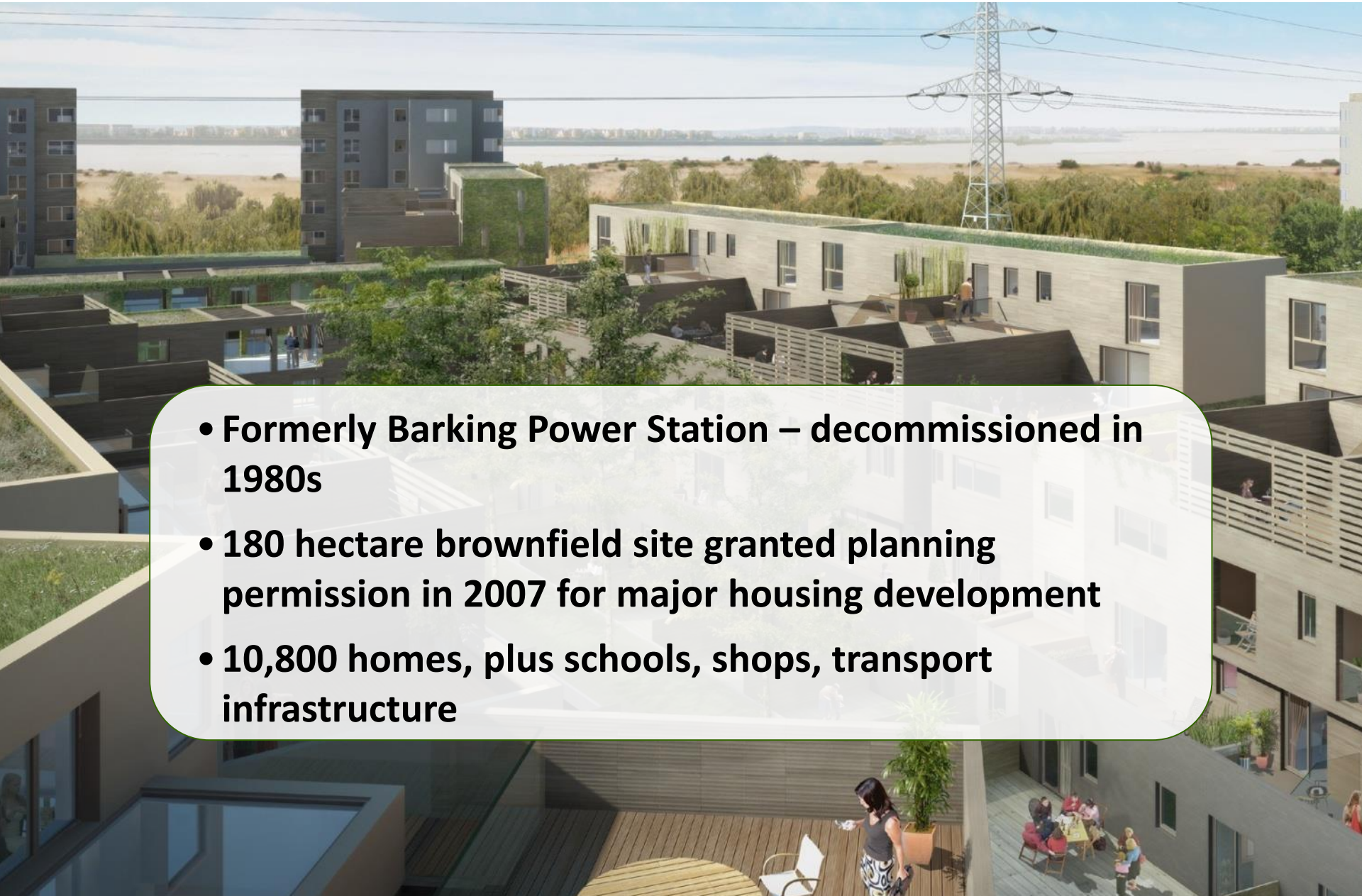
ECOMIMICRY

'Ecomimicry involves mimicking local animals and plants (or their ecological settings) to produce sustainable innovations…'
(Marshall, 2007)

- Ecomimicry approach – takes inspiration from locally typical, regionally important habitat and embeds that into urban green infrastructure design
- Multifunctional benefits – an ecomimicry approach can deliver ecosystem services such as urban cooling and stormwater attenuation AND provide suitable habitat for local biodiversity

https://www.researchgate.net/publication/306399880_The_Theory_and_Practice_of_Ecomimicry

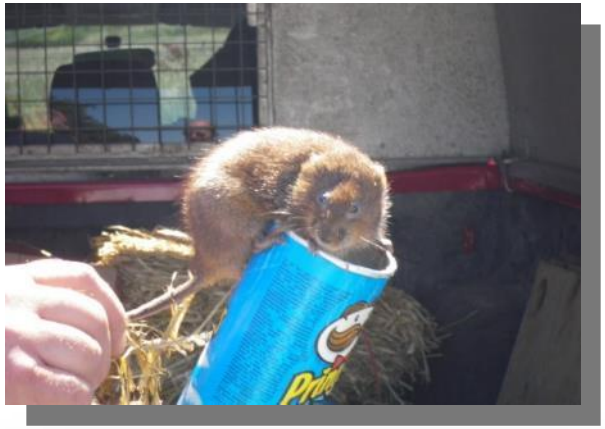
Barking Riverside – redevelopment



- **Formerly Barking Power Station – decommissioned in 1980s**
- **180 hectare brownfield site granted planning permission in 2007 for major housing development**
- **10,800 homes, plus schools, shops, transport infrastructure**

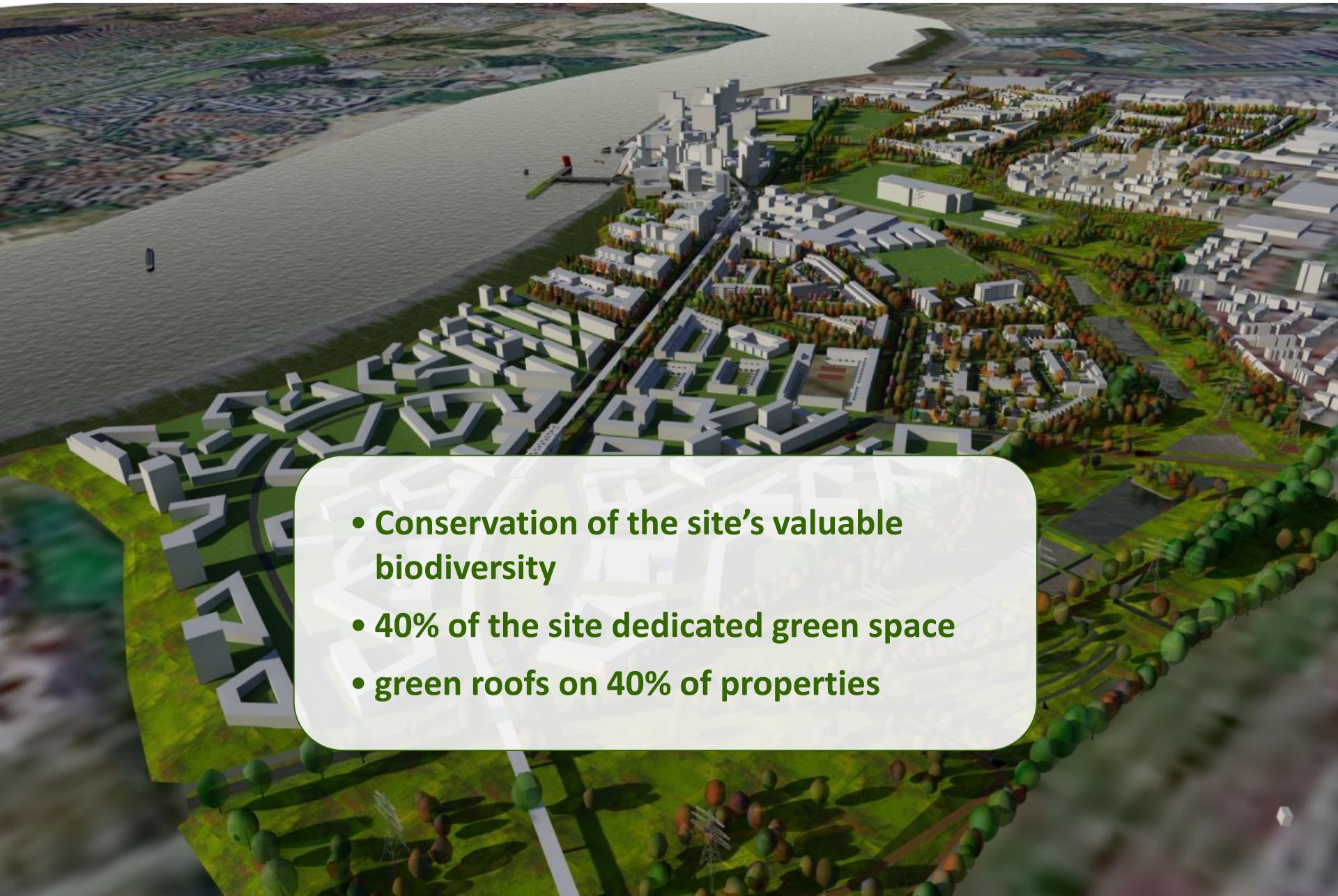
Barking Riverside – wildlife

- Open Mosaic Habitat of Metropolitan value
- Invertebrate assemblage of Regional value
- Populations of Protected Species (Wildlife & Countryside Act 1981) including water vole and grass snake



Planning consent included requirements to conserve valuable wildlife

Barking Riverside GI Masterplan



- Conservation of the site's valuable biodiversity
- 40% of the site dedicated green space
- green roofs on 40% of properties

Barking Riverside UGI ecomimicry research

Innovative UGI measures to support the site's biodiversity as it transitions to a new community

To move away from traditional design and take inspiration from important local habitat in the region

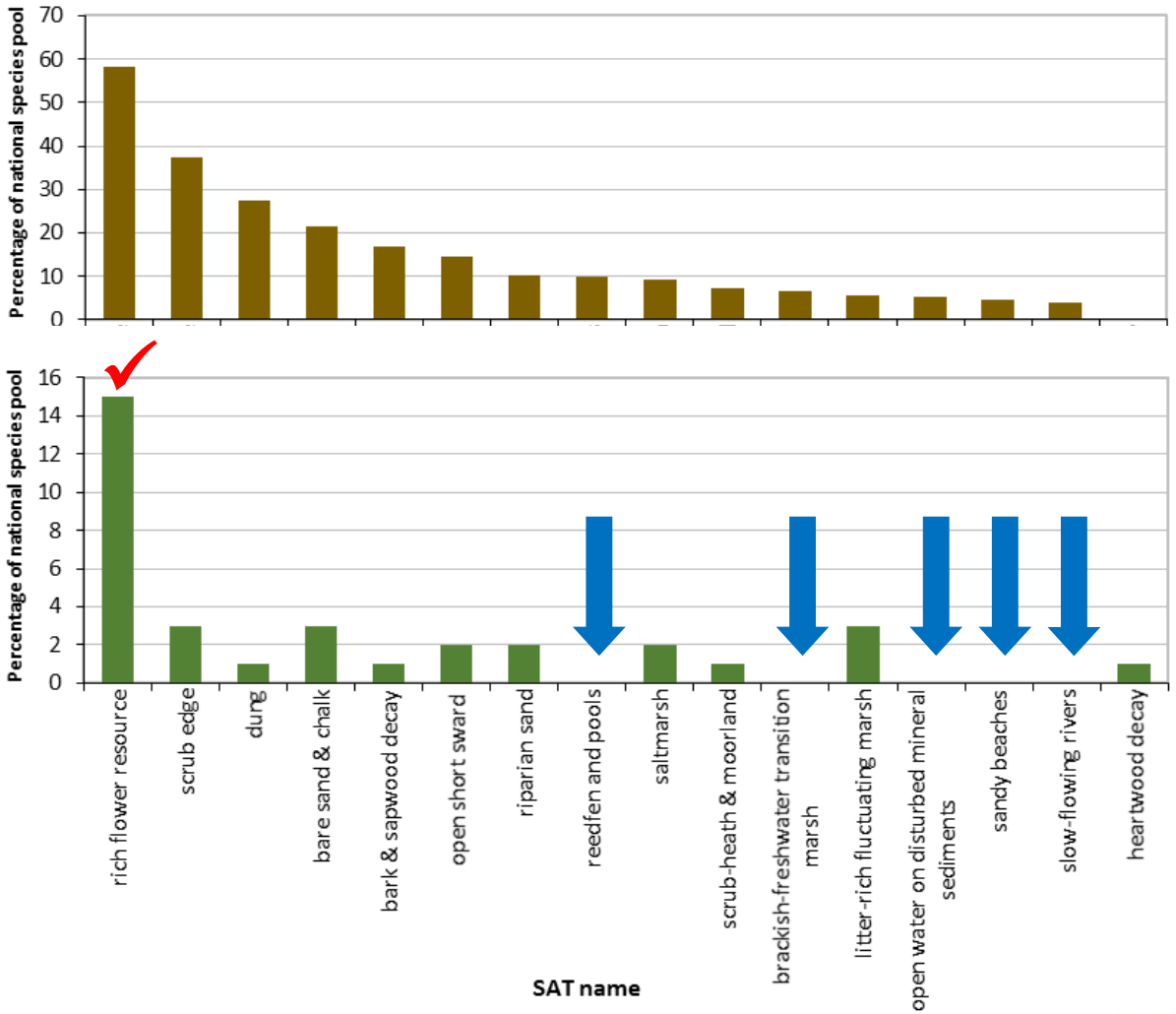
Barking Riverside ephemeral wetland green roof experiment

Ecologically-informed ecomimicry research

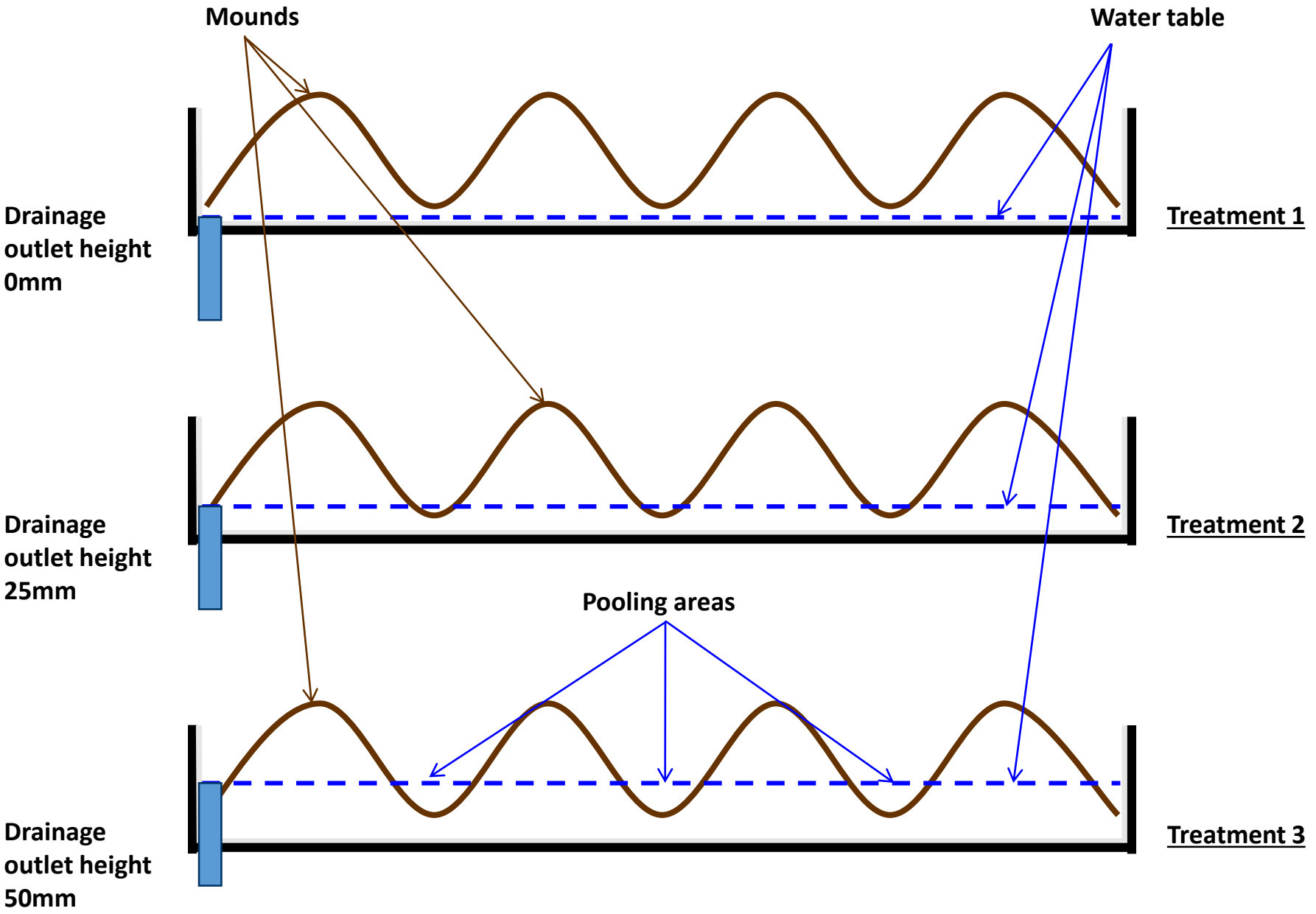
- Natural England's ISIS Invertebrate assemblage comparison of Thames Corridor brownfield sites and green roofs

Brownfield sites

Green roofs



Ephemeral wetland green roof design



Ecomimicry in green roof design

A replicated green roof experiment on nine 20 foot shipping containers which included key brownfield habitat features:

- **Blend of recycled substrates to create different thermal and moisture conditions**
- **A range of substrate depths to provide different habitat niches**
- **Diverse habitat niches to support a broader range of plants and invertebrates**

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Ecomimicry in green roof design

Seeded and planted with species characteristic of biodiverse brownfield sites in the region, including species tolerant of seasonal waterlogging

Ecomimicry - ephemeral wetland

Ephemeral wetland habitat niche on experimental green roof

Ephemeral wetland habitat on adjacent brownfield remnant

The ecomimicry design was mimicking the hydrology of nearby seasonally wet habitat on neighbouring brownfield remnant

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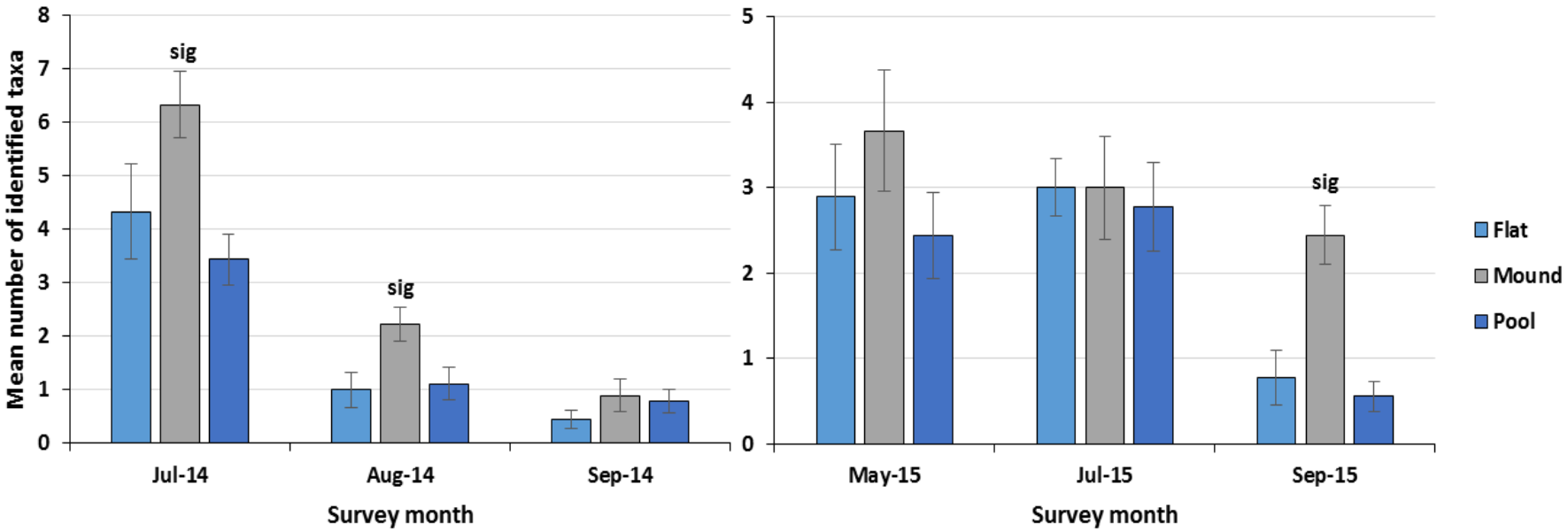
Invertebrate survey results

Invertebrates:

- 2 Red Data Book species: *Scybalicus oblongiusculus, Lasioglossum pauperatum*
- 7 Nationally scarce (Na/Nb) including: *Ophonus ardosiacus, Ponera coarctata, L. pauxillum*
- 22 Local species
- UK BAP Priority *Bombus humulis* recorded foraging on the roof

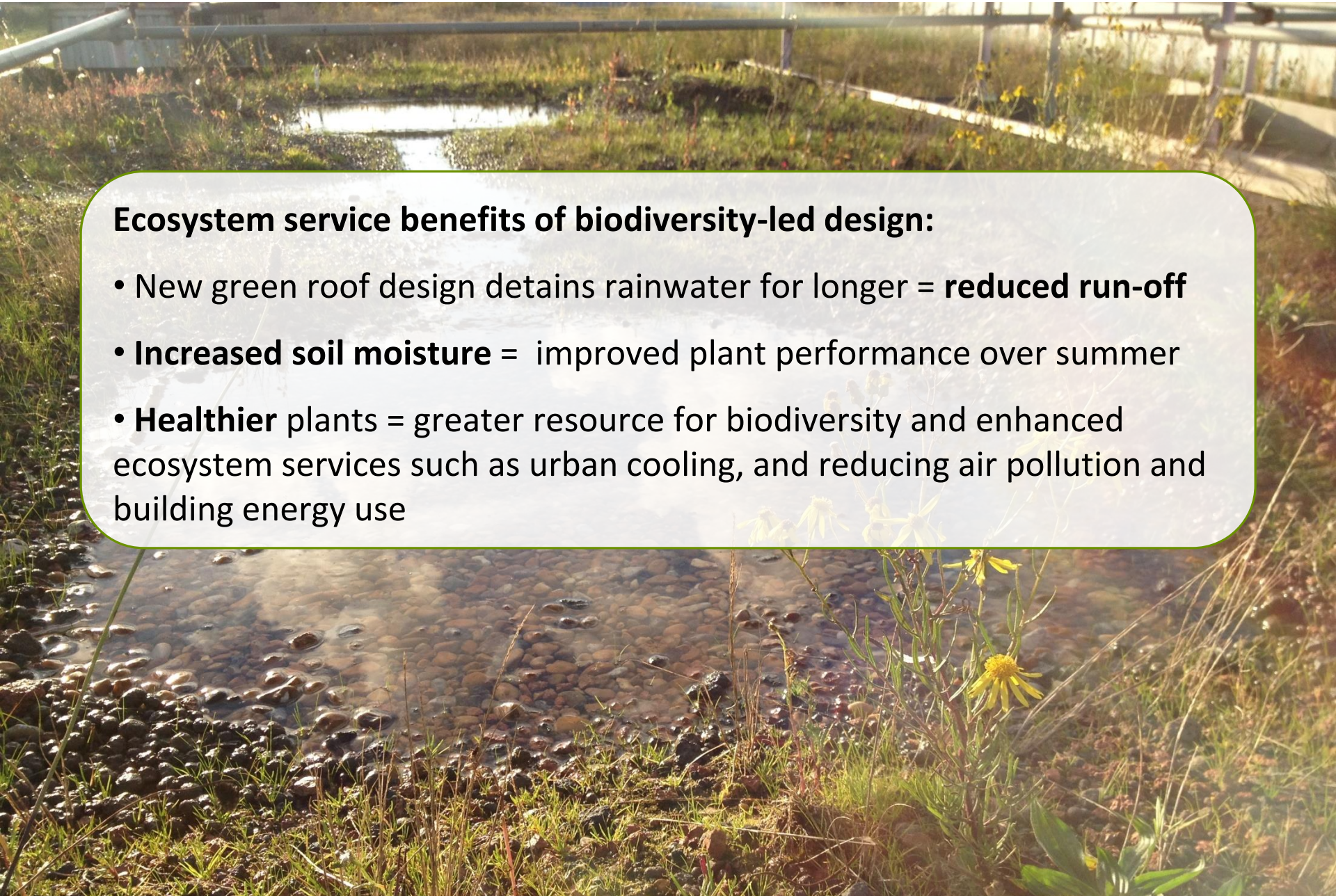
- **40%** of the invertebrate species sampled were **conservation priority species**
- many characteristic of the pre-development brownfield site
- **3** species with affinity to **wetland** habitats recorded

Invertebrate survey results



Significantly more invertebrate species recorded in pitfall traps on **mounds** compared to other sampled niches – potential refugia effect?

Ecomimicry in green roof design



Ecosystem service benefits of biodiversity-led design:

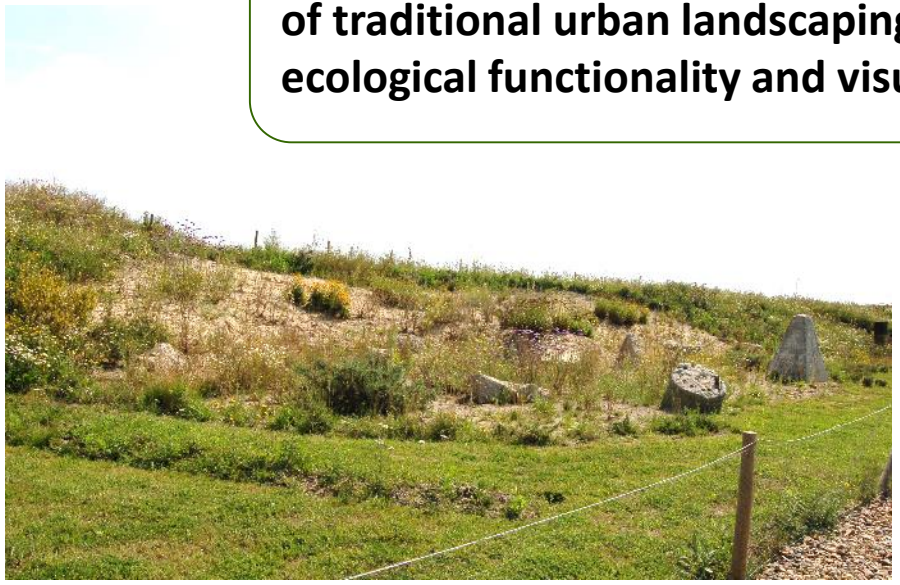
- New green roof design detains rainwater for longer = **reduced run-off**
- **Increased soil moisture** = improved plant performance over summer
- **Healthier** plants = greater resource for biodiversity and enhanced ecosystem services such as urban cooling, and reducing air pollution and building energy use

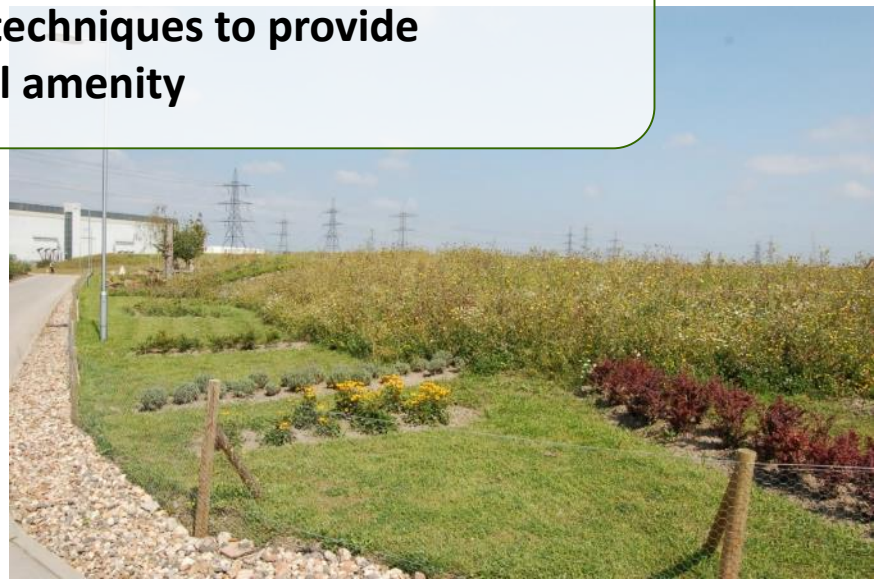
Barking Riverside brownfield landscaping

Innovative office landscaping scheme designed to include many of the microhabitat features of value to the regions unique invertebrate community

Barking Riverside brownfield landscaping

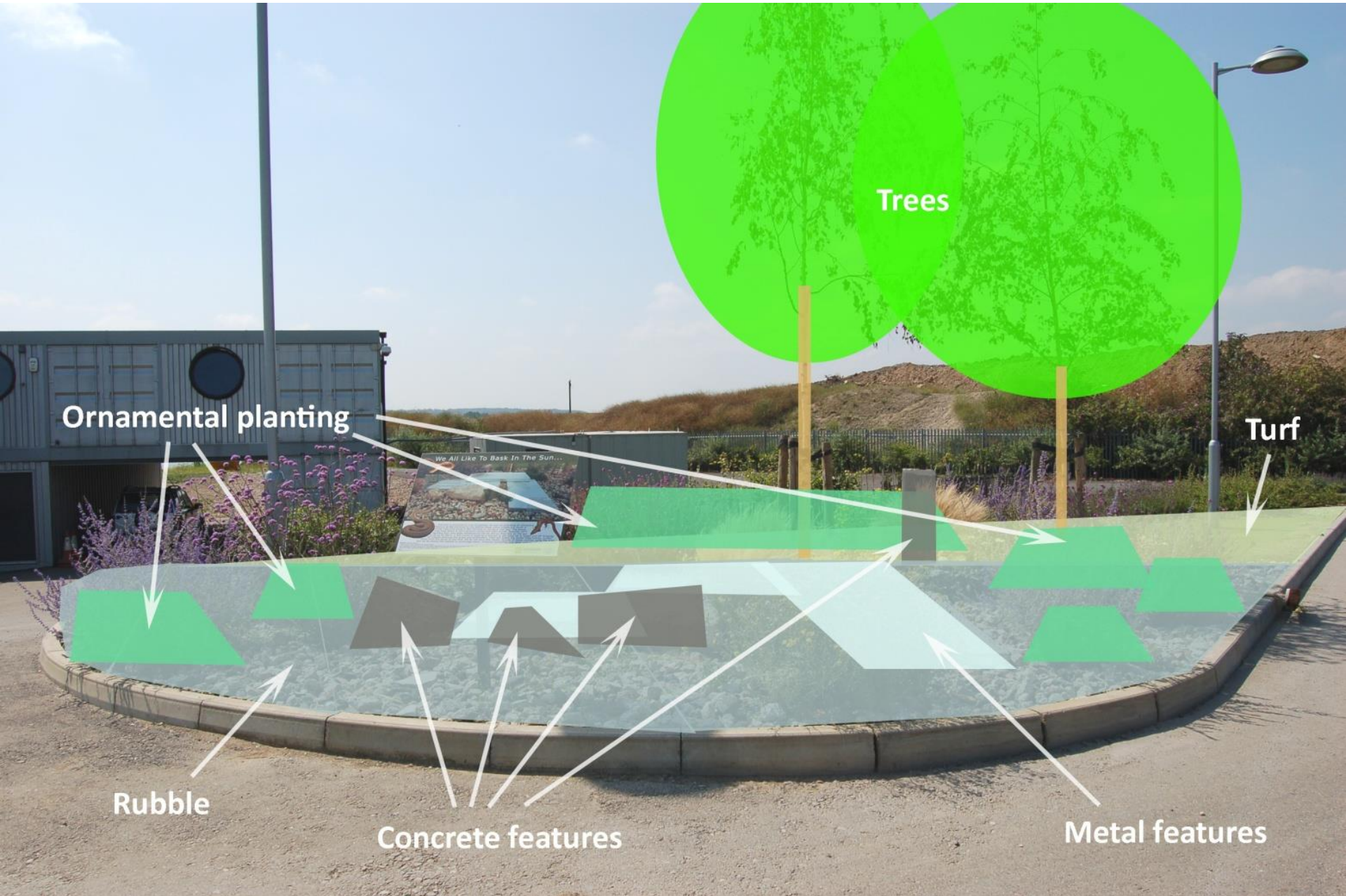
Blending valuable brownfield habitat niches with the aesthetics of traditional urban landscaping techniques to provide ecological functionality and visual amenity





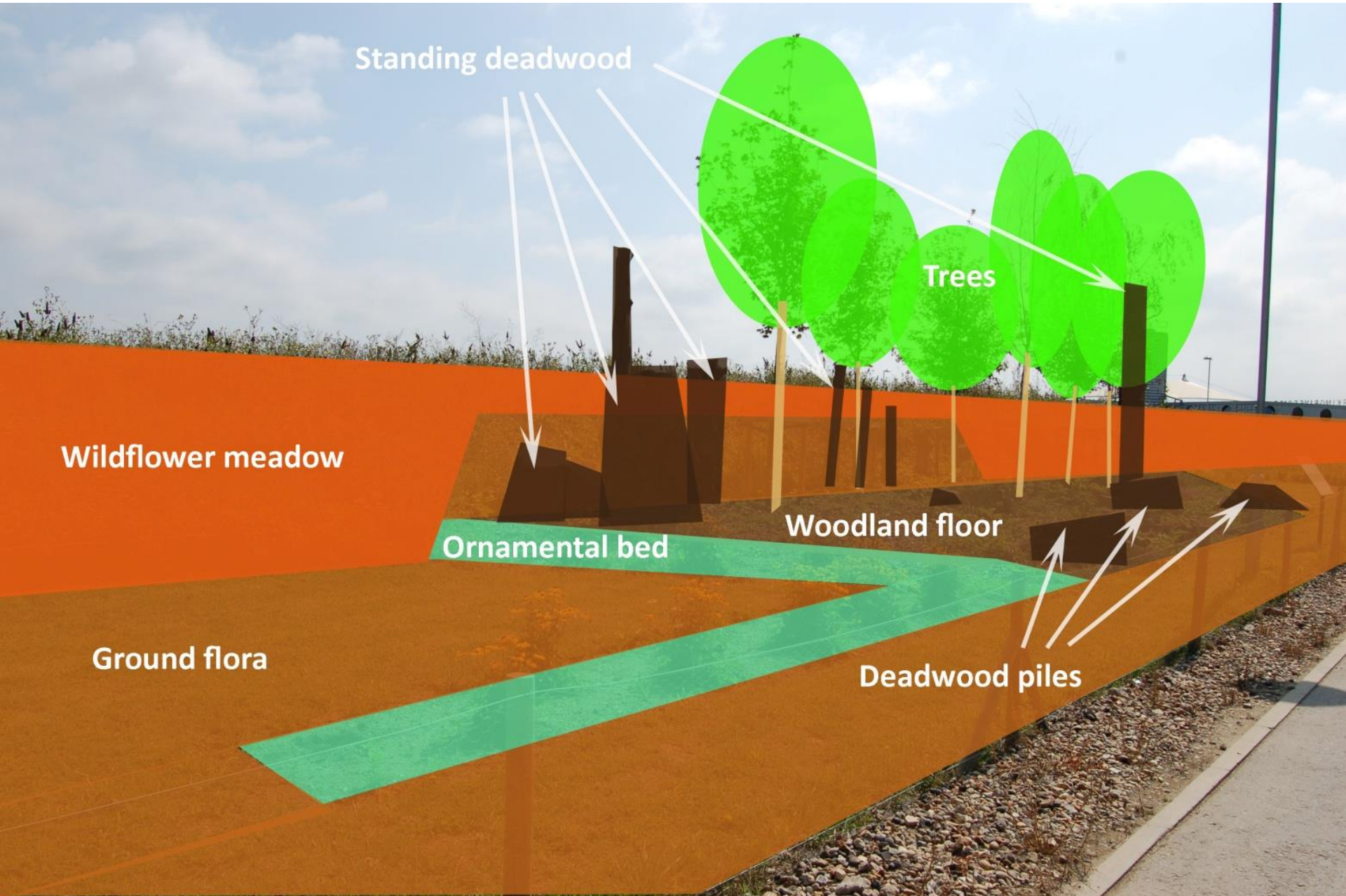
Rubble, metal sheeting and ornamental planting

- Benefit ground beetles that rest under rocks and species that require basking areas
- Ornamental plant species beneficial for pollinators



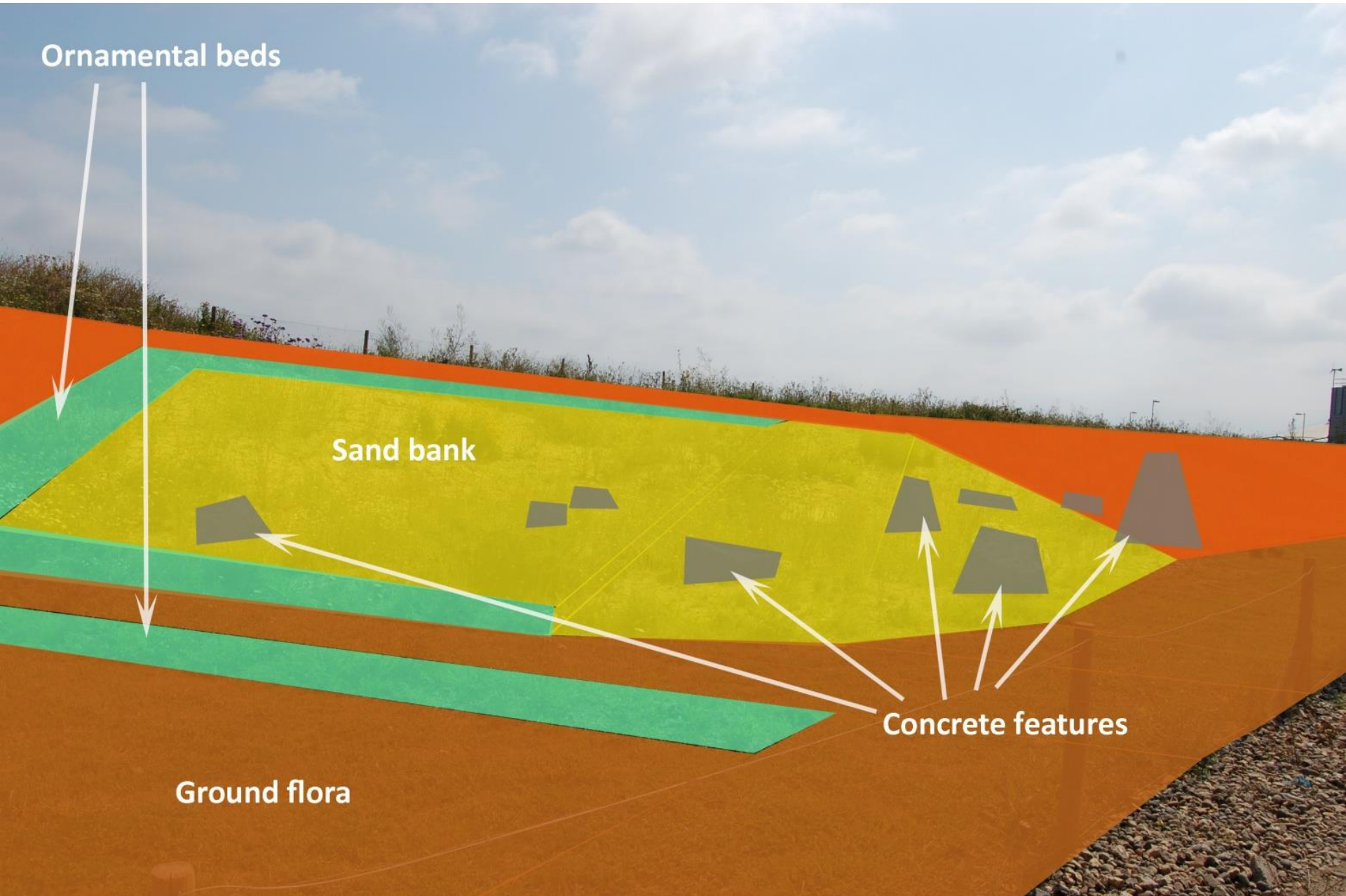
Woodland pocket: standing deadwood and log piles

- Benefits for saproxylic invertebrates and woodland floor species
- Also resources for pollinators



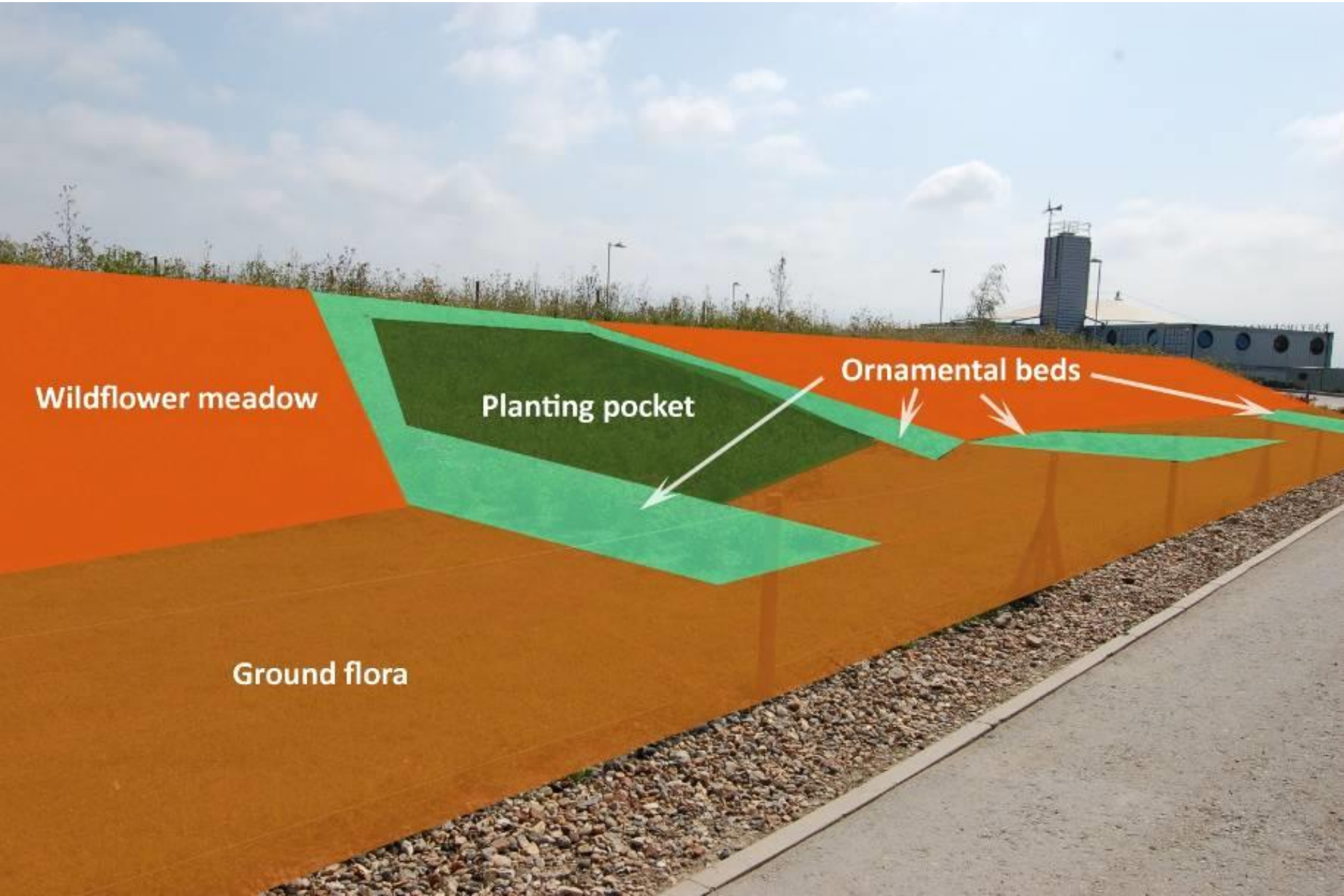
South-facing sandbank pocket

- Benefits for ground-nesting bees and wasps and other thermophilic insects
- Nesting, hunting and basking opportunities in proximity to foraging habitat

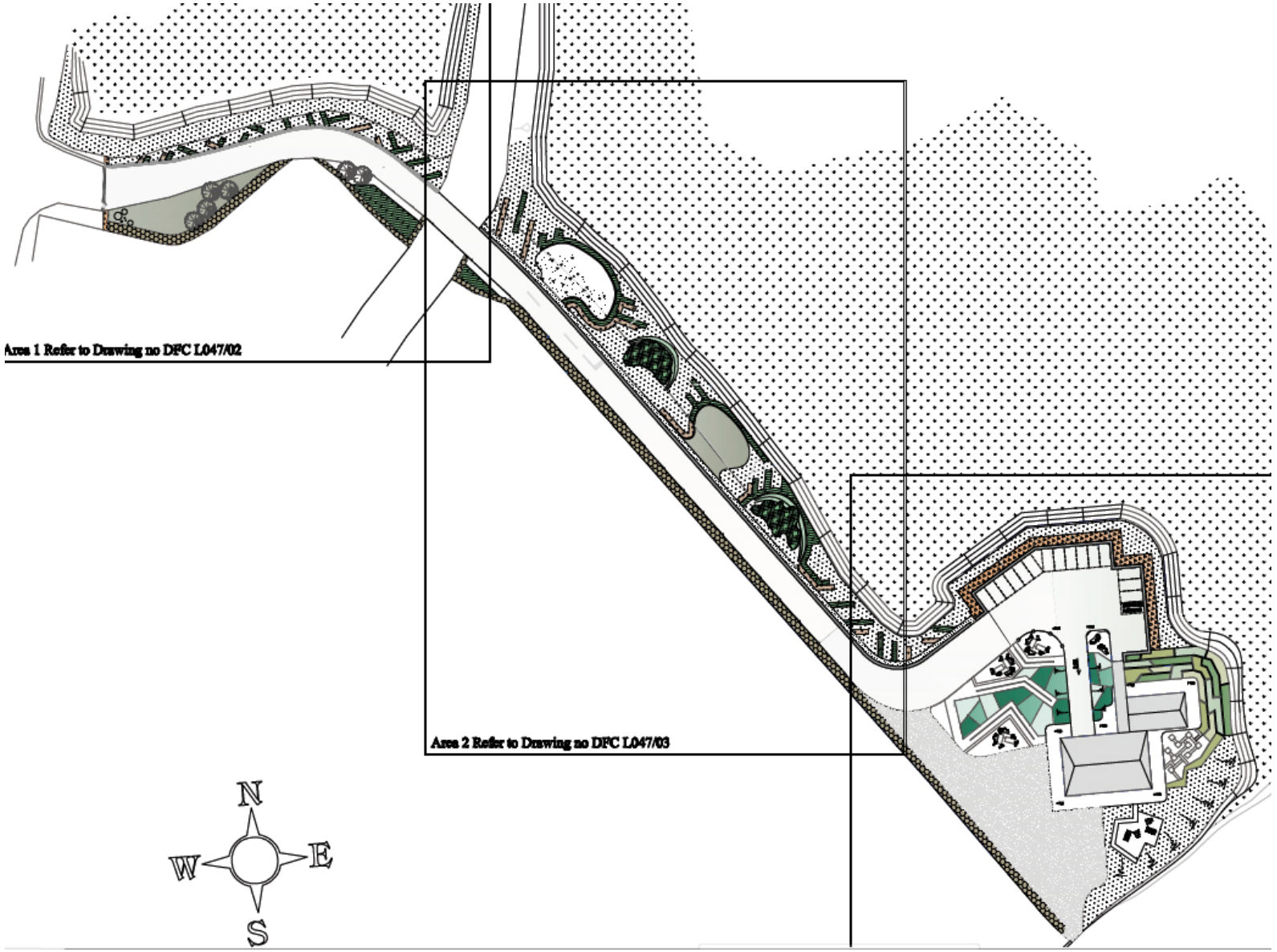


Wildflower meadow with planting pockets

- Blends typical amenity planting with wilder meadow areas
- Benefits pollinators and a range of other insects



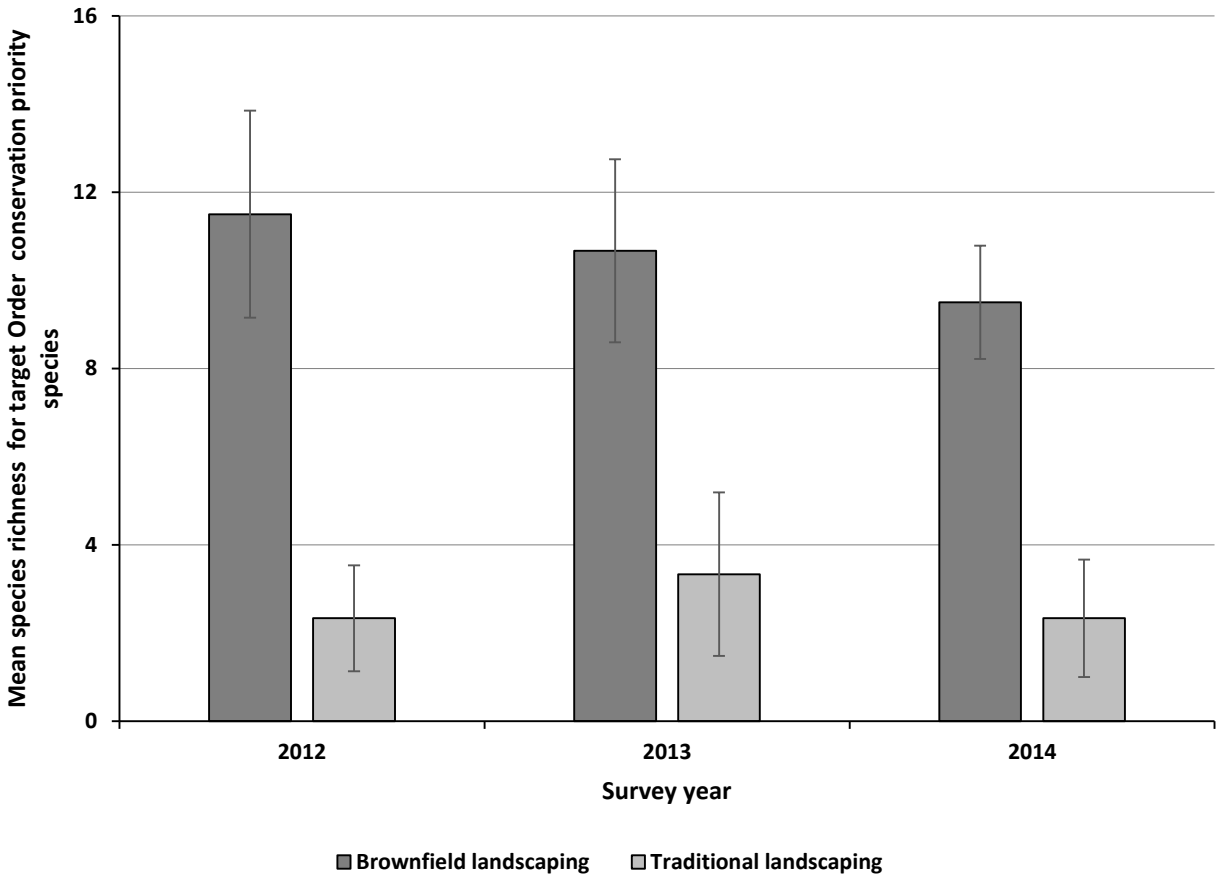
Barking Riverside brownfield landscaping



0.5 hectares in extent

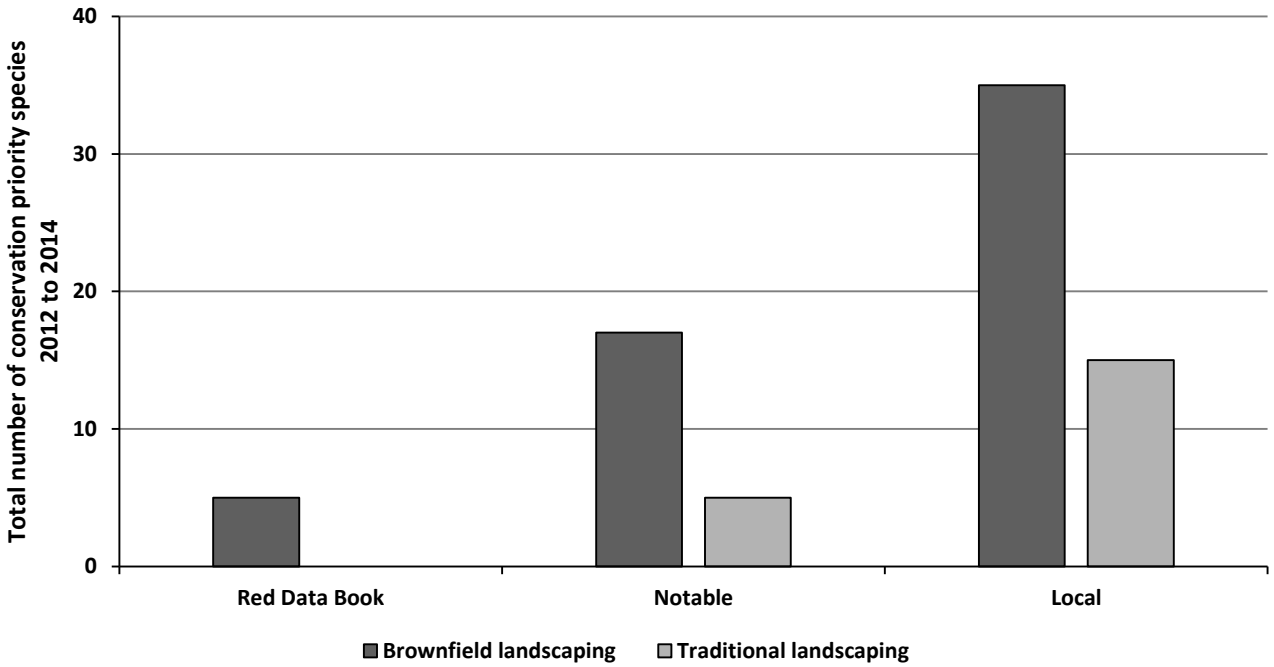
Barking Riverside traditional landscaping

Invertebrate monitoring results



Average species richness of conservation priority species recorded in pitfall traps for the target Orders Araneae, Coleoptera & Hymenoptera during 2012 to 2014.

Conservation priority species



- 57 conservation priority species recorded on brownfield landscaping, 5 Red Data Book, 17 Notable, & 35 Local (85 conservation priority species recorded during EIA surveys on site in 2004)
- 20 conservation priority species recorded on traditional landscaping, no Red Data Book, 5 Notable, & 15 Local

Invertebrate monitoring results

Bumblebee species richness and abundance was significantly higher on brownfield landscaping

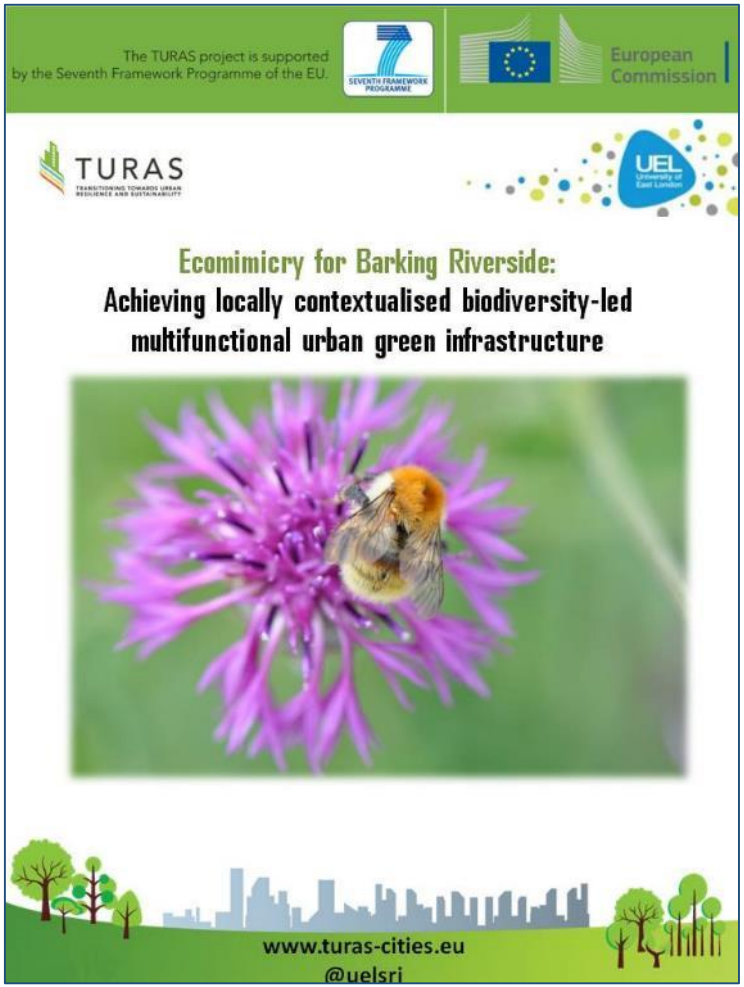
Brown-banded carder bee *B. humilis* nest recorded within the brownfield landscaping

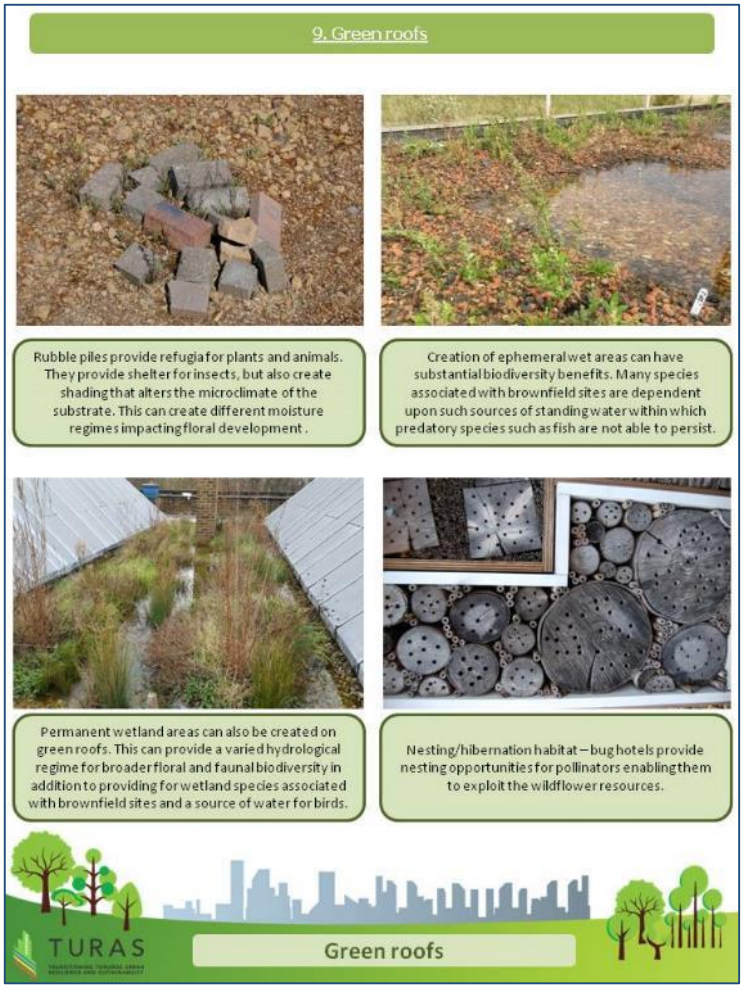
Invertebrate monitoring results

Dasypoda hirtipes © S Connop

- **50%** of species recorded on the brownfield landscaping **characteristic of the pre-development brownfield site**
- **Variation** in species and groups recorded **in different pockets**: woodland pocket – lesser stag beetle *Dorcus parallelipipedus* (Local), sandbank – hairy-legged mining bee *Dasypoda hirtipes* (Notable Nb) nesting
- **Sandbank** pocket supported **highest** species richness
- **Variation** between pockets indicated **desired habitat mosaic** had been achieved

From theory into practice- design guidance





http://roar.uel.ac.uk/4913/

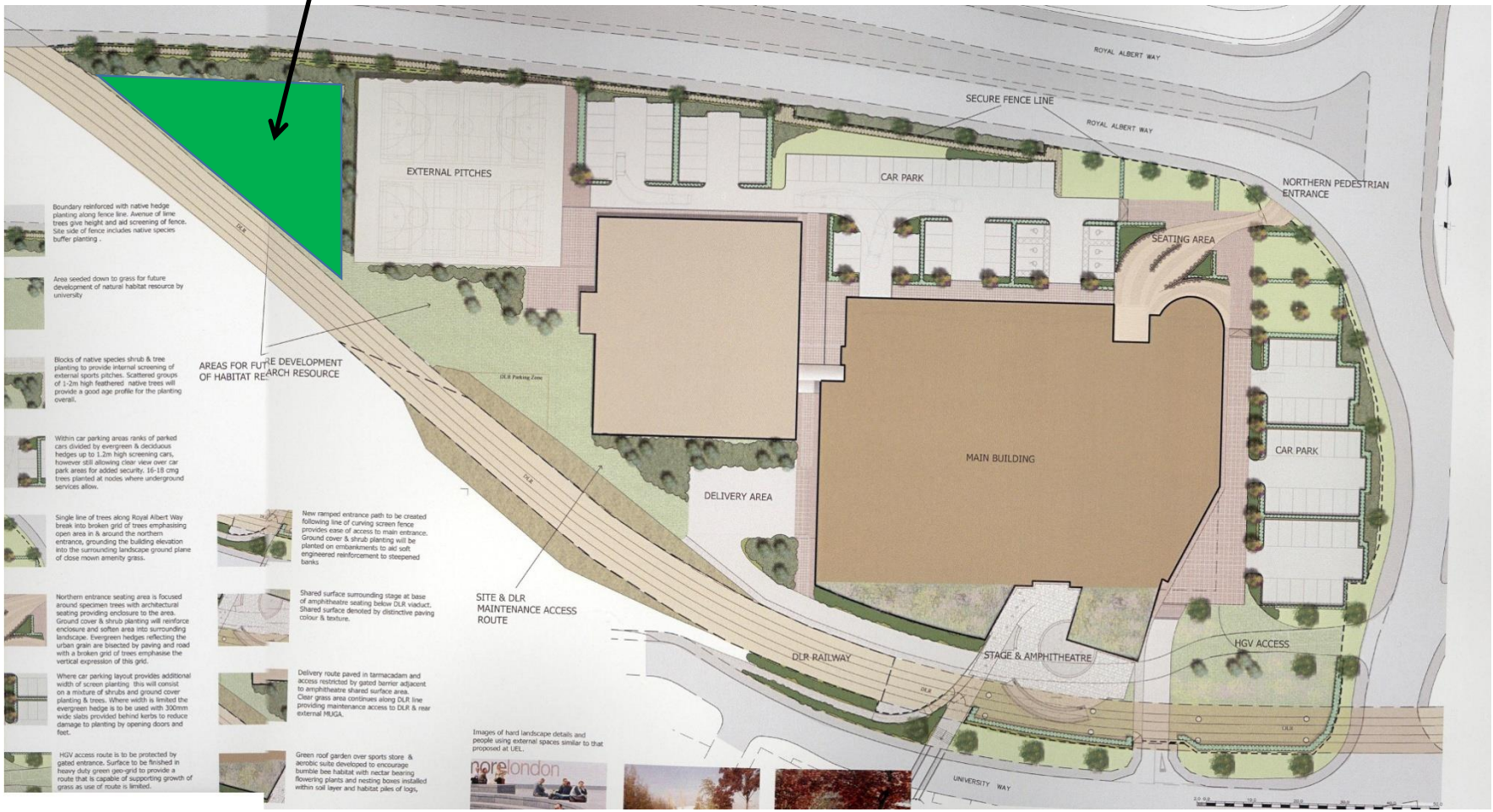
UEL's Beetle Bump

Streaked bombardier beetle (*Brachinus sclopeta*)

International Rescue!

UEL's Sports Dock

Beetle bump site (0.1 ha)



Beetle Bump construction

Recycled aggregates used:

- 20 tonnes of broken brick
- 20 tonnes of screened recycled soil
- 10 tonnes of chalk
- 10 tonnes of crushed concrete

Plants used:

- Wild carrot (*Daucus carrota*)
- Red deadnettle (*Lamium purpureum*)
- Wild parsnip (*Pastinaca sativa*)
- Red clover (*Trifolium pratense*)
- Bird's-foot trefoil (*Lotus corniculatus*)
- Red bartsia (*Odontites verna*)
- Narrow-leaved Bird's-foot trefoil (*Lotus glaber*)
- Black horehound (*Ballota nigra*)
- Musk mallow (*Malva moschata*)
- Autumn hawkbit (*Scorzoneroides autumnalis*)
- Weld (*Reseda luteola*)
- Mix of composites
- Commercial wildflower seed mix

Designed to mimic the region's brownfield sites and sites where the beetles had been found

Beetle bump aerial view

Combines brownfield habitat features with attractive artistic design to create a aesthetically pleasing wildflower-rich area that would be beneficial to both wildlife and staff and students

Beetle bump 2013

Nearby generic landscaping 2013

Beetle bump legacy

Good numbers of streaked bombardier beetles recorded on brick mounds

Other species recorded in 2013 and 2014 included:

- RDB species: *Stictopleurus abutilon and punctatonervosus*
- Nationally scarce : Spined Hylaeus bee *Hylaeus cornutus* (Na), Adonis ladybird *Hippodamia variegata* (Nb), carabid *Ophonus ardosiacus* (Nb)
- 11 Local species
- UK BAP Priority brown-banded carder bee *Bombus humulis*

Beetle bump – legacy

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Brownfield Hub

- How to manage brownfields
- Brownfield case studies
- Open Mosaic Habitat Inventory

Untidy Industries brownfield site

Jamie Robins

Welcome to Buglife's brownfield hub, a one stop shop for information on brownfields and their invertebrates. The brownfield hub is intended to help anyone from ecologists to planners, or developers to wildlife lovers to understand the value of brownfields for our rare invertebrates.

https://www.buglife.org.uk/brownfield-hub

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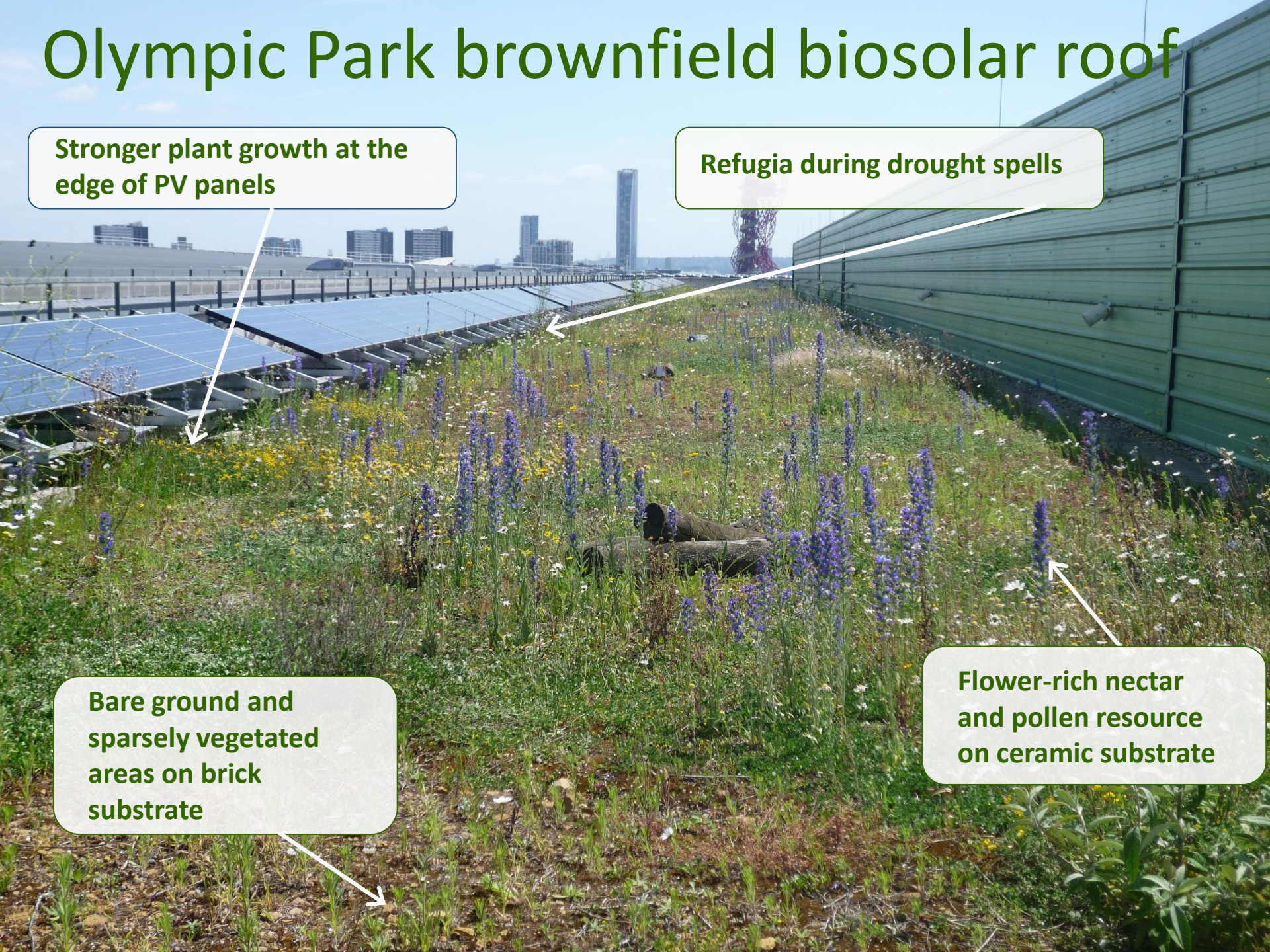
Olympic Park brownfield biosolar roof



Added value of ecomimicry approach

- **Ensures UGI provides ecological functionality in addition to other ecosystem services**
- **Makes urban landscapes more permeable to biodiversity and creates connectivity between key brownfield and semi-natural sites in the region**
- **Previous research by UEL at Barking Riverside has shown that biodiverse approaches to UGI design can enhance ecosystem service provision**
- **My research was focused on locally valuable habitat in London, but the ecomimicry technique could be applied to other geographical areas**

Connecting Nature

- **EU Horizon 2020 research project scaling up nature-based solutions (NbS) to build resilient and sustainable cities**
- **Produce a toolkit and guide book for cities seeking to deliver NbS**
- **Create a reference framework to evaluate the efficacy and impact of NbS**
- **Develop mechanisms to foster co-creation of NbS with commercial and social enterprises**


Thank you for listening