

Invertebrate Conservation and Brownfield Development

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Talk Outline

- Context – the Ecology of cities and Brownfields
- Brownfield Red Data?
 - National records
 - A test on brownfields in Birmingham
- What is structuring rarity and Diversity?
 - Environment and species correlates
- Does the landscape context matter?
 - The importance of habitat
- Brownfield development – damage limitation
 - Brownfields in the sky – a case for using green roofs?
 - Principles

Context

- **Urban areas** are a complex mosaic of habitats
 - parks, gardens, rivers, canals, ponds, woodland, hedgerows, brownfield
- **Human and Natural processes** - some habitats are managed/protected, others are occur by accident
- Initial ideas in the work of [Eversham et al. \(1996\)](#), suggested that 35% of rare UK carabids are found in anthropogenic habitats.
- [Gibson \(1998\)](#) - reviews the UK evidence and suggests that brownfield sites are important homes for rare species of invertebrates.

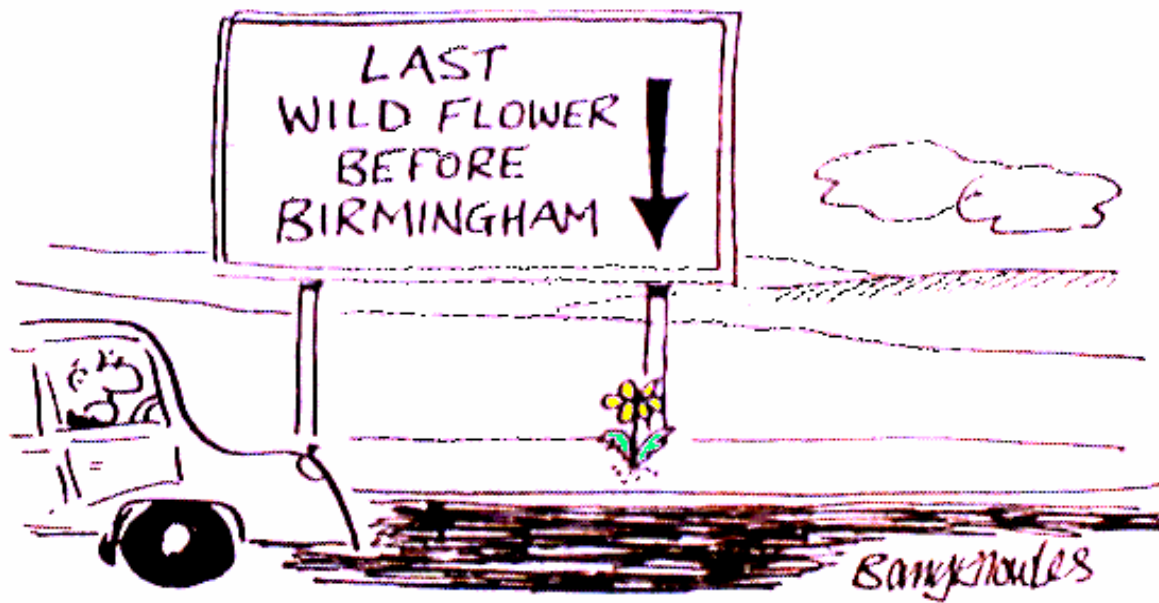
Key Green papers from HM Government

- The 'Urban Task Force' – 1999
- Green Space, Better Places – 2002
- Sustainable communities: building for the future – 2003

Policy Implications.....

Current policy is to build 60% of the new 3.8 mill. Houses needed in the UK by 2008 on 'Brownfield Sites'

No nature in there...

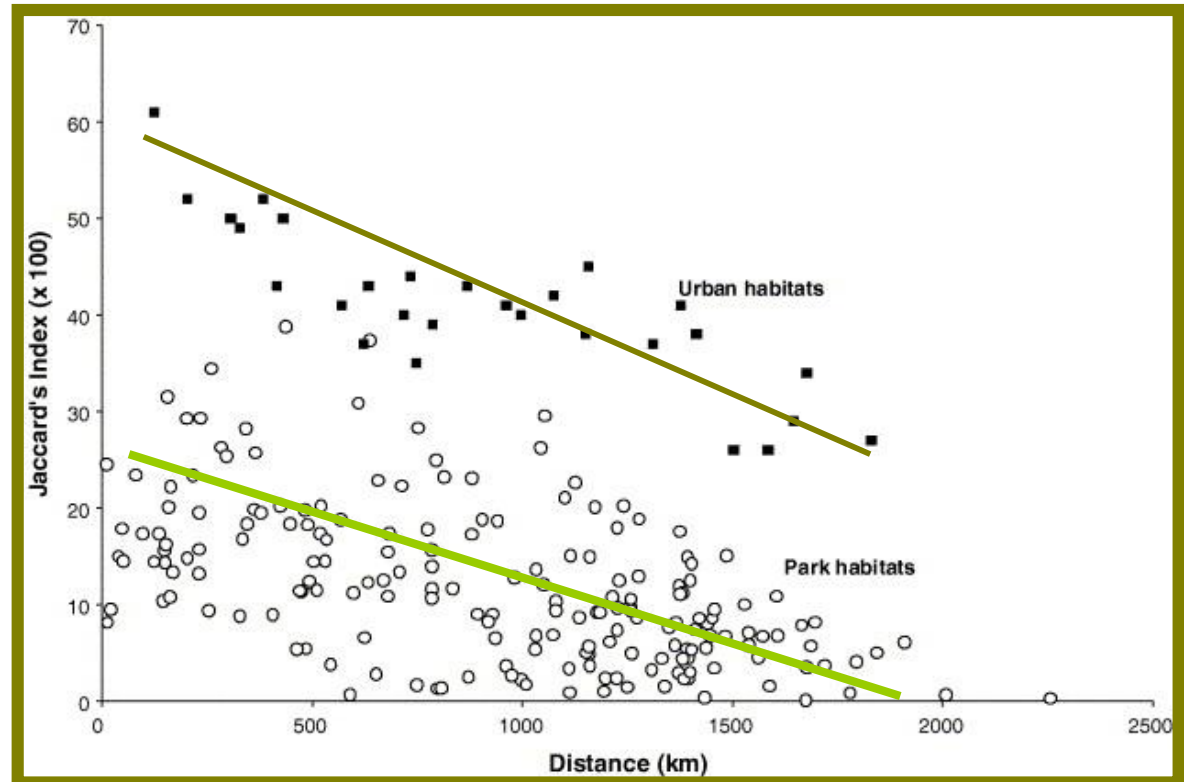


Urbanization as homogenization

Analysed plants for 8 cities:

1. Boston, 2. N. York, 3. Chicago
4. Philadelphia, 5. Minneapolis
6. Washington, 7. Detroit and
8. St. Louis

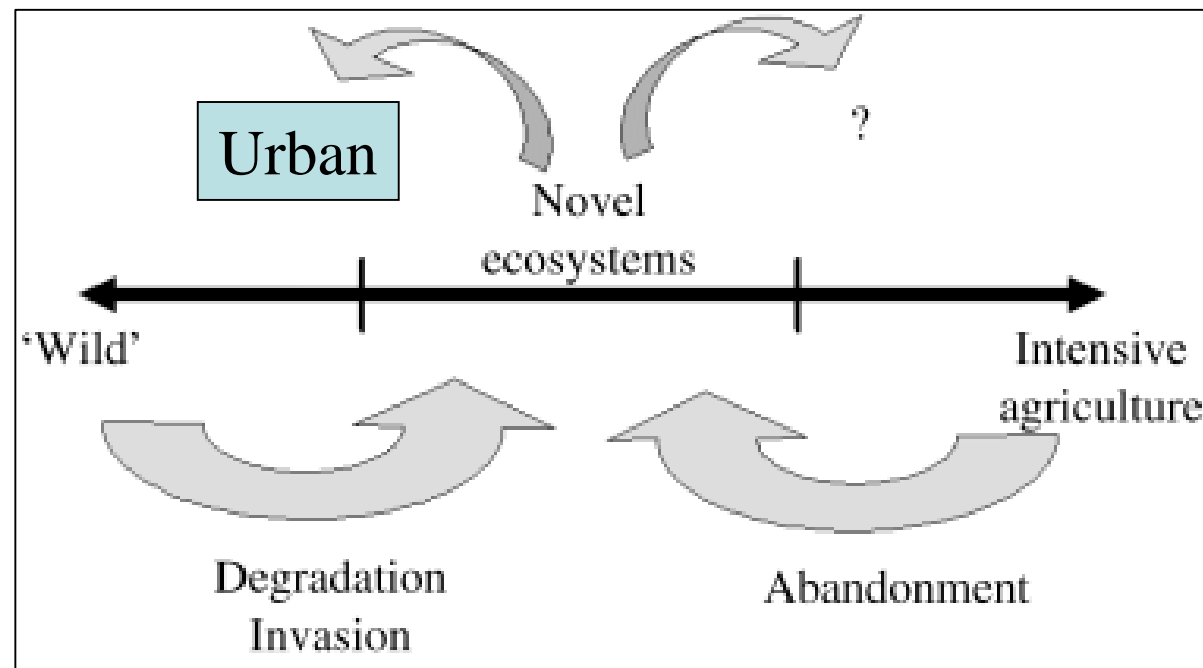
Found that urban areas have consistently higher similarities than natural areas – irrespective of distances between sites



McKinney 2006 Biol. Conserv. 127, 247-260

Urban ecosystems as novel / emerging ecosystems

- ∅ Juxtaposition of habitats and > habitat heterogeneity
- ∅ New combinations of species



Hobbs et al. 2006 – Global. Ecol. Biogeog., 15, 1-7

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Brownfields or urban commons



Designed Open Spaces



Photo: Dave Bell



Photo: Dave Bell



Photo: Dave Bell



Photo: Dave Bell

'Natural' Open Spaces

Jennens Road



Photo: Dave Bell

Digbeth Branch Canal



Photo: Dave Bell

River Rea



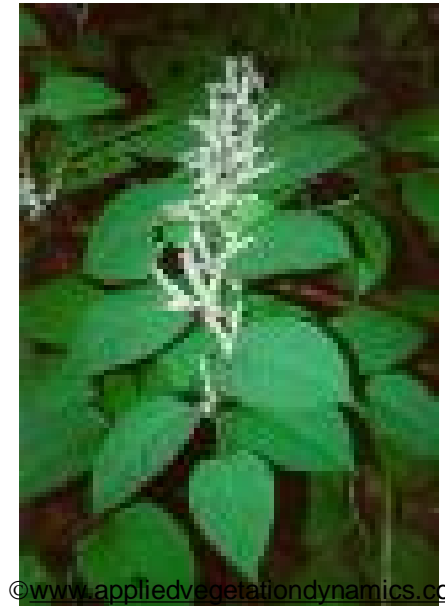
Photo: Dave Bell

New Bond St.



Photo: Rossa Donovan

Survey – Plants



Native

Naturalised

Invasive

Butterflies



- 1 – Small White
- 2 – Green-veined White
- 3 – Orange Tip
- 4 – Peacock
- 5 – Speckled Wood



Source: www.butterfly-guide.co.uk

Common

Survey – Birds

1. Black redstart
2. Starling
3. House Sparrow
4. Linnet
5. Song Thrush
6. Willow Warbler
7. Mistle Thrush
8. Grey Wagtail
9. Kestrel
10. Dunnock



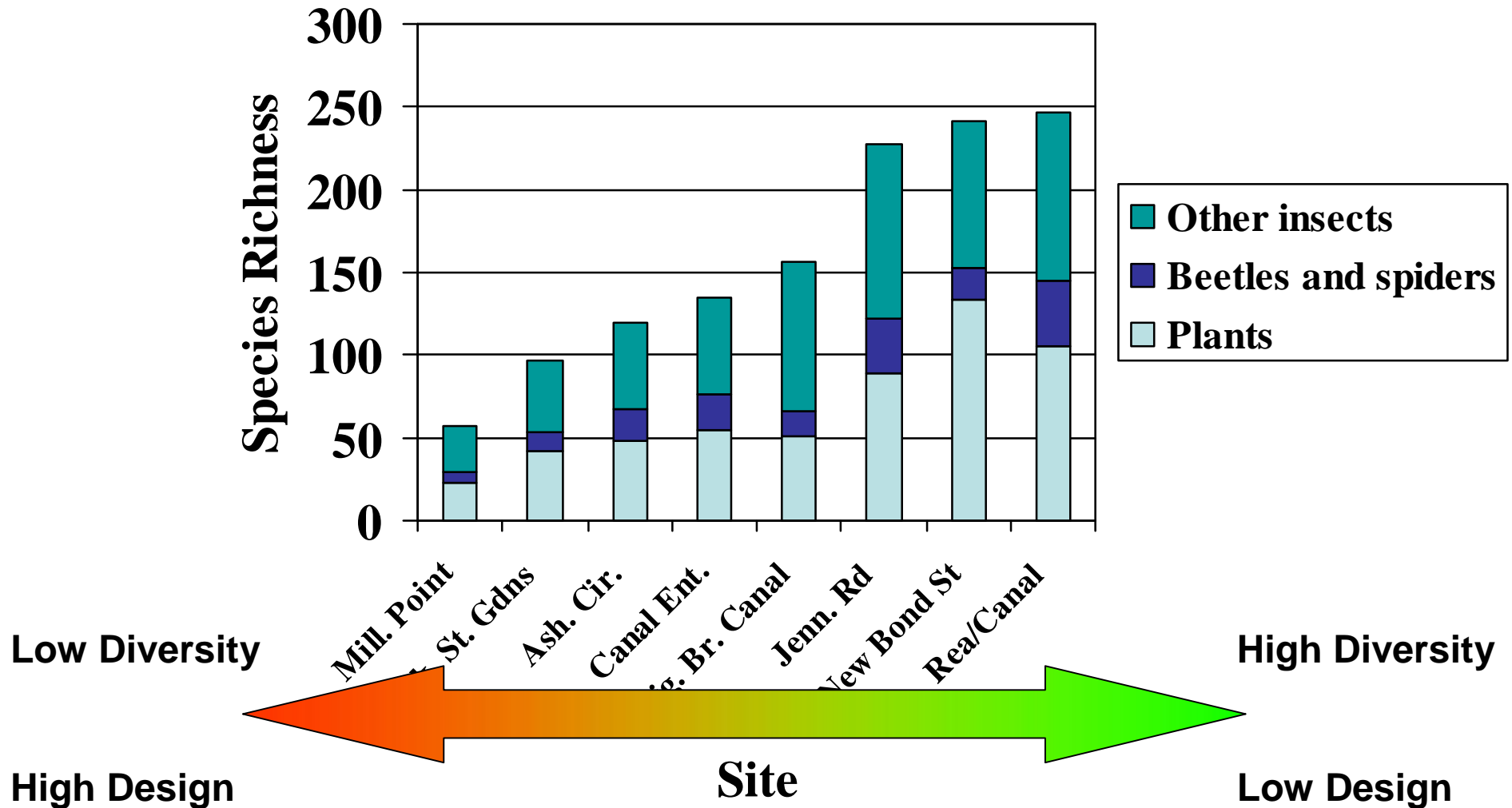
Source: RSPB

Red Data Book

Red List

Amber List

Comparisons of designed and brownfield sites

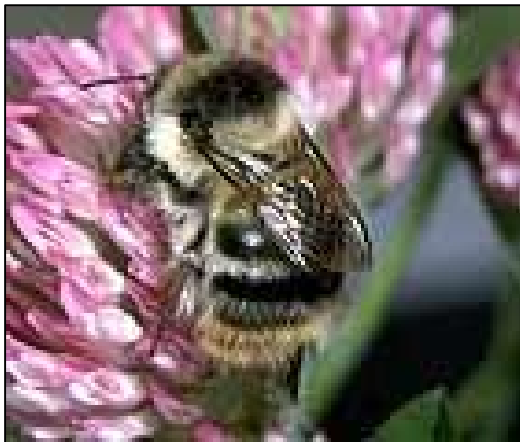
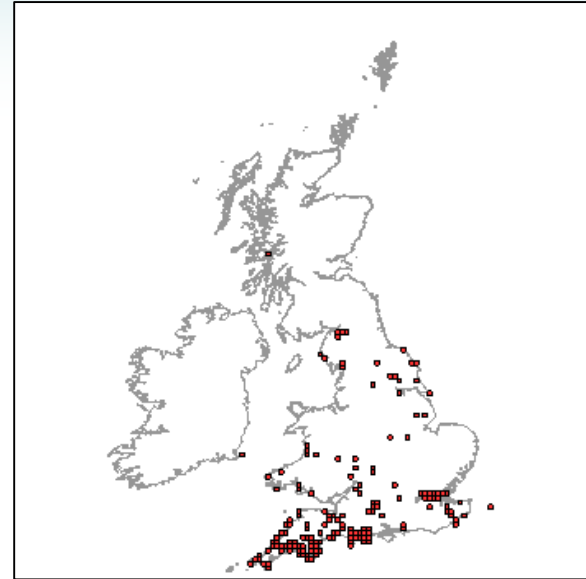


Source: Donovan, Sadler *et al.*, (2005)

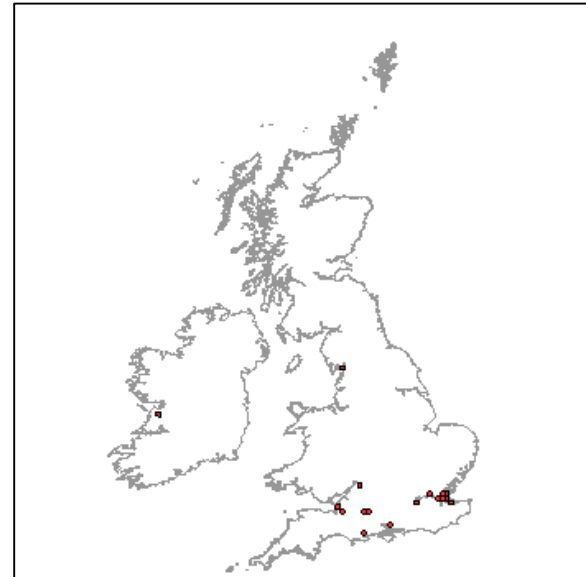
The national picture I



Brown-banded Carder Bee,
Bombus humilis © Roger Taylor



Shrill Carder Bee,
Bombus sylvarum © Roger Taylor



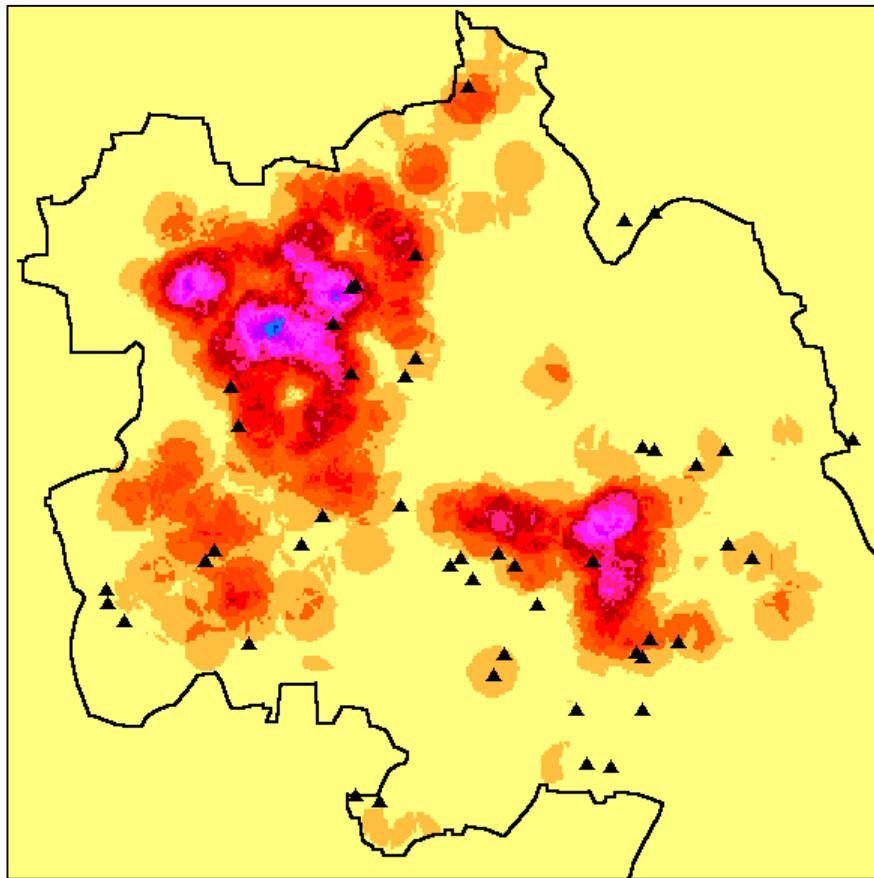
The national picture II

- **Eyre et al (2003)** report a survey of 78 brownfield between 1991 and 2001 throughout England
- A total of 182 records of 46 nationally rare and scarce species (16 ground, 10 rove and 20 phytophagous species) were generated.



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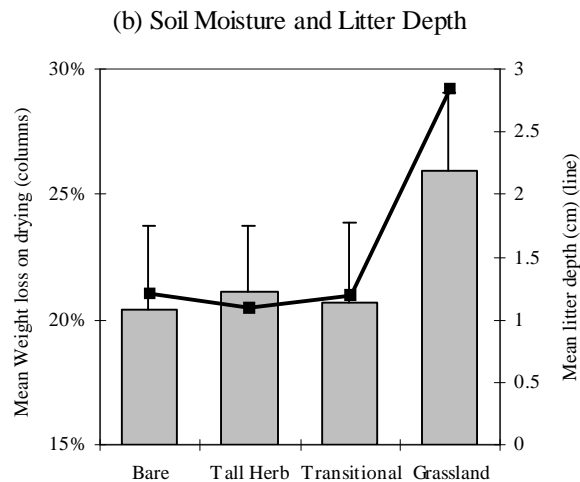
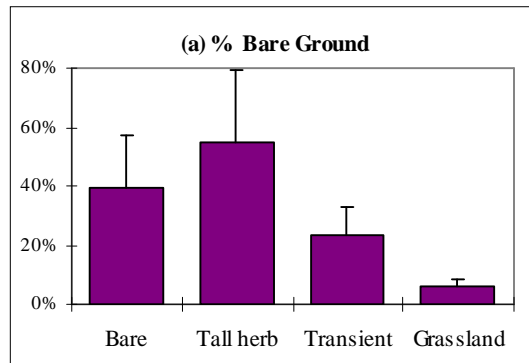
Analysing brownfields in Birmingham



- W.Midlands boundary
- ▲ Derelict land study sites
- Low density derelict land
- High density derelict land

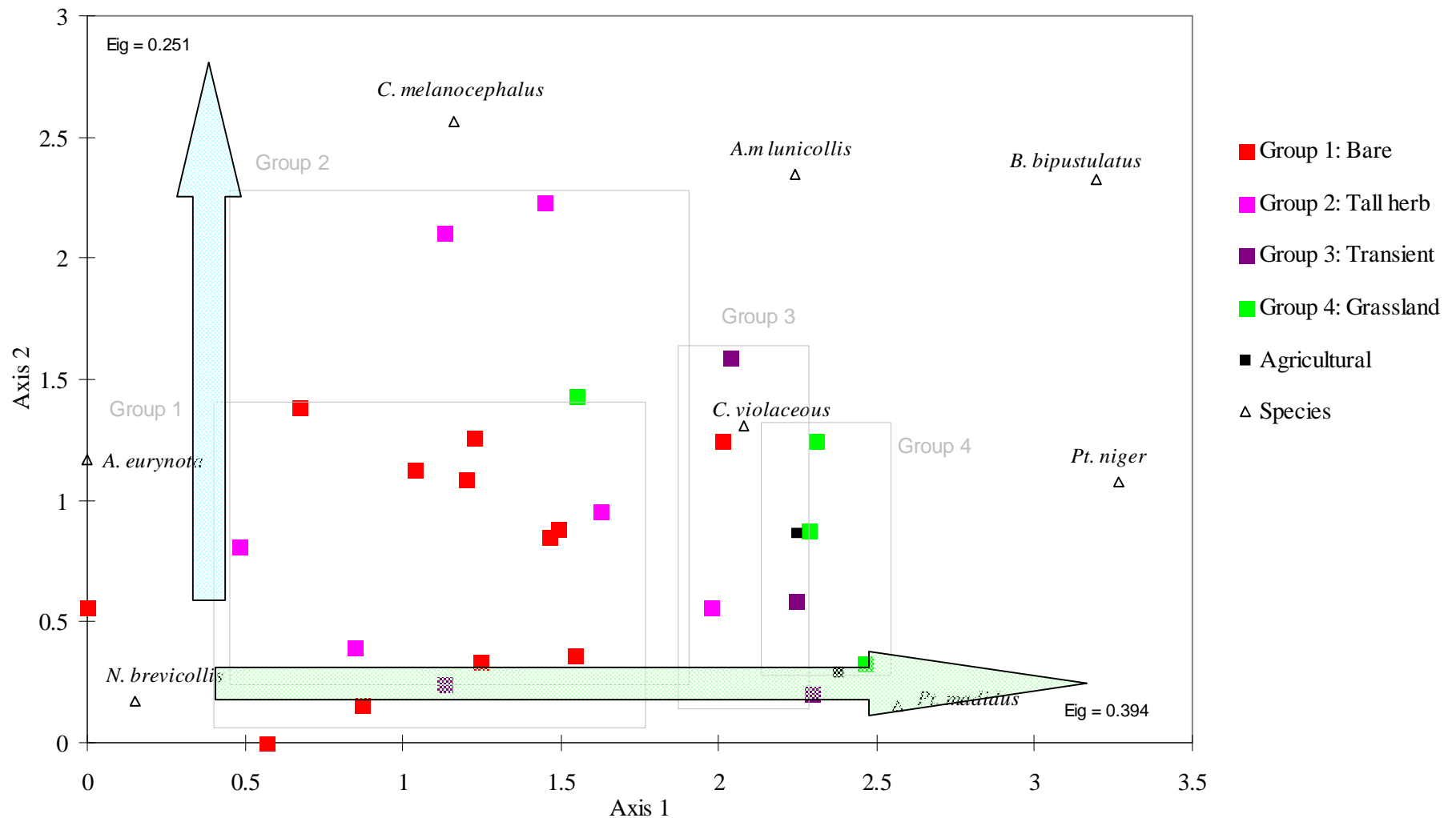
- Indices were developed to take account of the the nature ('permeability') of the urban matrix around each site.

Abiotic changes in relation to succession



- > Bare ground on early sites ($F=7.97$, $df=3$, $p<0.01$)
- > soil moisture on later sites ($F=3.29$, $df=3$, $p=<0.05$)
- > litter depth ($F=2.97$, $df=3$, $p<0.1$) on later sites

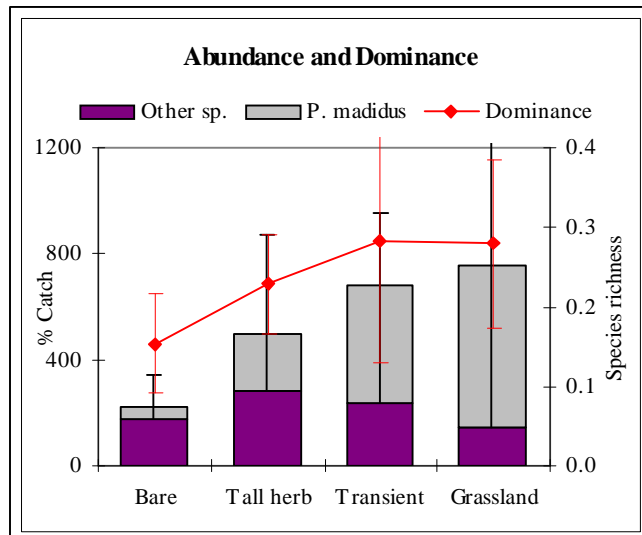
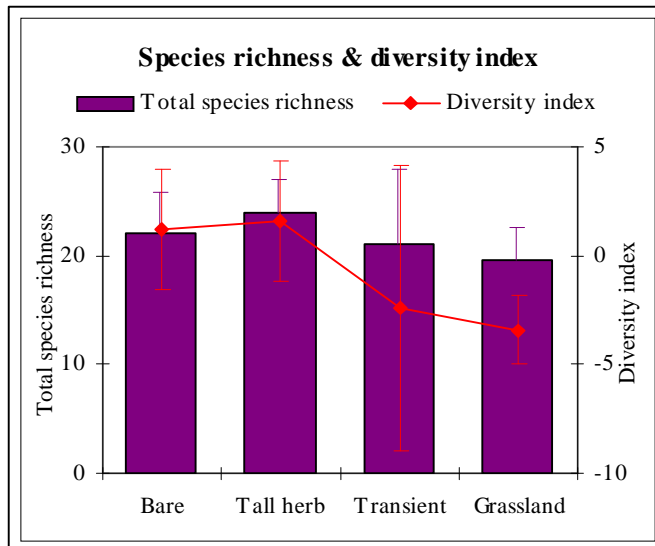
DCA of derelict beetles



Carabid assemblage significantly related to vegetation type

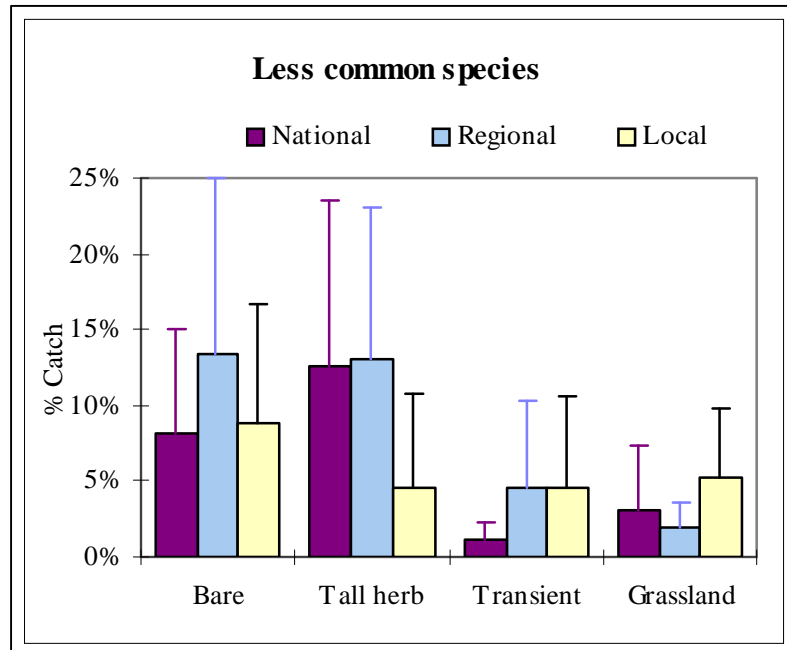
$$r_s = -0.528, n=26, p=0.006$$

Biotic changes: community metrics



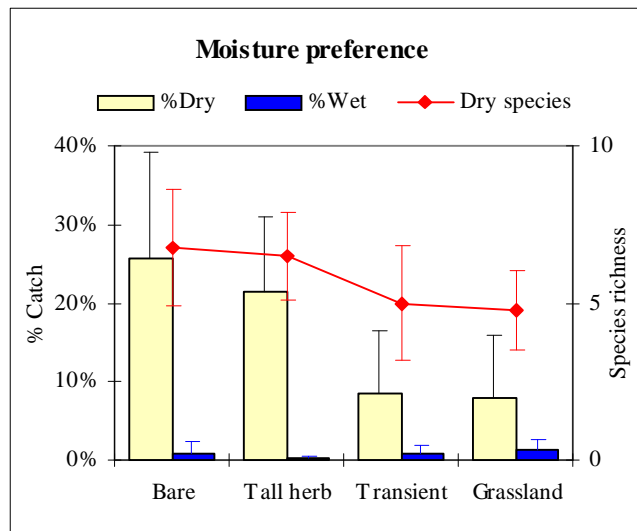
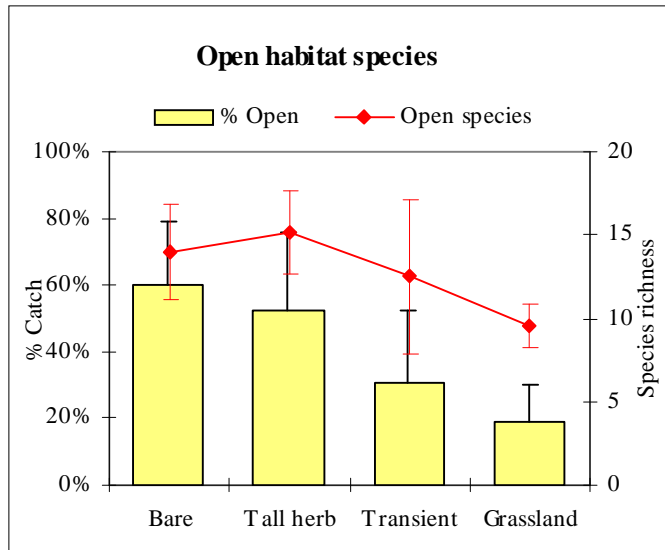
- Richness is higher in early successional habitats ($r_s = -0.528$, $n=26$, $p=0.006$)
- Species evenness changes along the gradient

Biotic changes: rarity



- Rarer species are more common on early successional habitats

Biotic change: species traits

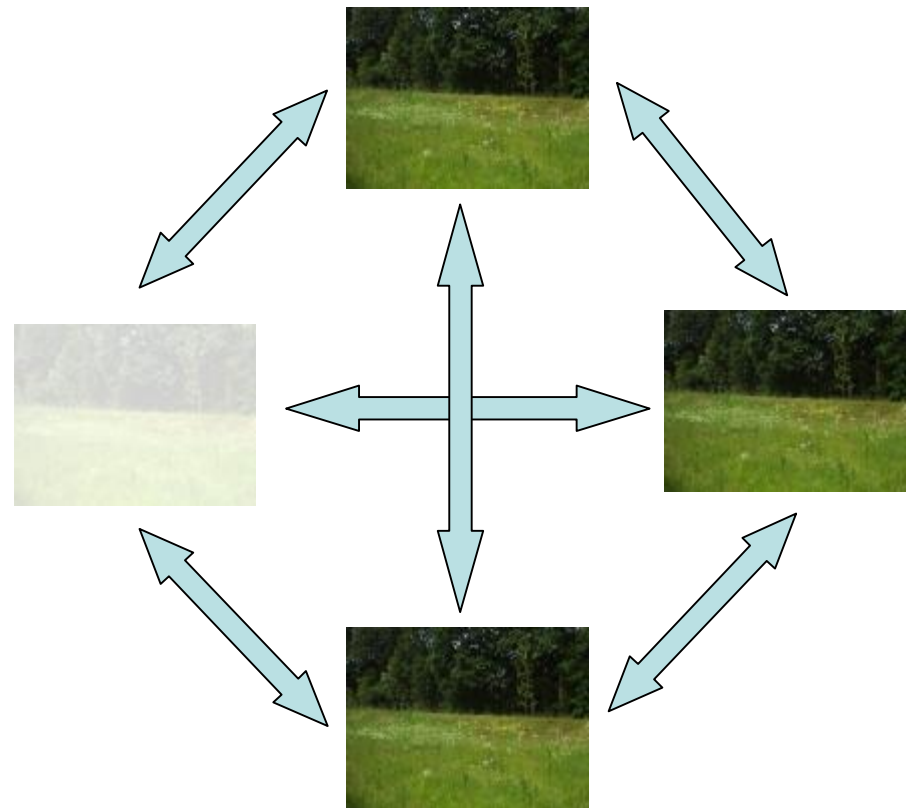


- > open habitat species on early sites ($\chi^2 = 11.27$, $p < 0.01$)
- > xeric species on early sites

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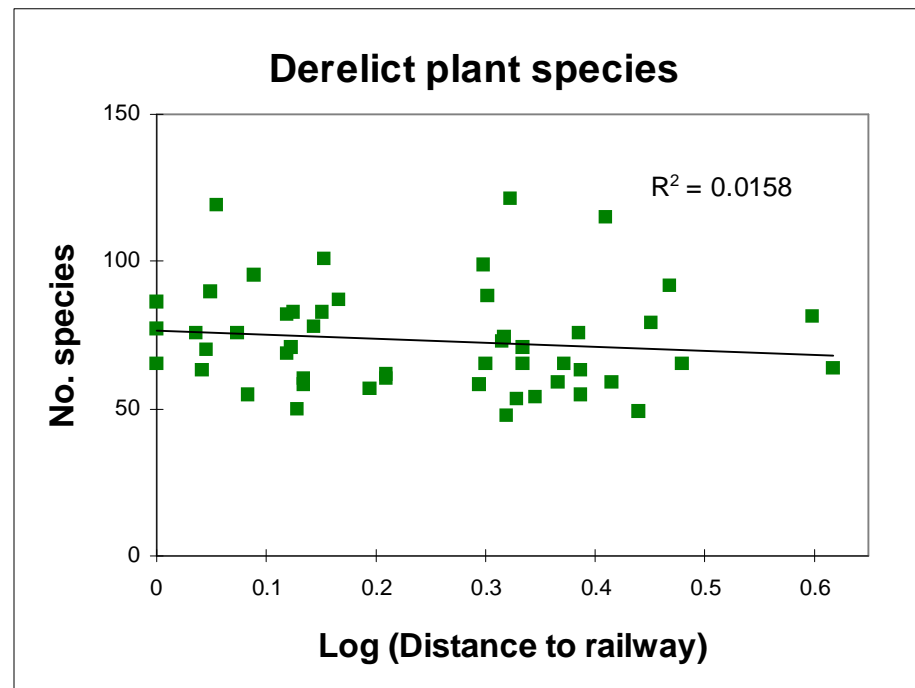
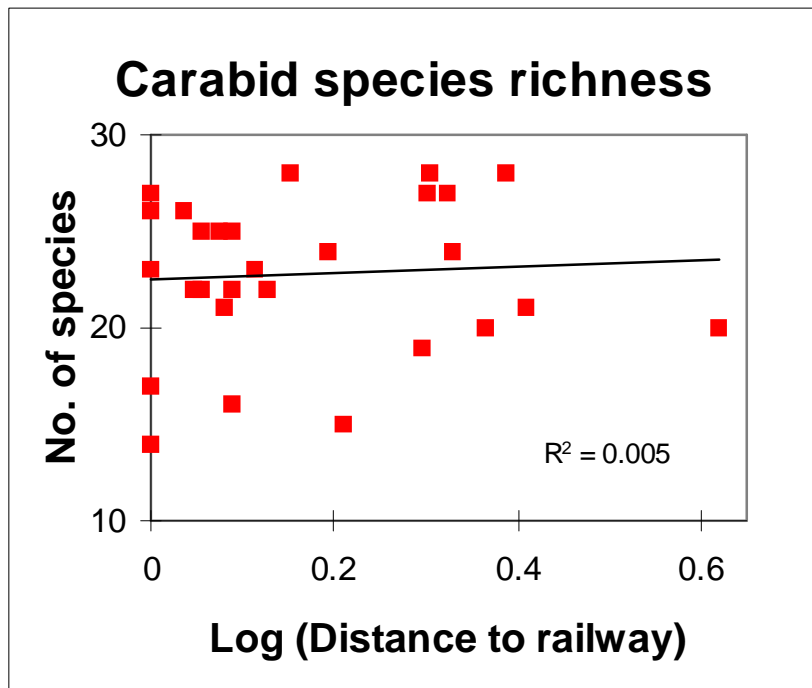
Ecological Processes – Metapopulation Theory

- Metapopulation model – complex of connected populations, each of which couldn't persist on its own, but is viable as a whole
- Each population is discrete in space, but connected to others by limited migration
- Can only exist so long as population extinctions are balanced by colonisation of empty patches

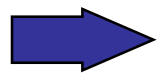


After Levin (1969)

Biotic change: Landscape issues

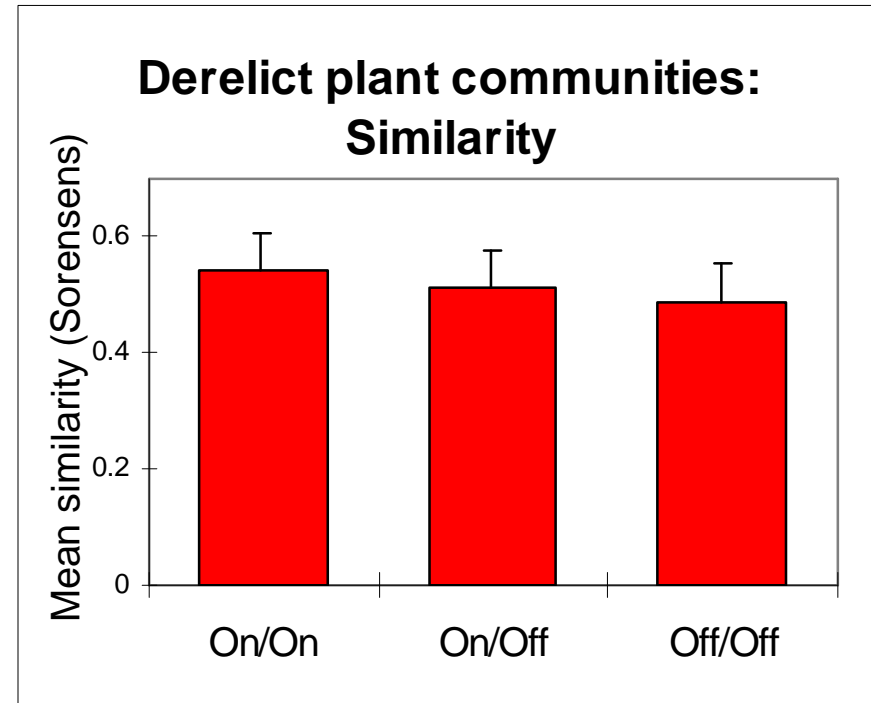
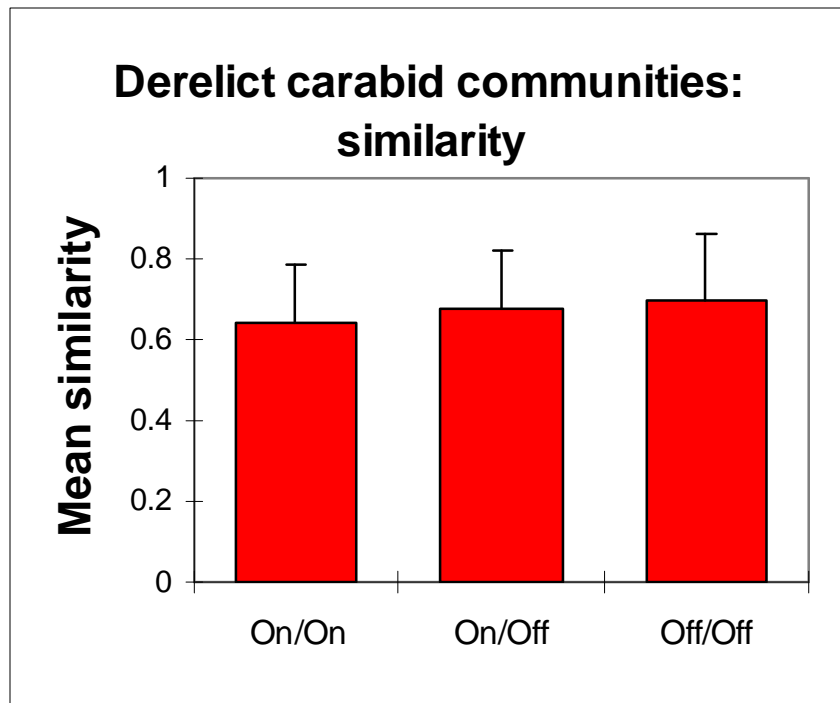


H: Sites on habitat corridors (or Greyways) will tend to have higher diversity

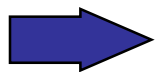


Not found

Biotic change: Similarity



*H: Sites on corridors will tend to be similar to each other;
sites off corridors will tend to be dissimilar*



Not found

Genetics Research on Butterflies



Green-veined white



Meadow brown



Gatekeeper



Small Heath

Landscape and genetics

- Green-veined Whites and Meadow Brown populations are well connected
- Gatekeeper and Small Heath populations showed some evidence of limited geographic structuring
- Distribution and abundance is more likely to be limited by habitat availability than dispersal ability.
- The presence of a corridor does not influence the gene flow of butterflies with high to medium mobility



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- Concluding thoughts

Green roofs



Green roof types - biodiversity roof

- 'Brown' roof - designed to replicate brownfield habitats; heavier than normal roof systems; have potential to meet conservation objectives; in-situ re-use of aggregates - no maintenance



Concluding thoughts

- There is no doubt that brownfields support a high diversity of invertebrates
- But they are targeted for development (especially housing)
- The way forward:
 - Do nothing and hope it sorts itself out
 - Be creative
 - think about landscaping to maximise important elements (e.g. bare ground, substrate variability, graded banks, appropriate planting and so on)
 - use brown roofs **and** other forms of green engineering