



# Buzzing Around SUDS: Pollinators and Sustainable Urban Drainage Systems

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## Pollinator targeted action

- restore natural habitats including wildflower-rich areas
- reduce pesticide use
- integrate invertebrate conservation measures in urban and agricultural areas



Centre for  
Conservation &  
Restoration Science

## Order Diptera – Family Syrphidae

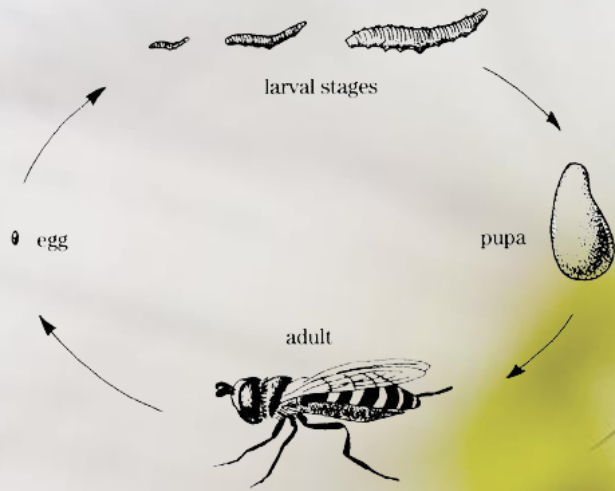
- 6000 species globally, 282 in Britain
- Ecosystem services: pollination (>72% of global food crops), natural pest control, nutrient cycling
- ~ US\$300 billion / year (FAO, 2017)



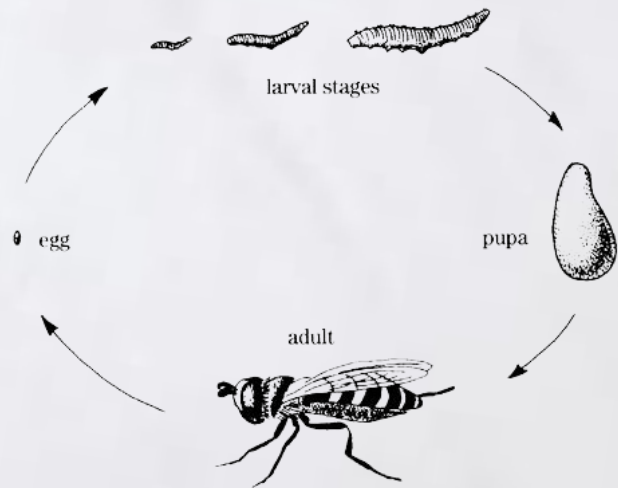
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- Phytophagous and mycophagous larvae
- Zoophagous larvae
- Saprophagous larvae



*Eristalis tenax* adult



*Eristalis tenax* larva

Phytophagous and mycophagous larvae

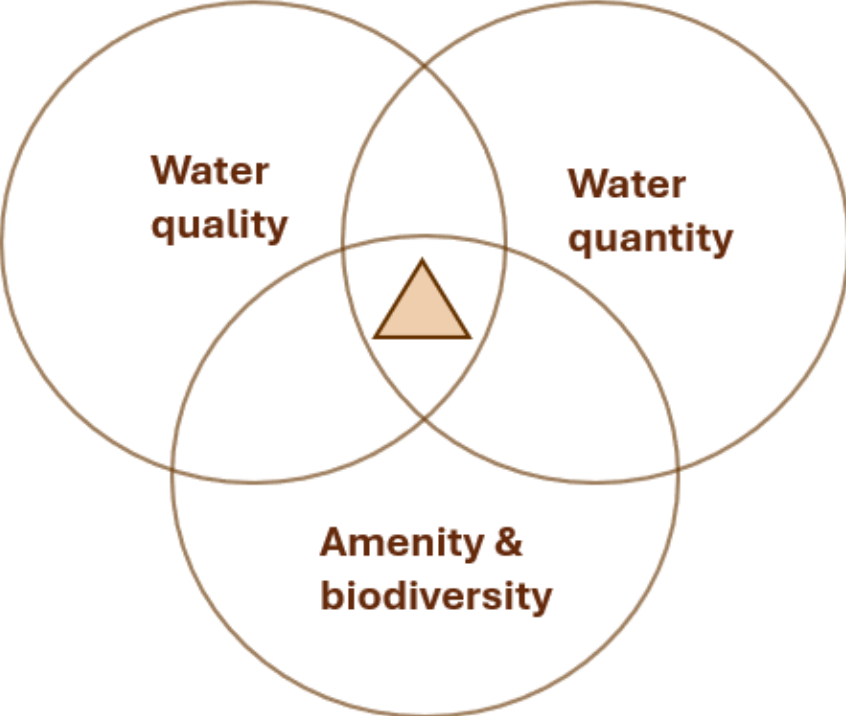
Zoophagous larvae

Saprophagous larvae



sap runs, under bark, rot-holes, decaying tree roots, decaying vegetation

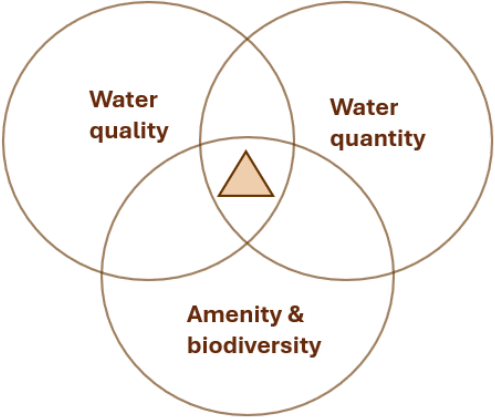
# Sustainable Urban Drainage Systems - SUDS



The SUDS triangle  
From Woods-Ballard et al. 2007



# Sustainable Urban Drainage Systems - SUDS



The SUDS triangle  
From Woods-Ballard et al. 2007



- pollution retention/absorption ✓
- pluvial flood risk management ✓
- biodiversity ?



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Examine the **variation** in the abundance and composition of pollinators in urban habitats **with** and **without** SUDS

**Identify habitat** and **SUDS features**, including physical and habitat characteristics, water quality, surrounding vegetation diversity, that are **correlated** with abundance and **diversity of pollinators**

Objective 1

Objective 2



Compare **traditional field sampling techniques** and **eDNA approaches** to determine the relative efficacy of these for accurate assessments of hoverfly pollinator diversity within freshwater habitats

Examine the **predictors of recruitment** of pollinators to artificial egg laying sites (**hoverfly lagoons**) in urban habitats with and without SUDS

Objective  
3

Objective  
4





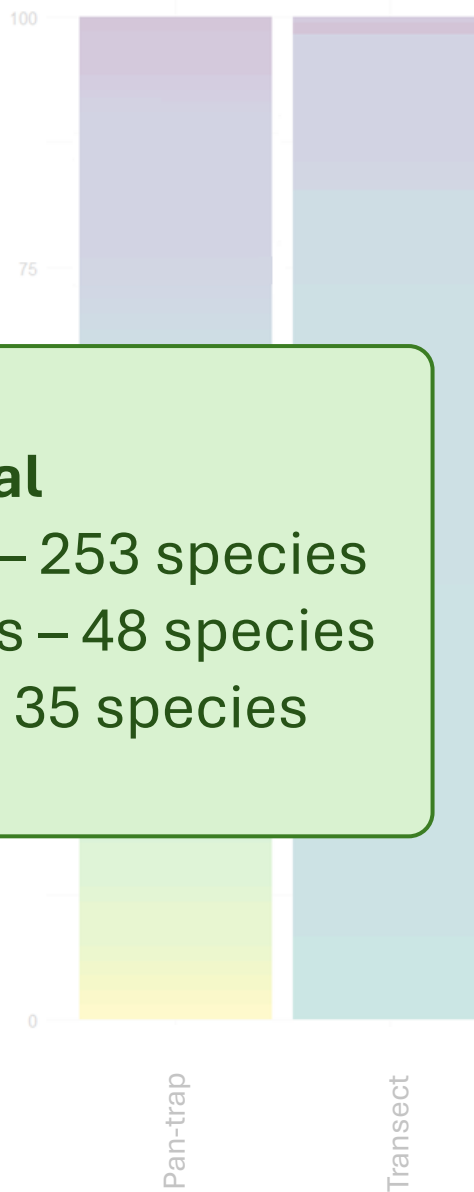
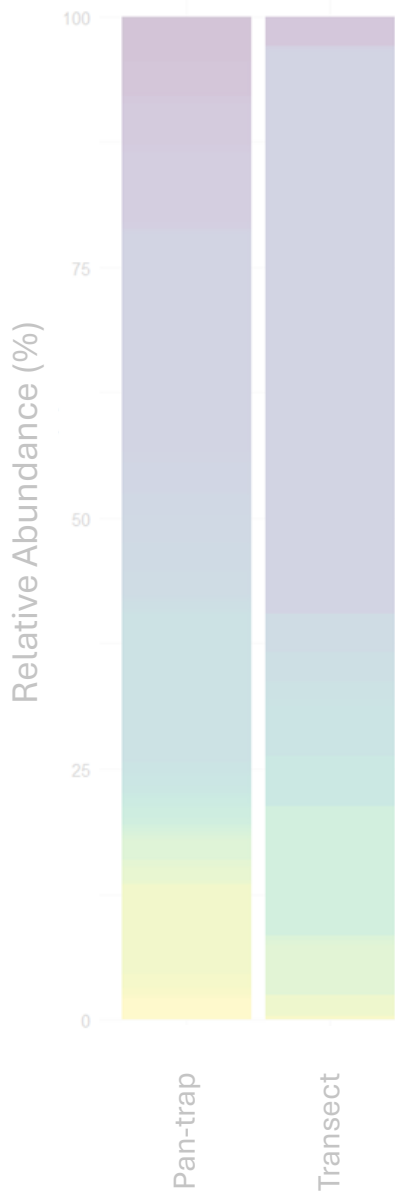
Hoverfly species (Diptera:Syrphidae)

- |                                  |                               |                                |
|----------------------------------|-------------------------------|--------------------------------|
| <i>Anasimyia contracta</i>       | <i>Eupeodes corollae</i>      | <i>Platycheirus peltatus</i>   |
| <i>Anasimyia lineata</i>         | <i>Eupeodes latifasciatus</i> | <i>Platycheirus splendidus</i> |
| <i>Cheilosia illustrata</i>      | <i>Eupeodes luniger</i>       | <i>Rhingia campestris</i>      |
| <i>Cheilosia impressa</i>        |                               |                                |
| <i>Cheilosia NA</i>              |                               |                                |
| <i>Cheilosia proxima</i>         |                               |                                |
| <i>Chrysogaster cimiteriorum</i> |                               |                                |
| <i>Chrysogaster solstitialis</i> |                               |                                |
| <i>Chrysotoxum festivum</i>      |                               |                                |
| <i>Dasysyrphus albostratus</i>   |                               |                                |
| <i>Episyrphus balteatus</i>      |                               |                                |
| <i>Eristalis sepulchralis</i>    |                               |                                |
| <i>Eristalis arbustorum</i>      |                               |                                |
| <i>Eristalis intricaria</i>      |                               |                                |
| <i>Eristalis nemorum</i>         |                               |                                |
| <i>Eristalis pertinax</i>        |                               |                                |
| <i>Eristalis tenax</i>           |                               |                                |



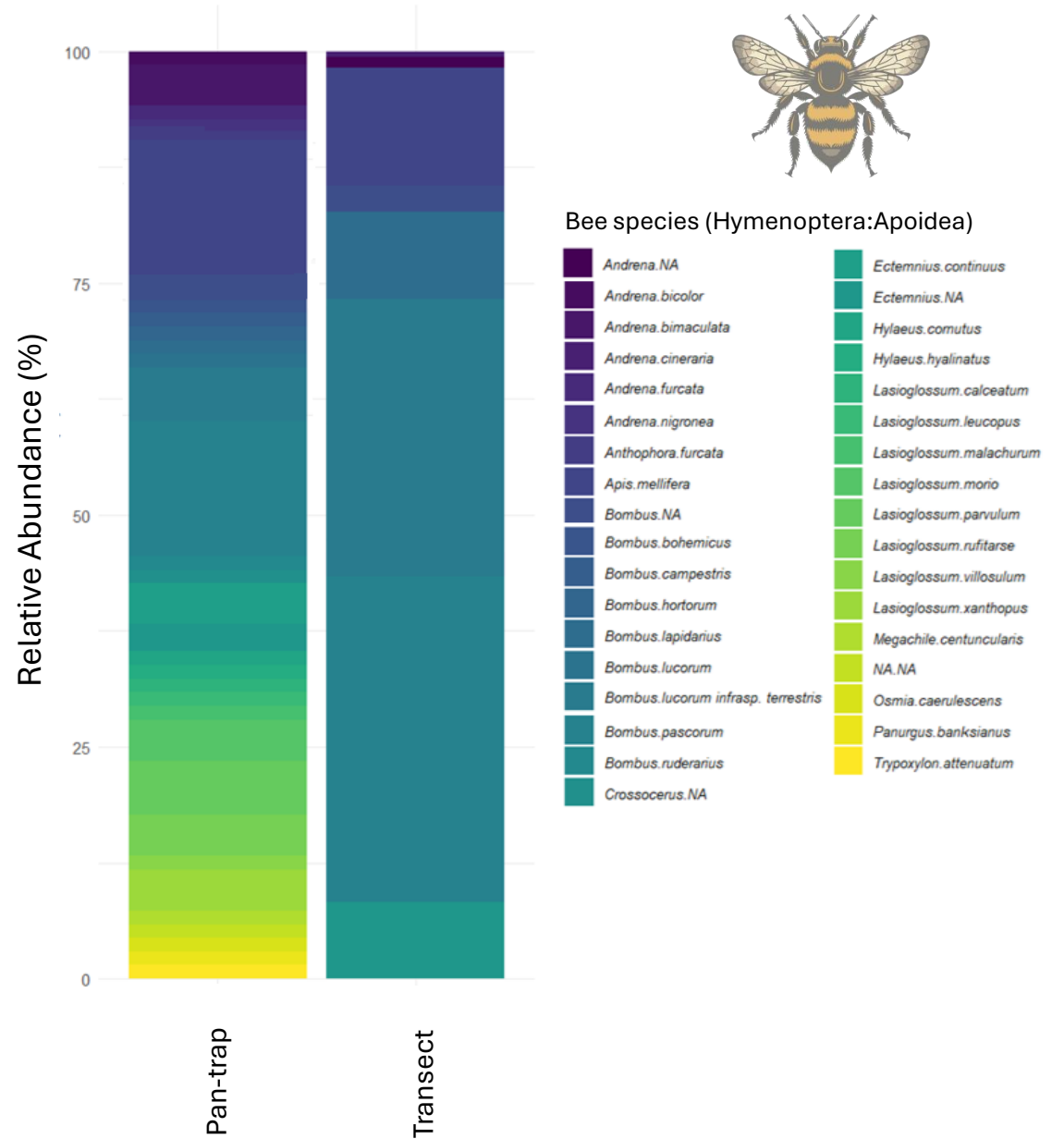
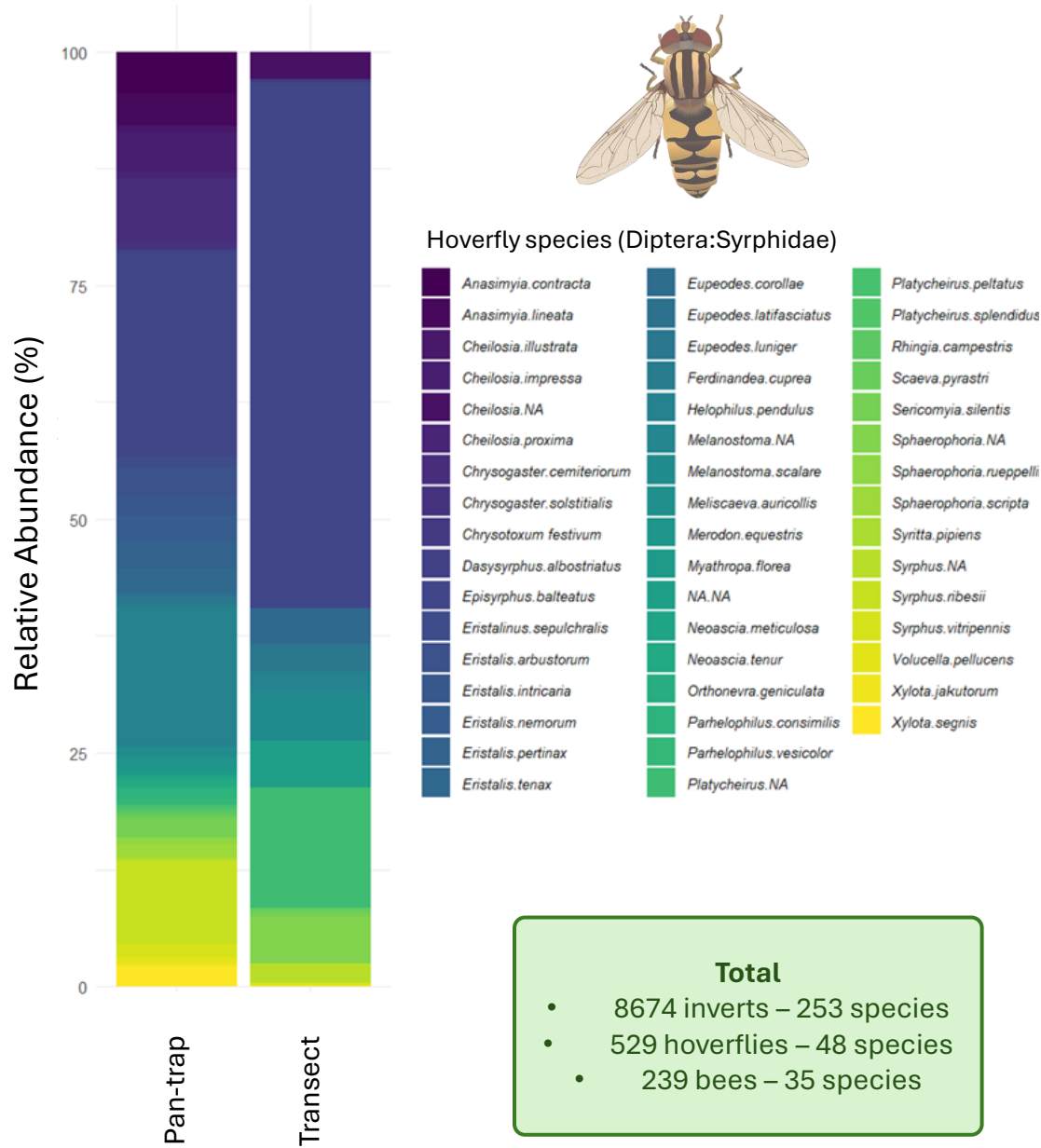
Bee species (Hymenoptera:Apoidea)

- |  |                                |
|--|--------------------------------|
| <i>Andrena NA</i>                        | <i>Ectemnius continius</i>     |
| <i>Andrena bicolor</i>                   | <i>Ectemnius NA</i>            |
| <i>Andrena bimaculata</i>                | <i>Hylaeus comutus</i>         |
| <i>Andrena cineraria</i>                 | <i>Hylaeus hyalinatus</i>      |
| <i>Andrena furcata</i>                   | <i>Lasioglossum calceatum</i>  |
| <i>Andrena nigrona</i>                   | <i>Lasioglossum leucopus</i>   |
| <i>Anthophora furcata</i>                | <i>Lasioglossum malachurum</i> |
| <i>Apis mellifera</i>                    | <i>Lasioglossum morio</i>      |
| <i>Bombus NA</i>                         | <i>Lasioglossum parvulum</i>   |
| <i>Bombus bohemicus</i>                  | <i>Lasioglossum rufitarse</i>  |
| <i>Bombus campestris</i>                 | <i>Lasioglossum villosulum</i> |
| <i>Bombus hortorum</i>                   | <i>Lasioglossum xanthopus</i>  |
| <i>Bombus lapidarius</i>                 | <i>Megachile centuncularis</i> |
| <i>Bombus lucorum</i>                    | <i>NA NA</i>                   |
| <i>Bombus lucorum infras. terrestris</i> | <i>Osmia caeruleascens</i>     |
| <i>Bombus pascorum</i>                   | <i>Panurgus banksianus</i>     |
| <i>Bombus ruderarius</i>                 | <i>Trypoxylon attenuatum</i>   |
| <i>Crossocerus NA</i>                    |                                |



**Total**

- 8674 inverts – 253 species
- 529 hoverflies – 48 species
- 239 bees – 35 species





### Hoverfly species (Diptera:Syrphidae)

<i>Anasimyia contracta</i>	<i>Eupeodes corollae</i>	<i>Platycheirus peltatus</i>
<i>Anasimyia lineata</i>	<i>Eupeodes latifasciatus</i>	<i>Platycheirus splendidus</i>
<i>Cheilosia illustrata</i>	<i>Eupeodes luniger</i>	<i>Rhingia campestris</i>
<i>Cheilosia impressa</i>	<i>Ferdinanda cuprea</i>	<i>Scaeva pyrastris</i>
<i>Cheilosia NA</i>	<i>Helophilus pendulus</i>	<i>Sercomyia silentis</i>
<i>Cheilosia proxima</i>	<i>Melanostoma NA</i>	<i>Sphaerophoria NA</i>
<i>Chrysogaster cemiteriorum</i>	<i>Melanostoma scalare</i>	<i>Sphaerophoria rueppellii</i>
<i>Chrysogaster solstitialis</i>	<i>Meliscaeva auricollis</i>	<i>Sphaerophoria scripta</i>
<i>Chrysotoxum festivum</i>	<i>Merodon equestris</i>	<i>Syrnitta pipiens</i>
<i>Dasysyrphus albostrigatus</i>	<i>Myathropa florea</i>	<i>Syrphus NA</i>
<i>Episyrphus balteatus</i>	<i>NA NA</i>	<i>Syrphus ribesii</i>
<i>Eristalinus sepulchralis</i>	<i>Neoascia meticulosa</i>	<i>Syrphus vitripennis</i>
<i>Eristalis arbustorum</i>	<i>Neoascia tenur</i>	<i>Volucella pellucens</i>
<i>Eristalis intricana</i>	<i>Orthonevra geniculata</i>	<i>Xylota jakutorum</i>
<i>Eristalis nemorum</i>	<i>Parhelophilus consimilis</i>	<i>Xylota segnis</i>
<i>Eristalis pertinax</i>	<i>Parhelophilus vesicolor</i>	
<i>Eristalis tenax</i>	<i>Platycheirus NA</i>	

Relative Abundance (%)

100  
75  
50  
25  
0

permanent

SUDS seasonality

temporary



# Influence of Local & Landscape Variables

## Local Variables

Impact of SUDS seasonality, vegetation and floral variables, water & sediment characteristics, etc.

1

## Landscape Variables

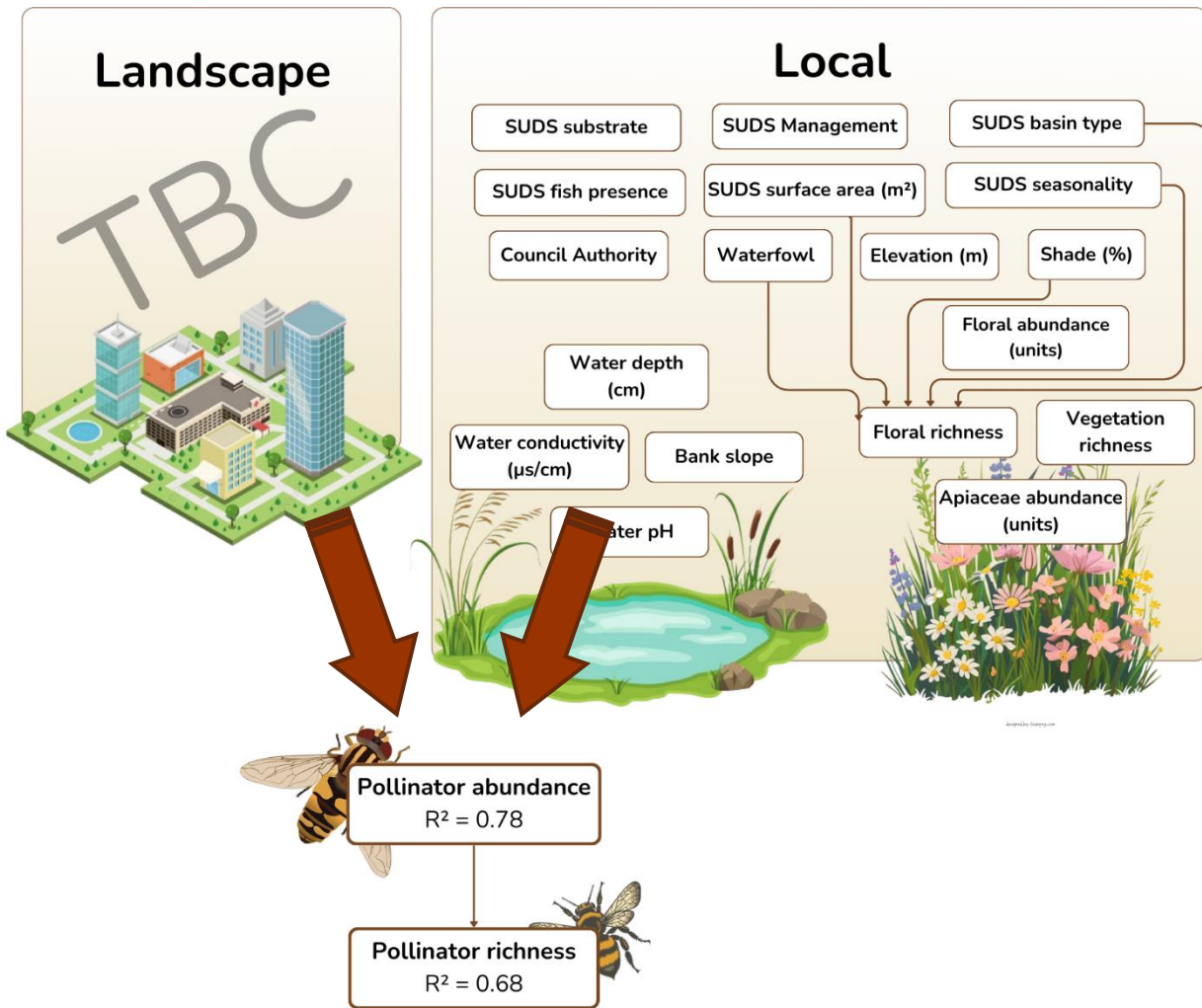
Percentage of various land covers in 50m, 100m, 1000m buffer area.

2

## Multi-Scale Analysis

Structural equation models for hoverfly abundance and richness.

3



**Local Variables**  
Impact of SUDS seasonality, vegetation and floral variables, water & sediment characteristics, etc.

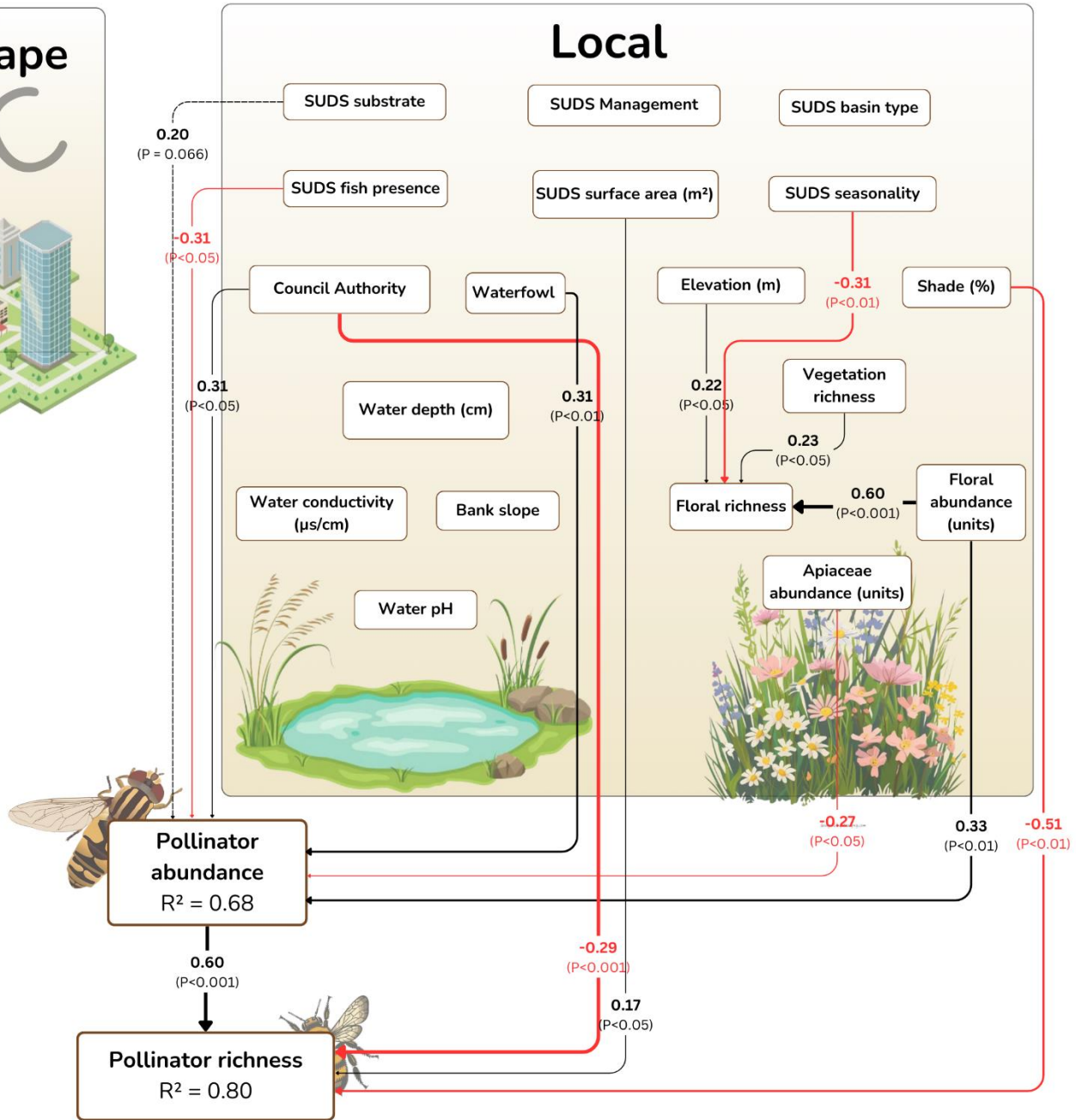
1

**Landscape Variables**  
Percentage of various land covers in 50m, 100m, 1000m buffer area.

2

**Multi-Scale Analysis**  
Structural equation models for hoverfly abundance and richness.

3



Global goodness-of-fit:  
Fisher's C = 41.082, df = 38,  
P-value = 0.337



### **Pollinator Strategy for Scotland**

NatureScot - inform policy for Green Infrastructure Strategic Intervention projects



### **Connectivity corridors**

Buglife - develop SUDS connectivity corridors for pollinators



### **Urban development**

Provide urban developers with targeted conservation measures in urban greenspaces



### **Further research**

eDNA innovation for pollination research





# Thank you!

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