WrEN Flying Insect
Biodiversity Research
Lauren Fuller, University of Stirling
Overview

- WrEN project intro
- Ecological networks
- WrEN research
- Preliminary results
- Summary
WrEN Project: The Team

Kirsty Park
University of Stirling

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Forest Research

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Natural England

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University of Stirling

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University of Stirling

Lauren Fuller
University of Stirling
British Woodland

![Diagram showing change in % cover over years BP](image_url)
British Woodland

- Small and isolated within agricultural landscape
WrEN Project

• Woodland creation and Ecological Networks

• A long-term, large-scale ‘natural’ experiment

• Woodland creation in the British landscape
Ecological networks

• Current conservation policy to tackle habitat fragmentation: build and enhance ‘ecological networks’

• A suite of core habitat areas connected by buffer zones, corridors and smaller stepping stones that allow movement of species or their propagules

• Concept based on sound scientific principles but supported by limited empirical evidence: debate on relative importance of alternative conservation actions
Ecological networks

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  – Restore patches *(BETTER)*
Ecological networks

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  – Create new patches (MORE)
Ecological networks

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  - Join up patches: e.g. corridors and stepping stones (JOINED)
Ecological networks

How to prioritise?

Local (bigger, better) vs. landscape (more, joined) level actions?

- Increase size of existing patches *(BIGGER)*
- Restore patches *(BETTER)*
- Create new patches *(MORE)*
- Join up patches: e.g. corridors and stepping stones *(JOINED)*
• Restoration limited by available space and resources
**WrEN Project: Site selection**

- Semi-automated site selection protocol using digital spatial datasets and historic maps to identify recently created woodland patches of different character:
  - **Bigger** – patch area
  - **Better** – age
  - **More** – surrounding habitat
  - **Joined** – isolation

- In homogeneous landscapes (arable/mixed agriculture) and controlling environmental variables (e.g. soil, topography and climate).
Secondary broadleaf woodland
WrEN sites

Scotland n=67

England n=39
WrEN sites
WrEN sites
Taxa

- Vascular plants
- Lichens and bryophytes
- Small mammals
- Ground-dwelling invertebrates
- Bats
- Birds
Flying insects

Hoverflies

Craneflies

• Ecosystem functions
  – Food webs
  – Pollination
  – Decomposition

• Ecological indicators of habitat quality

• Dispersal ability
Sampling

- Malaise net trapping
- Three samples per woodland – one from June, July and August
- 45 sites in Scotland
- 33 sites in England
Sampling

35 sites in Scotland
30 sites in England
### Results

<table>
<thead>
<tr>
<th>Invertebrate Group</th>
<th>Abundance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diptera</td>
<td>166,654</td>
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<tr>
<td>Hymenoptera</td>
<td>39,879</td>
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<tr>
<td>Hemiptera</td>
<td>21,415</td>
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<tr>
<td>Collembola</td>
<td>18,468</td>
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<tr>
<td>Coleoptera</td>
<td>9,187</td>
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<tr>
<td>Acari</td>
<td>4,615</td>
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<tr>
<td>Araneae</td>
<td>3,985</td>
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<tr>
<td>Lepidoptera</td>
<td>3,054</td>
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<tr>
<td>Dermaptera</td>
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<tr>
<td>Thysanoptera</td>
<td>1,789</td>
</tr>
<tr>
<td>Opilione</td>
<td>1,735</td>
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<tr>
<td>Trichoptera</td>
<td>1,126</td>
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<tr>
<td>Plecoptera</td>
<td>478</td>
</tr>
<tr>
<td>Isopoda</td>
<td>296</td>
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<tr>
<td>Psocoptera</td>
<td>234</td>
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<tr>
<td>Neuroptera</td>
<td>187</td>
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<tr>
<td>Odonata</td>
<td>119</td>
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<tr>
<td>Mecoptera</td>
<td>93</td>
</tr>
<tr>
<td>Orthoptera</td>
<td>54</td>
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<tr>
<td>Ephemeroptera</td>
<td>25</td>
</tr>
<tr>
<td>Gastropod</td>
<td>15</td>
</tr>
<tr>
<td>Myriapoda</td>
<td>9</td>
</tr>
<tr>
<td>Pseudoscorpion</td>
<td>2</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>276,093</strong></td>
</tr>
</tbody>
</table>
**WrEN: Hoverflies**

57 species
- 44 in England
- 34 in Scotland

{22 species shared

**England habitat associations**

- Not woodland associated, 8, 18%
- Woodland associated, 16, 36%
- Woodland and open associated, 20, 46%

**Scotland habitat associations**

- Not woodland associated, 6, 18%
- Woodland associated, 13, 38%
- Woodland and open associated, 15, 44%
**WrEN: Hoverflies**

**England**
Episyrphus balteatus 48%
Eupeodes corollae 8%
Syrphus ribesii 8%

**Scotland**
Melanostoma scalare 63%
Episyrphus balteatus 6%
Platycheirus albimanus 2%
Results: Hoverflies
**WrEN: Data analysis**

[Diagram showing various ecological variables and their interconnectivity]

- **Size**
  - Patch area
  - Patch shape
  - Edge impacts (e.g., amount of semi-natural)

- **Surrounding habitat**
  - Amount of woodland (any type)
    (100, 250, 500, 1000, 1500, 2000, 2500, 3000 m)
  - Amount of broadleaved woodland
    (100, 250, 500, 1000, 1500, 2000, 2500, 3000 m)
  - Amount of ancient woodland
    (100, 250, 500, 1000, 1500, 2000, 2500, 3000 m)

- **Quality**
  - In-situ grazing
  - Tree species richness
  - Tree density
  - Tree DBH (stdev)
  - Understory %
  - Canopy %
  - Woodland age

- **Heterogeneity**
  - Ecological continuity

- **Connectivity**
  - Distance to nearest woodland (any type)
  - Distance to nearest broadleaved woodland
  - Distance to nearest ancient woodland

- **Isolation**
  - Land cover / permeability
    (e.g., amount of arable, semi-natural, water, urban 100, 250, 500, 1000, 1500, 2000, 2500, 3000 m)

- **Matrix**
  - Adjacent matrix (agricultural) type
    (arable, grassland, mixed)

*Interconnectivity*
WrEN: Data analysis
Results: England (total richness)

- Total richness vs. AGE
- Total richness vs. Area ha
- Total richness vs. Shape index
- Total richness vs. TREE DENS PER HA
- Total richness vs. TREE SPP RICH
- Total richness vs. CANOPY COVER
- Total richness vs. Nearest_more broadleaved
- Total richness vs. PropCover_more broadleaved Buffer 1500
Results: England (woodland richness)
Results: England (migrant richness)
Results: England (non-migrant richness)
Results: Scotland (total richness)
Results: Scotland (woodland richness)
Results: Scotland (migrant richness)
Results: Scotland (non-migrant richness)
## Summary

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<thead>
<tr>
<th></th>
<th>Local</th>
<th>Landscape</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>England</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total richness</td>
<td>Canopy cover ↓</td>
<td>-</td>
</tr>
<tr>
<td>Woodland specialist richness</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Migrant richness</td>
<td>Canopy cover ↓</td>
<td>-</td>
</tr>
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WrEN: Hoverflies
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Saproxylic species

- Chalcosyrphus nemorum
- Criorhina berberina
- Criorhina floccosa
- Myathropa florea
- Ferdinandeia cuprea
- Xylota segnis
- Xylota sylvarum
WrEN: Craneflies

Tipula paludosa

Rhipidia maculata

Cheilotrichia cinerascens

Limonia flavipes

Limonia stigma
WrEN: To be continued...
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2016 research:
Ancient woodland compared with secondary woodland
Many thanks to the field and lab assistants (Katja Bitenc, Nadine Royle and Roy Allen) and to the landowners who allowed us access to their woodlands.
Questions?