Citation


URL

https://oro.open.ac.uk/94801/

License

(CC-BY 4.0) Creative Commons: Attribution 4.0

https://creativecommons.org/licenses/by/4.0/

Policy

This document has been downloaded from Open Research Online, The Open University's repository of research publications. This version is being made available in accordance with Open Research Online policies available from Open Research Online (ORO) Policies

Versions

If this document is identified as the Author Accepted Manuscript it is the version after peer review but before type setting, copy editing or publisher branding
Maximising the benefit of urban woodlands for butterflies

Bradley Neal, BSc (Hons), MSc.  
Postgraduate Researcher  

Supervision: Dr. Phil Wheeler and Dr. Yoseph Araya  
15th December 2023  

@BradleyNealEnv  

The Open University  
Natural Environment Research Council  
CENTA
Research

A decline in 80% of species since the 1970s

Bioindicator species

Economic + intrinsic value

The State of the UK's Butterflies 2022

A decline in 80% of species since the 1970s
Research

68% British Butterflies use woodlands in some way
Milton Keynes, United Kingdom

Image: OpenTopography
Bialowieza Forest (Between Poland and Belarus)

Images: OpenTopography
Impacts of habitat fragmentation

Species–Area Relationship (SAR)

- Immediate loss of habitat, which means an immediate loss of species.
Method
Woodlands & Butterflies

Surveyed 22 different woodland patches of different type and size.

- Thirty-eight 500 m transects.
- 8-week survey period in 2022.
- 16-week survey period May – September 2023.
- Over 2,400 butterflies recorded, of 20 different species.
Method
Habitat

- Light environment
- Tree height
- Canopy cover % (1–2m, 2–5m, 5–10m, 10m+)
- Ground cover
- Leaf litter
- Bare ground

Structural complexity

Standard deviation of canopy height

Low structural complexity

High structural complexity
Lower structural complexity
Higher structural complexity
# Results

Linear models at the site scale

<table>
<thead>
<tr>
<th>Variable</th>
<th>Richness (site)</th>
<th>Abundance (site)</th>
<th>Simpson (site)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Estimates</td>
<td>CI</td>
<td>p</td>
</tr>
<tr>
<td>Structural complexity</td>
<td>1.86</td>
<td>1.08</td>
<td>2.64</td>
</tr>
<tr>
<td>Area (log)</td>
<td>1.9</td>
<td>0.99</td>
<td>2.82</td>
</tr>
</tbody>
</table>

Light environment

<table>
<thead>
<tr>
<th>n</th>
<th>22</th>
<th>22</th>
<th>22</th>
</tr>
</thead>
<tbody>
<tr>
<td>$R^2$ / $R^2$ adjusted</td>
<td>0.86 / 0.82</td>
<td>0.63 / 0.59</td>
<td>0.76 / 0.70</td>
</tr>
</tbody>
</table>
## Results

### Linear models at the transect scale

<table>
<thead>
<tr>
<th>Variable</th>
<th>Estimates (CI)</th>
<th>p</th>
<th>Estimates (CI)</th>
<th>p</th>
<th>Estimates (CI)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Richness (transect)</strong></td>
<td></td>
<td></td>
<td><strong>Abundance (transect)</strong></td>
<td></td>
<td><strong>Simpson (transect)</strong></td>
<td></td>
</tr>
<tr>
<td>Structural complexity</td>
<td>2.43 (1.55 – 3.30)</td>
<td>&lt;0.001</td>
<td>8.64 (2.96 – 14.32)</td>
<td>0.005</td>
<td>0.04 (0.01 – 0.07)</td>
<td>0.02</td>
</tr>
<tr>
<td>Area (log)</td>
<td></td>
<td></td>
<td>5.66 (1.19 – 10.13)</td>
<td>0.02</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Light environment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.03 (0.00 – 0.06)</td>
<td>0.05</td>
</tr>
<tr>
<td>Canopy cover 2 – 5 m (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.03 (0.00 – 0.05)</td>
<td>0.03</td>
</tr>
<tr>
<td>n</td>
<td>22</td>
<td></td>
<td>22</td>
<td></td>
<td>22</td>
<td></td>
</tr>
<tr>
<td>R² / R² adjusted</td>
<td>0.75 / 0.70</td>
<td></td>
<td>0.71 / 0.59</td>
<td></td>
<td>0.62 / 0.47</td>
<td></td>
</tr>
</tbody>
</table>
Conservation management

More structurally complex transects have higher richness and diversity

![Graph showing the relationship between structural complexity and butterfly richness, with p < 0.001.](image1)

![Graph showing the relationship between structural complexity and Simpson diversity, with p < 0.001.](image2)
Conservation management

...BUT... transects in larger sites show no correlation with species diversity

p = 0.90
Summary

What does this mean for urban woodlands?

1. Large patches with structurally complex canopies support the most species.

2. Habitat heterogeneity (SAR mechanism) can be created in smaller patches.

3. A large patch is not enough: structurally complex transects explain richness and diversity, not area alone.

4. Urban woodlands should be managed to maximise habitat structure.
Thank you!

Get in touch:
Bradley.neal@open.ac.uk
@BradleyNealEnv