Introduction

Spatial modelling approaches are increasingly being used to design and direct woodland management and conservation plans at the landscape scale. Buffer-radius approaches are popular for locating suitable areas for conservation action by assessing habitat connectivity within the landscape using dispersal parameters and spatial land cover variables. However, because of the general lack of accurate species and spatial data, there is a need to validate these approaches.

Objective

The objective of this study was to assess the accuracy of different buffer-radius approaches in predicting functional woodland habitat networks for flightless woodland insects.

Methods

Three buffer-radius approaches were adopted using data collected for the model species wood cricket (Nemobius sylvestris) to generate habitat networks for the woodlands on the Isle of Wight (UK).

With an increase in data detail:

- Approach 1 used an equidistant buffer distance of 60 meter
- Approach 2 used a buffer distance weighted by the habitat surrounding woodlands as defined in Land Cover Map 2000
- Approach 3 used a buffer distance weighted by the surrounding habitat, including roads and watercourses derived from OS data

Weighted buffer distances used were:

- Semi-natural landscape features and grasslands: 30 m
- Arable and urban developed land: 2 m
- Estuaries, roads, inland water bodies and streams: 1 m

Simple buffer-radius approaches overestimate habitat connectivity for flightless woodland insects

Table 1: Summary table comparing the approaches used based on presence/absence and species specific dispersal data of wood cricket for the woodlands on the Isle of Wight.

<table>
<thead>
<tr>
<th>Approach</th>
<th>Nr of networks for all woodlands</th>
<th>Nr of networks for all surveyed woodlands</th>
<th>All unoccupied networks</th>
<th>All occupied networks</th>
<th>Nr of occupied woodlands included</th>
<th>Nr of unoccupied woodlands included</th>
<th>Percentage of occupied woodlands included</th>
</tr>
</thead>
<tbody>
<tr>
<td>Approach 1</td>
<td>284**</td>
<td>43*</td>
<td>30*</td>
<td>13</td>
<td>32</td>
<td>59*</td>
<td>35%</td>
</tr>
<tr>
<td>Approach 2</td>
<td>301**</td>
<td>60*</td>
<td>52*</td>
<td>17</td>
<td>32</td>
<td>36*</td>
<td>47%</td>
</tr>
<tr>
<td>Approach 3</td>
<td>532**</td>
<td>97*</td>
<td>75*</td>
<td>22</td>
<td>32</td>
<td>24</td>
<td>57%</td>
</tr>
</tbody>
</table>

* P < 0.05; ** P < 0.001; chi-square test.

Results

- Woodland habitat on the Isle of Wight is highly fragmented for flightless woodland insects (Fig. 1)
- Using more accurate species specific and detailed spatial data significantly increased:
  - The total number of isolated woodland networks for flightless insect species (Table 1)
  - The accuracy of predicting functional habitat networks for wood cricket (57%; Table 1, Fig. 2 & 3)
- Sensitivity analyses revealed significant impacts on the results shown in Table 1 when subtle changes in buffer distance were made stressing the importance of acquiring accurate input data

Discussion

The results highlight the demand for detailed species and land cover data to validate the use of buffer-radius modelling tools in predicting functional habitat networks within rural landscapes. This detailed data is generally lacking and therefore buffer-radius approaches should be used as an indicative rather than prescriptive tool within the existing conservation toolset to assist and support conservation planning and policy.

Acknowledgements

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Figure 1: Habitat connectivity on the Isle of Wight based on Approach 1.

Figure 2: The details show the break-up of a woodland network using the different approaches. The different shades of grey indicate individual networks. Lines represent roads and small watercourses. The large black network shown in Approach 3 contains the only woodland occupied by wood cricket, indicating the high level of habitat fragmentation for this species.

Figure 3: Black patches indicate the total area that is included in the occupied functional networks for wood cricket predicted by Approach 1 (3136 ha) and Approach 3 (1585 ha). This indicates the significant overestimation of the amount of woodland available for this and similar species when using a simple buffer-radius approach (i.e. Approach 1).