The Stonehenge Landscape: restoring biodiversity and connectivity

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Summary

- Habitat restoration at the landscape scale is an effective, long-term approach to enhance biodiversity and restore landscape connectivity.
- Quite rapid restoration success is achievable for some habitats and Lepidoptera ecological groups.
- Additional management is needed for specialist species.
- Landscape connectivity modelling can assist in the planning and implementation of restorative measures.

Aims

- To investigate the isolation of chalk grassland fragments and the connectivity of the new restoration grasslands.
- To evaluate differences in the landscape connectivity for different ecological groups of Lepidoptera.
- To parameterize a landscape connectivity model.

Introduction

Habitat restoration at the landscape scale has the potential to re-connect fragmented landscapes. The surrounding land cover is also important as it can facilitate or impede the movement of organisms to new habitats (i.e. matrix permeability). Since 2000 over 500 hectares of chalk grassland have been newly created at the active chalk workings of Stonehenge World Heritage Site (WHS), using species rich, locally sourced seed mixtures (2, Fig. 1). An aim of this project was to increase the extent of permanent grasslands, thus connecting the WHS to the surrounding SSLAs and enhancing its nutrient capture value.

Methods

Edge permeability

Field surveys of Lepidoptera were undertaken (2011-2012) at the National Trust Stonehenge Landscape. The proportion of Lepidoptera responding to the edge of chalk fragments with adjacent land cover types of arable land or new restoration grassland (1:2 ratio) were recorded (methods adapted from 5).

Statistical analyses were conducted in R (6) on the proportion of Lepidoptera crossing following edges:
- compared to expected if movement was random (X2),
- as a response to the environmental variables of matrix type, Lepidoptera density, nectar flower richness, density of Asteraceae and Dipsacaceae, nectar flowers, variation in vegetation density (CV), month of survey, wind direction, wind speed and Jeffrey’s J (Ji) of matrix type and landscape density and wind speed (GLM; GAM; Binomial errors).

For total Lepidoptera and for species in tall-grass and short-grass ecological groups (4, 6, 9) separately.

Results and Discussion

Grassland restoration as little as 2 years old may potentially reduce the functional isolation of adjacent chalk grassland fragments, especially for species associated with short-grass habitats such as L. bellargus, C. minimus and Common blue (Polyommatus icarus) (Fig. 4).

- The proportion of Lepidoptera crossing chalk grassland edges with an adjacent land cover of arable land was significantly lower than expected, but not for new restoration (Fig. 4a).
- For short-grass Lepidoptera, the edge at new restoration was three times more permeable than arable land (Fig. 4b).
- The proportion of Lepidoptera following edges was significantly higher than expected (Fig. 4d).


tables

<table>
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<th>Variables</th>
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The proportion of Lepidoptera crossing and following edges was affected by the type of matrix, habitat characteristics, abiotic conditions and is density dependent (Table 1). But the significant environmental variables differ for ecological groups:

- Tall-grass Lepidoptera group (mostly M. urticae and M. galloprovincialis) were density dependent and affected by matrix type.
- Short-grass Lepidoptera group may be affected by the density of nrich composite flowers (Asteraceae). (Arbogen)