Impact of historic land use change on shifts in pollinator communities

Deepa Senapathi *

Luisa G. Carvalheiro°, Stuart P.M. Roberts*, Rebecca Evans*, Jacobus C. Beismeijer†, William E. Kunin° & Simon G. Potts*

** University of Reading, UK*

° University of Leeds, UK

† Naturalis Biodiversity Centre, Netherlands

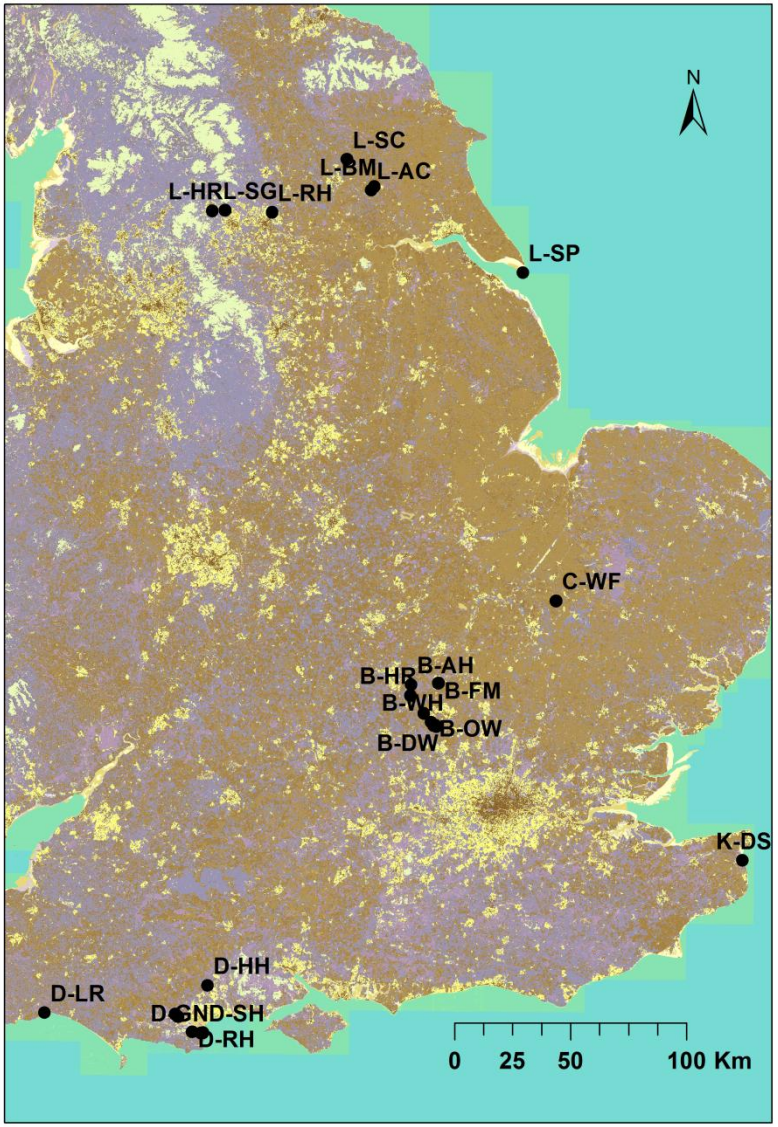
Aims of this project

- To test for links between land-use changes and the condition of British pollinator communities
  - Assessing the impact of current land utilisation
  - Historic land use and the impacts of changes from pre-war era to present day

Original idea: Repeat historic surveys of pollinators in sites known to have undergone different amount of land use change

Final plan: Utilised sites with available historic pollinator data and then compare and contrast the land use changes within those sites

Site Selection

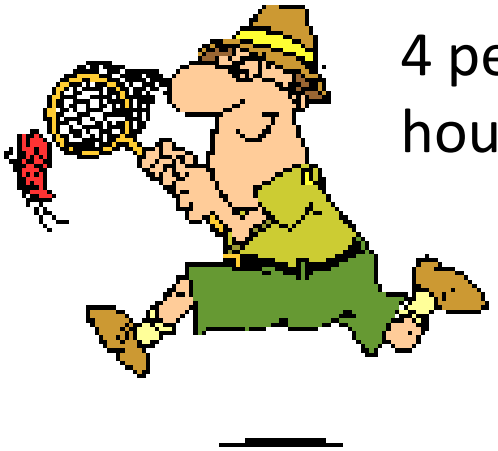


- Based on data from BWARS database
- Time period 1921-1950; coincides with earliest Land Utilisation survey in Britain
- 24 sites – 7 Yorkshire, 7 Dorset, 8 Bedfordshire, 1 Cambridgeshire & 1 Kent
- Majority are protected habitat including SSSI, NNR, FC land
- Predominantly heathland historically

Sampling

3 rounds of sampling per site per season
(2011 & 2012)

x 5 sets

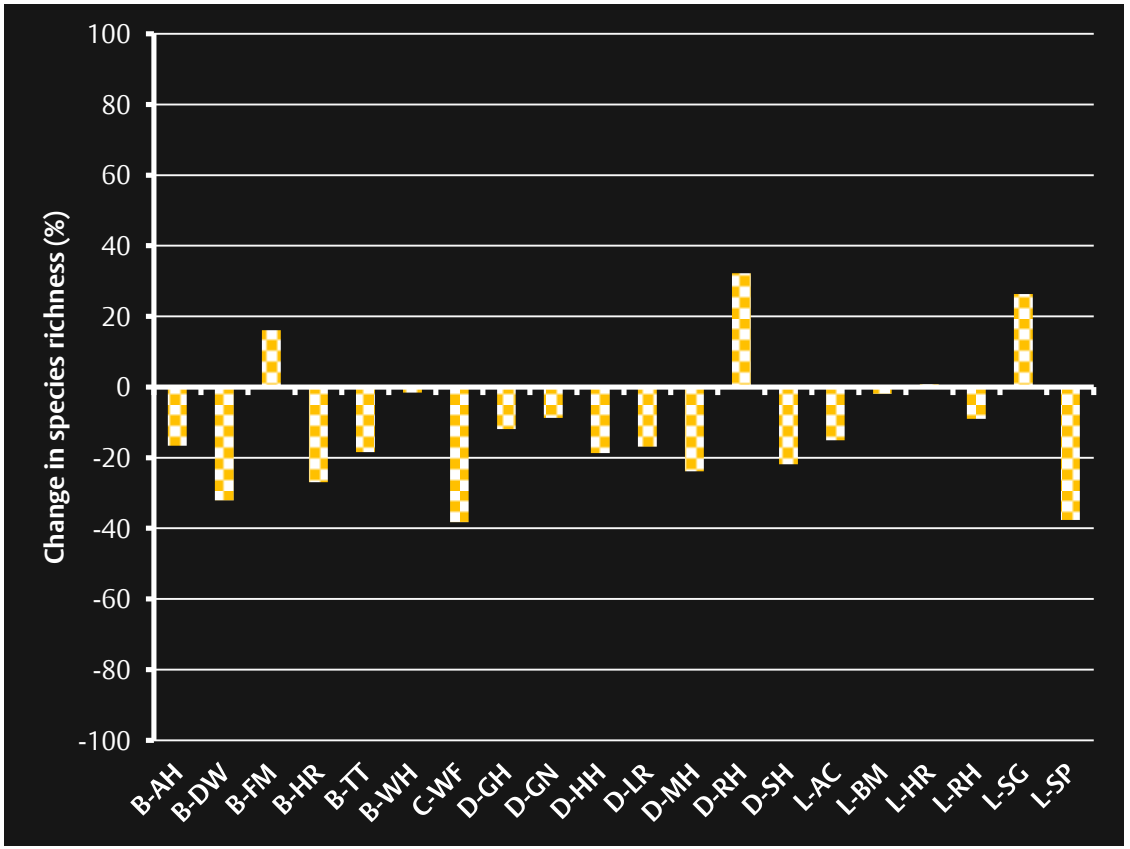


4 person hours

Additional data
from 2003 – 2012
from BWARS

Results – Bee Species Richness

- Selection criteria: Min. Sp. = 5; min. records.= 10; < 10 fold difference in no. of records between periods
- 20 sites met selection criteria
- 15/ 20 sites i.e. 75% of sites showed significant declines in bee species richness
- 3 sites showed increases

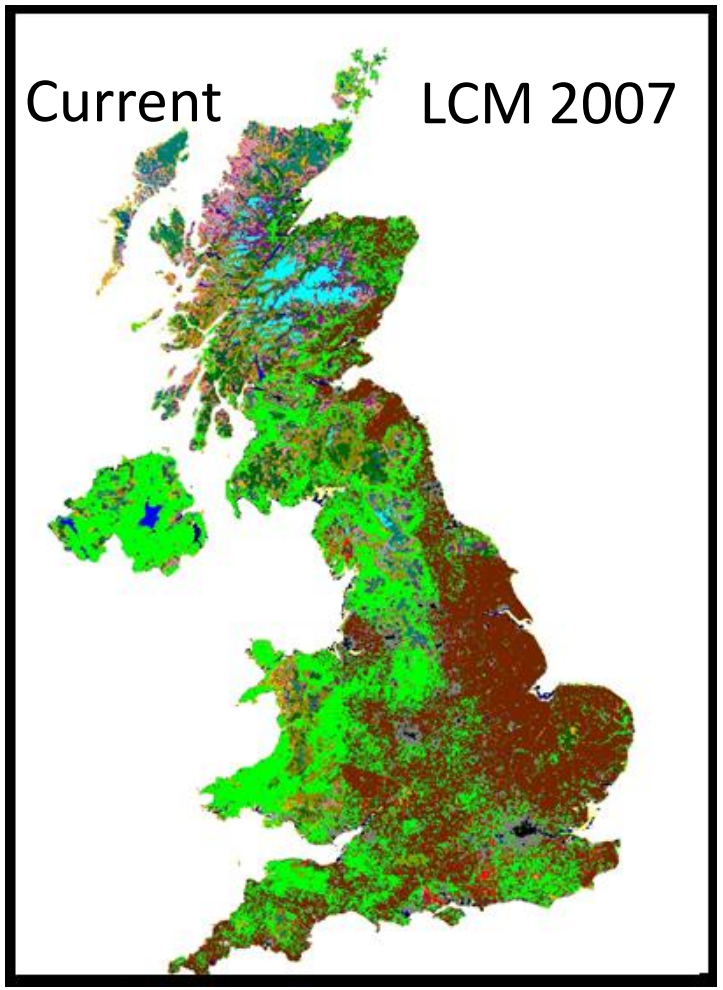


Are these changes /declines related to changes in land-use?

Land Use Data

University of Reading

Historic map - Dudley Stamp 1936



Reclassification of LCM 2007

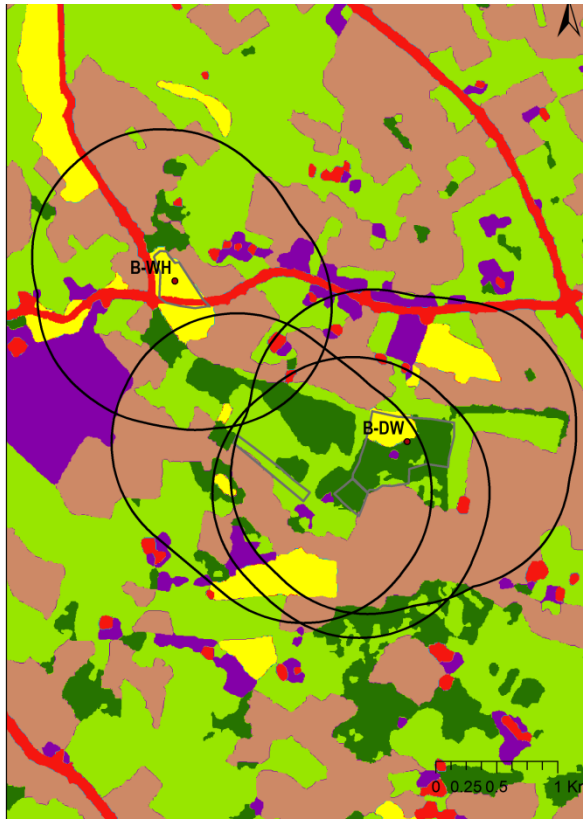
University of Reading

	LCM 2007		Dudley Stamp	
1	Broad leaved, mixed & Yew woodland		Forest & Woodland	7
2	Coniferous woodland		Forest & Woodland	7
3	Arable & Horticulture		Arable	4
4	Improved Grassland		Meadow & Grassland	6
5	Rough Grassland		Meadow & Grassland	6
6	Neutral grassland		Meadow & Grassland	6
7	Calcareous grassland		Meadow & Grassland	6
8	Acid grassland		Meadow & Grassland	6
9	Fen, Marsh & Swamp		Heath & Moorland	1
10	Heather		Heath & Moorland	1
11	Heather grassland		Heath & Moorland	1
12	Bog		Heath & Moorland	1
13	**Montane habitats**		Heath & Moorland	1
14	Inland Rock		**Other**	9
15	Saltwater		Water	3
16	Freshwater		Water	3
17	Supra-littoral rock		**Other**	9
18	**Supra-littoral sediment**		Heath & Moorland	1
19	Littoral rock		**Other**	9
20	**Littoral sediment**		Heath & Moorland	1
21	**Saltmarsh**		**Other**	9
22	Suburban		Suburban	5
23	Urban		Urban	2

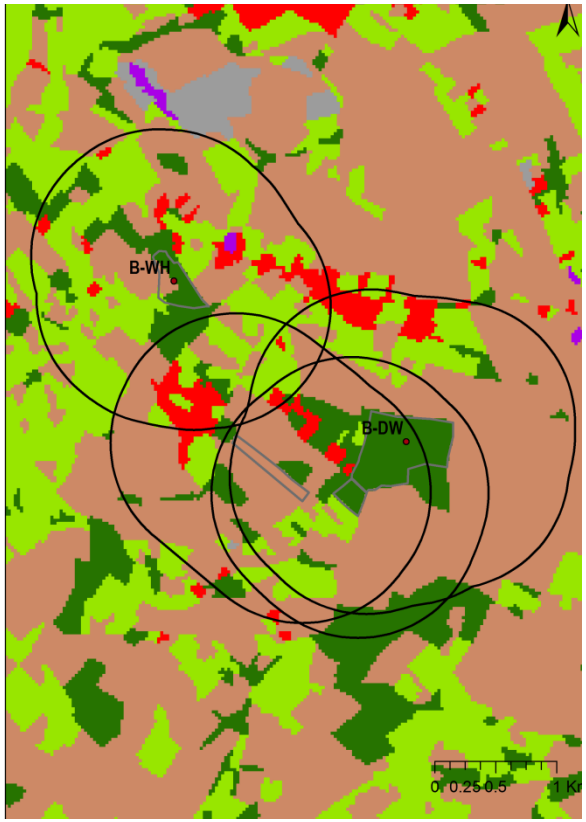
Change Detection Analysis

University of Reading

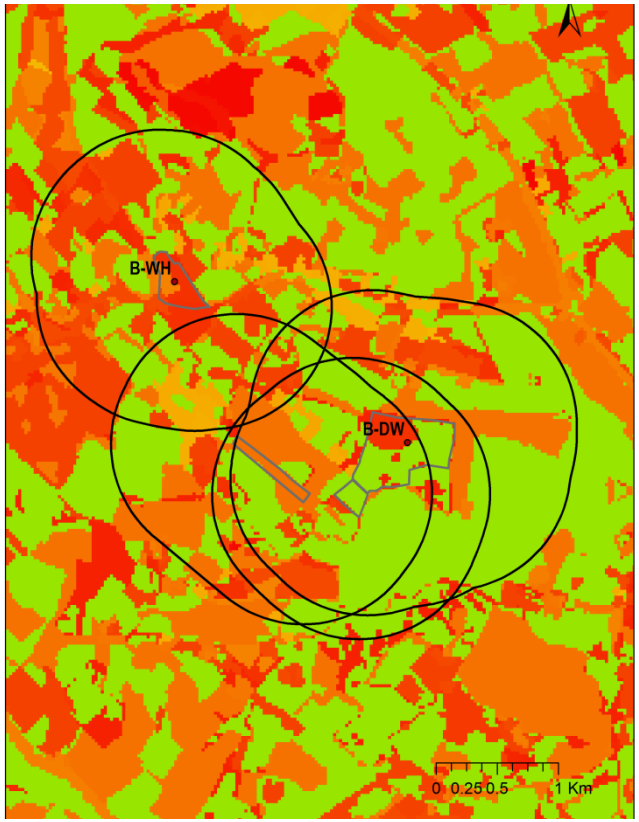
Historic



Current



Change



URBAN

WOODLAND / FOREST

GRASSLAND / MEADOW

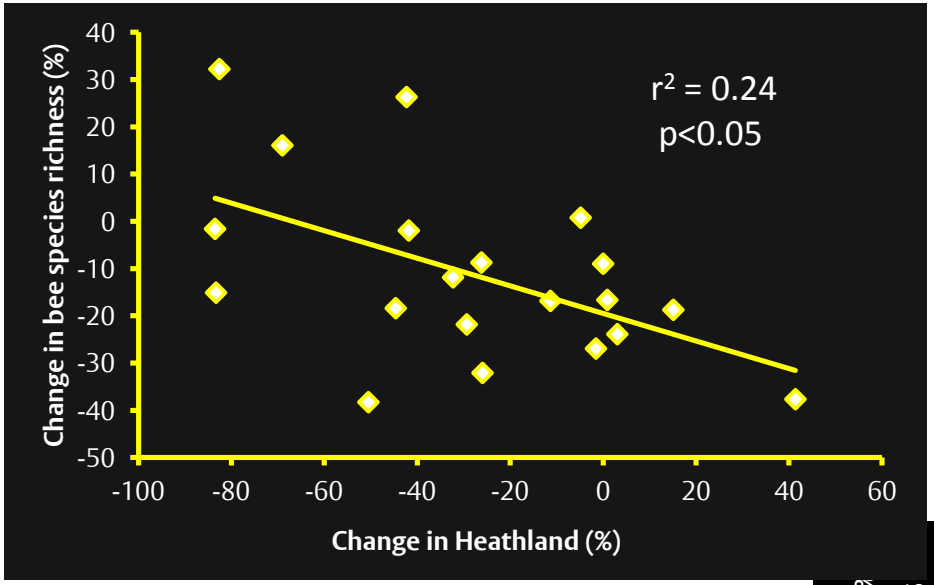
ARABLE

HEATHLAND / MOORLAND

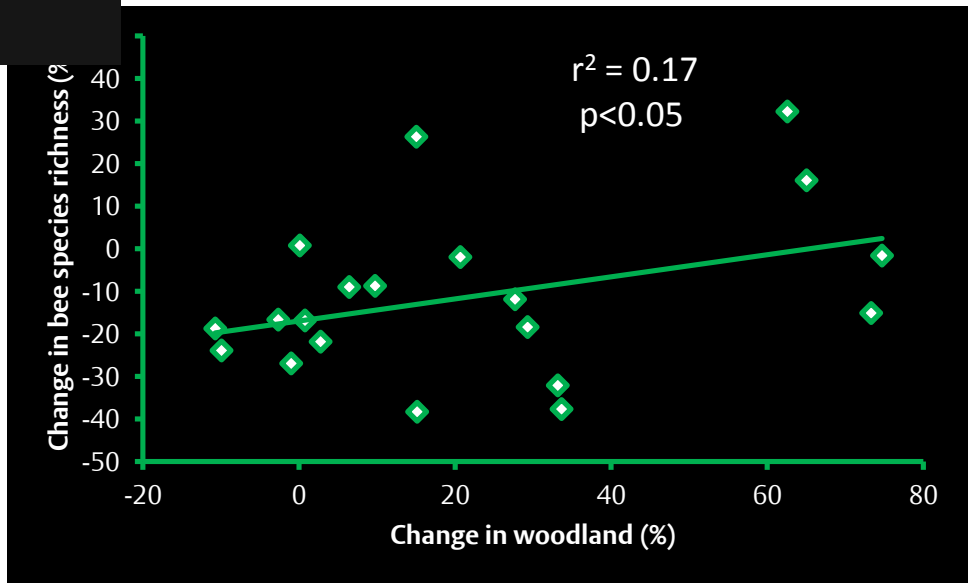
CHANGE

NO CHANGE

General Trends at Site



Change in Heathland negatively correlated to change in Woodland
Pearson's cor = -0.84
p <0.001n = -0.84
p<0.001



Heathland to Woodland transition

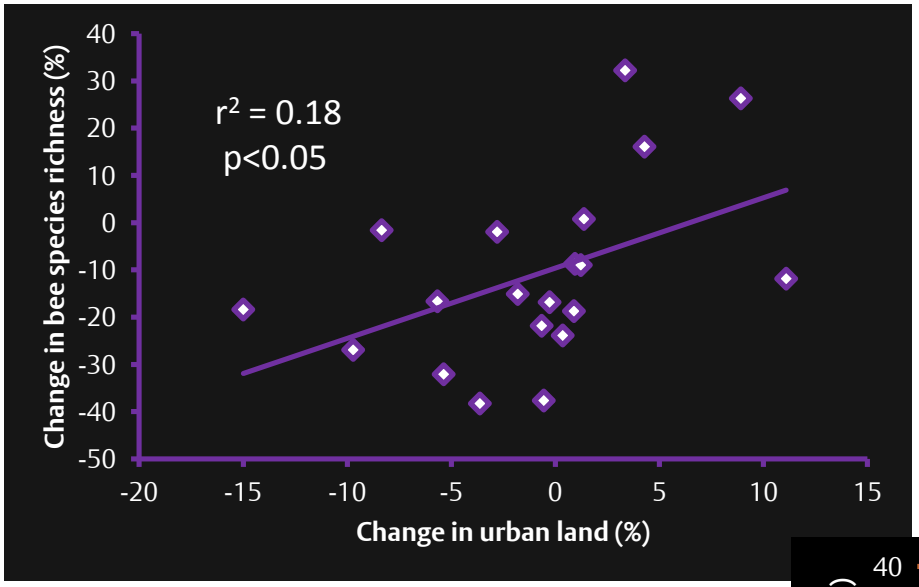
Studland Heath

Godlingston Heath

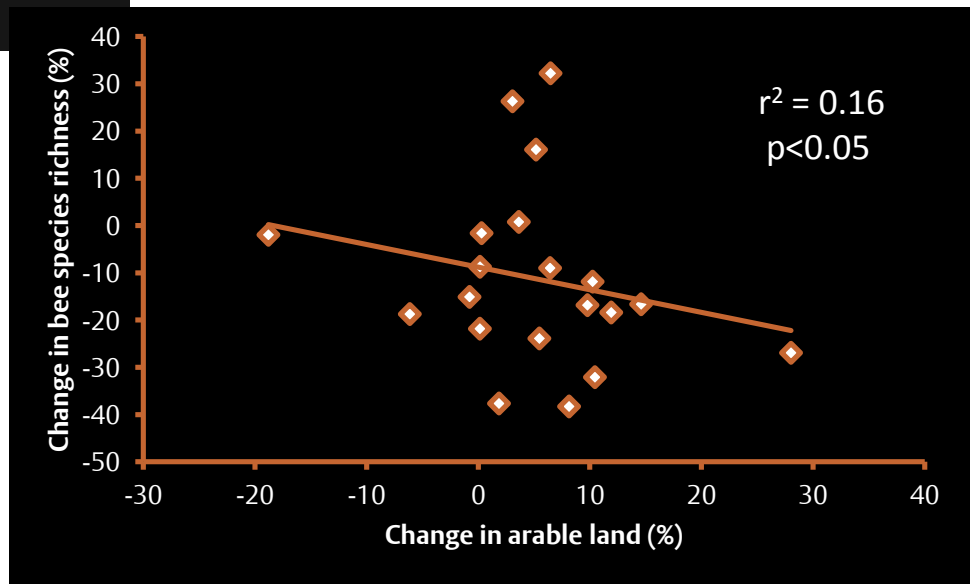
Heathland to Woodland transition

University of Reading

General Trends outside site (1 km)

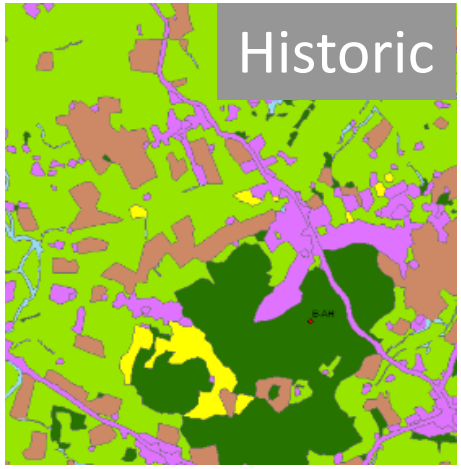


Change in Urban negatively correlated to change in Arable land
Pearson's cor =-0.62
p<0.01



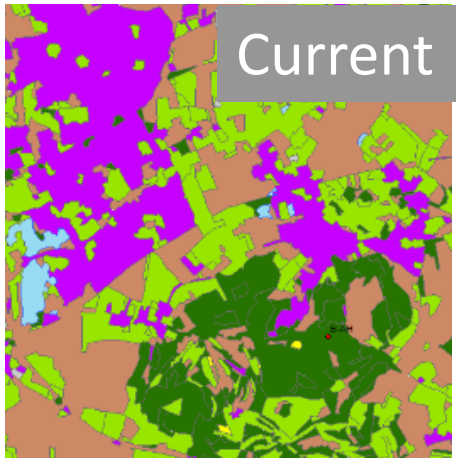
University of Reading

Aspley Heath



Site original habitat
Loss of 8%

Bee Species Richness
Loss of 17%



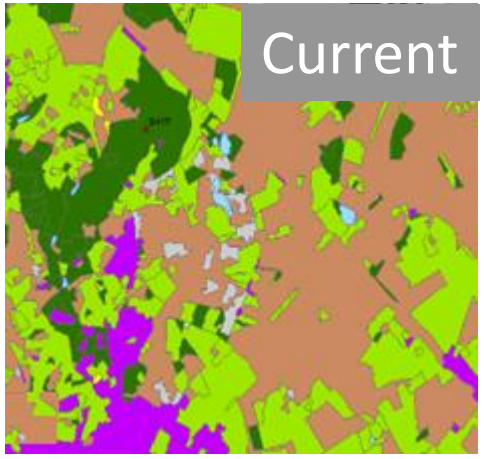
Main change around site
Urbanisation Increase of 26%

King's Wood

Site original habitat
Loss of 5%

Bee Species Richness
Loss of 27%

Main change around the site
Arable land Increase of 30%



URBAN AREAS
WOODLAND / FOREST
ARABLE
HEATHLAND / MOORLAND
GRASSLAND / MEADOW

Arable vs. Urban surroundings

Conclusions

- Declines in pollinator species richness in 75 % of sites surveyed
- Land cover changes within site as well as changes at 1km around sites have an impact on species richness change
- Transition from heathland to woodland on site has a significant impact, possibly due to edge habitat effects
- Sites surrounded by urban expansion showing less declines than sites surrounded by arable intensification
- Transition from single land cover to more diverse habitats may provide resources to support a greater number of species

Wider Implication

University of Reading

Should conservation management consider the diversity of landscapes in order to support greater diversity of species or should the focus be on protecting individual specialist species and habitats?

Acknowledgments

University of Reading

BWARS

The Wildlife Trusts

Natural England

Princes Golf Club Sandwich

Forestry Commission

National Trust

Royal Cinque Ports Golf Club

Royal St George's Golf Club

fera – The Food and Environment Research Agency

Living With Environmental Change

wellcome trust

The Scottish Government

BBSRC

University of Leeds

defra – Department for Environment Food and Rural Affairs

Natural Environment Research Council

CEH – Centre for Ecology & Hydrology – Natural Environment Research Council

University of Bristol

Ellen Moss

Stuart Roberts

Cassie Dodson

Louise Truslove

Megan McKerchar

Rebecca Evans