Bridging the disciplinary divide: integrating data to understand patterns and processes in human-dominated landscapes

Work based on a collaboration between 2 RELU studies

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Rationale

- Rural areas are undergoing rapid change due to various socio-economic drivers (e.g. CAP, WFD)
- Need to predict responses of rural economies
- This is dependent on understanding the interplay between cultural, physical and ecological factors
- Sustainability indicators
  - provide summary of status of economy
  - but functional relationships not understood, so cannot be used in a predictive manner
- Aim of this collaboration:
  - to enhance understanding by analysis of the interactive effect of environmental, socio-economic and cultural factors on biodiversity

Aims

- To spatially disaggregate agricultural land use data (Agricultural Census) to the 1km^2 level, using Genetic Algorithms.
- To investigate the relationship between agricultural land use and biodiversity, using bird species richness data at 10-km square resolution (BTO bird atlas data).
- To assess the extent to which the inclusion of additional socio-economic and cultural variables help to explain large-scale spatial patterns in biodiversity.
- To use the results of this preliminary analysis to identify the next steps for our research.

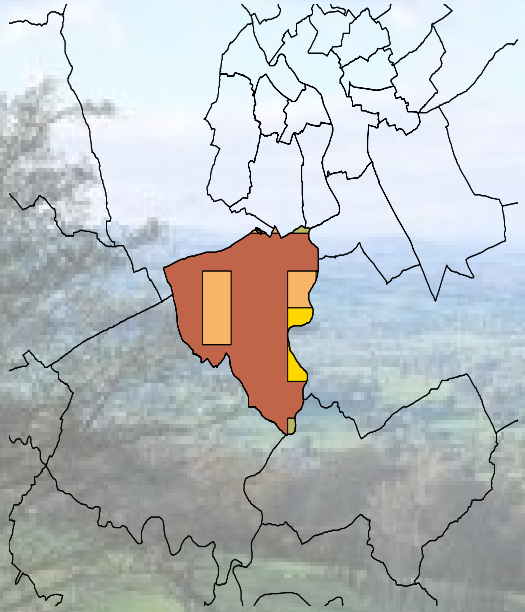
A key dataset linking cultural, physical and ecological factors

- **Agricultural Census – Land Use**
  - **Defra collects data from farmers**
    - **Land Use, Livestock, Labour**
    - **Highest resolution of returns is at ward level (previously parish/parish group)**
  - **Agricultural census data needs to be disaggregated to 1km^2 type resolution**
    - **Becomes useful for study of ecology**
    - **Can be aggregated back up to other administrative/cultural units**

Disaggregating Agricultural Land Use

- Requires a “key” to map recorded ward-level census variables onto finer spatial resolution
- CEH Land Cover Map of GB (1 km^2 grid as in CS2000)
- Use a Genetic Algorithm to find probabilities of getting each land use on each land cover
  - Heuristic optimisation method
  - Regional probabilities found to speed process
- Simulations made to allocate each “hectare” of land use in a ward to a “hectare” of land cover in a km^2 in the ward
  - based on the probabilities found above

Example of Land Use and Land Cover Data



Land Cover	Area (ha)
Arable	1426
Improved Grass	80
Unimproved Grass	20
Urban	293
Grand Total	1819

Based on Dominant Habitat in the CEH Land Cover Map (2000)

Copmanthorpe ward
Reported Land Use (ha) from Agricultural Census (2003)

Total area	1699.4
Temporary grass area	171.1
Permanent grass area	294.0
Rough grazing area	---
Woodland area	38.4
Set-aside area	104.7
All other land area	60.1
Wheat area	512.8
Winter barley area	137.1
Spring barley area	80.8
Oats area	---
Other cereals area	---
Potatoes area	---
Sugar beet area	72.0
Horticulture area	---
Field beans area	29.2

Peas for harvesting dry area	---
Oilseed rape area	79.6
Linseed area	---
Turnips_etc area	---
Other crops for stockfeeding area	---
Maize area	25.4
Other arable crops area	0.0
Bare fallow area	---
Peas and beans area	---
Allother veg and salad area	0.0
Area under glass/plastic area	---
Top fruit area	0.0
Small fruit area	---
Hardy nursery area	---
Bulbs and flowers area	0.0

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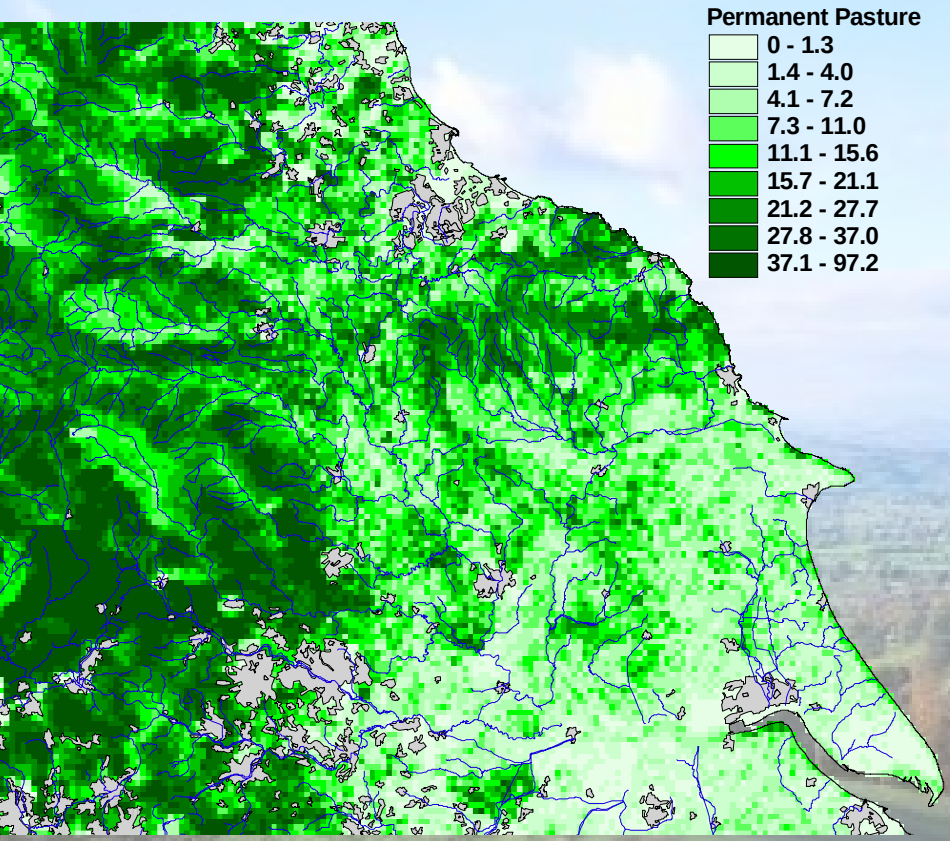

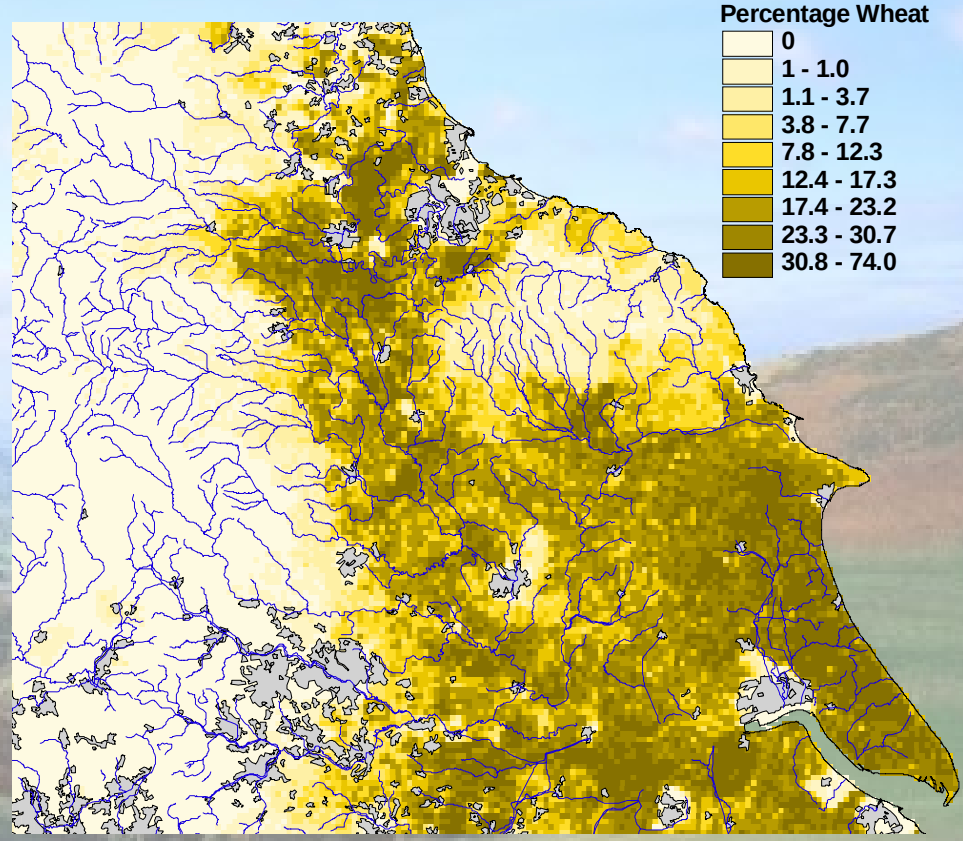

Results for England, but this area of N. England illustrates pattern of activity for two land use types recorded in census

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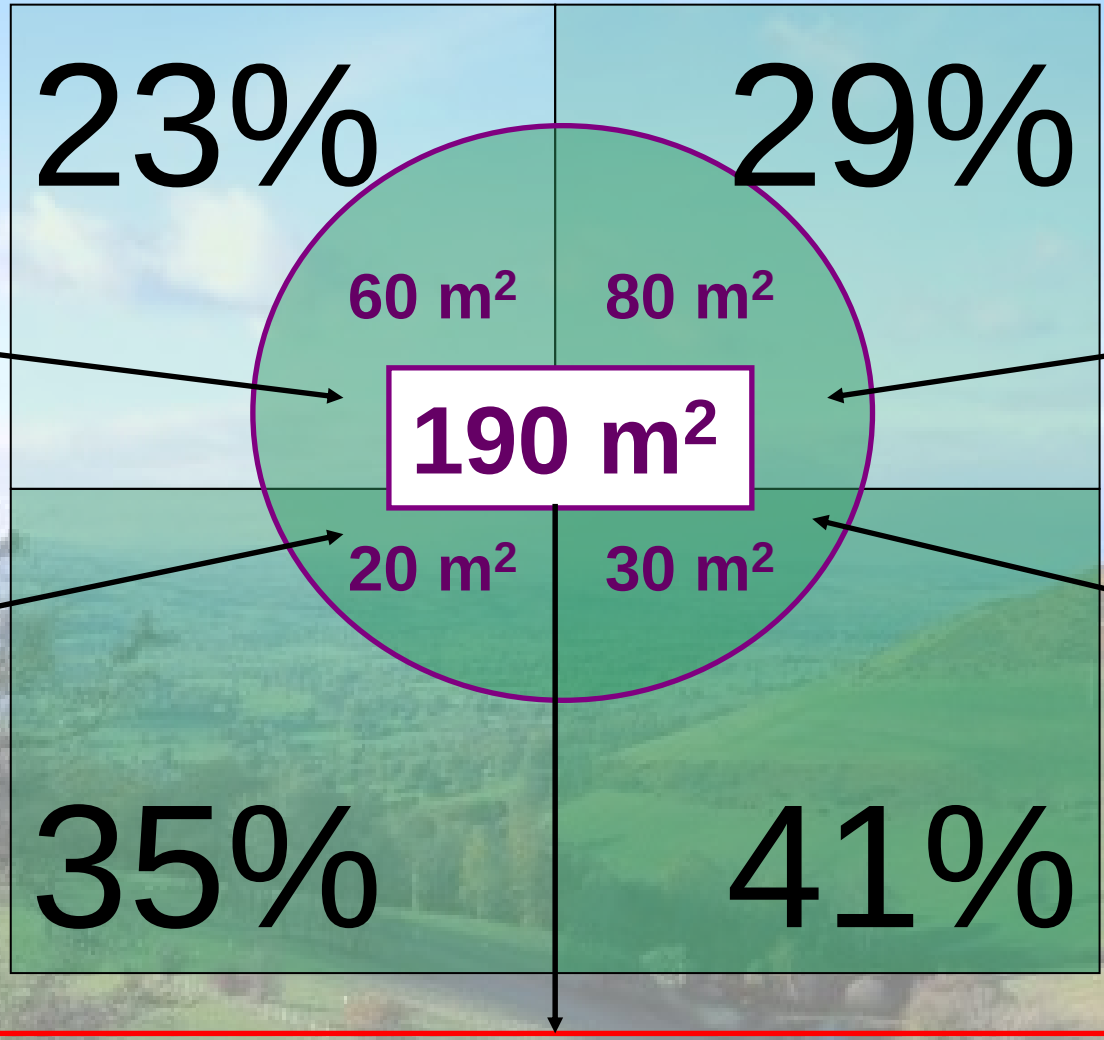

0.23 x 60
= 13.8m²

0.29 x 80
= 23.2m²

0.35 x 20
= 7m²

0.41 x 30
= 12.3m²

(13.8 + 23.2 + 7 + 12.3) / 190 = **30.2%**

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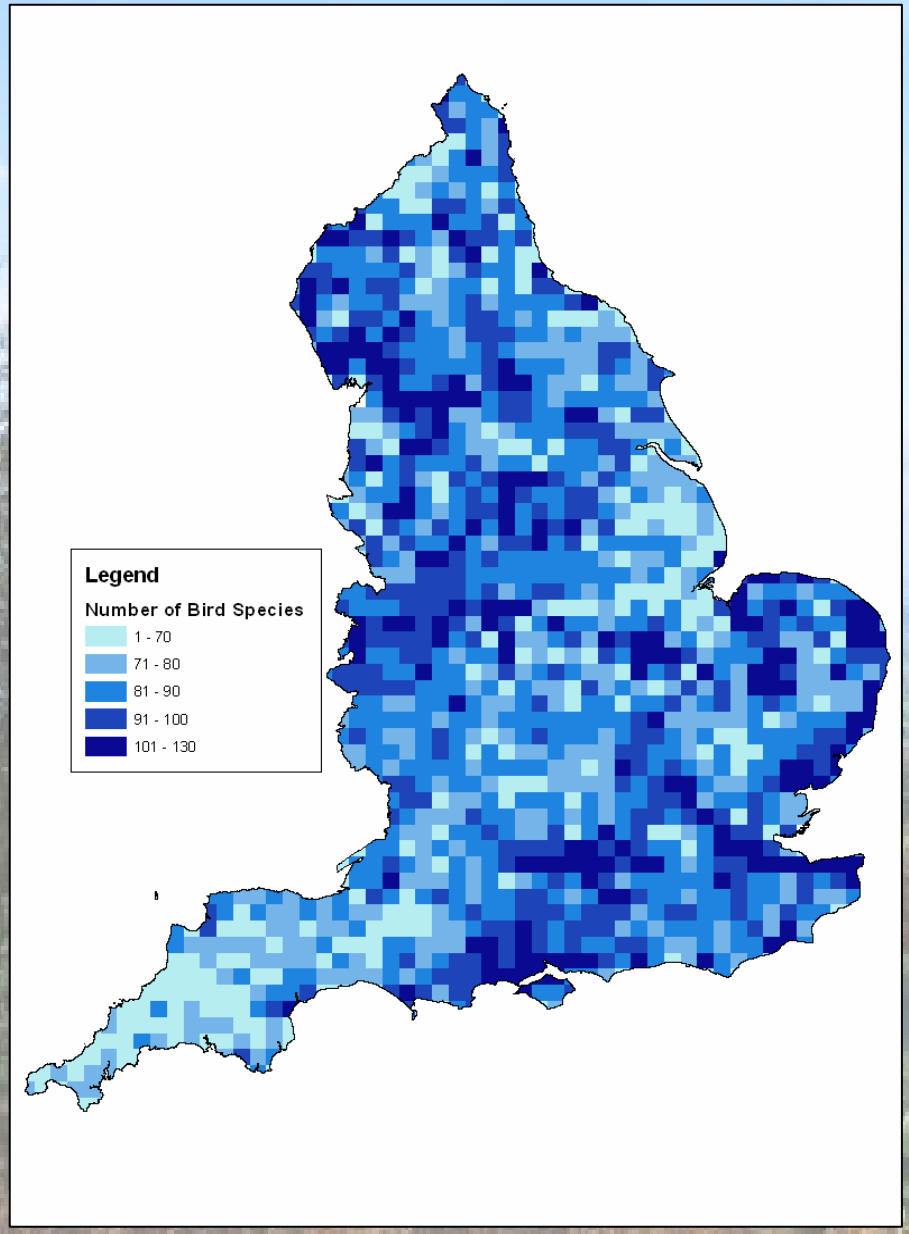

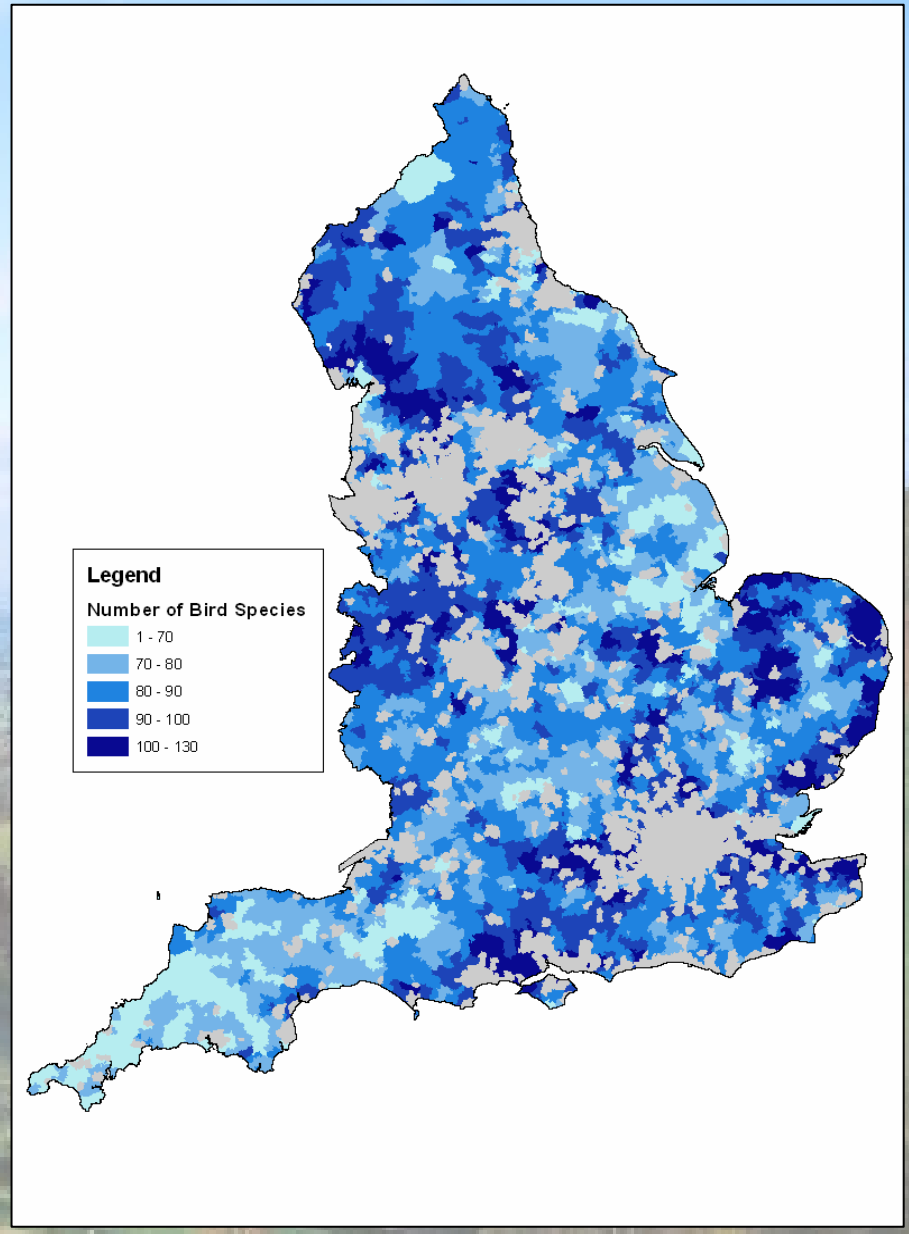

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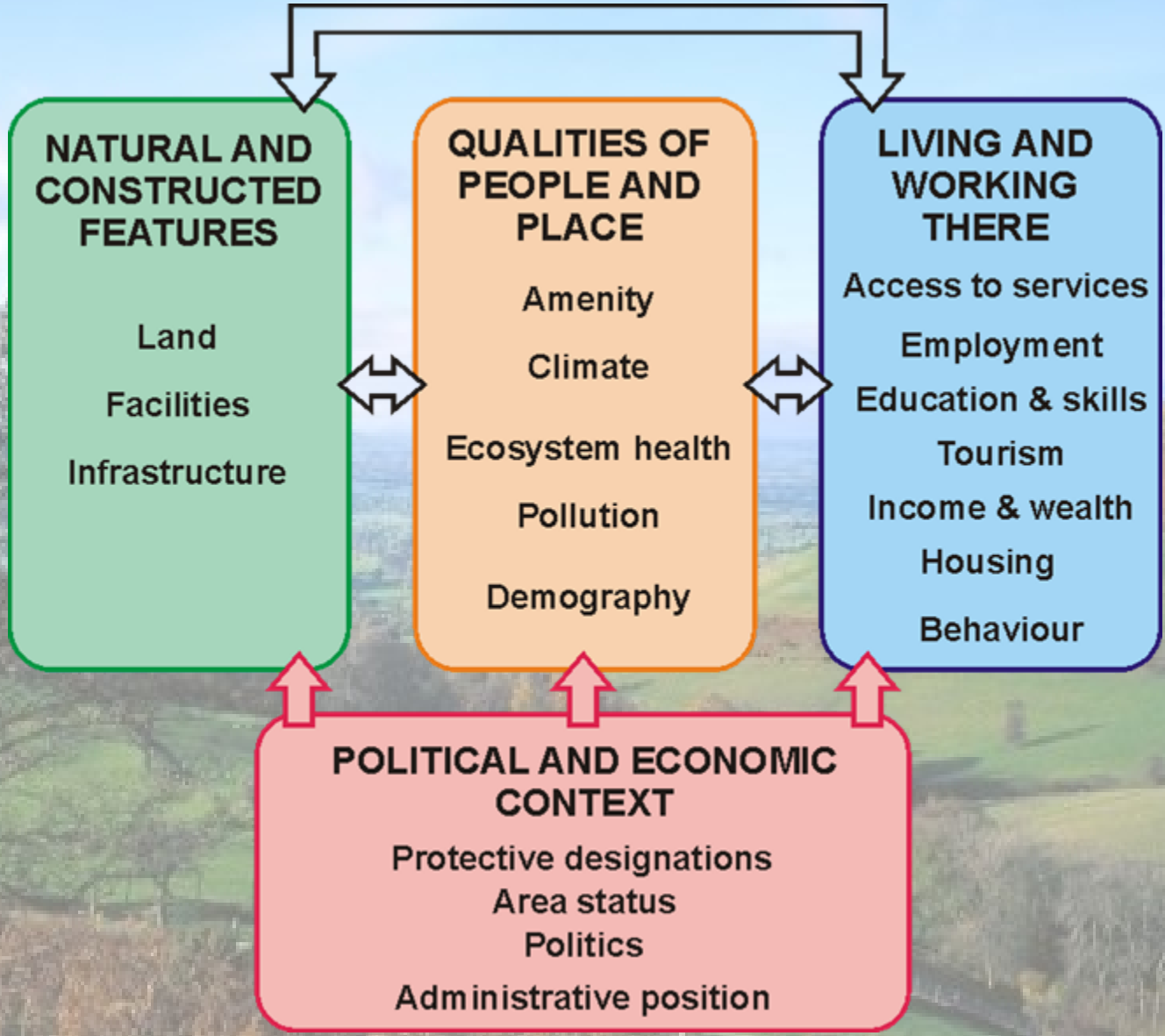
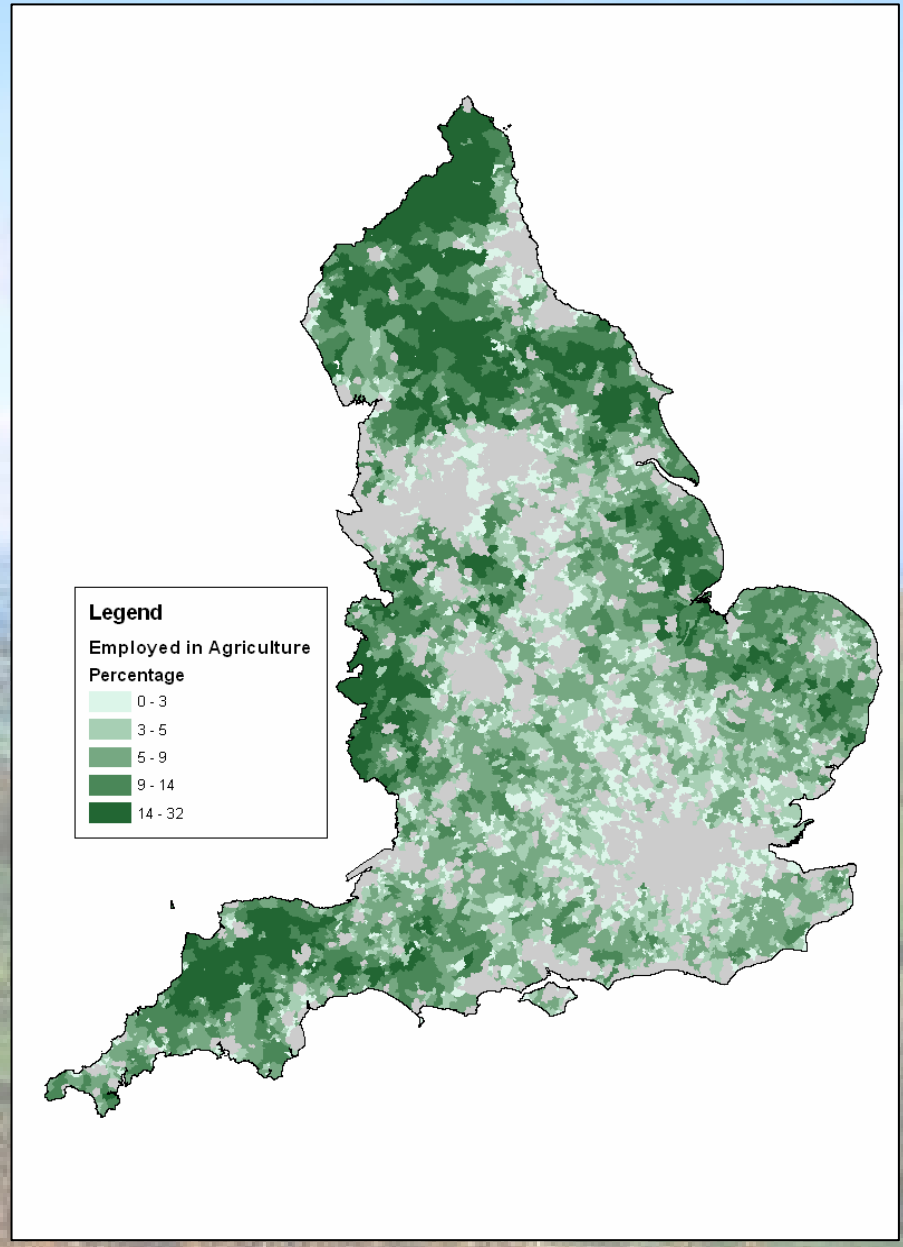

NATURAL AND CONSTRUCTED FEATURES
Land
Facilities
Infrastructure
QUALITIES OF PEOPLE AND PLACE
Amenity
Climate
Ecosystem health
Pollution
Demography
LIVING AND WORKING THERE
Access to services
Employment
Education & skills
Tourism
Income & wealth
Housing
Behaviour
POLITICAL AND ECONOMIC CONTEXT
Protective designations
Area status
Politics
Administrative position



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RURAL ECONOMY AND LAND USE

More bird species predicted in areas with:

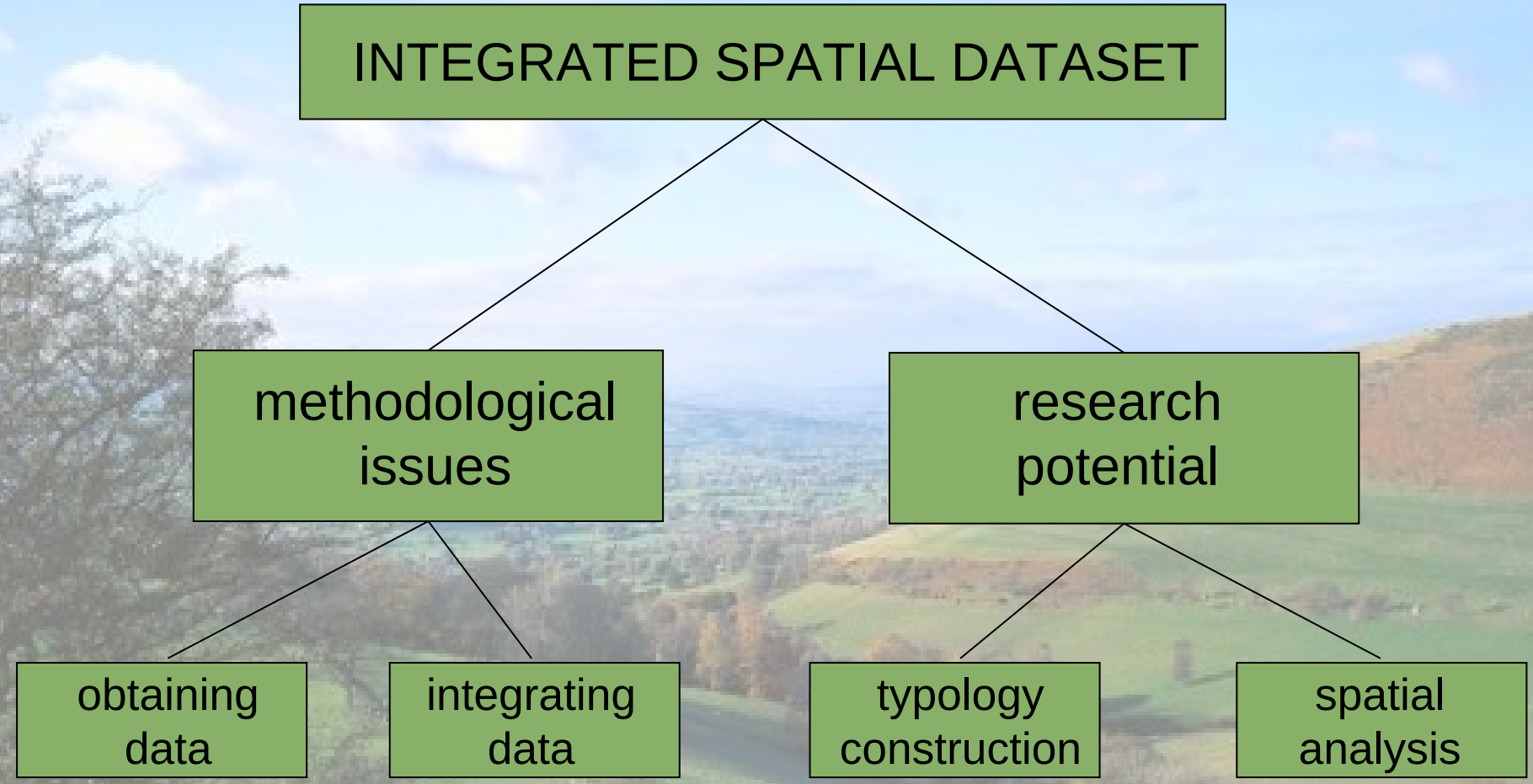
- **Lower** proportions of land covered by cereal crops
- **Lower** proportions of grassland or rough grazing
- **Lower** proportions of set-aside or bare fallow land
- **Higher** proportions of woodland

More bird species predicted in areas that are relatively better-off with:

- **Lower** % working population employed in agriculture
- **Lower** % employed population working from home
- **Less deprivation** in terms of both income and employment

More bird species predicted in areas with settlements in the form of villages or dispersed dwellings rather than rural towns with :

- **More** net outward migration 2000-2001
- **More** land designated for environmental protection
- **More** land covered by National Parks


INTEGRATED SPATIAL DATASET
methodological issues
research potential
obtaining data
integrating data
typology construction
spatial analysis