

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 1km² 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.

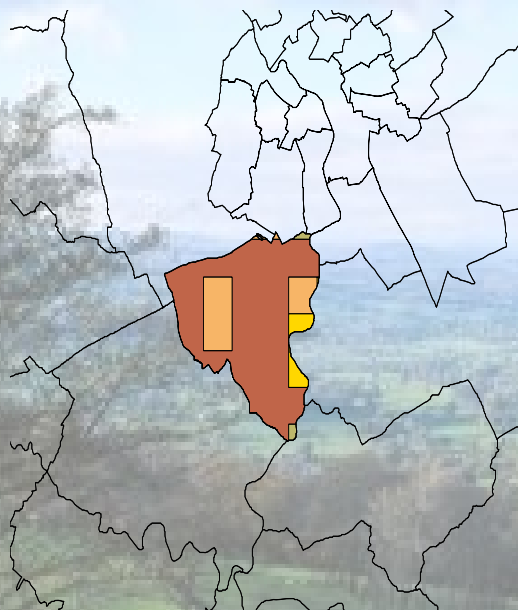
A key dataset linking cultural, physical and ecological factors

- **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 1km² 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 km² 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 km² in the ward
 - based on the probabilities found above

Example of Land Use and Land Cover Data

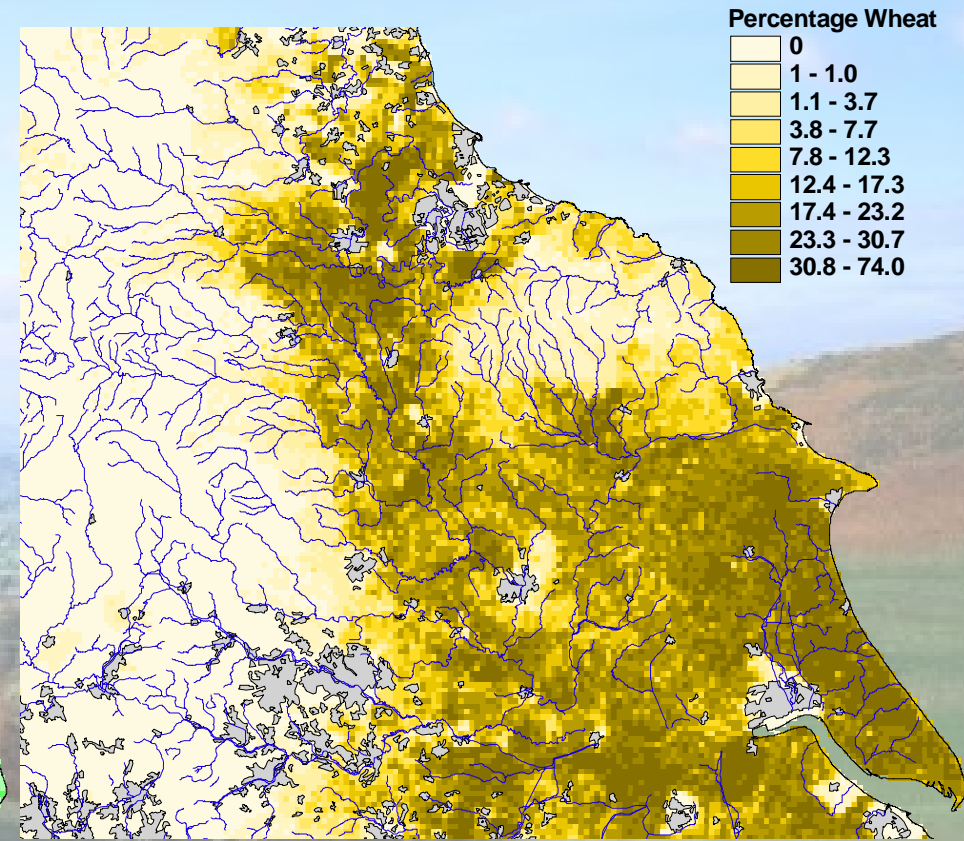
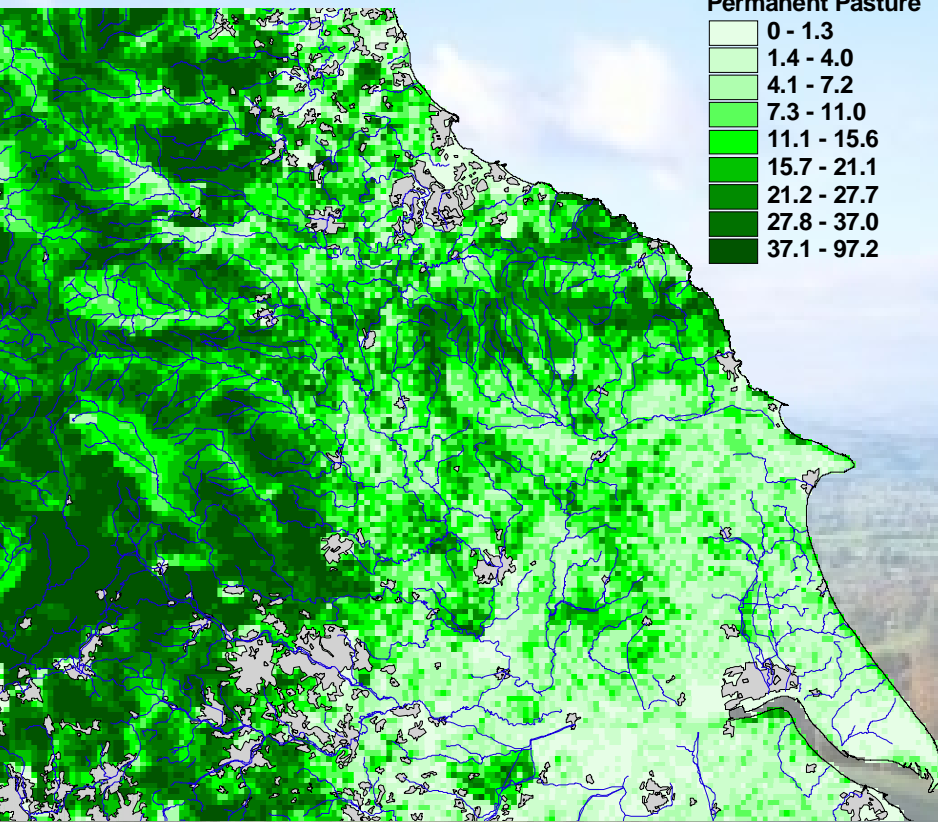


Land Cover	Area (ha)
Arable	1426
Improved Grass	80
Unimproved Grass	20
Urban	293
Grand Total	1819

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

Total area	1699.4		
Temporary grass area	171.1	Peas for harvesting dry area	---
Permanent grass area	294.0	Oilseed rape area	79.6
Rough grazing area	---	Linseed area	---
Woodland area	38.4	Turnips_etc area	---
Set-aside area	104.7	Other crops for stockfeeding area	---
All other land area	60.1	Maize area	25.4
Wheat area	512.8	Other arable crops area	0.0
Winter barley area	137.1	Bare fallow area	---
Spring barley area	80.8	Peas and beans area	---
Oats area	---	All other veg and salad area	0.0
Other cereals area	---	Area under glass/plastic area	---
Potatoes area	---	Top fruit area	0.0
Sugar beet area	72.0	Small fruit area	---
Horticulture area	---	Hardy nursery area	---
Field beans area	29.2	Bulbs and flowers area	0.0

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



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

23%

29%

60 m²

80 m²

190 m²

20 m²

30 m²

35%

41%

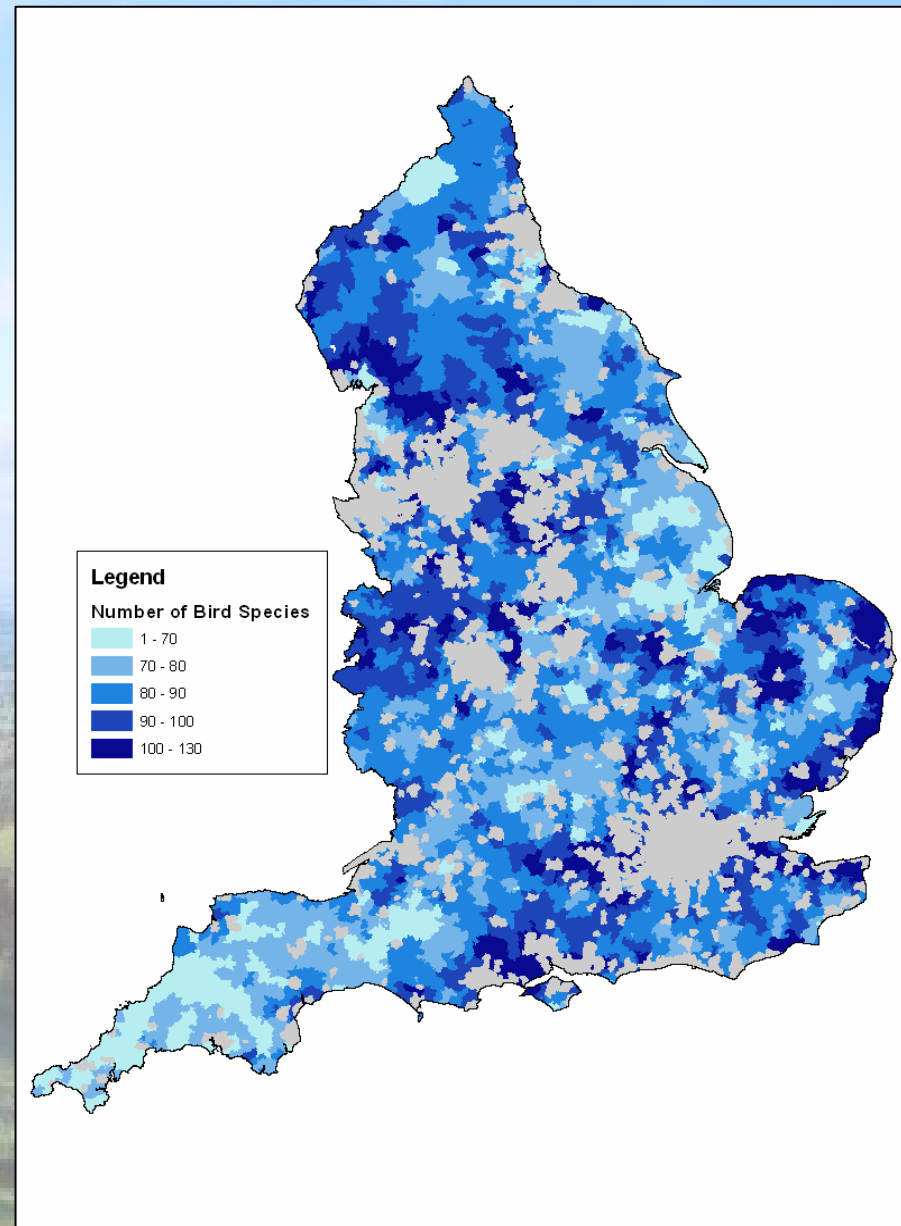
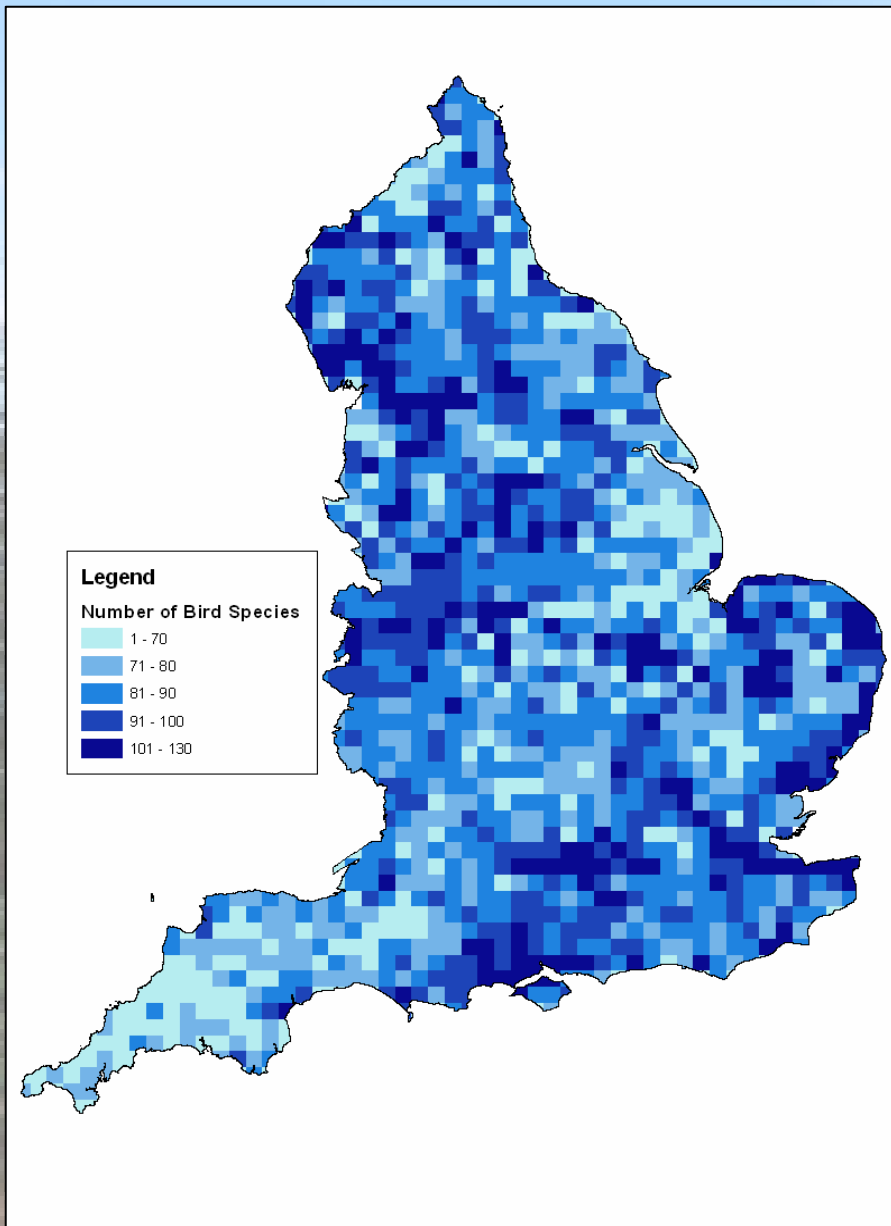
$$0.23 \times 60 = 13.8\text{m}^2$$

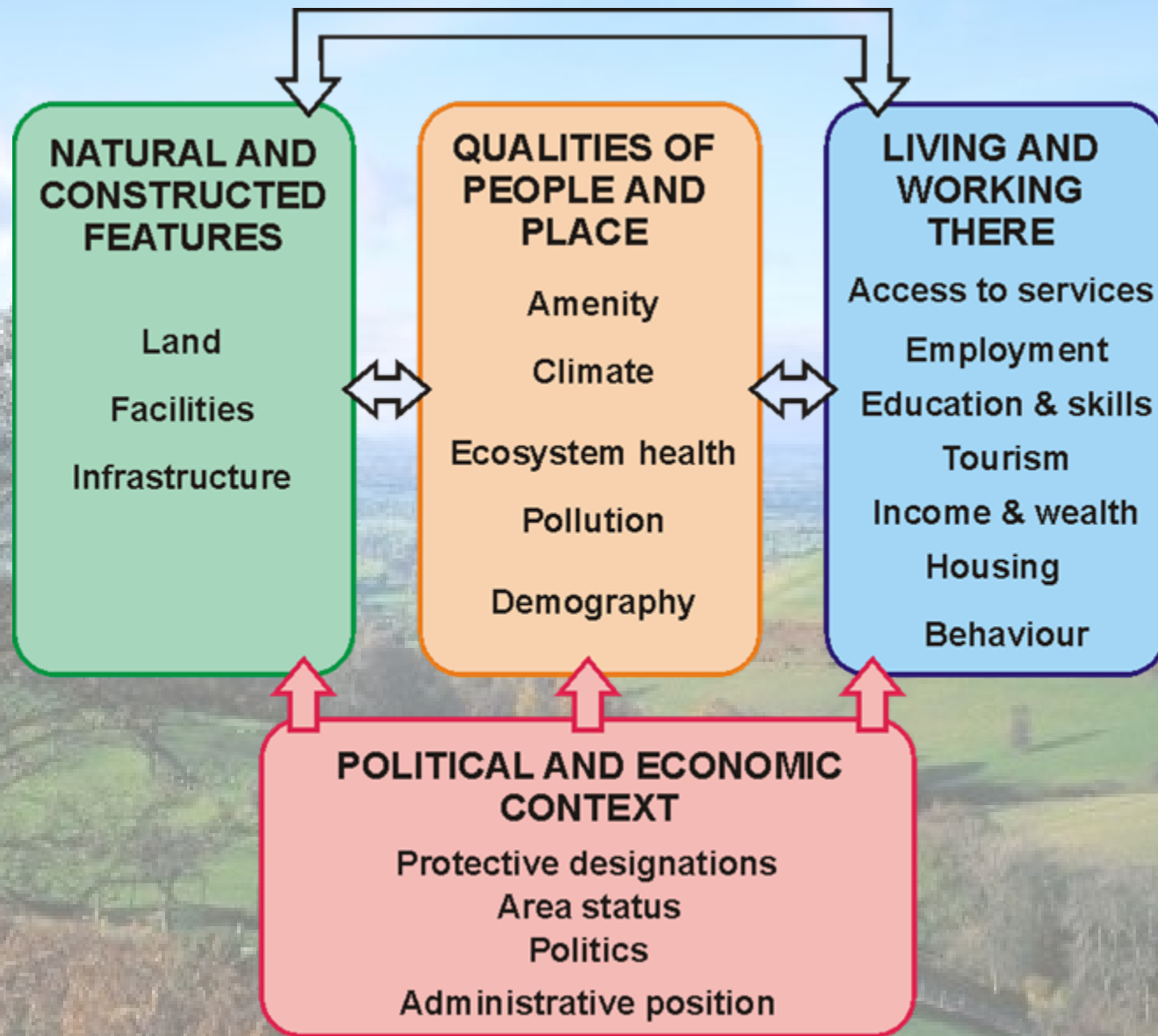
$$0.29 \times 80 = 23.2\text{m}^2$$

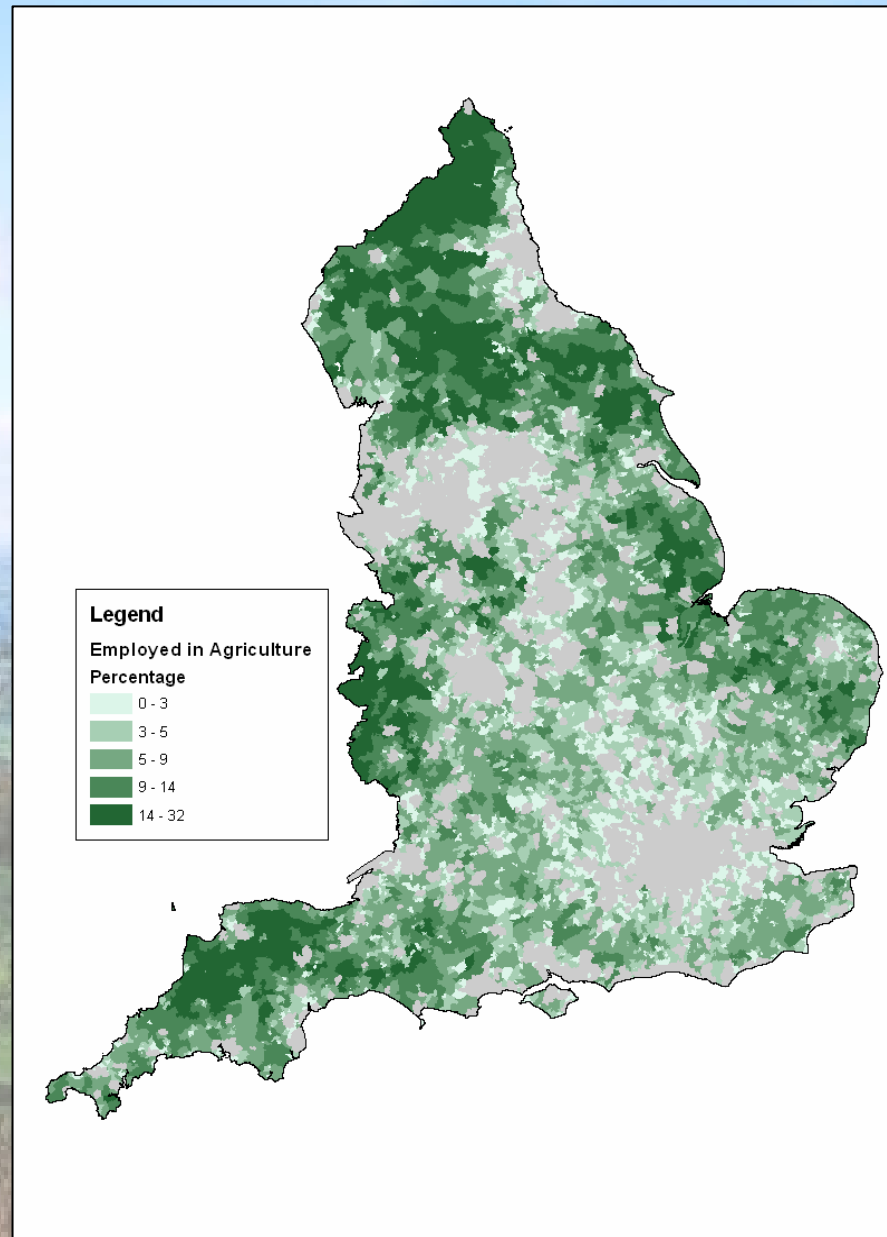
$$0.35 \times 20 = 7\text{m}^2$$

$$0.41 \times 30 = 12.3\text{m}^2$$

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







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