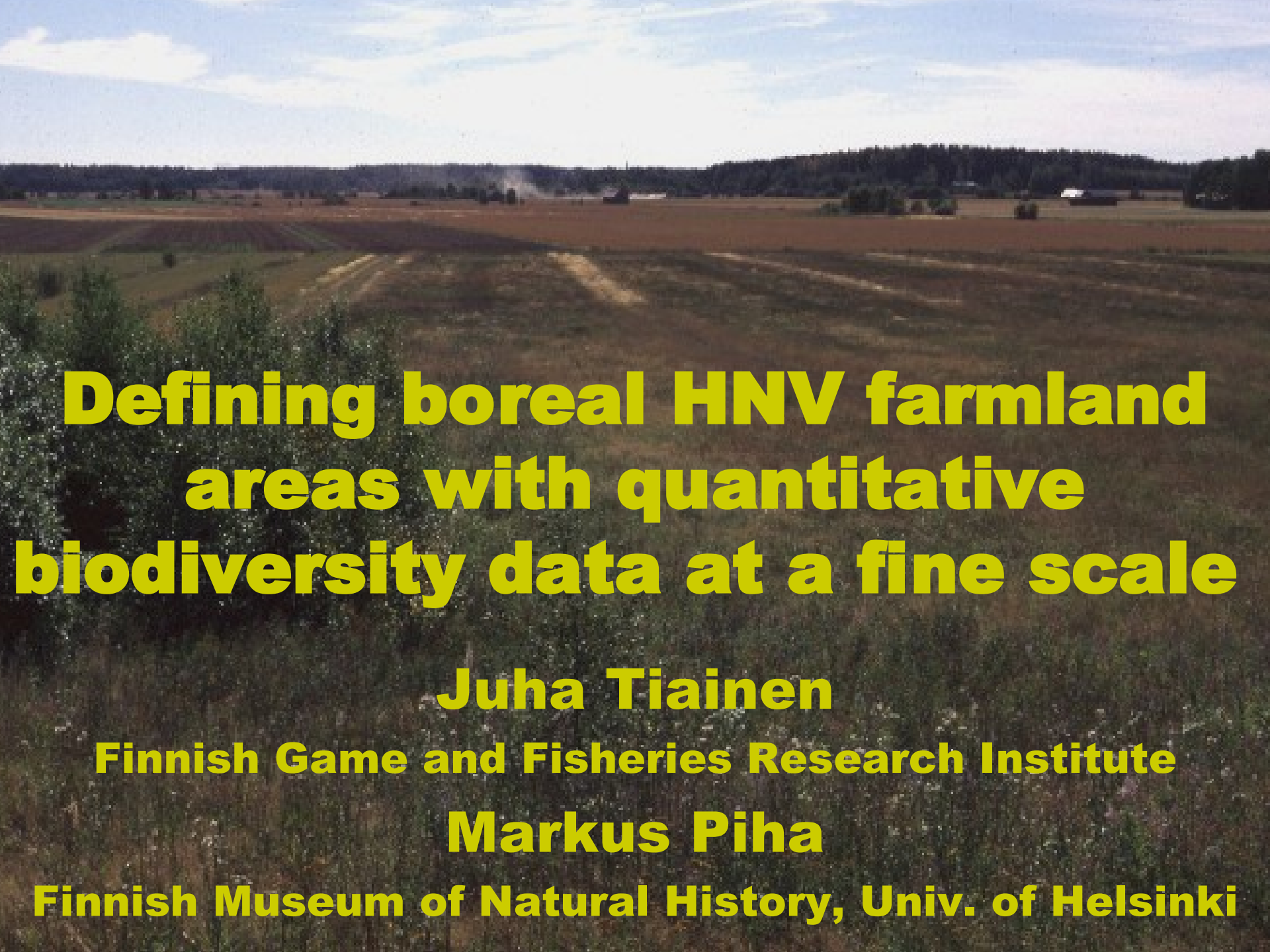

Defining boreal HNV farmland areas with quantitative biodiversity data at a fine scale

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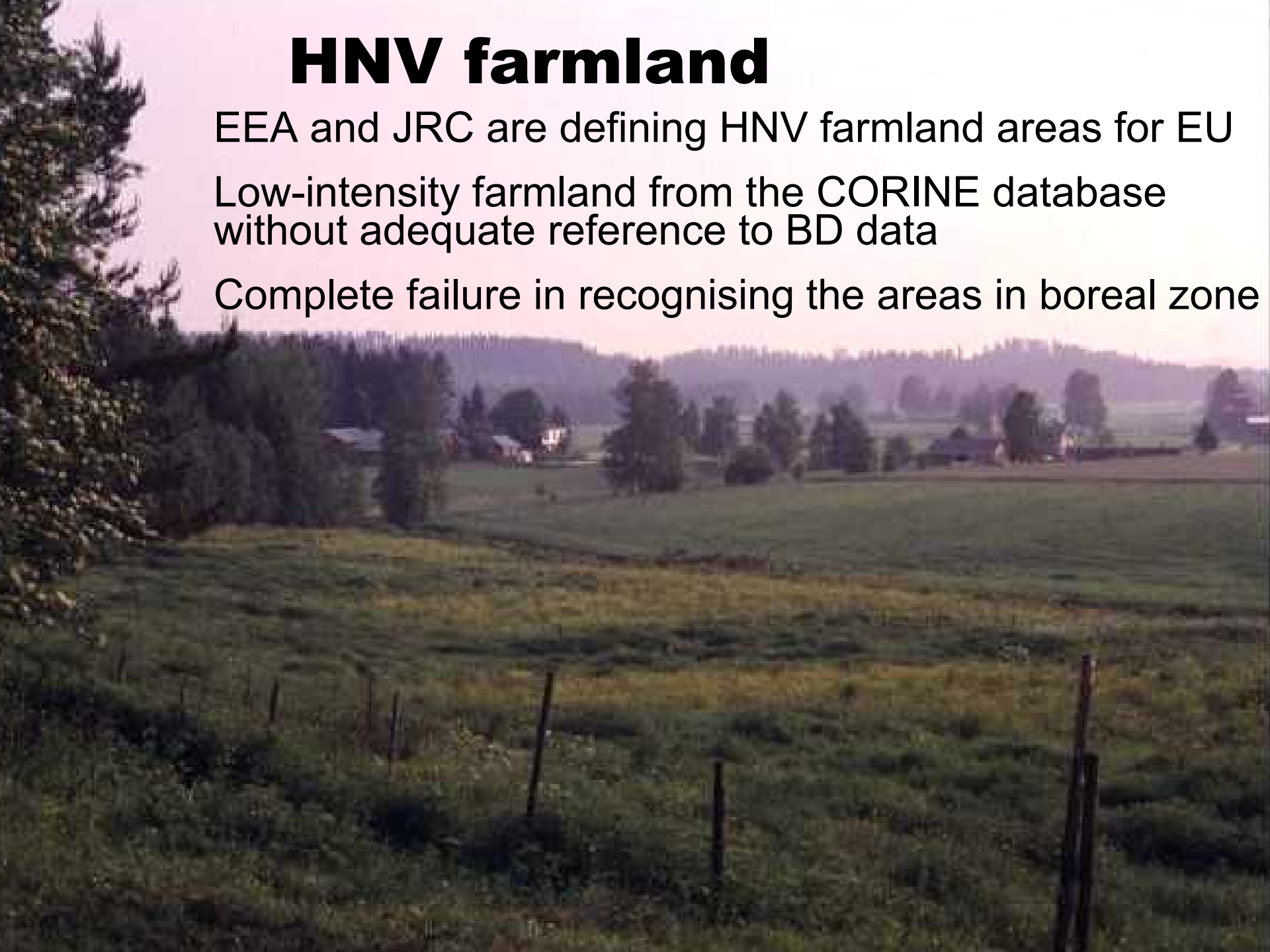
HNV farmland

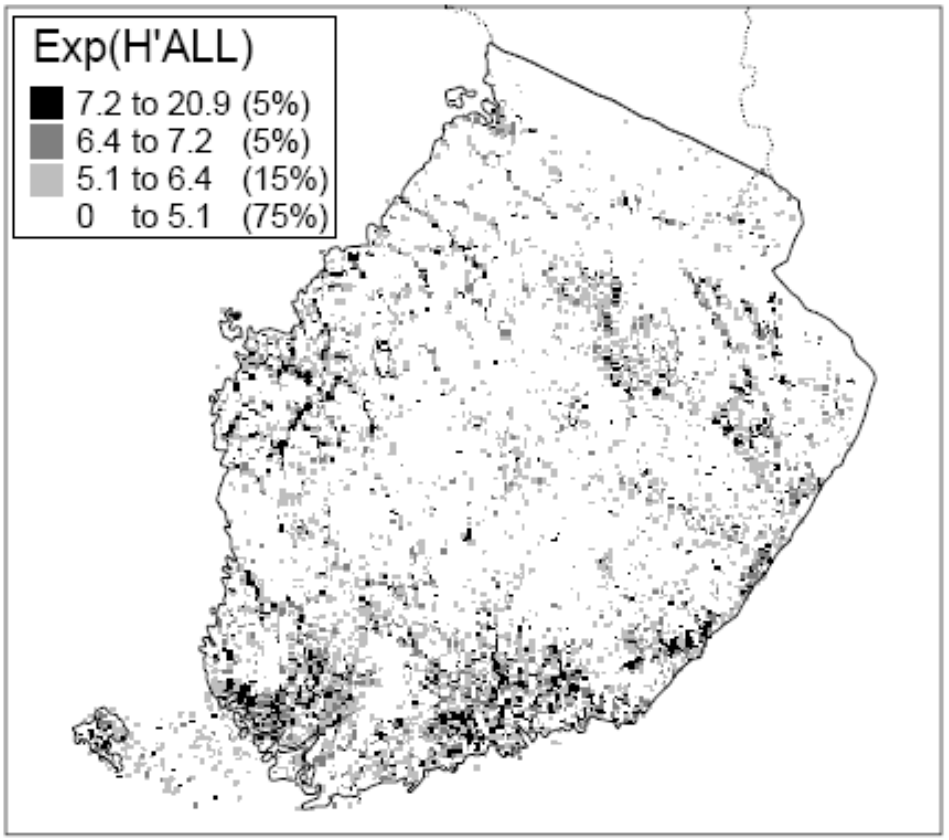
EEA and JRC are defining HNV farmland areas for EU

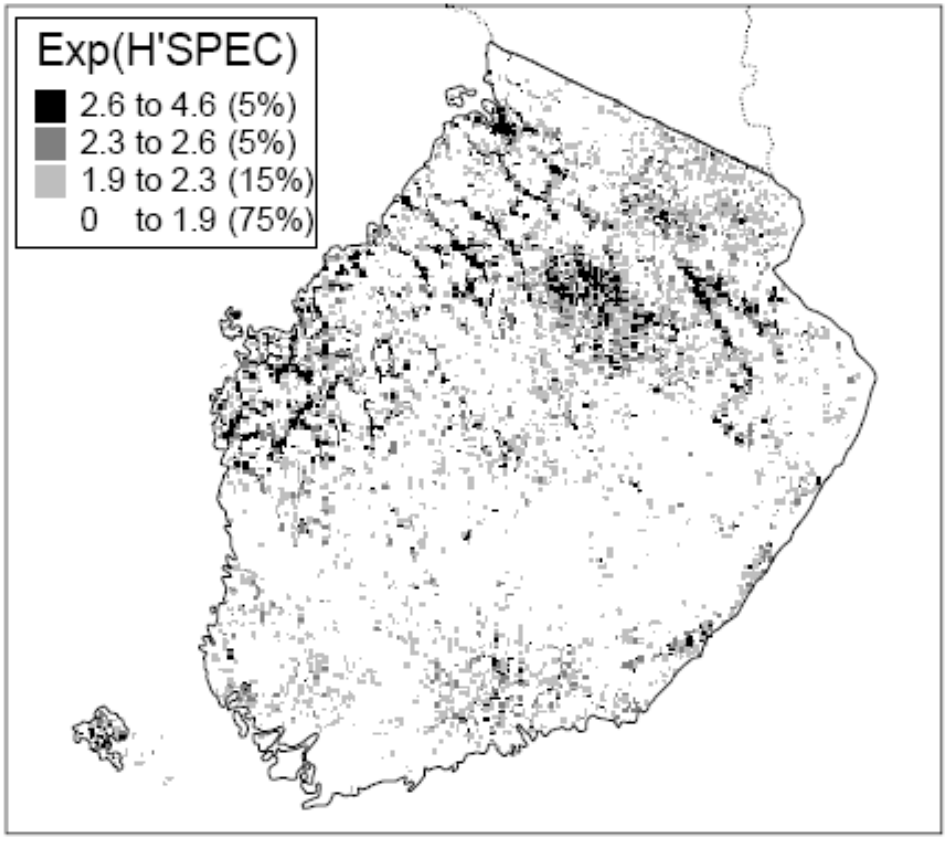
Low-intensity farmland from the CORINE database without adequate reference to BD data

Complete failure in recognising the areas in boreal zone



Hotspots of farmland bird species diversity





Data, 2000–06

	No. territories
Alauda arvensis	15192
Emberiza citrinella	10442
Turdus pilaris	9739
Sylvia communis	6551
…	
52 species	90266

All territories stored in a GIS database

Farmland bird census areas in 2000–06

Total no. of census areas (1 km^2 each)

2000	2001	2002	2003	2004	2005	2006
59	118	80	76	91	141	75

Total number of territories used:

N_{ALL} = 13 986

N_{SPEC} = 4044

Need for a predictive modelling study

which

- is applicable to large areas
- provides spatial predictions of abundance rather than occurrence
- has an adequate scale for land use and management planning

The problem

How to define HNV farmland using birds

Aims

- to identify the main landscape and climatic elements determining farmland bird diversity, species richness and abundance in boreal farmland landscapes

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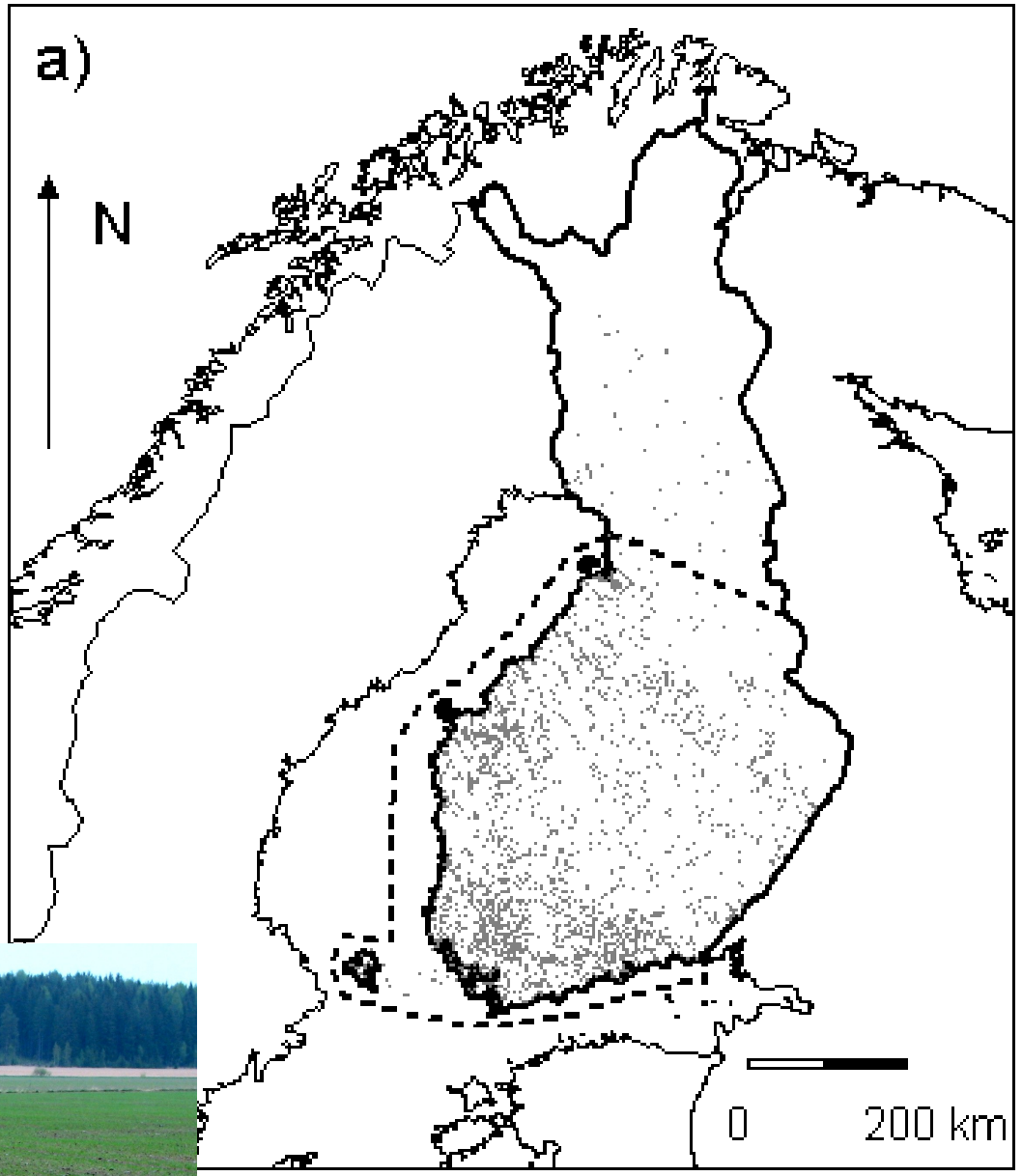
- to identify the main landscape and climatic elements determining farmland bird diversity, species richness and abundance in boreal farmland landscapes
- to make fine-scale spatial predictions to be used for identifying hotspots of farmland birds in Finland
- to study whether prioritizing farmland bird diversity hotspots is area-effective,
  i.e. if BD benefits accumulate faster than the area required for conservation actions

Finnish farmland

22 728 km² (7 %)
- ca. 30 % in the south
- ca. 12 % in the middle
- ca. 1 % in the north

Short growing season

Barley sward 23.5.2006



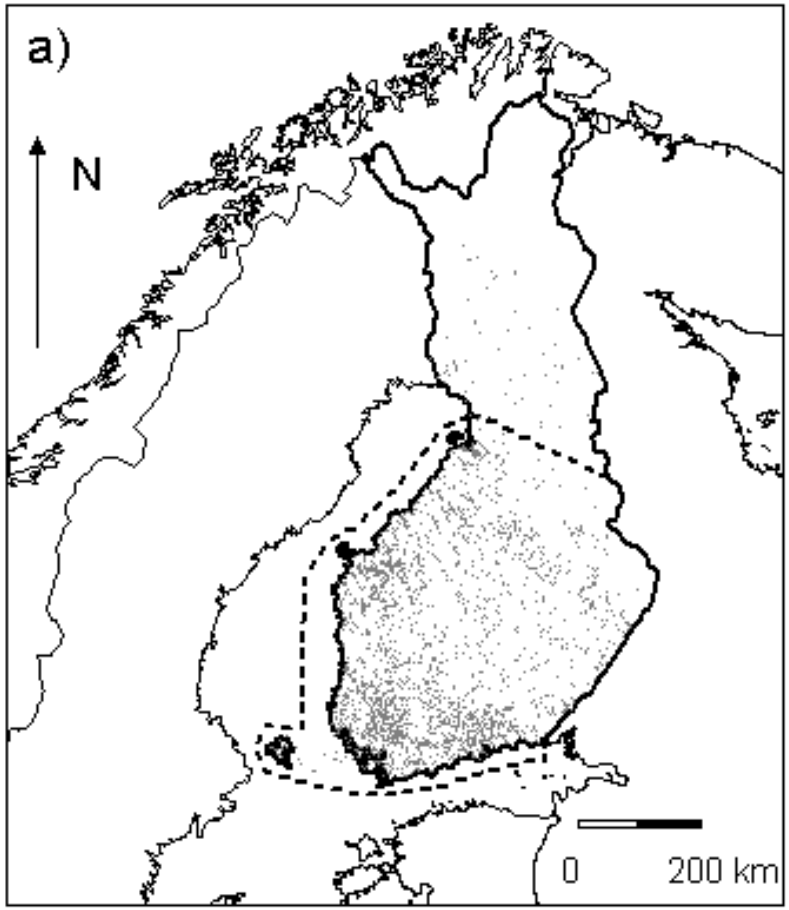
Study design

500 x 500 m grid cells with at least some agricultural land; total N = 380 635 grid cells

Census data from 520 grid cells:

- 390 grid cells for model building (training set)
- 130 grid cells for model evaluation (test set)

These 520 grid cells covered 7100 ha of agricultural land



Model-ling

Response variables

H'_{ALL} H'_{SPEC}

S_{ALL} S_{SPEC}

N_{ALL} N_{SPEC}

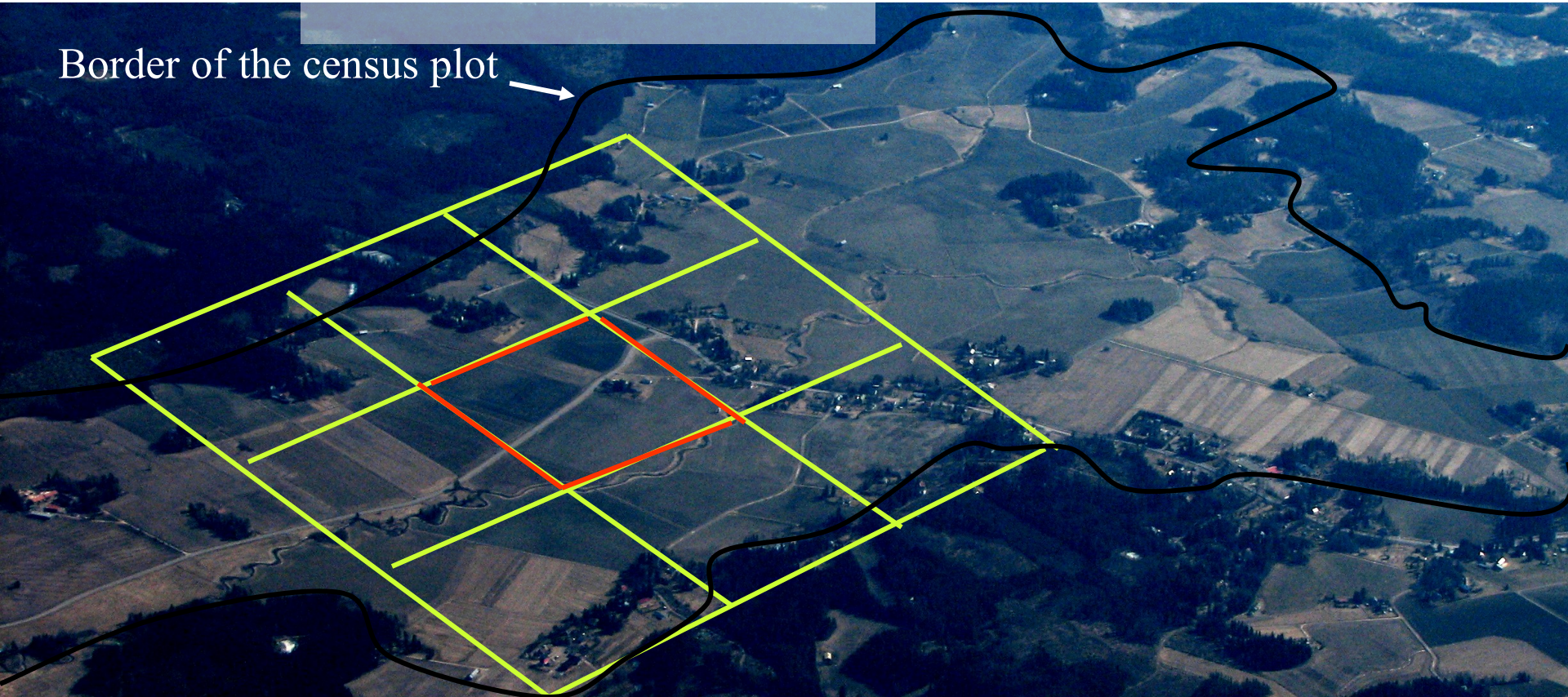
Predictors

Local level (square itself)

Landscape level (neighbour squares)

Regional level

One of the study areas 10.4.2007



Predictors

Local and landscape levels; from CORINE data

- cultivated fields
- low intensity farmland
- waters
- forest
- rural settlement
- wetland
- boundary length between farmland and other habitat
- habitat heterogeneity

Regional level

Geographical location

- longitude
- latitude

Climatic variables [1]

- growing degree days
- summer precipitation
- melting date of permanent snow cover

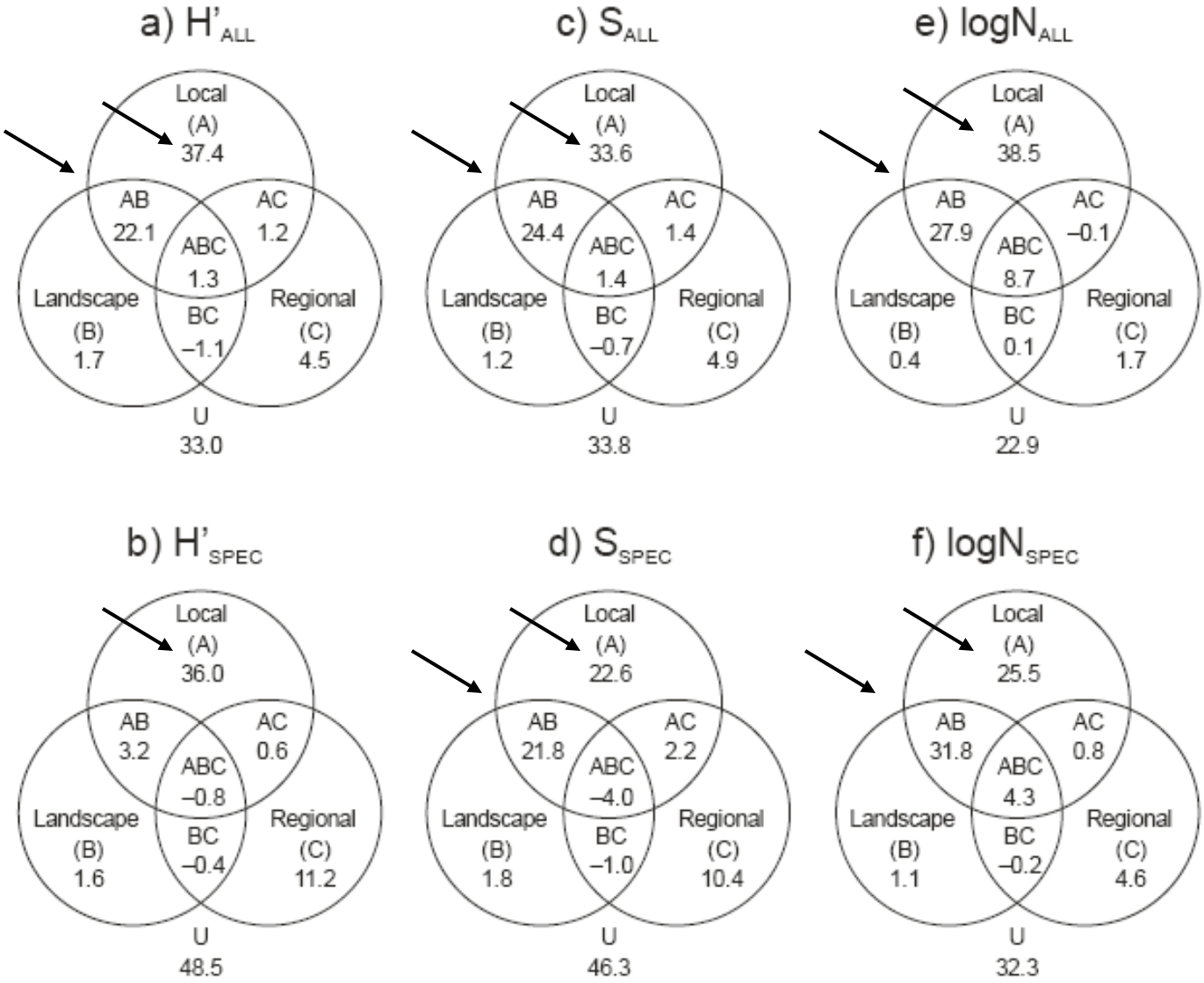
[1] Calculated in a 10 x 10 km grid system as mean values of 1986–2005; Finnish Meteorological Institute

Modelling

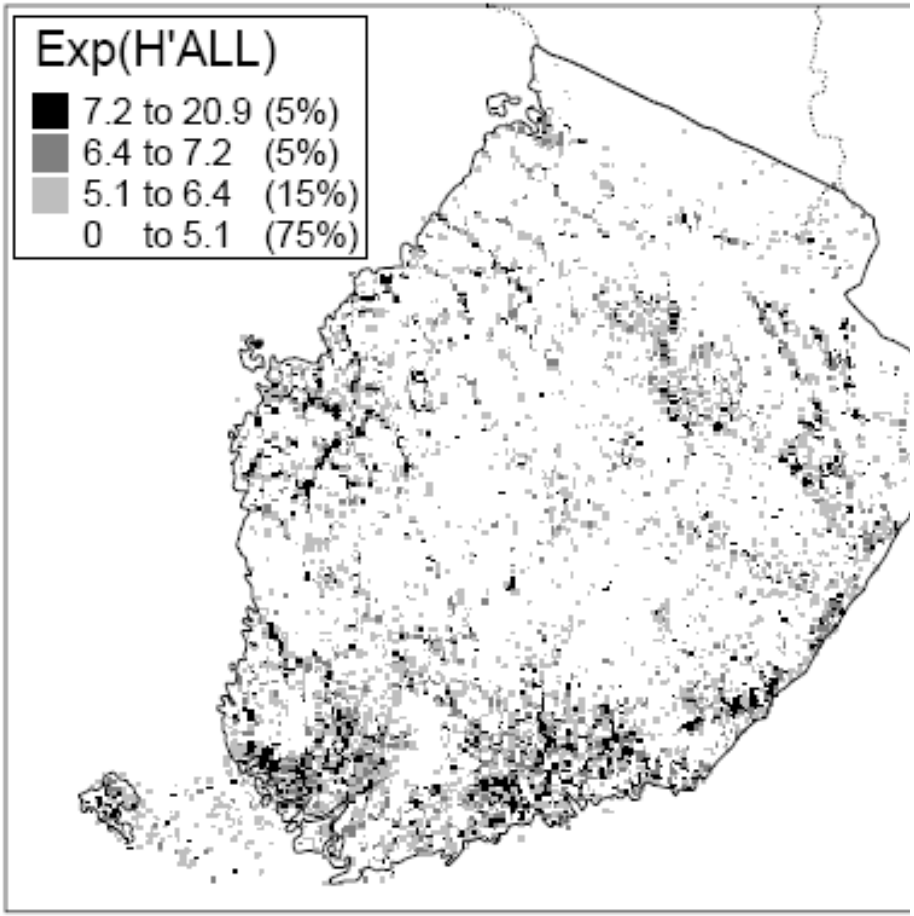
- Principal Component Analyses for each response variable in each scale
- Generalized Additive Models using PCA scores for the training set

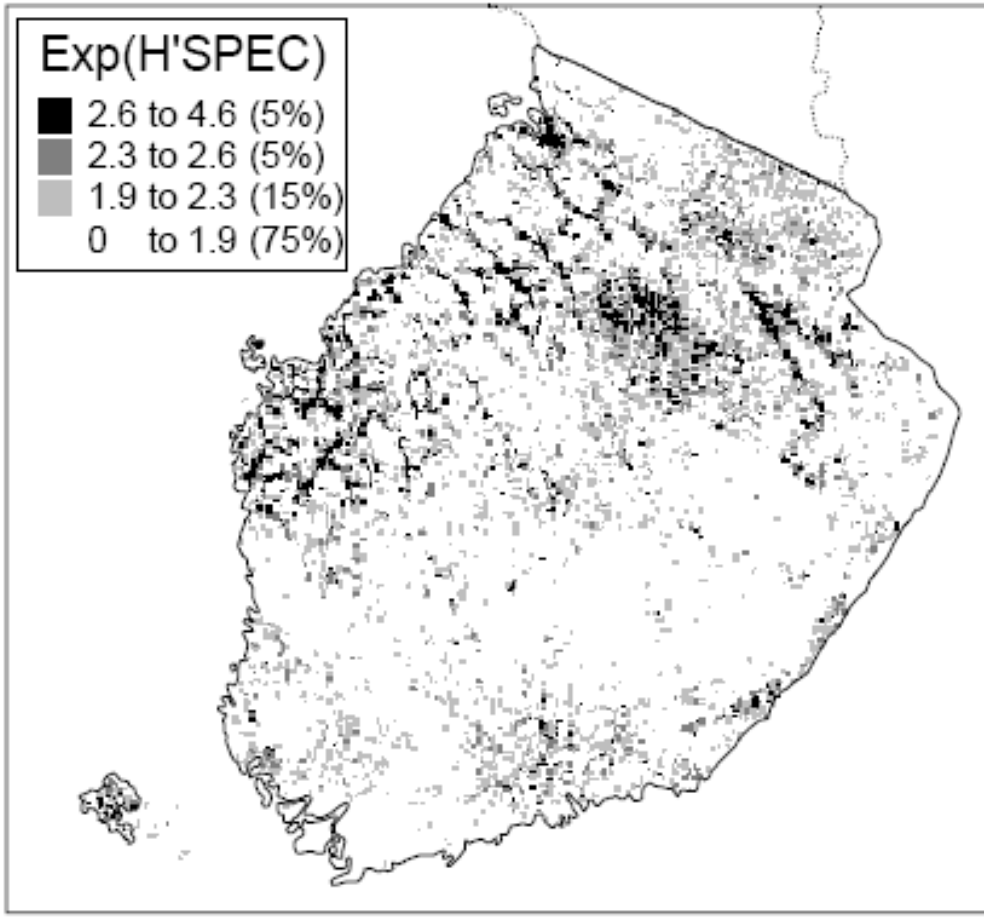
  ⟶ Model selection using AICc
- Model evaluation: comparison of model predictions and observed values of the test set (predictive power)

Variation partitioning



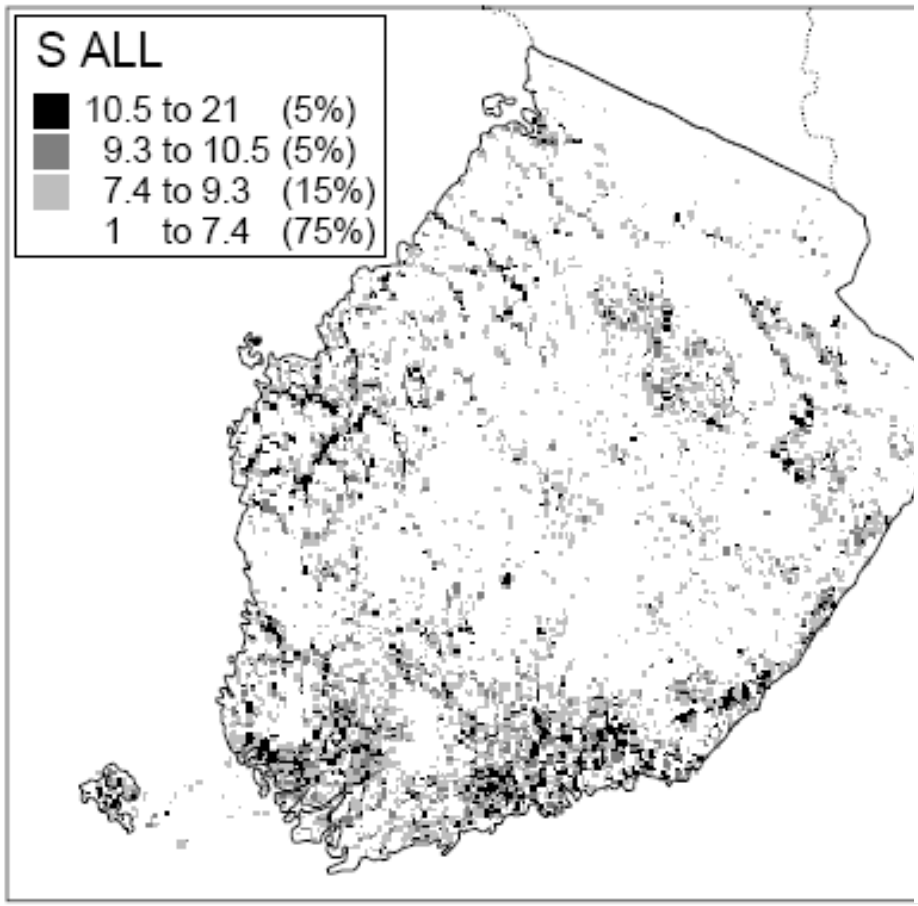
Prediction output for species diversity

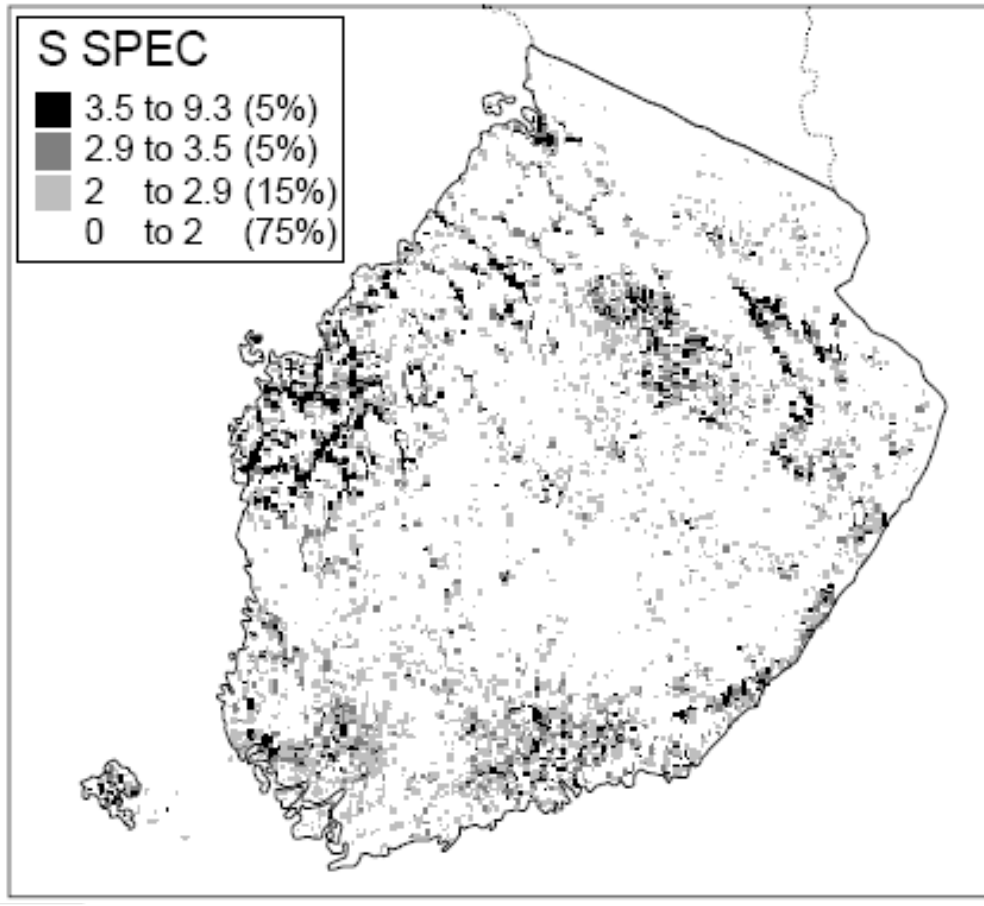




Predictive power of the model (R^2) 63 % (all species) and 49 % (SPECs)

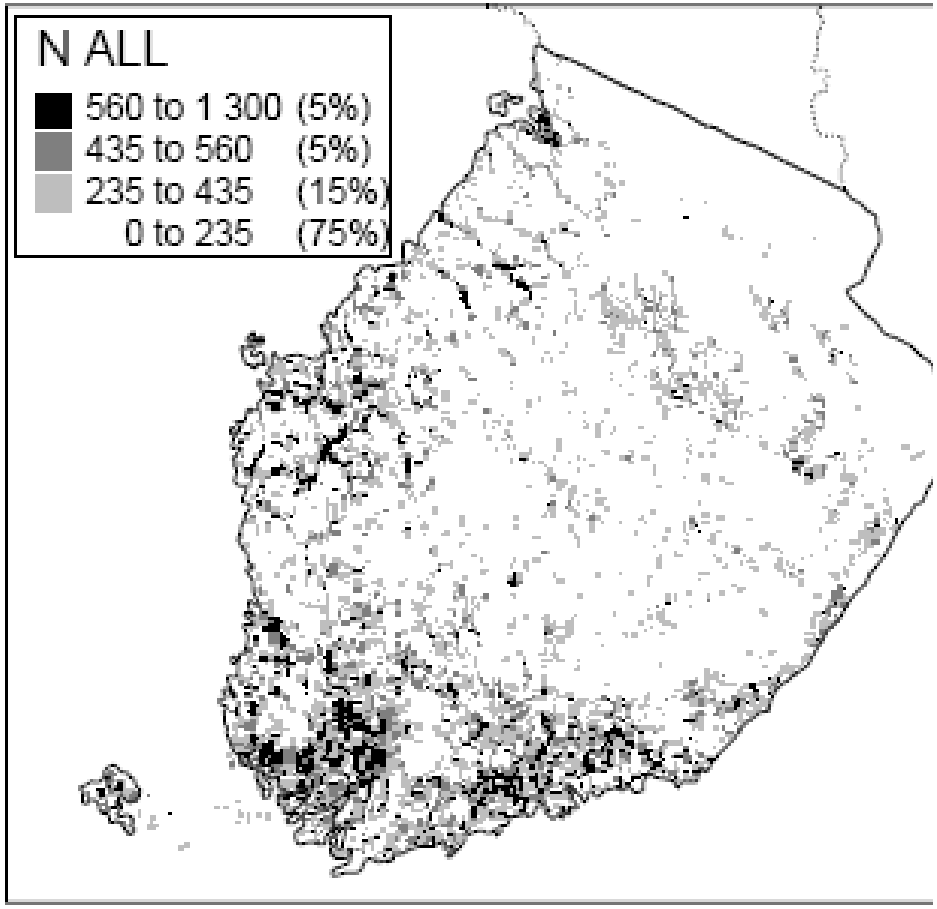
Prediction output for species number

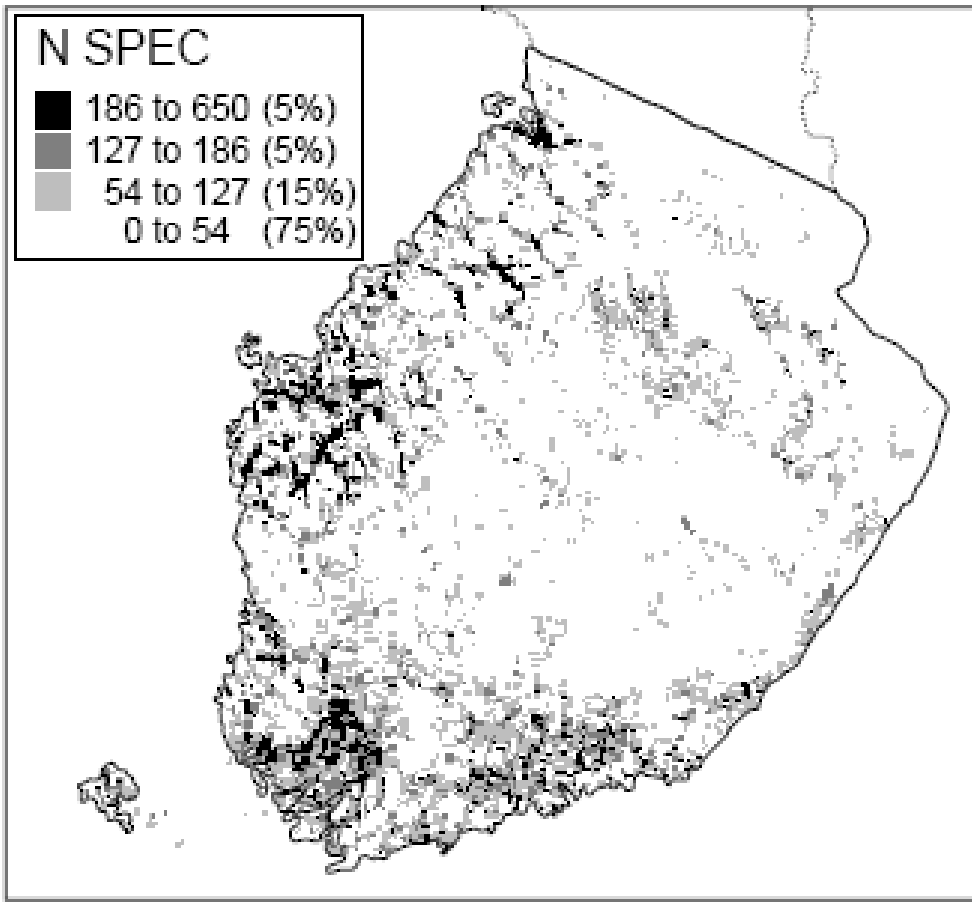




Predictive power of the model (R^2) 66 % (all species) and 55 % (SPECs)

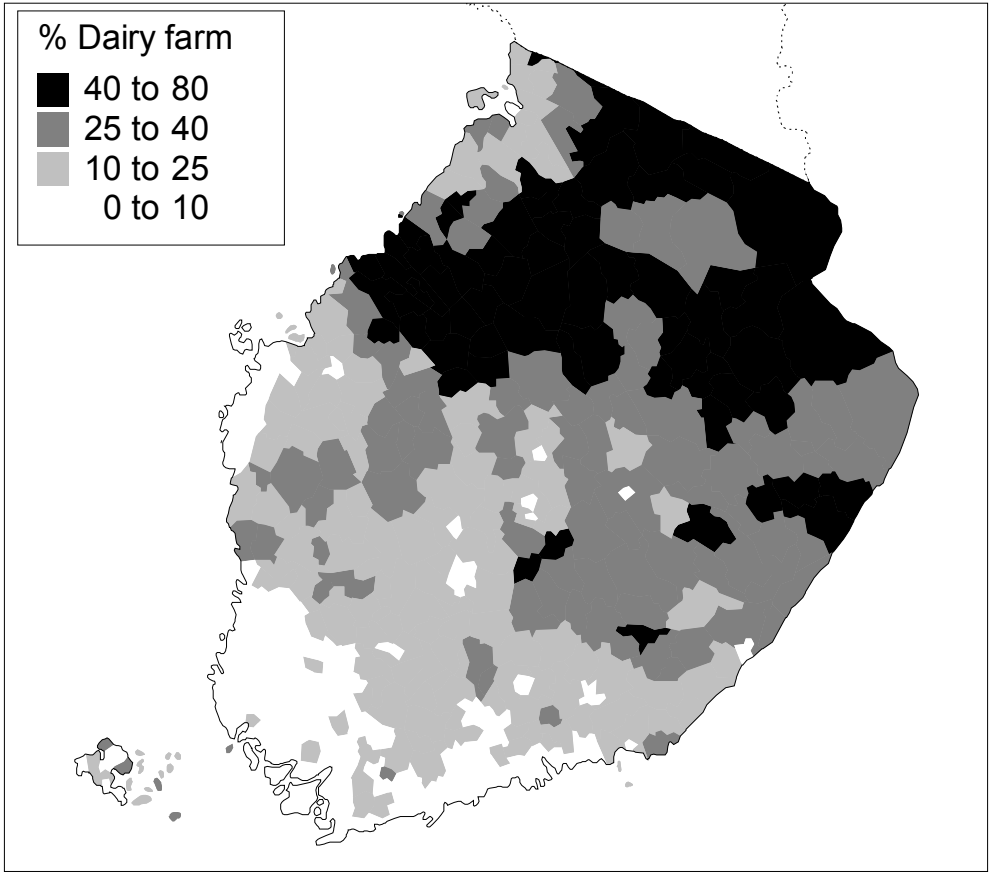
Prediction output for total abundance

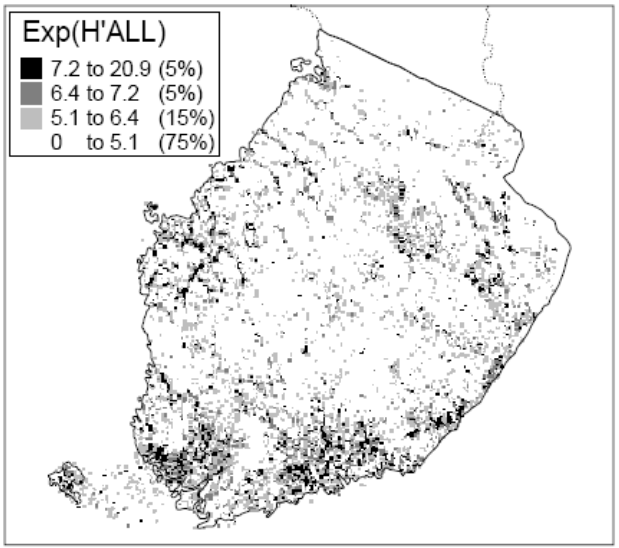


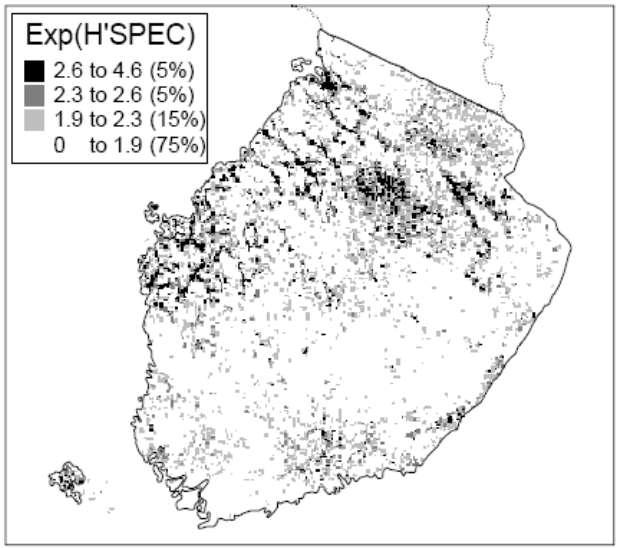


Predictive power of the model (R^2) 75 % (all species) and 69 % (SPECs)

Prediction reflects regional features in farming practices







Conclusions

Farmland bird abundance and diversity hotspots can be predicted at an adequate scale for improving targeting of conservation actions

H', S and N were mostly explained by local scale env. factors

- Abundance of mosaic-like farmland habitats was positively associated with all the variables studied
- Low-intensity farming appeared as an important factor

Midnight on 20 June, 2001