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Effect of farmland heterogeneity on multiple ES spatial variability and trade-offs

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FarmLand

biodiversa

EcoSummit 2016 29 August – 1 September 2016 Montpellier, France

Dynafor

INRA SCIENCE & IMPACT

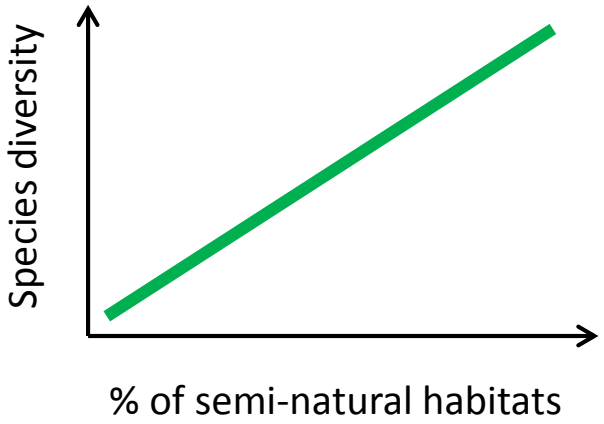
Centre d'Ecologie Fonctionnelle & Evolutive

Centre d'études biologiques de Chizé

cnrs dépasser les frontières

The role of agricultural landscape heterogeneity

Proportion of semi-natural habitats



Role studied/known

Implementation not always feasible

The role of agricultural landscape heterogeneity: a paradox

Proportion of *few* semi-natural habitats

Role studied/known

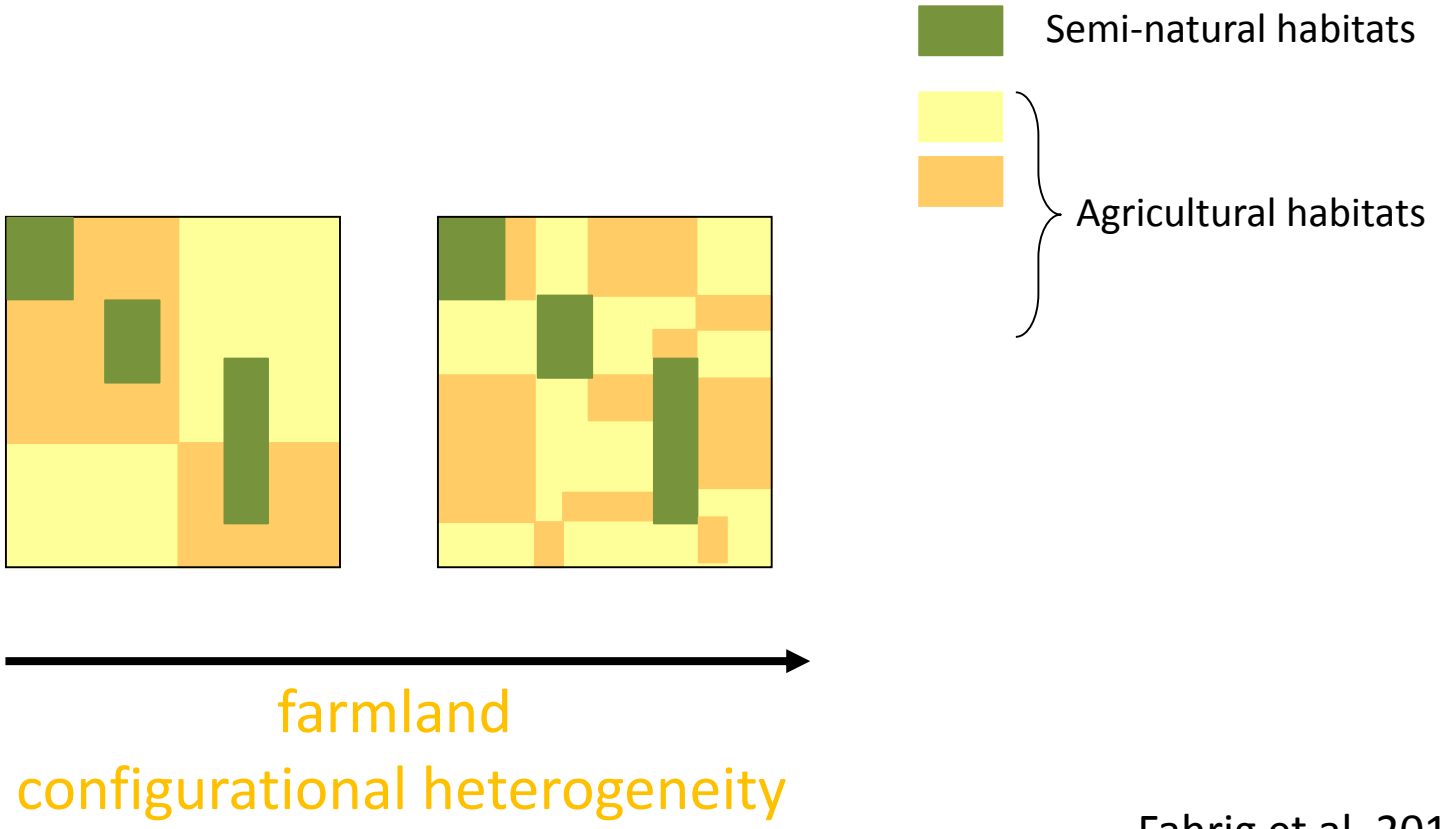
Implementation not always feasible

Heterogeneity of the *large* « farmland matrix »

Role ?

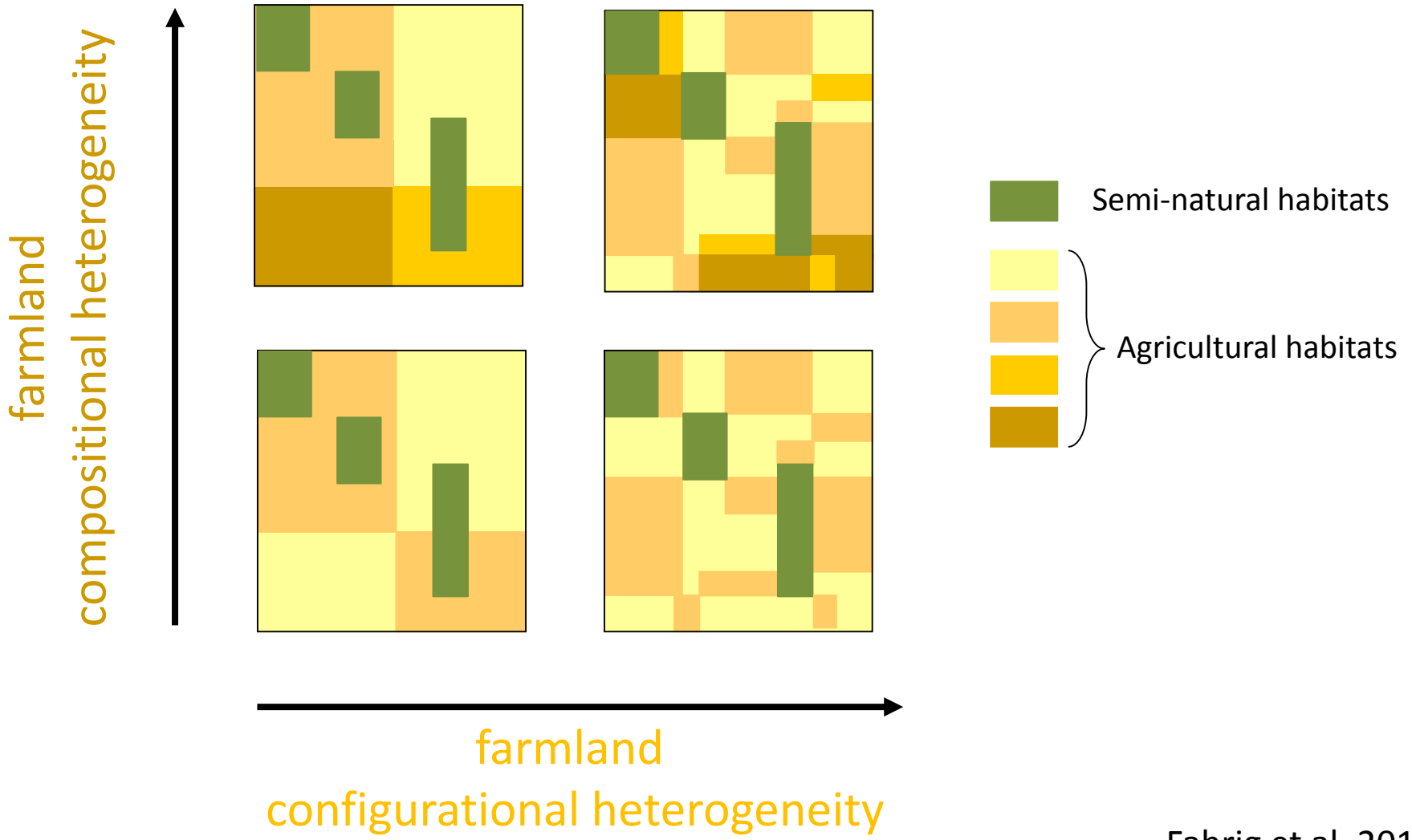
Implementation ?

Farmland heterogeneity



Fahrig et al. 2011

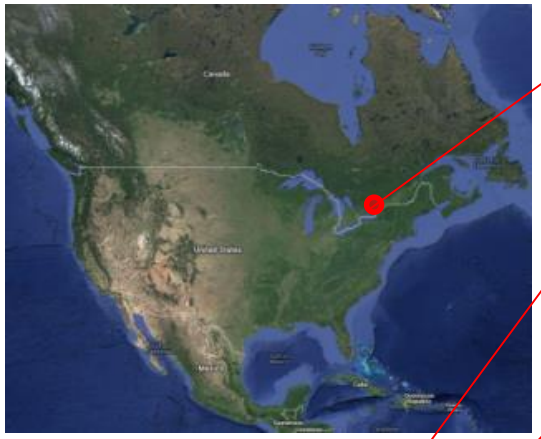
Farmland heterogeneity

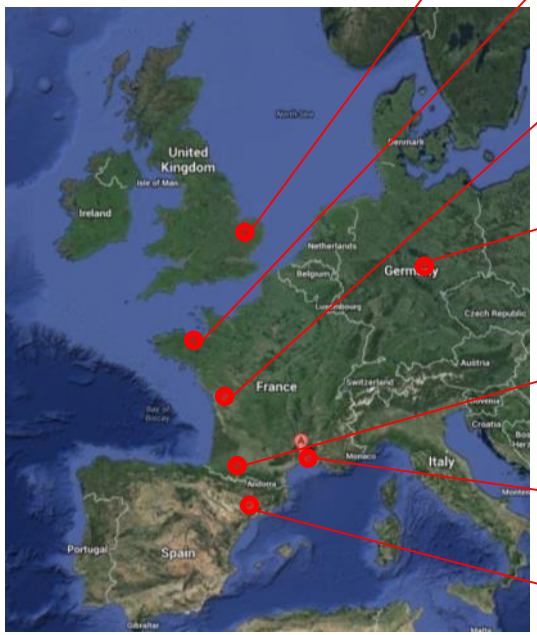


Fahrig et al. 2011

A multi-region, multi-taxa, multi-ES project

FarmLand

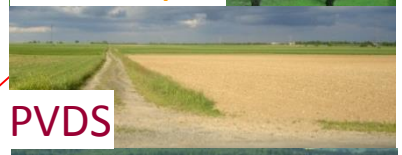





Ontario

East Anglia

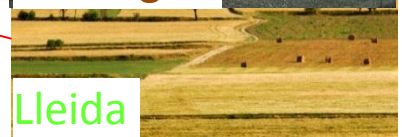

Armorique


PVDS

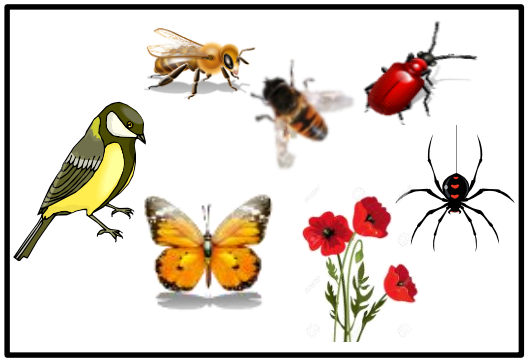

Goettingen


Coteaux

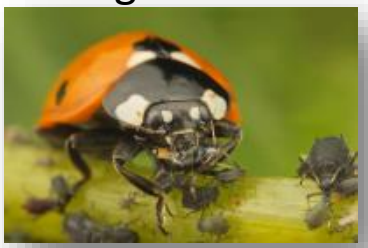

Camargue


Lleida

Biodiversity (7 taxa)



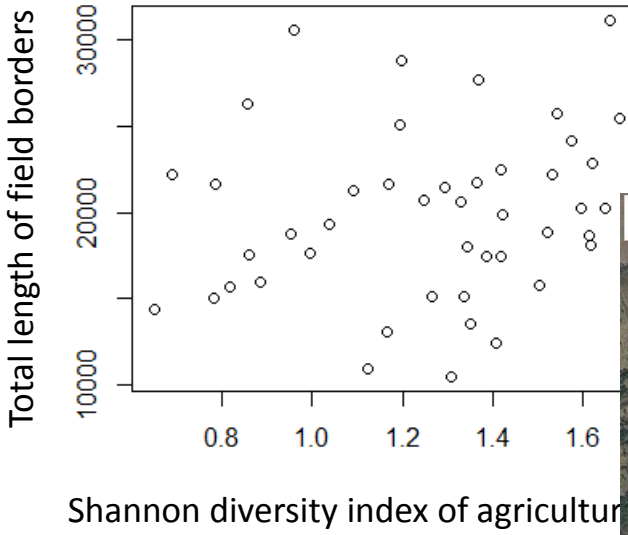
Biological control



Pollination

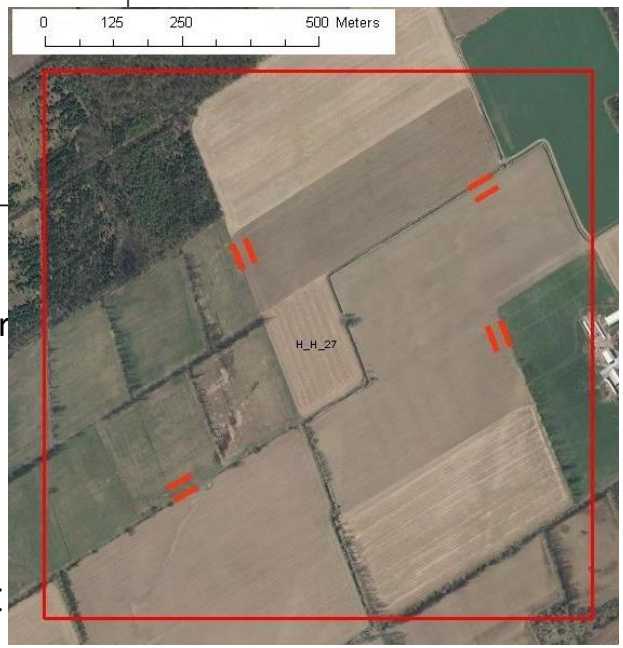
Production

Common protocols across regions



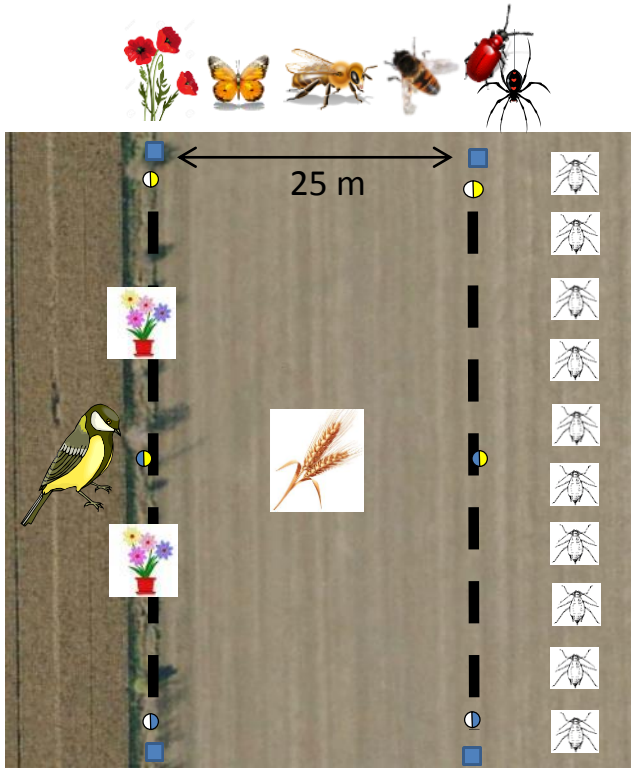
1. Landscape selection

⇒ 1 x 1 km
⇒ 2 independent gradients
⇒ 60-90% semi-natural habitat
⇒ 30-90 landscapes/region
Total: 435 landscapes



2. Sampling site selection

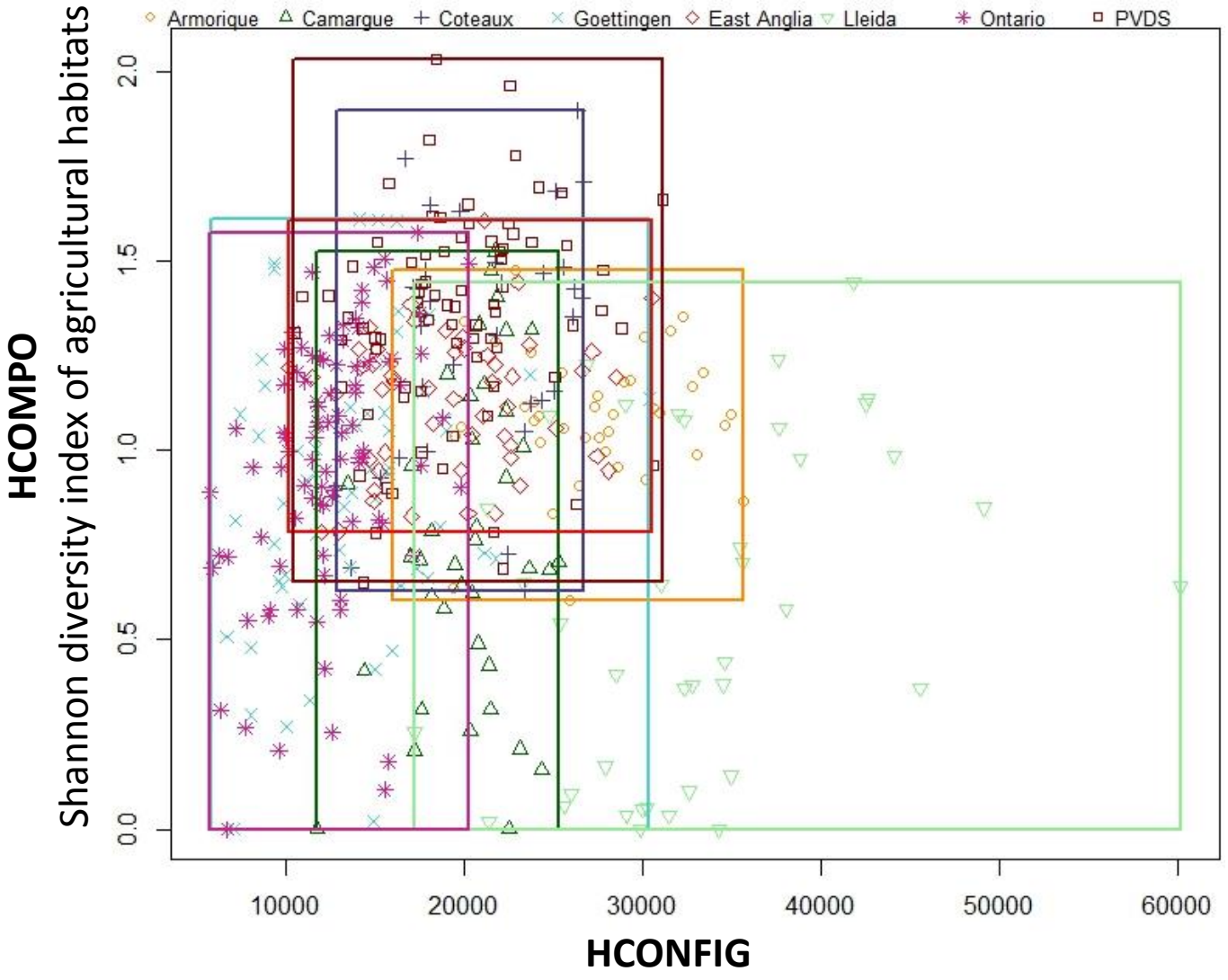
⇒ 3 representative fields (cereal, corn, grassland)
Total: 1305 fields



3. ES measures

Total: 2795 species,
78000 aphids glued,…

Farmland heterogeneity gradients



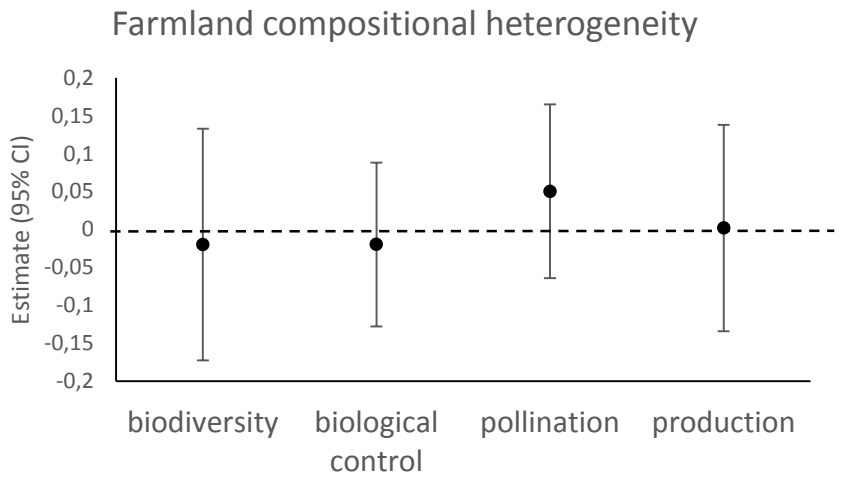
Testing the effect of farmland heterogeneity

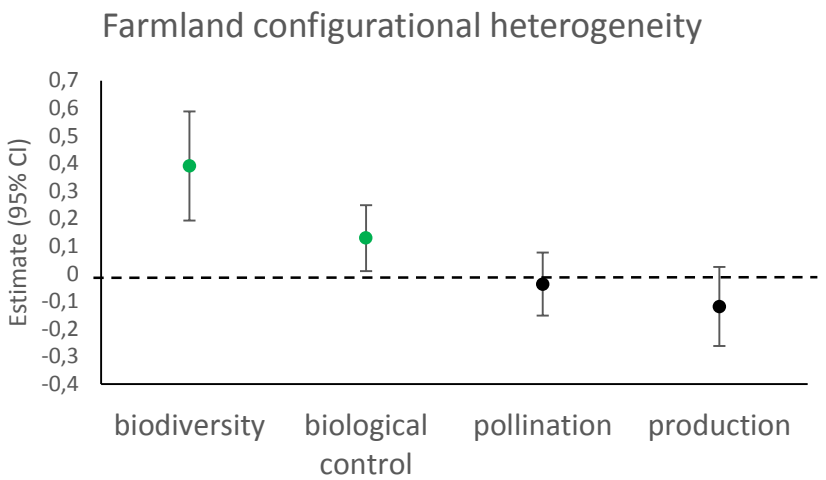
Landscape selection:
435 landscapes
2 uncorrelated gradients across/among regions
limited variations in % semi-natural habitat within each region

Mixed model:
ES ~ HCOMPO + HCONFIG + % semi-natural + (1|Region)

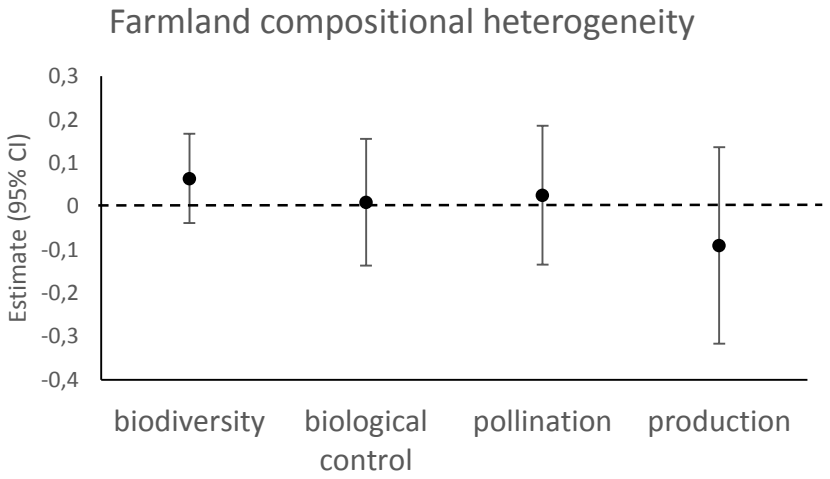
Farmland heterogeneity effects

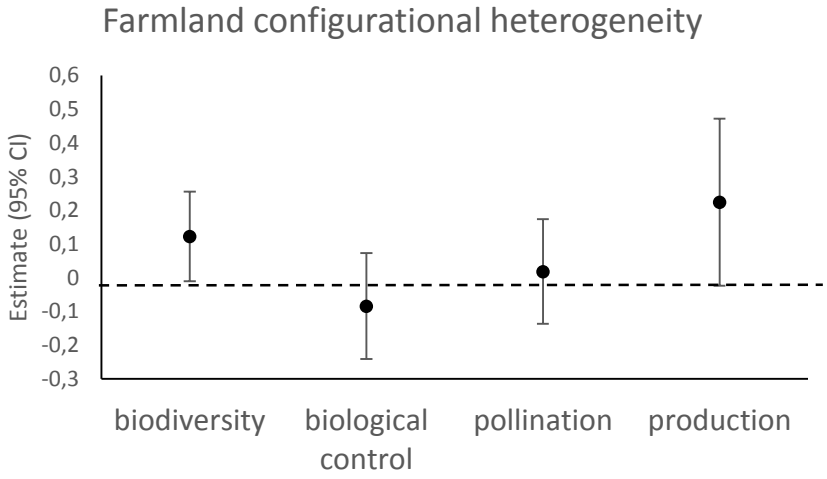
ES average





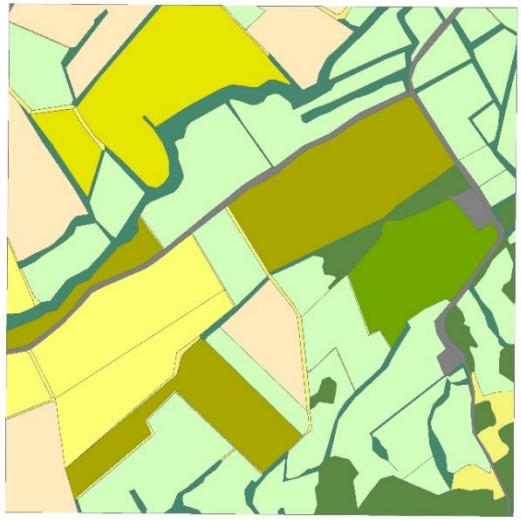
ES spatial variability





True effect of configurational heterogeneity?

Coteaux de Gascogne



HCONFIG

Linear SN habitats

Effect ?

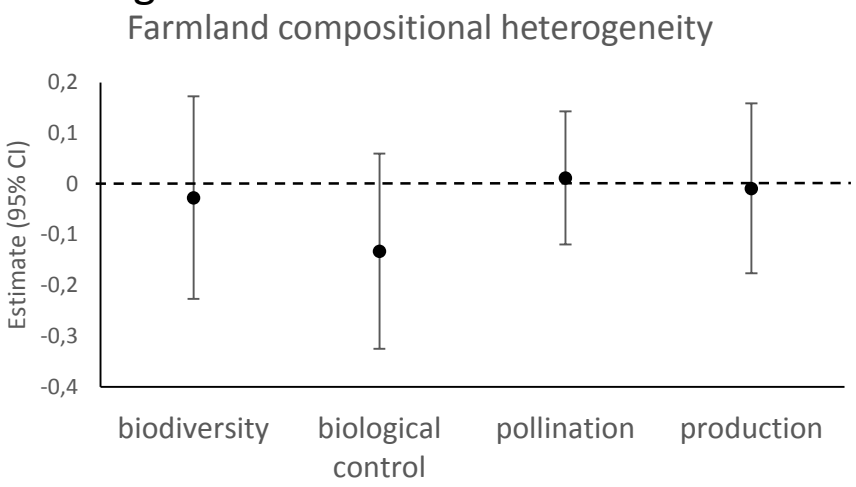
Testing the true effect of farmland heterogeneity

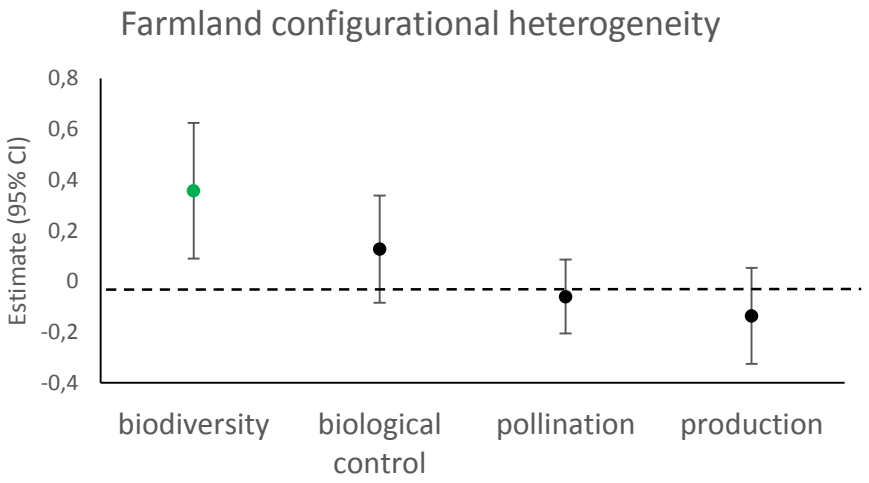
Landscape selection:
selection of a subset of 274 landscapes
correlations between explanatory var. across/among regions <0.4

Model 2:
ES ~ HCOMPO + HCONFIG + % SN + length linearSN + (1|Region)

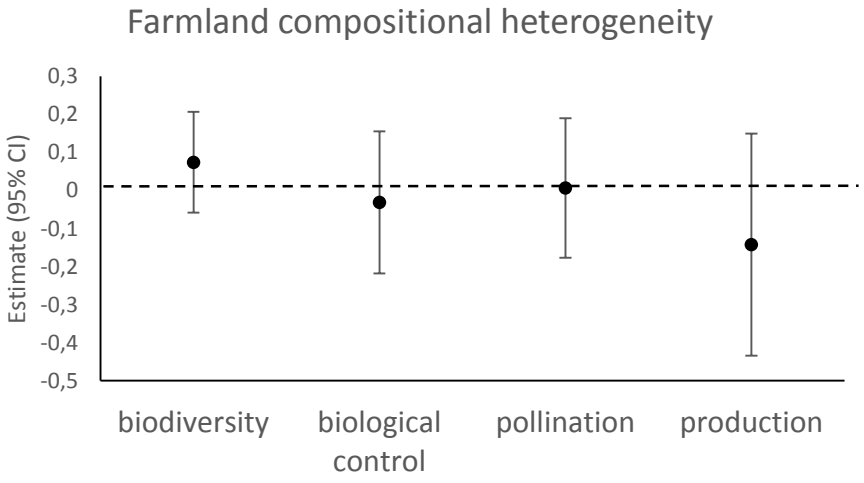
Farmland true heterogeneity effects

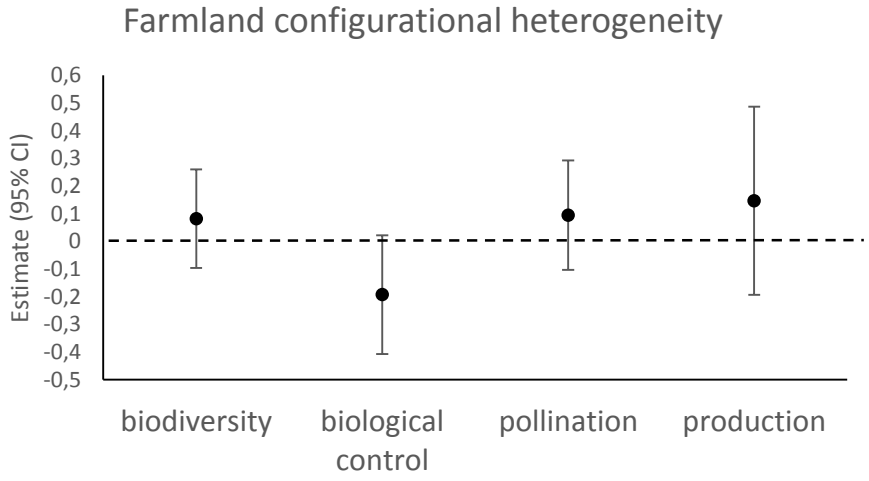
ES average





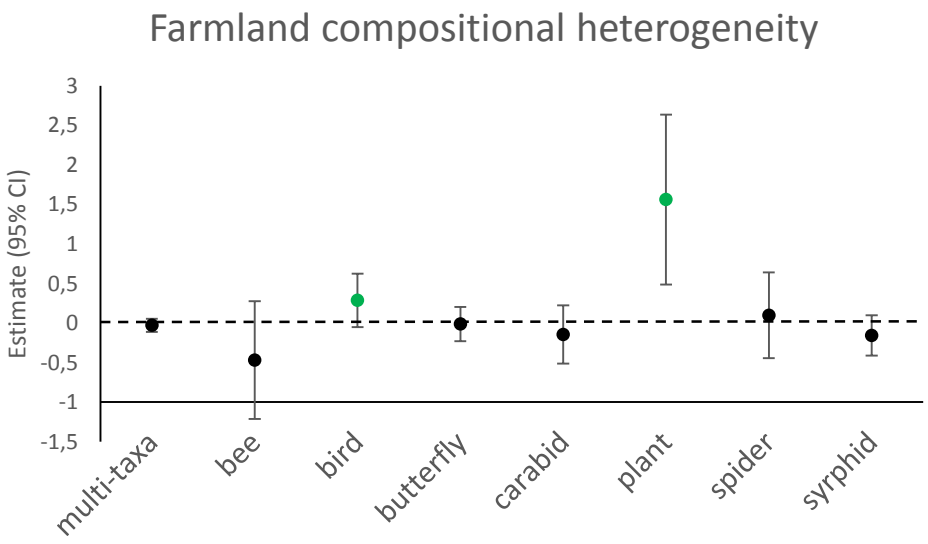
ES spatial variability

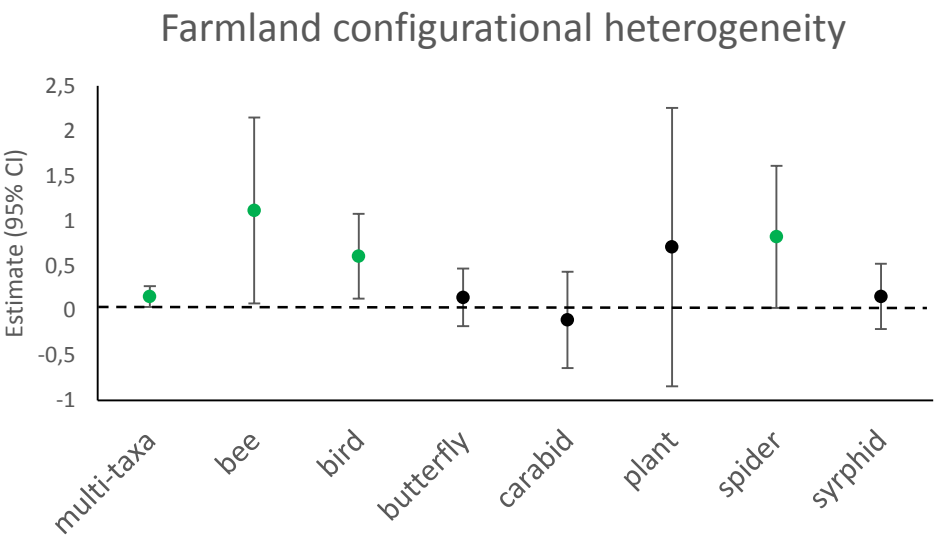




Farmland true heterogeneity effects

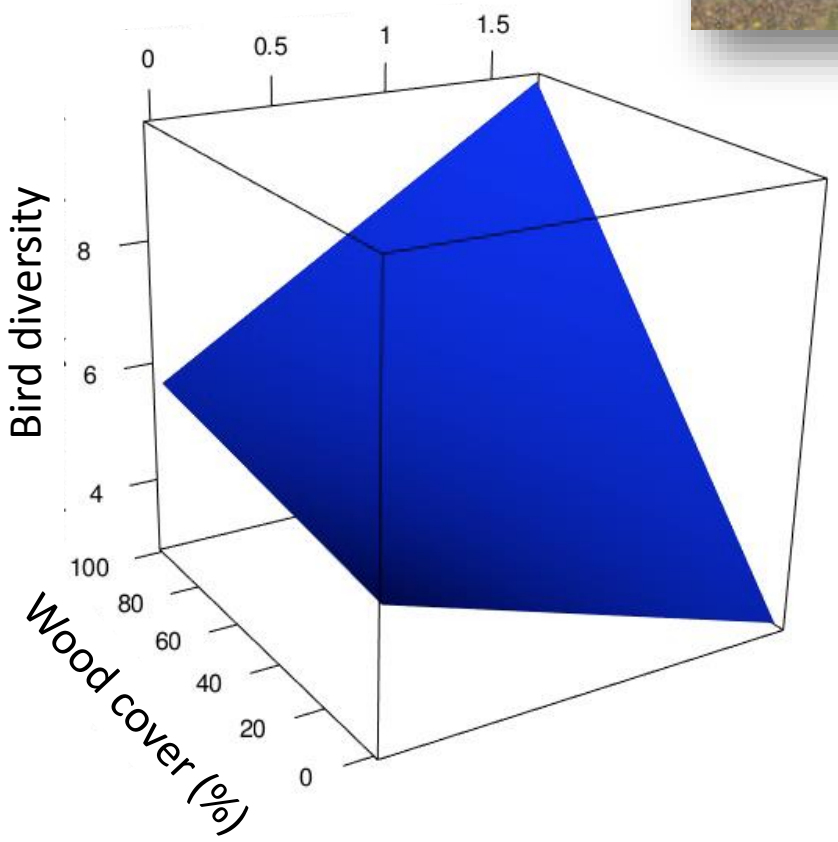
Response variations between taxa

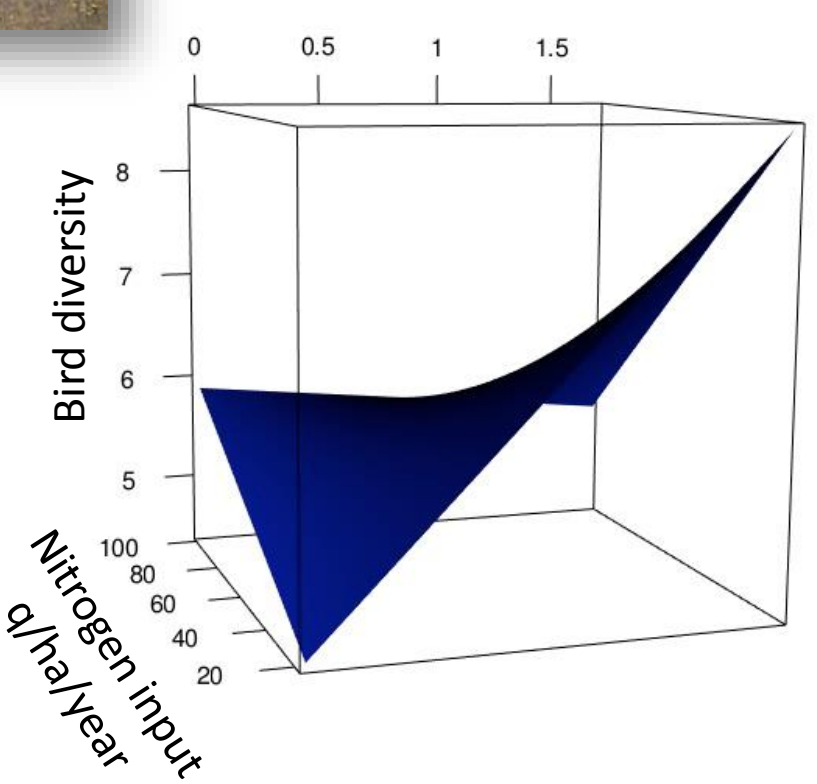




ALL TAXA

Multiple interactions





Henckel et al. (in prep.)

Take-home messages

- ✓ Farmland heterogeneity has a true positive effect on biodiversity - in particular bee, bird, plant, spider

- ✓ Positive effect on biological control - due to linear semi-natural elements. No effect on pollination and production.

- ✓ Complex interactions :

  Farmland heterogeneity⇔Semi-natural % ⇔Practices

- ➢ **Agricultural policies should start considering field configuration while maintaining semi-natural habitats and agrochemical reduction**

Acknowledgments

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AGENCE NATIONALE DE LA RECHERCHE
ANR

GLEL
Geomatics and Landscape Ecology Research Laboratory

BTO
Looking out for birds

CENTRE TECNOLÒGIC FORESTAL DE CATALUNYA

Centre d'études biologiques de Chizé

CENTRE D'ECOLOGIE FONCTIONNELLE & EVOLUTIVE

Observatoire des Sciences de l'Univers de Rennes
Terre, Écosystèmes et Sociétés

TOUR DU VALAT

Dynafor