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

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

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The FarmLand consortium  
[www.farmland-biodiversity.org](http://www.farmland-biodiversity.org)

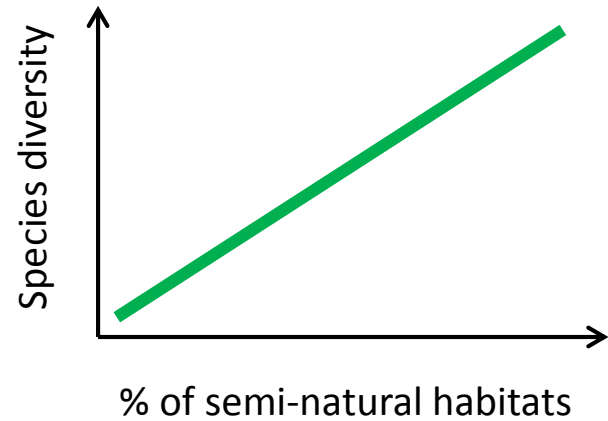
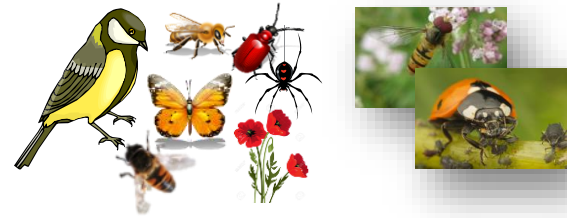


EcoSummit 2016 29 August – 1 September 2016 Montpellier, France



# 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**

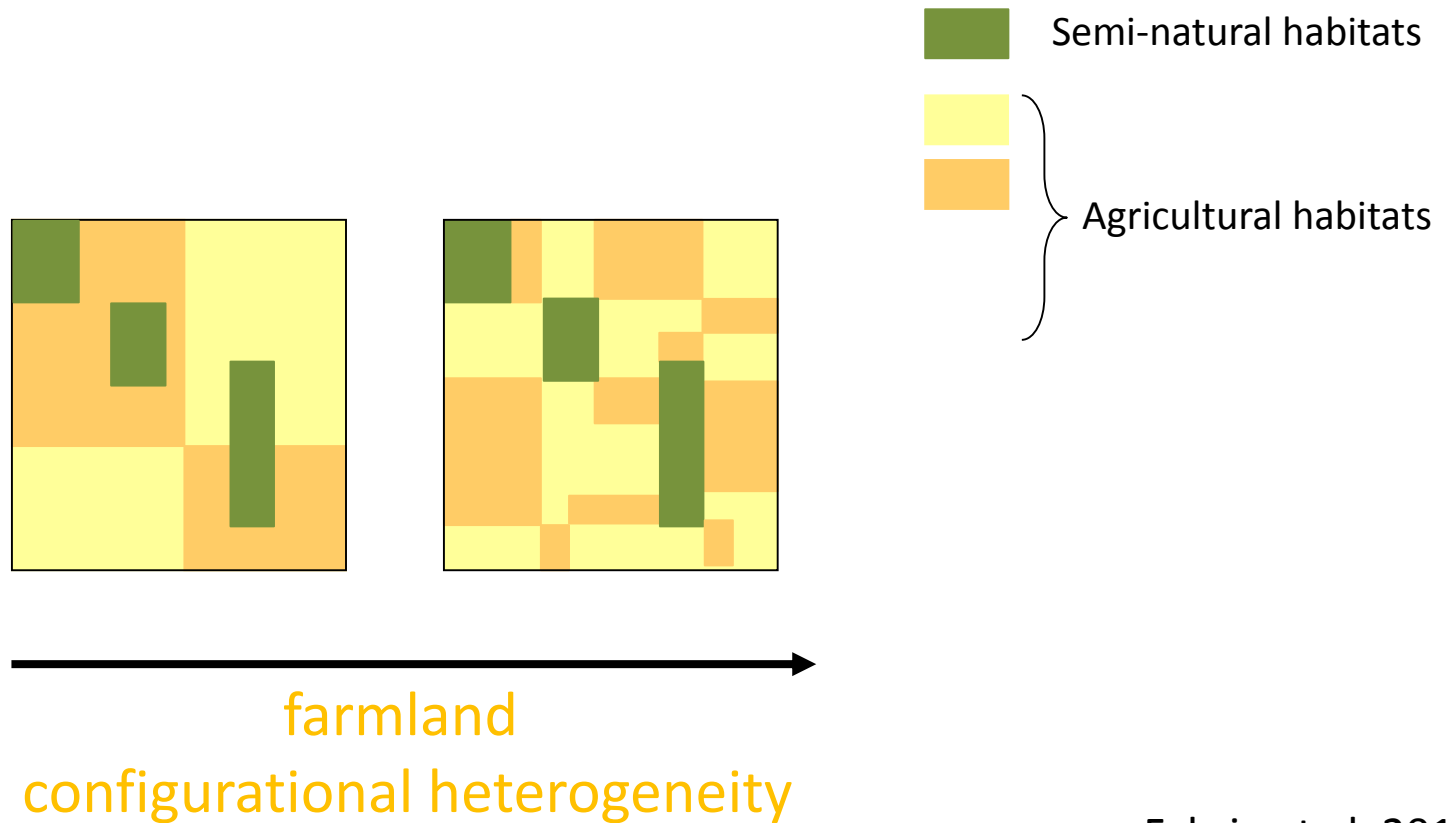
**Heterogeneity of the  
*large* « farmland matrix »**



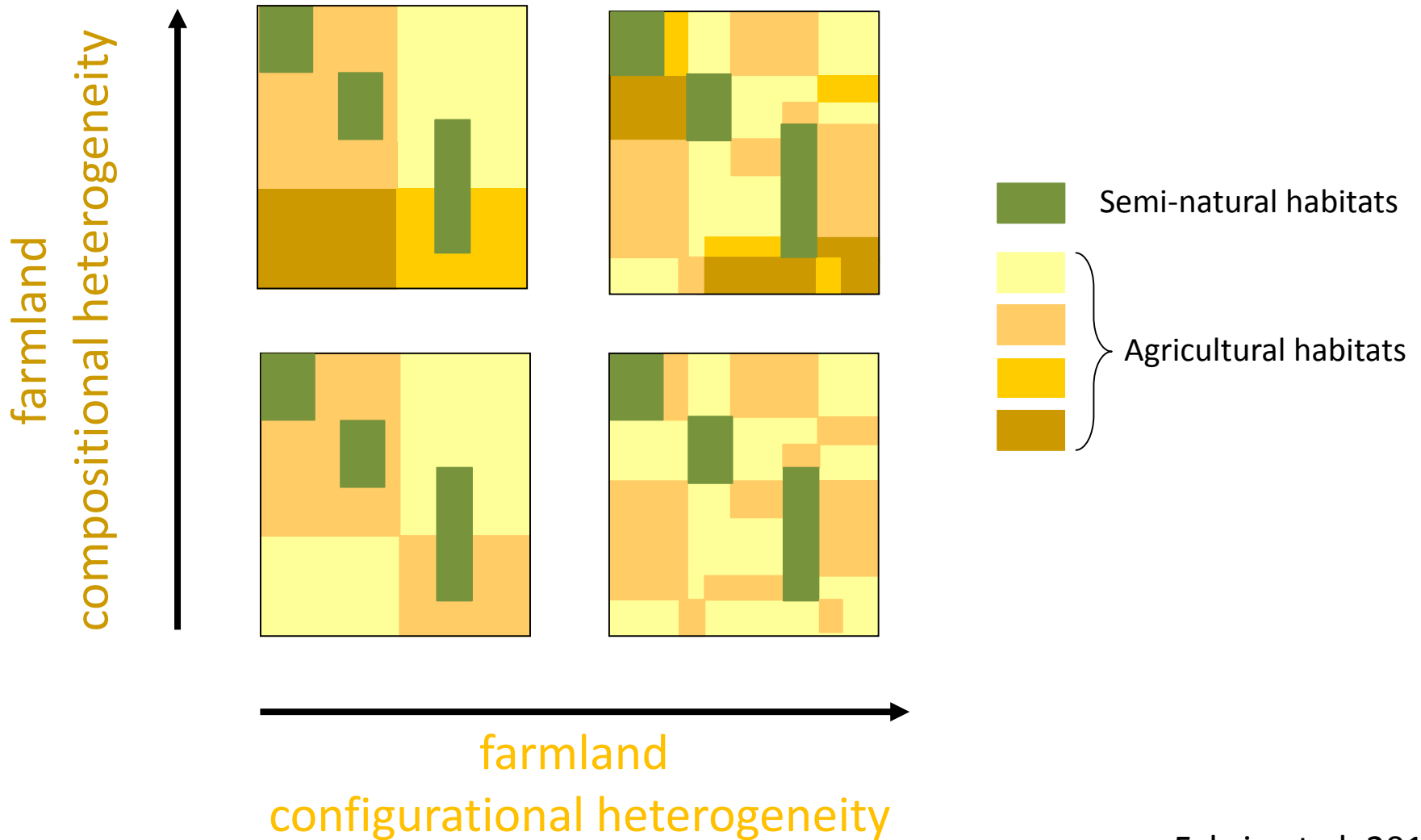
**Role ?**

**Implementation ?**

# Farmland heterogeneity

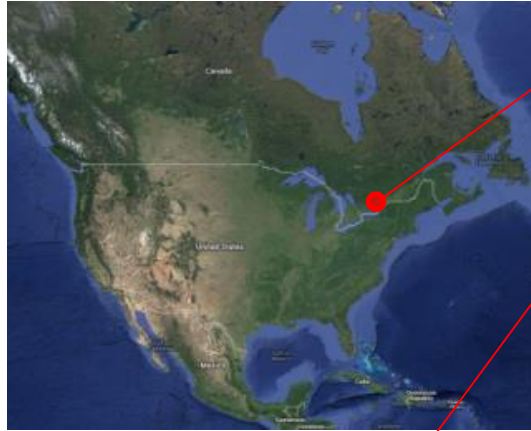


# Farmland heterogeneity





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



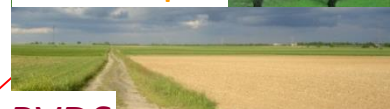
Ontario



East Anglia



Armorique



PVDS



Goettingen



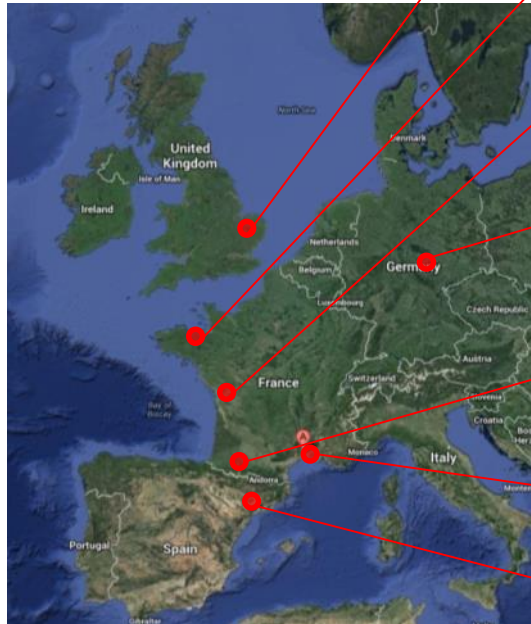
Coteaux



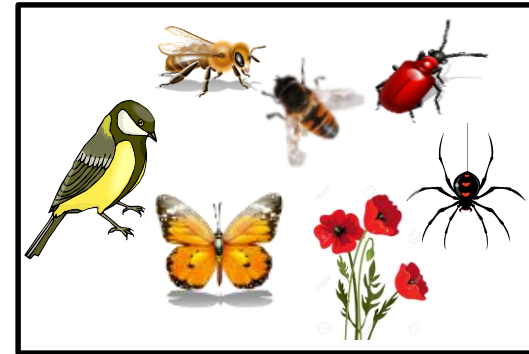
Camargue



Lleida



Biodiversity (7 taxa)



Biological control



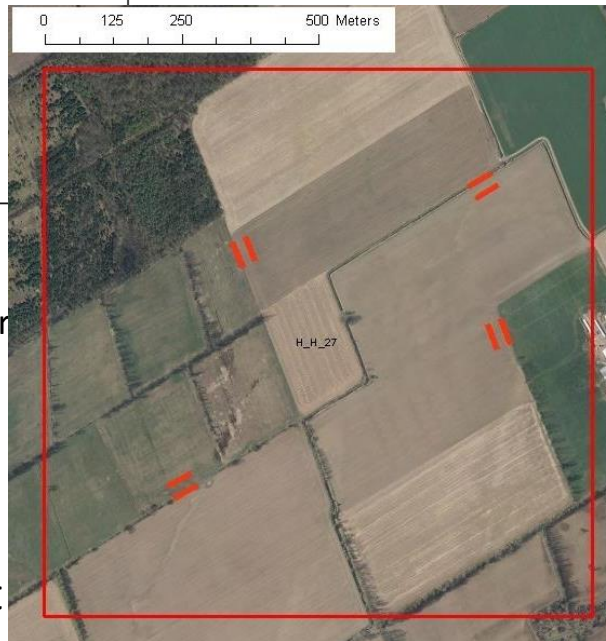
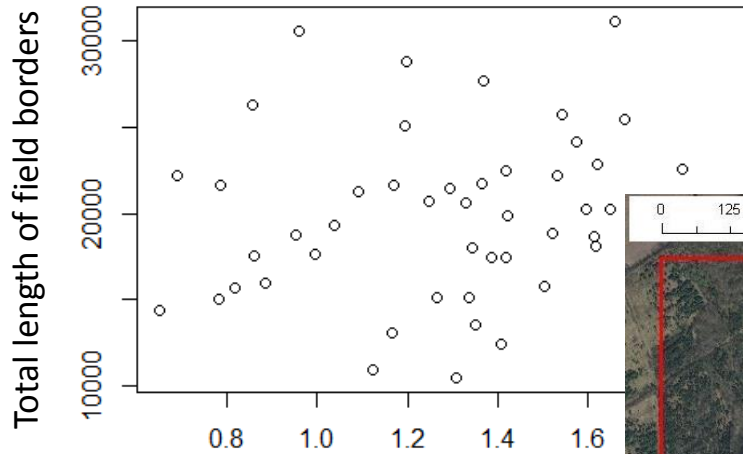
Pollination



Production



# Common protocols across regions



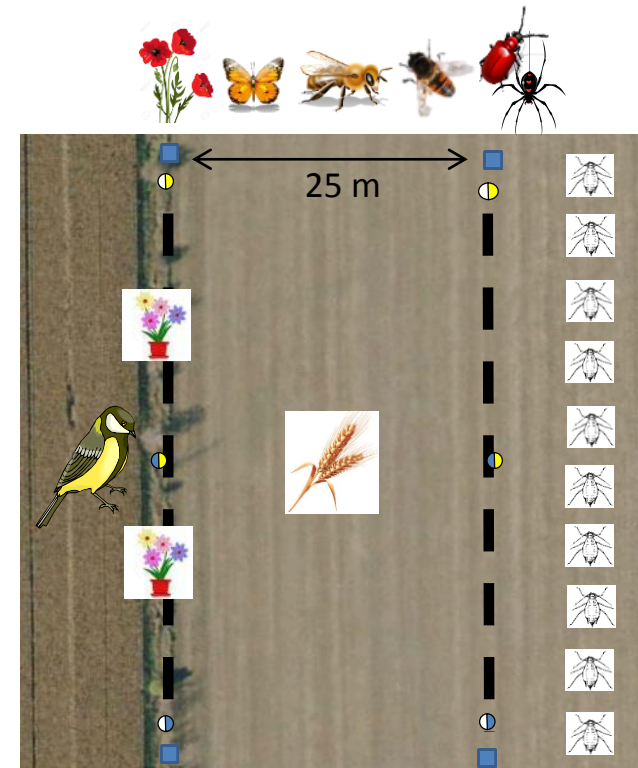
Shannon diversity index of agricultural

## 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

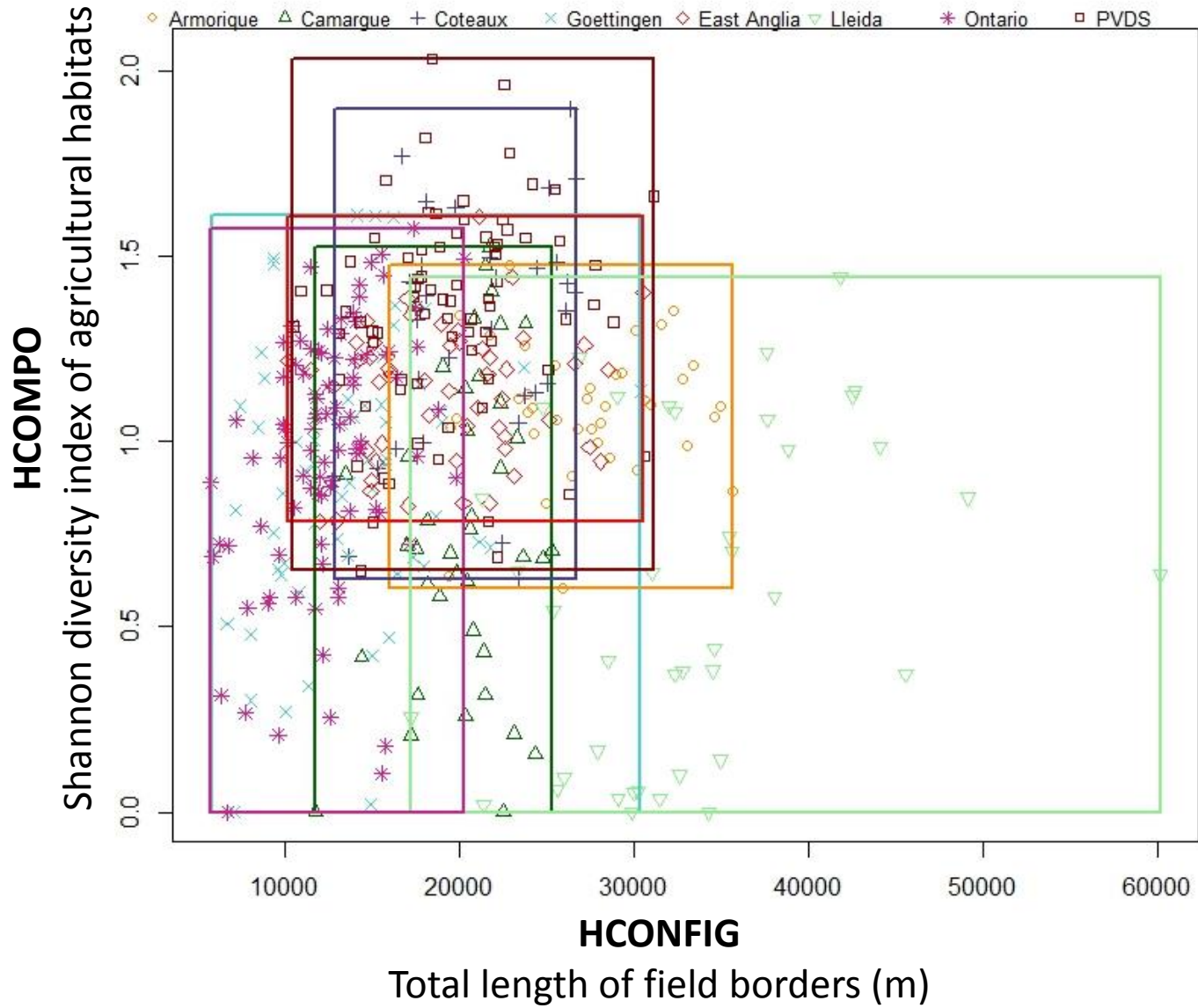


## 3. ES measures

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

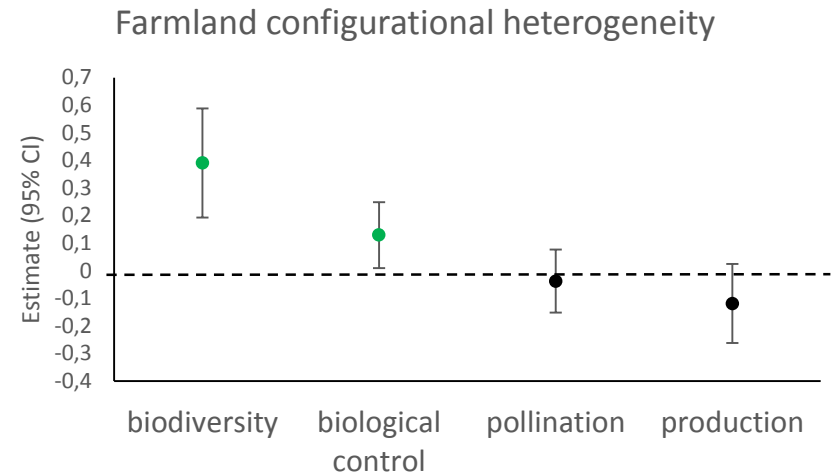
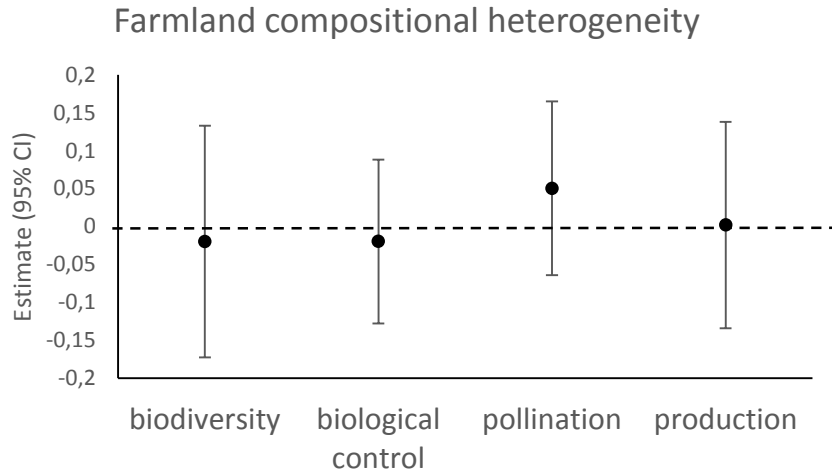
limited variations in % semi-natural habitat within each region

## Mixed model:

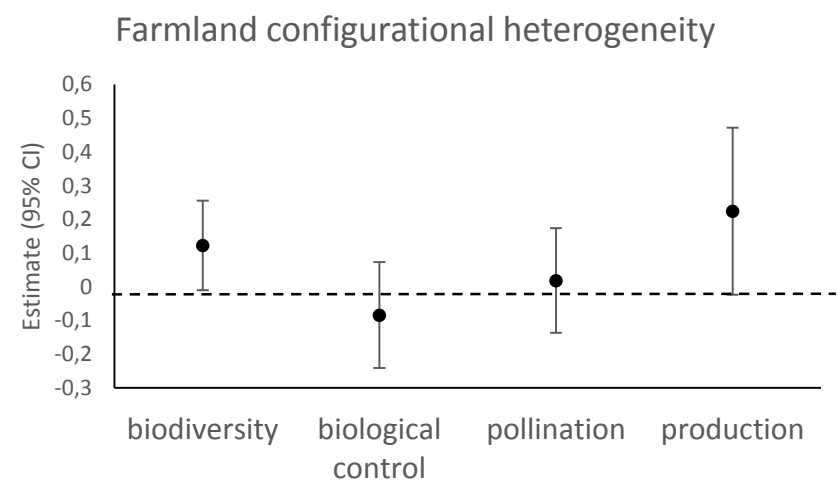
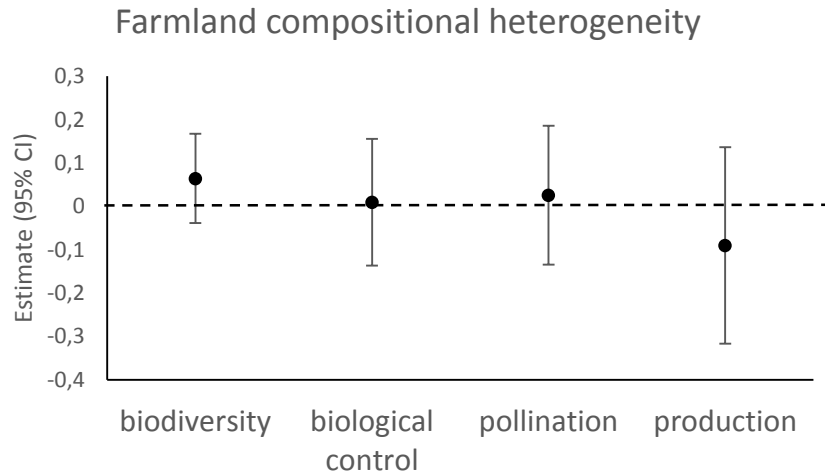
$ES \sim HCOMPO + HCONFIG + \% \text{ semi-natural} + (1 | \text{Region})$

# Farmland heterogeneity effects

## ES average



## ES spatial variability



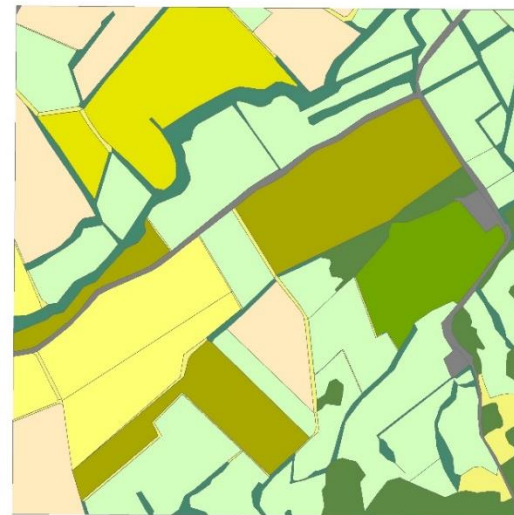
# True effect of configurational heterogeneity?



Coteaux de Gascogne



1 km



1 km



Effect  
?

# Testing the true effect of farmland heterogeneity

## Landscape selection:

selection of a subset of 274 landscapes

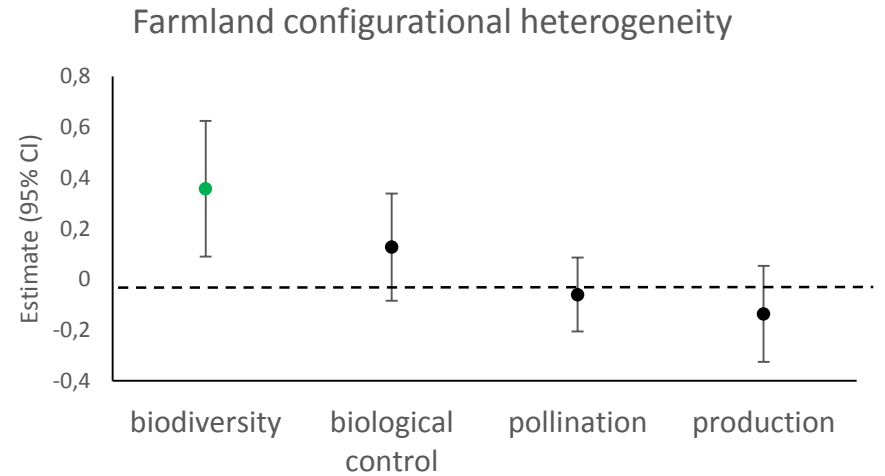
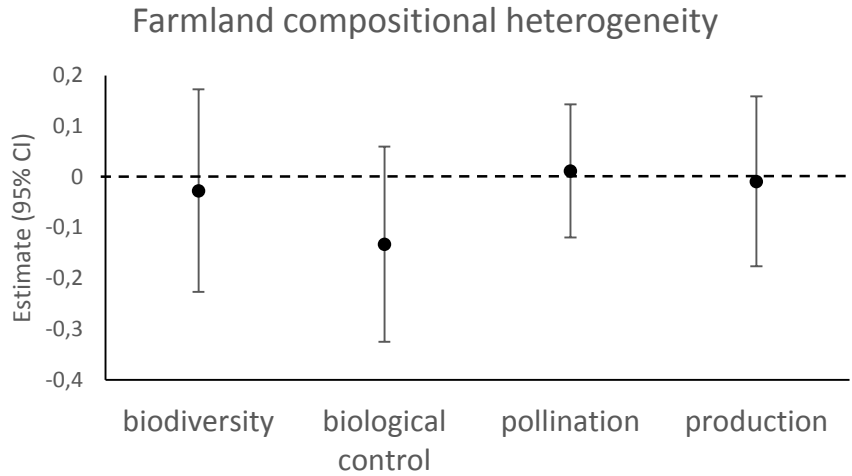
correlations between explanatory var. across/among regions <0.4

## Model 2:

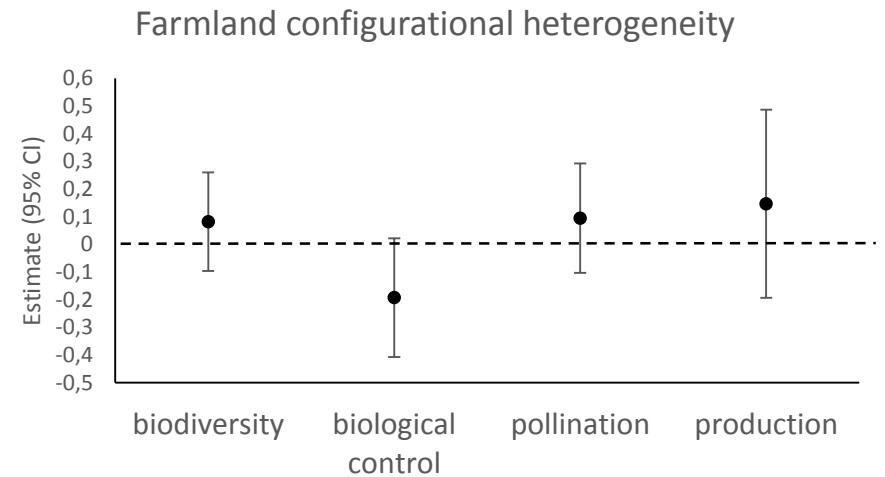
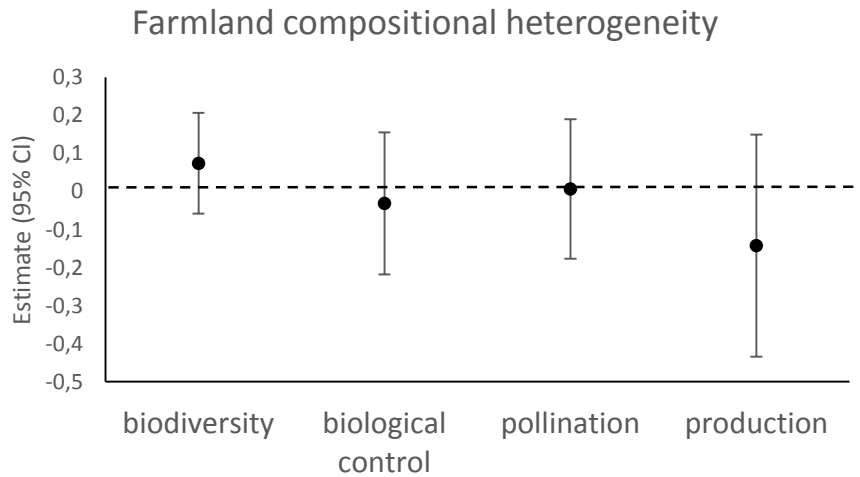
ES ~ HCOMPO + HCONFIG + % SN + length linearSN + (1 | Region)

# Farmland true heterogeneity effects

## ES average



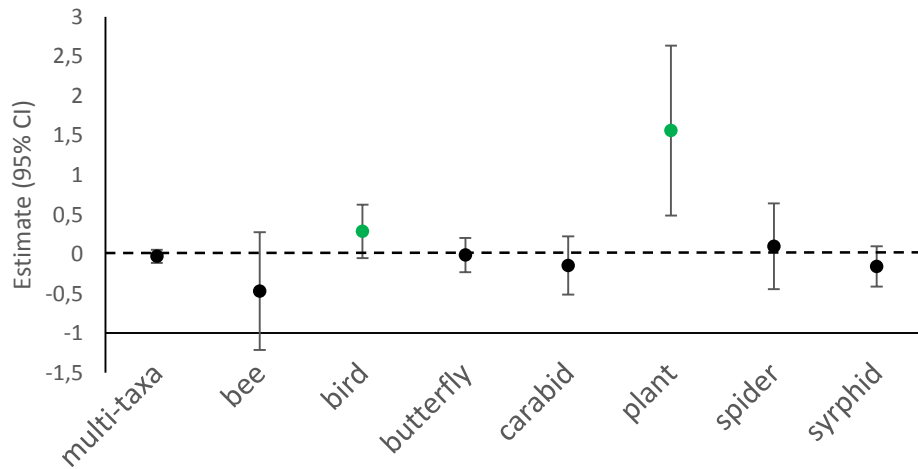
## ES spatial variability



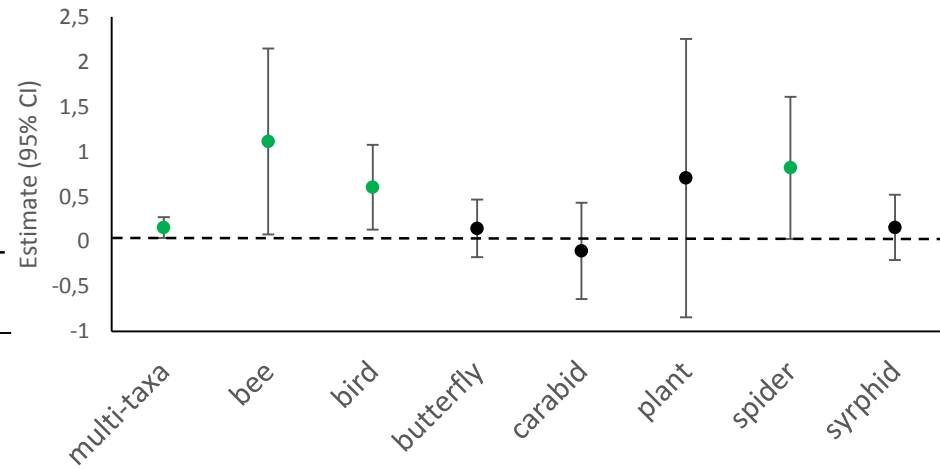
# Farmland true heterogeneity effects

Response variations between taxa

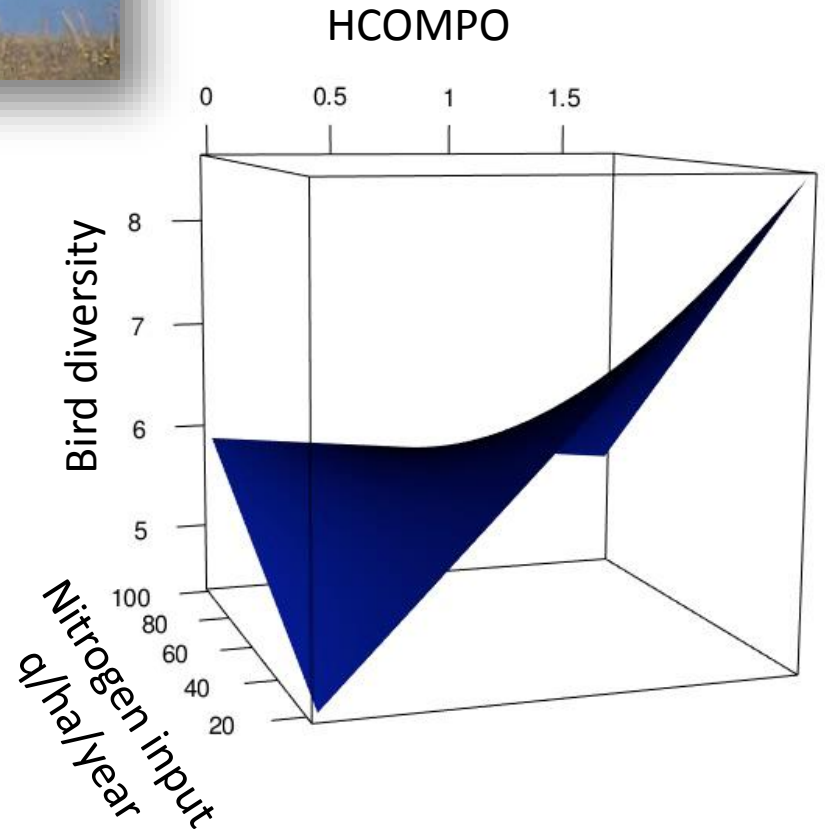
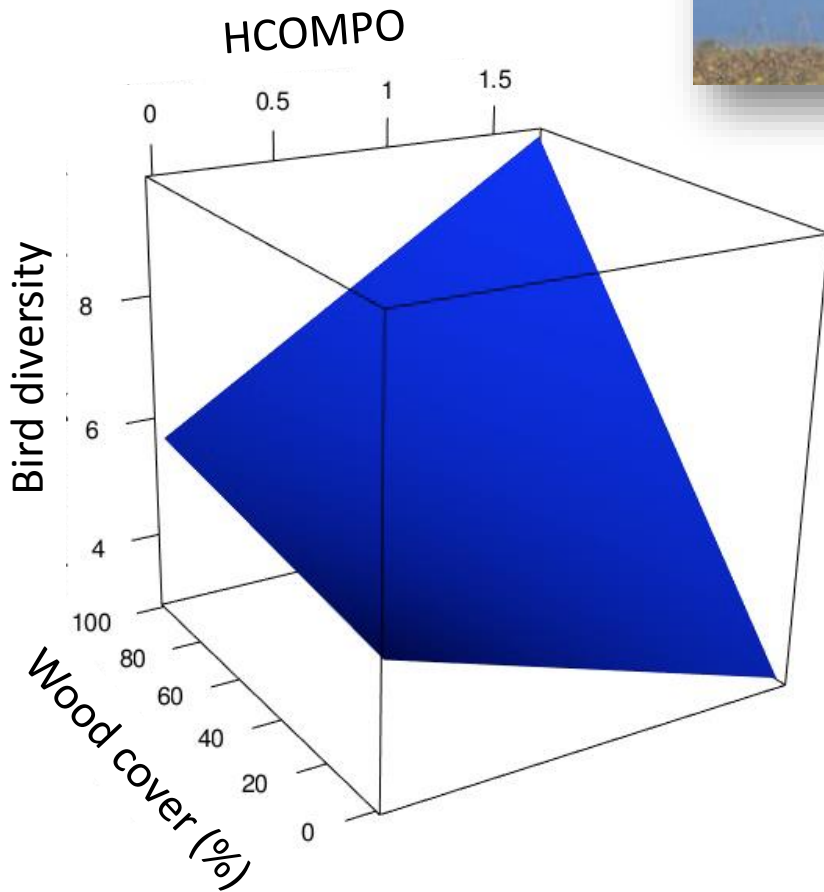
Farmland compositional heterogeneity



Farmland configurational heterogeneity



# Multiple interactions





## 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

