



**HAL**  
open science

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

Clélia Sirami, Bertrand Gauffre

► **To cite this version:**

Clélia Sirami, Bertrand Gauffre. Effect of farmland heterogeneity on multiple ES spatial variability and trade-offs. 5. International EcoSummit 2016. Ecological Sustainability: Engineering Change, Aug 2016, Montpellier, France. 17 p. hal-01607149

**HAL Id: hal-01607149**

**<https://hal.science/hal-01607149>**

Submitted on 5 Jun 2020

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



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

Clélia Sirami, Bertrand Gauffre,  
The FarmLand consortium  
[www.farmland-biodiversity.org](http://www.farmland-biodiversity.org)

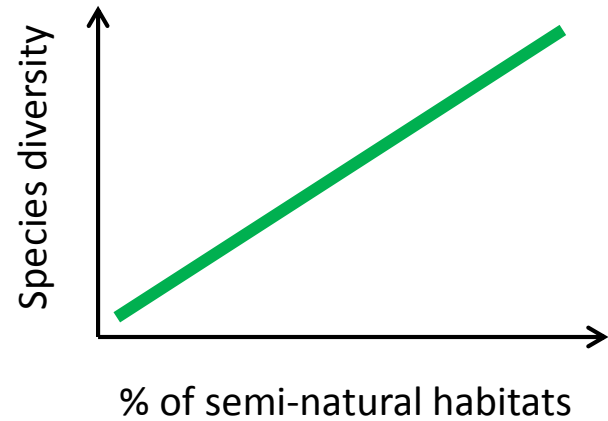
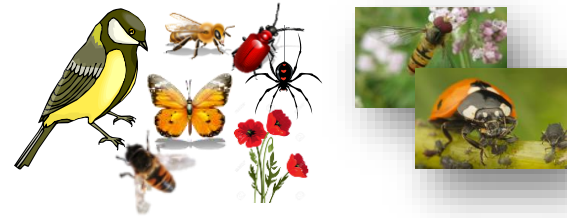


EcoSummit 2016 29 August – 1 September 2016 Montpellier, France



# 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**

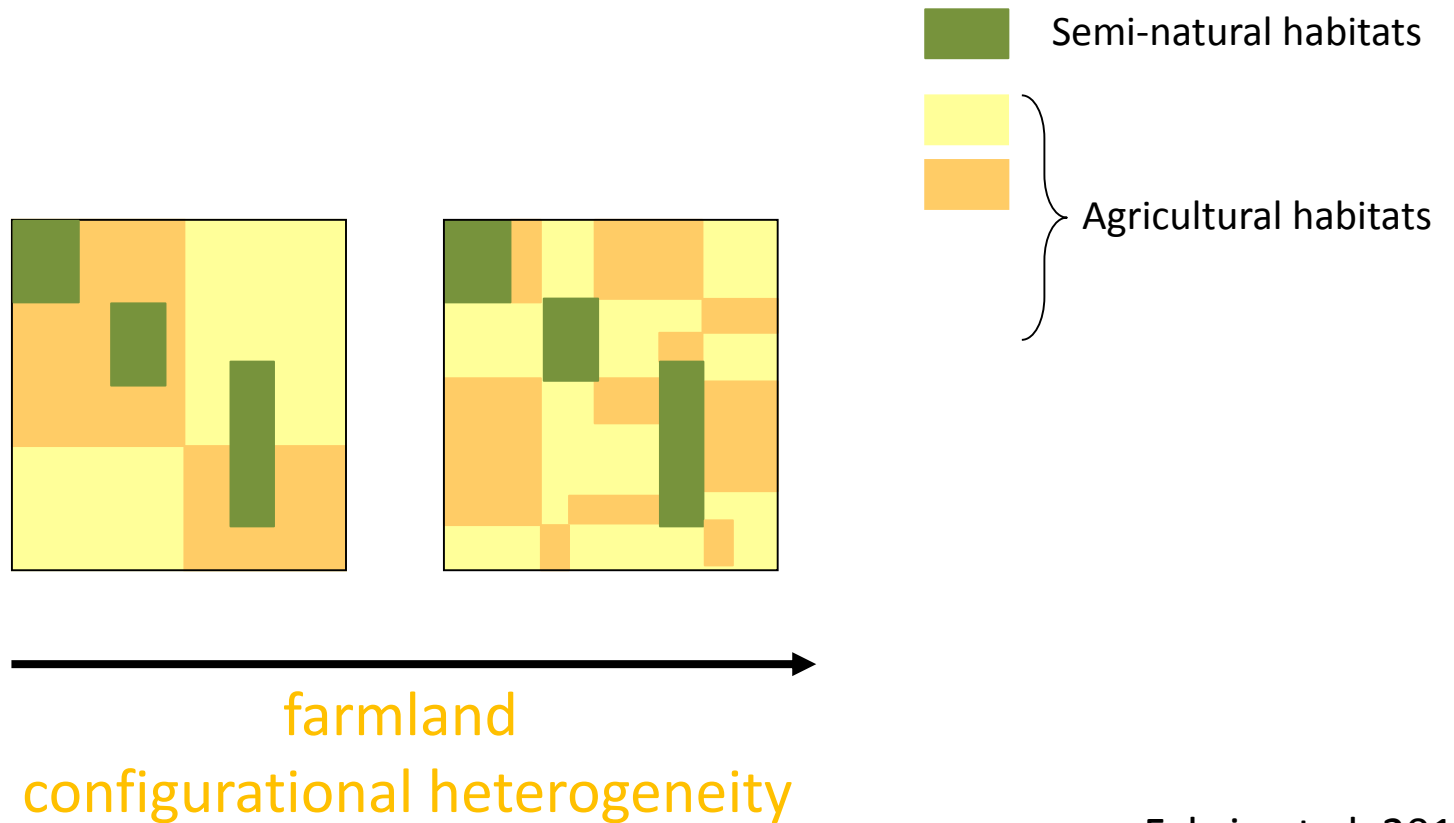
**Heterogeneity of the  
*large* « farmland matrix »**



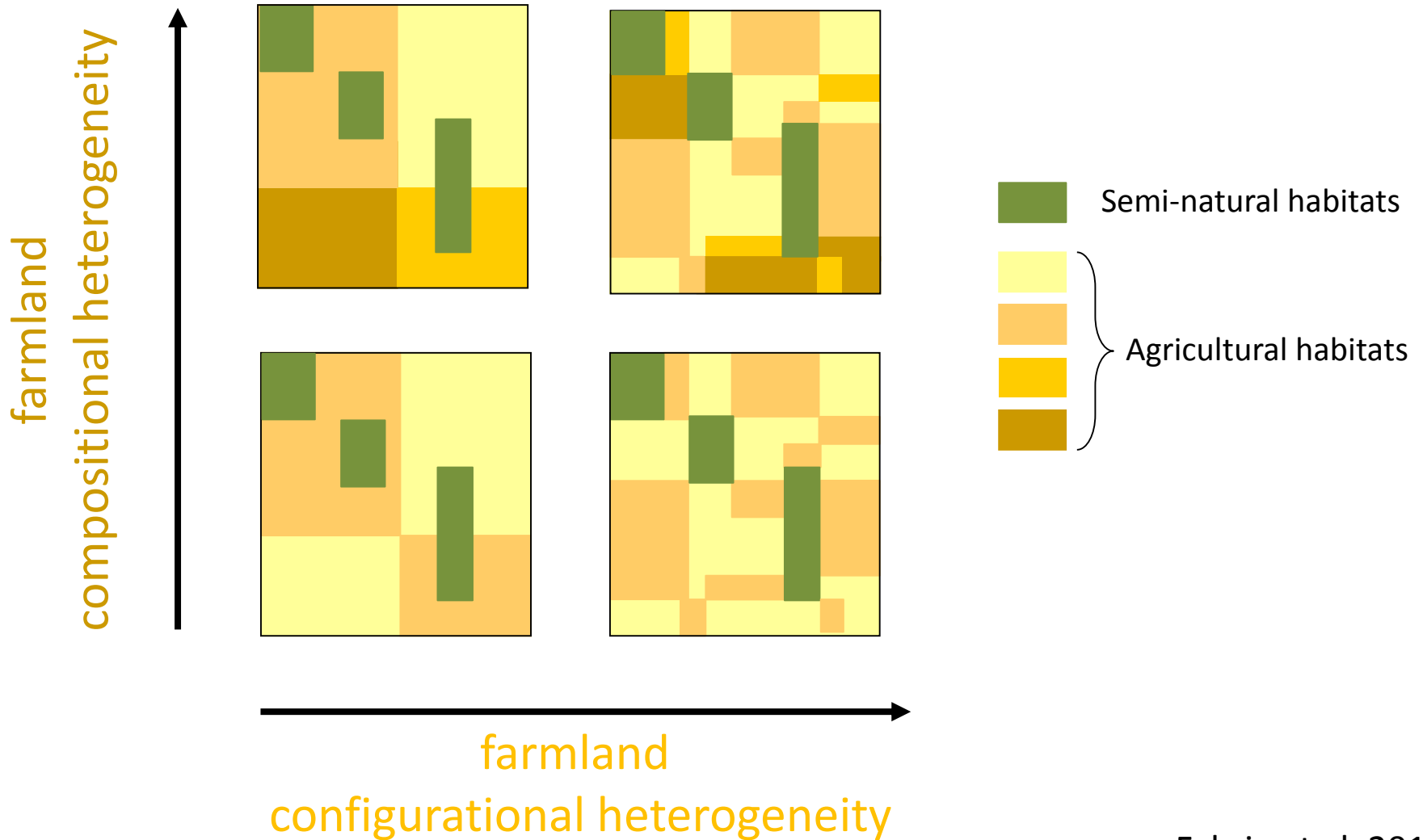
**Role ?**

**Implementation ?**

# Farmland heterogeneity

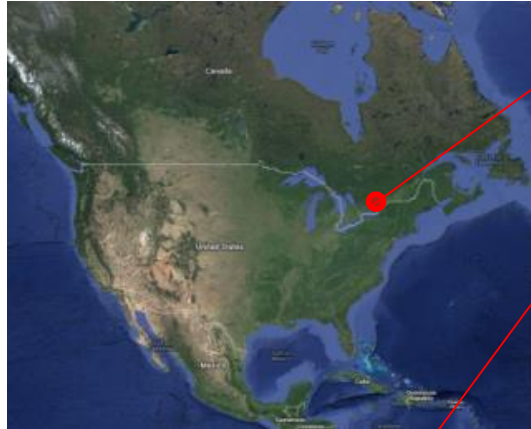


# Farmland heterogeneity





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



Ontario



East Anglia



Armorique



PVDS



Goettingen



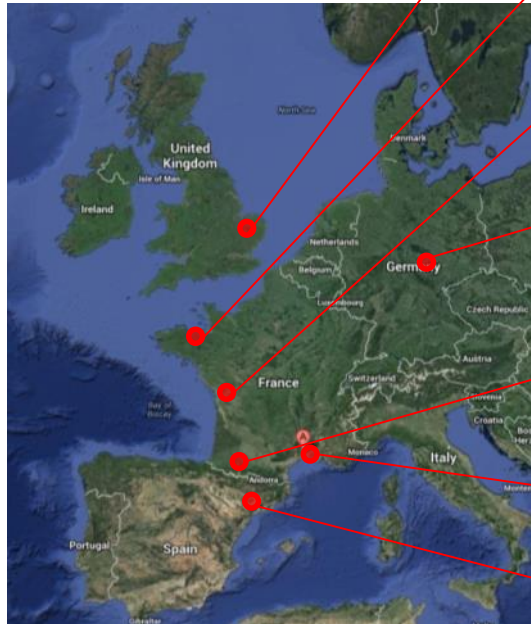
Coteaux



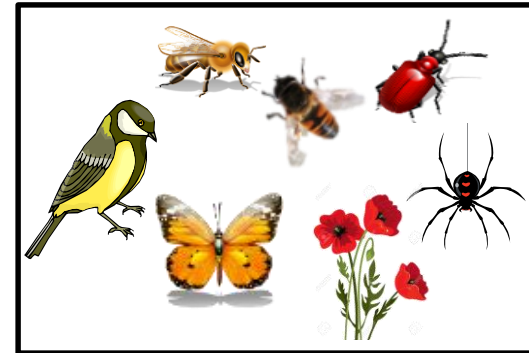
Camargue



Lleida



Biodiversity (7 taxa)



Biological control



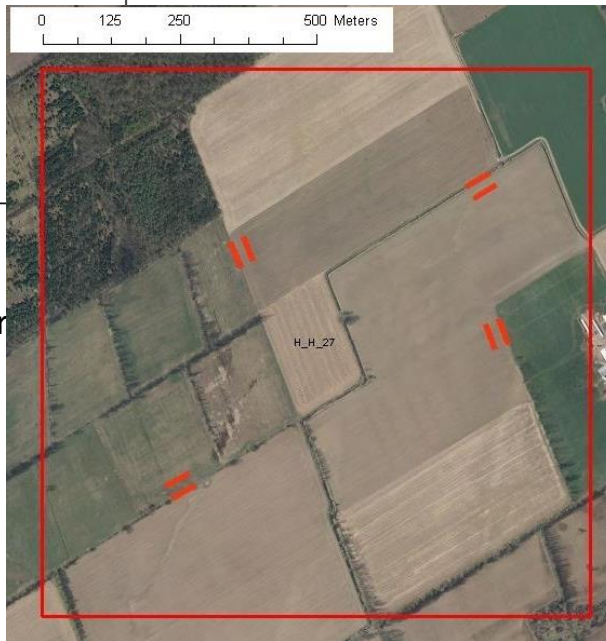
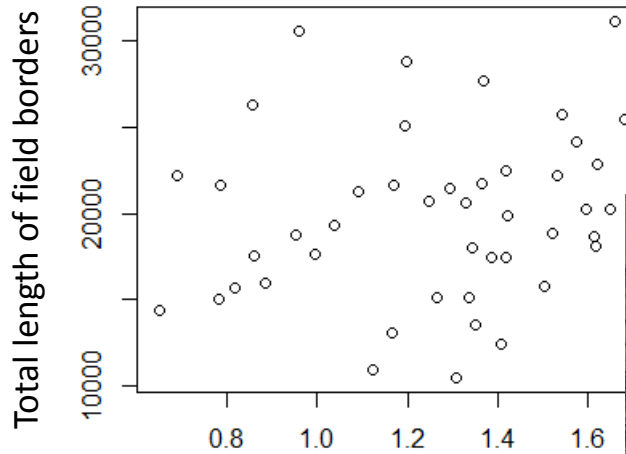
Pollination



Production



# Common protocols across regions



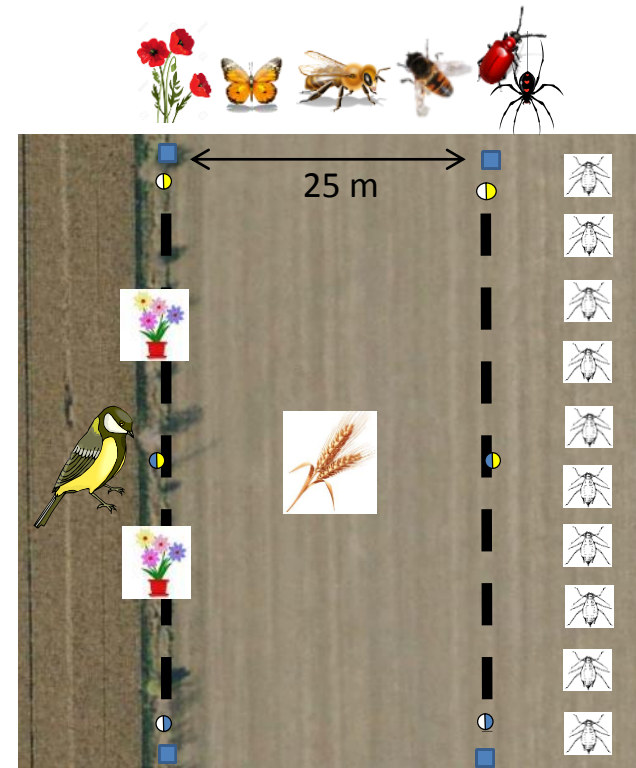
Shannon diversity index of agricultural

## 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

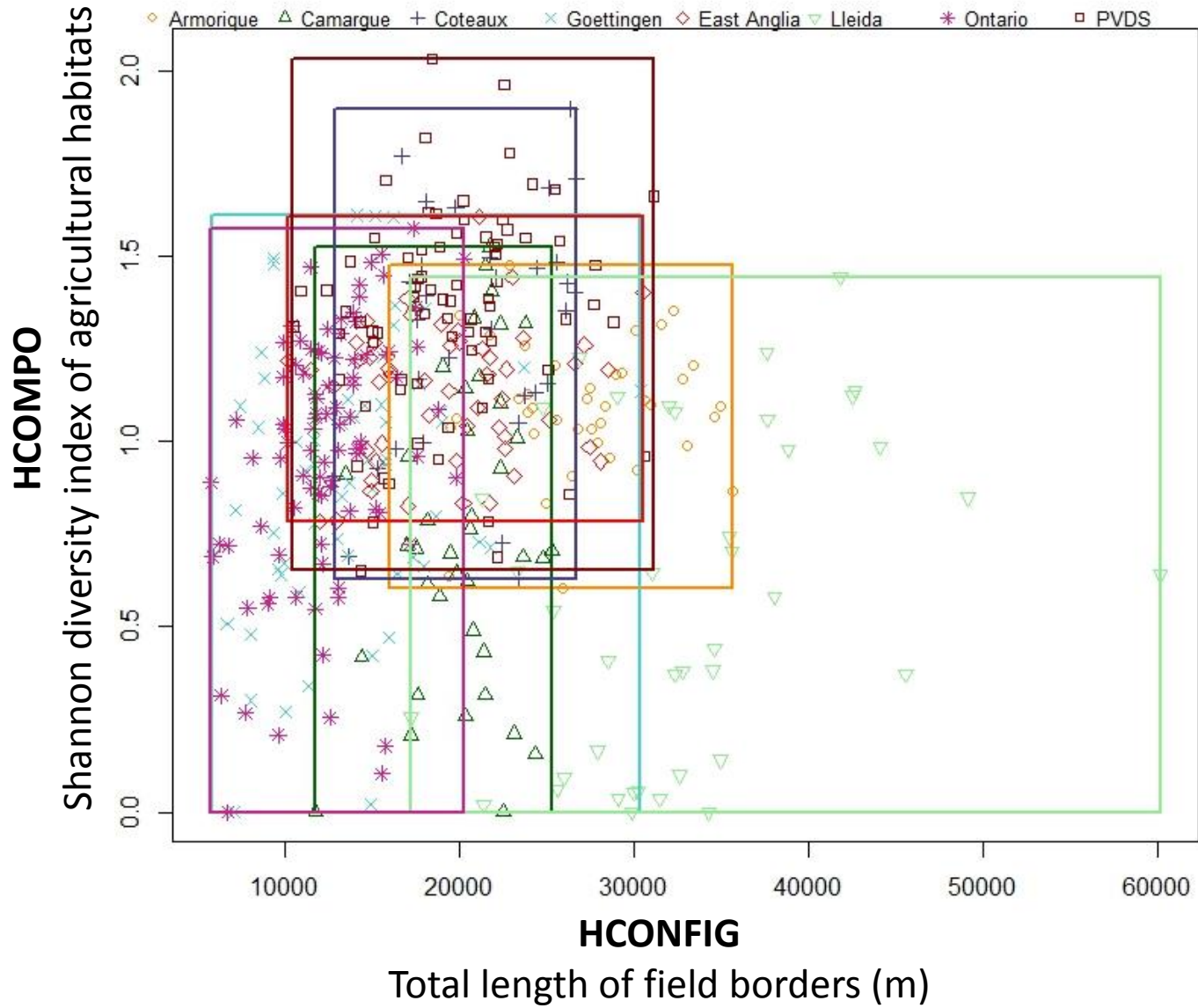


## 3. ES measures

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

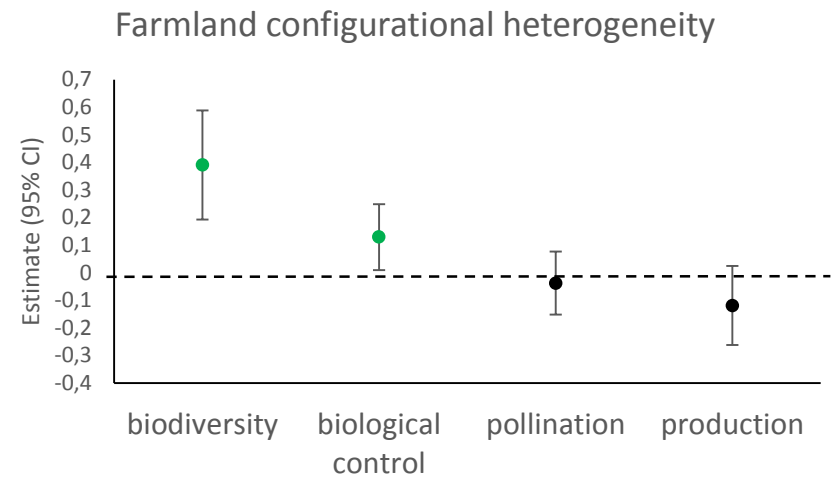
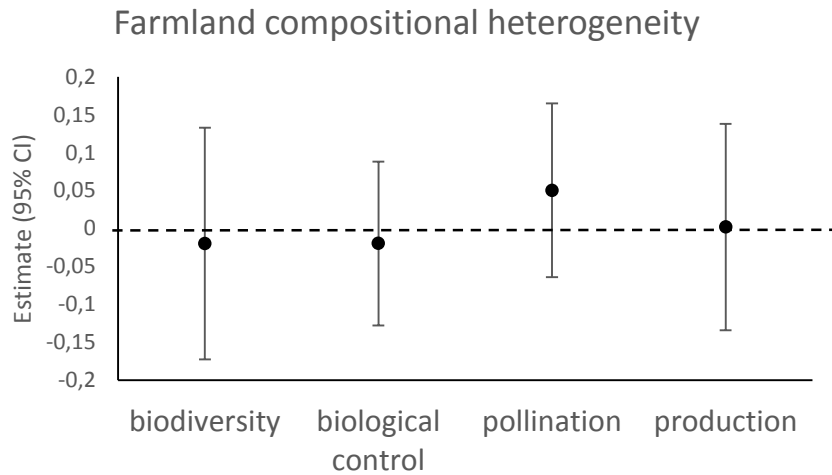
limited variations in % semi-natural habitat within each region

## Mixed model:

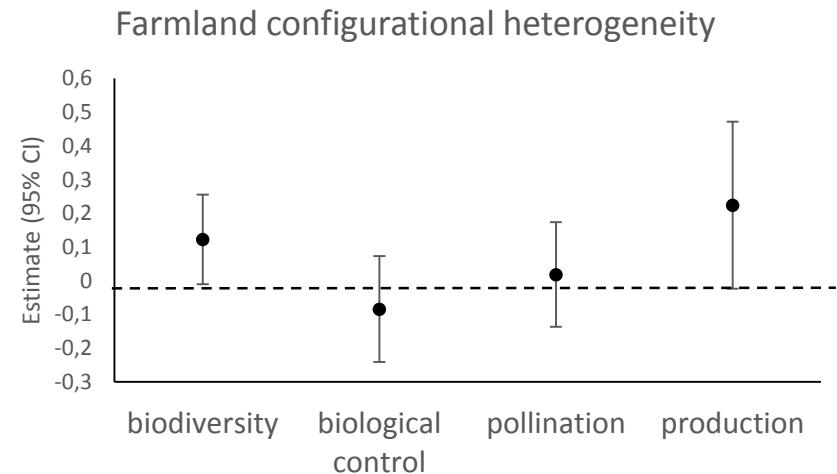
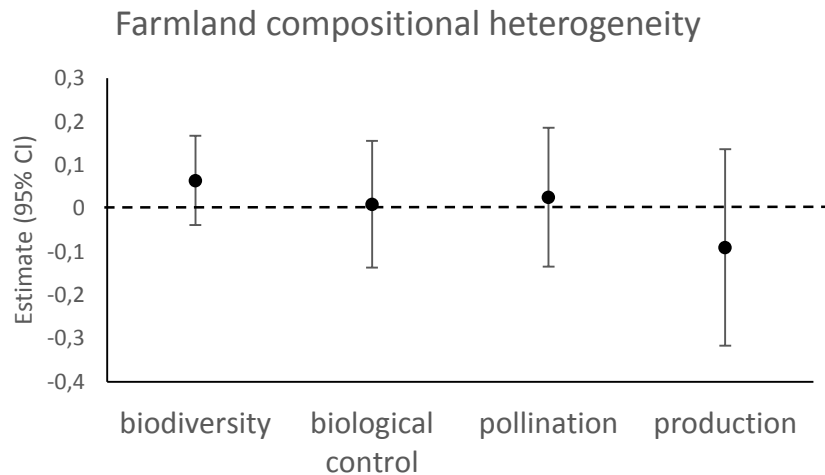
$ES \sim HCOMPO + HCONFIG + \% \text{ semi-natural} + (1 | \text{Region})$

# Farmland heterogeneity effects

## ES average



## ES spatial variability



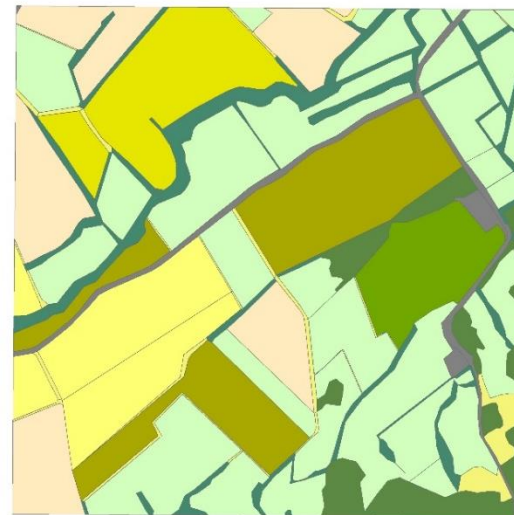
# True effect of configurational heterogeneity?



Coteaux de Gascogne



1 km



1 km



Effect  
?

# Testing the true effect of farmland heterogeneity

## Landscape selection:

selection of a subset of 274 landscapes

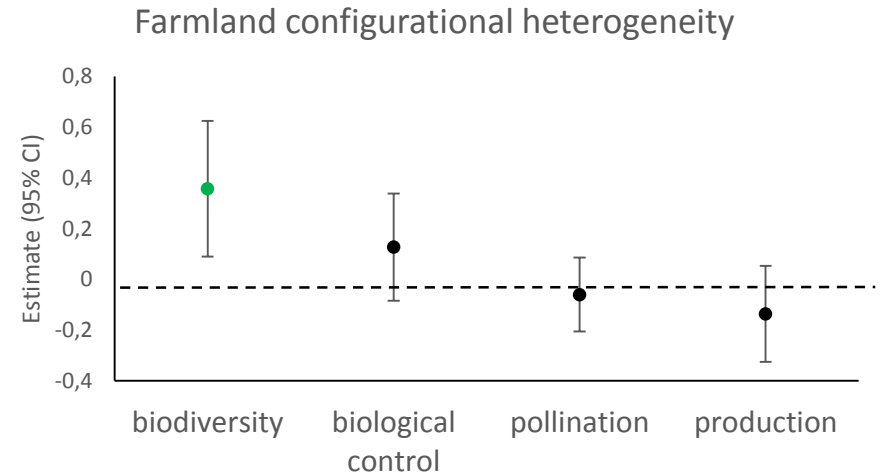
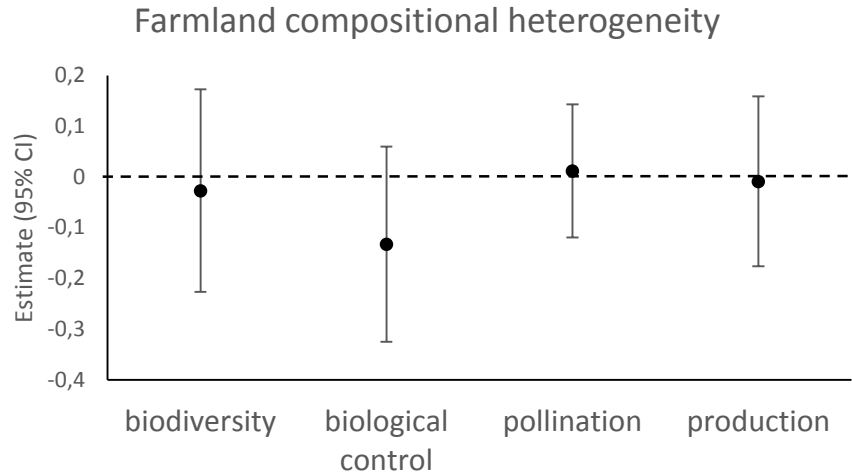
correlations between explanatory var. across/among regions <0.4

## Model 2:

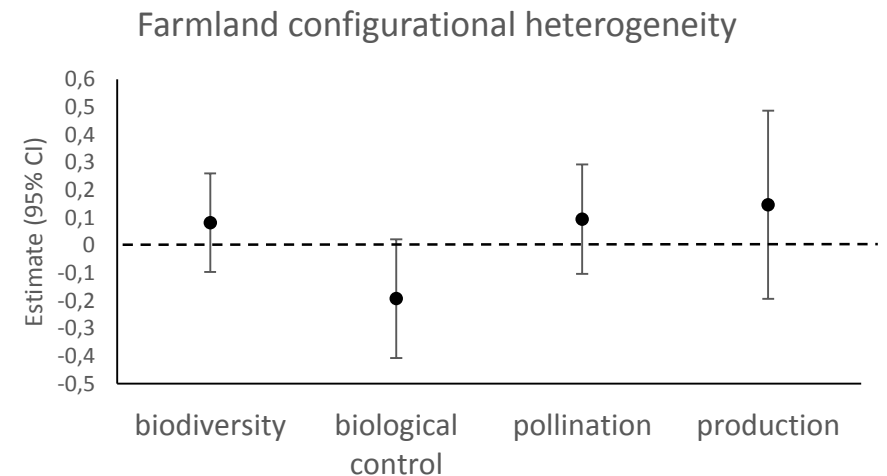
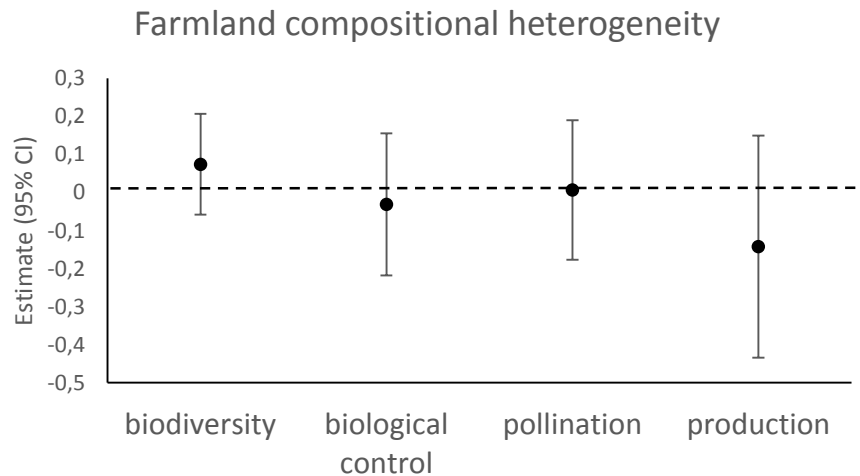
ES ~ HCOMPO + HCONFIG + % SN + length linearSN + (1 | Region)

# Farmland true heterogeneity effects

## ES average



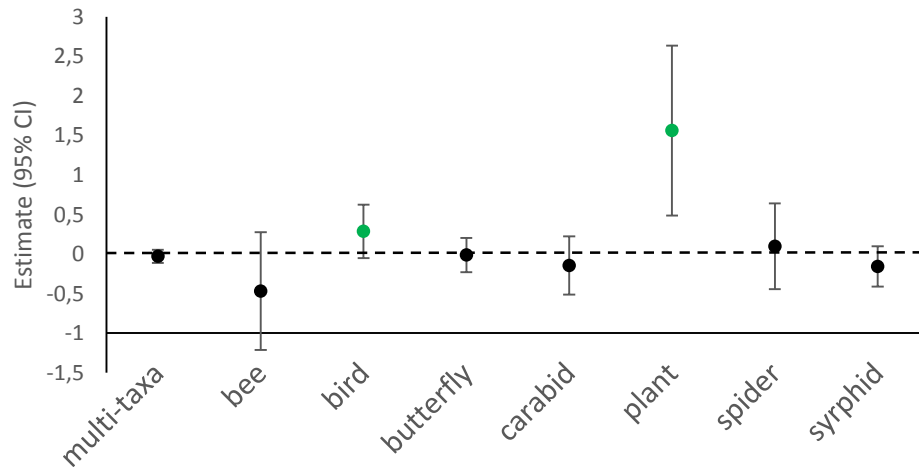
## ES spatial variability



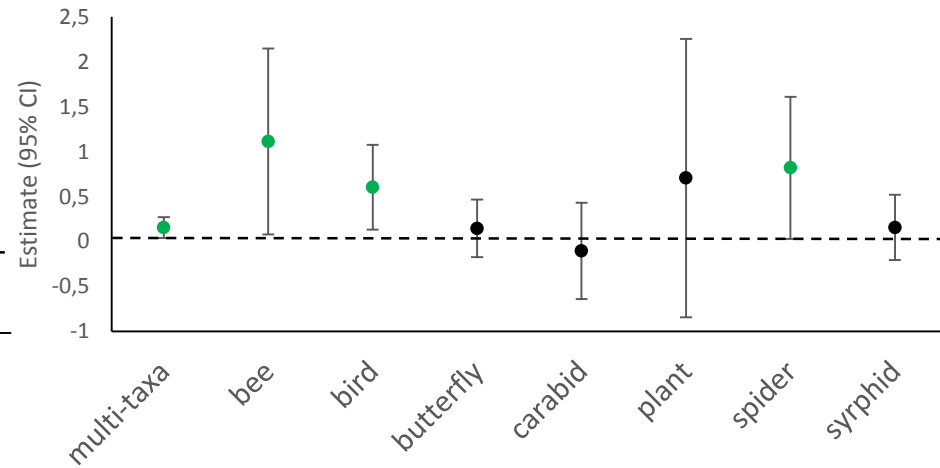
# Farmland true heterogeneity effects

## Response variations between taxa

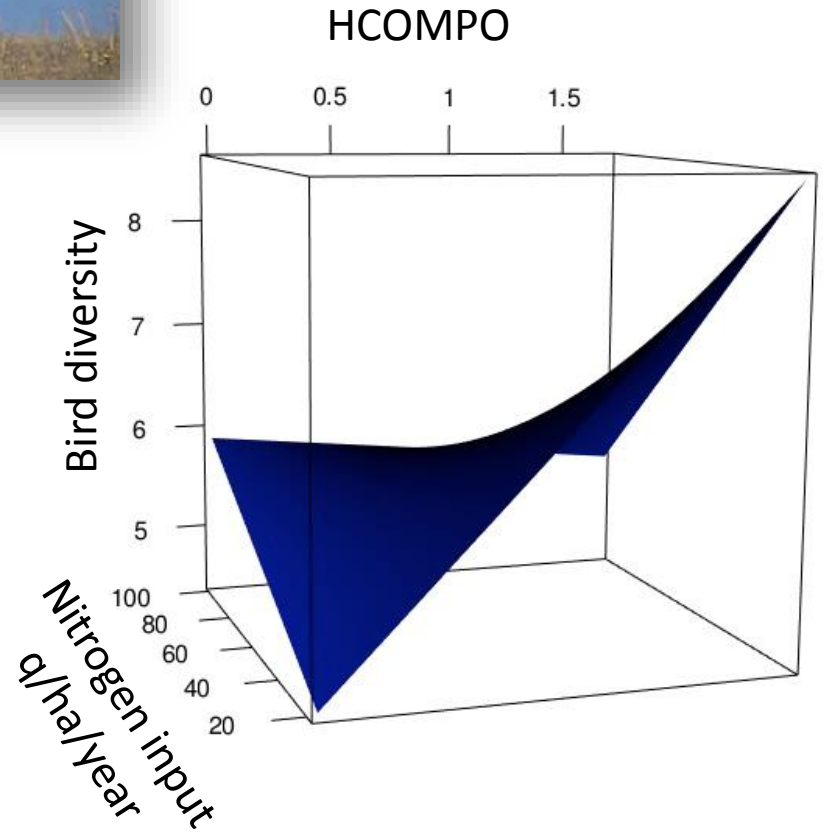
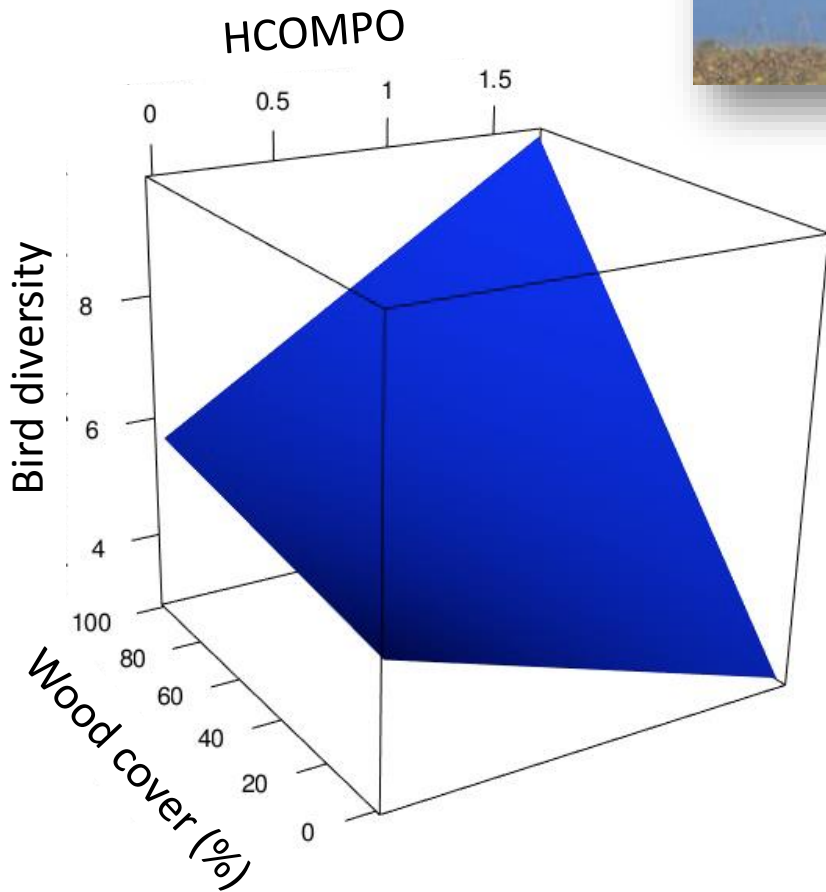
Farmland compositional heterogeneity



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

