



# Long-term changes in field margin vegetation in north-western France

Audrey ALIGNIER  
audrey.alignier@inra.fr

# Field margins are key landscape features



Habitats, refugia and resources for fauna and flora

Support for a wide range of ecological services

Contribution to species movements through landscape connectivity



Persistence of local communities and **metacommunities**

Large body of research on factors driving their biodiversity :

Structural condition, *i.e. presence of a shrub/tree layer*

Width

Management techniques, *i.e. coppicing*

Landscape heterogeneity

Connectivity





# What about their dynamics ?

...but addressing current vegetation diversity

No study on the **long-term dynamics** of vegetation (meta-)communities within field margins (except Staley *et al.* 2013).



...and no considering other management techniques than those of the tree layer



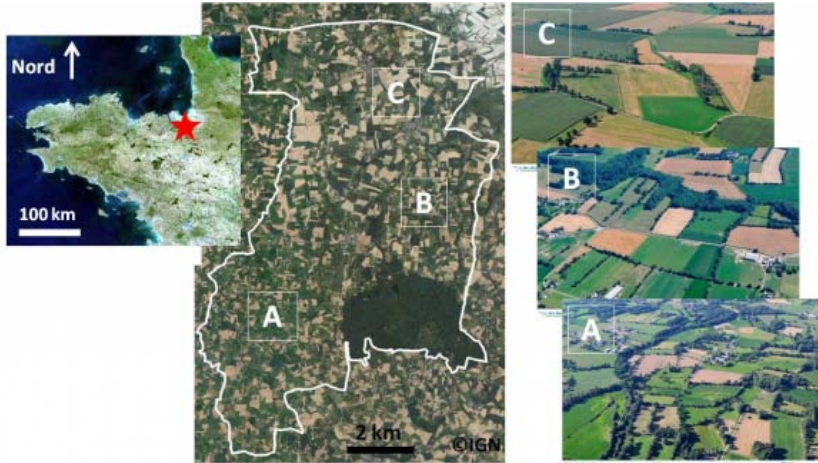
# Aim and expectations

To evaluate the conservation implications of **long term change in vegetation** community of field margins at **local and metacommunity** scale

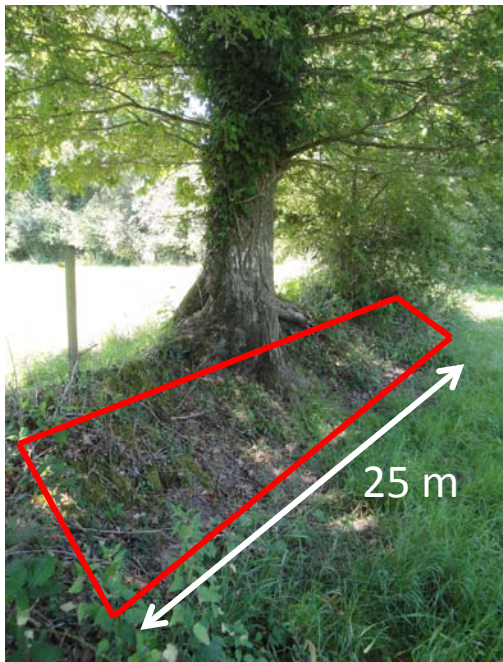
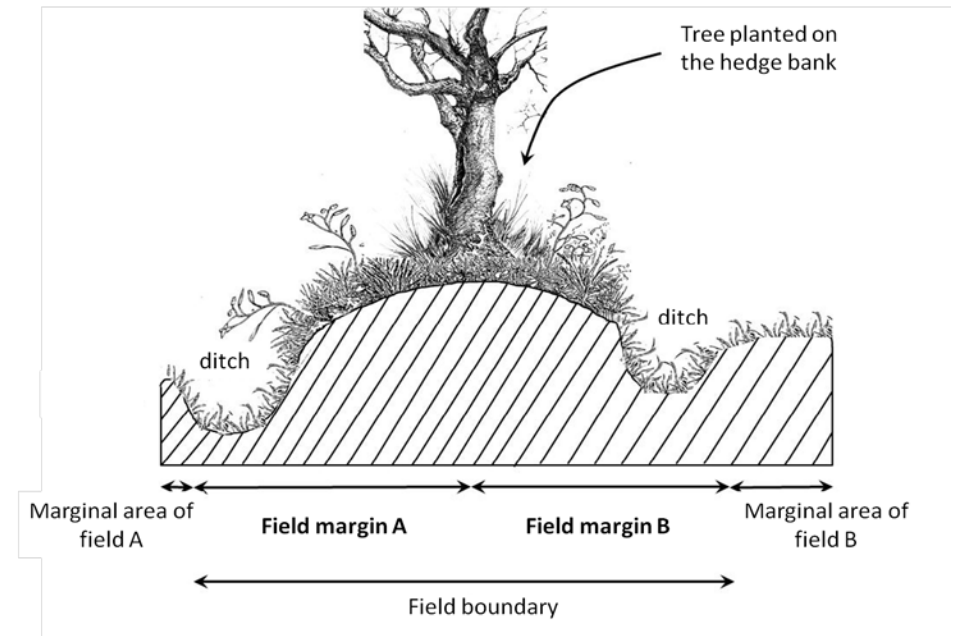


1. Change in alpha, beta and gamma diversity due to changes in management practices
2. Shift in species composition towards species associated with higher soil fertility and with more competitive life-history strategies in response to management intensification (of the herb layer)
3. Change in metacommunity structure

# Study area and vegetation sampling



309 field margins from three hedgerow network landscapes in Zone Atelier Armorique







Vegetation surveys in **1994** and **2015** according to the **same protocol**  
25m-long transect, representative of the field margin  
all vascular species, abundance data  
12 life history traits (Ellenberg values, life form,...)


# Explanatory variables: management practices

Information about presence/absence of management, summarized by the two first axes of the Correspondence Analysis


## Herb layer:

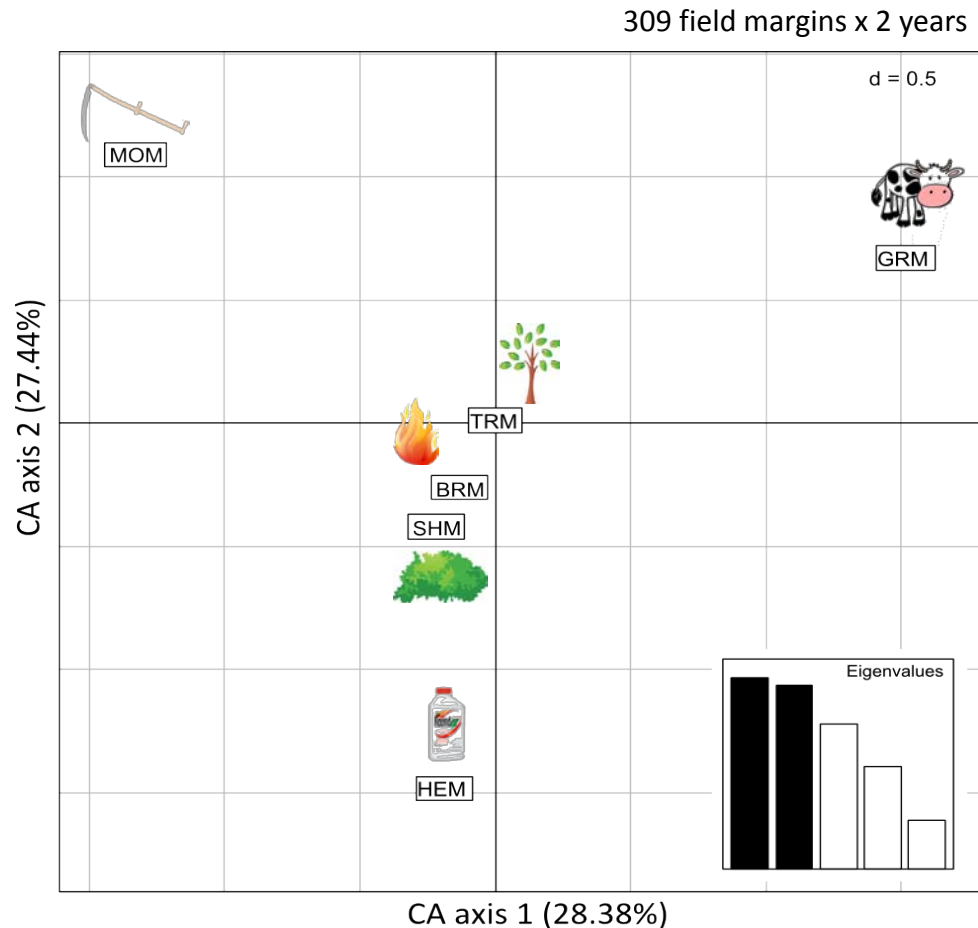
grazing   
herbicide use   
mowing   
brulis 

## Shrub layer:

trace of shrub  
management 

## Tree layer:





trace of tree  
management 




# Explanatory variables: management practices

Information about presence/absence of management, summarized by the two first axes of the Correspondence Analysis


## Herb layer:

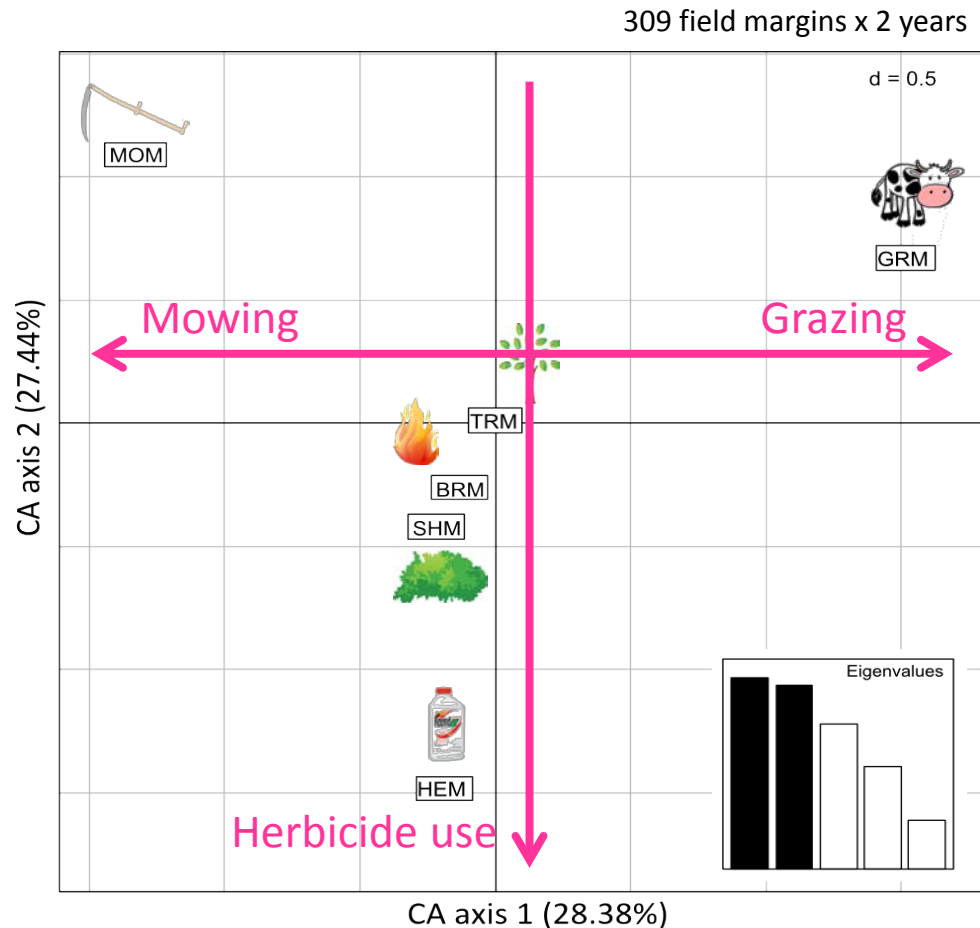
grazing   
herbicide use   
mowing   
brulis 

## Shrub layer:

trace of shrub  
management 

## Tree layer:

trace of tree  
management 

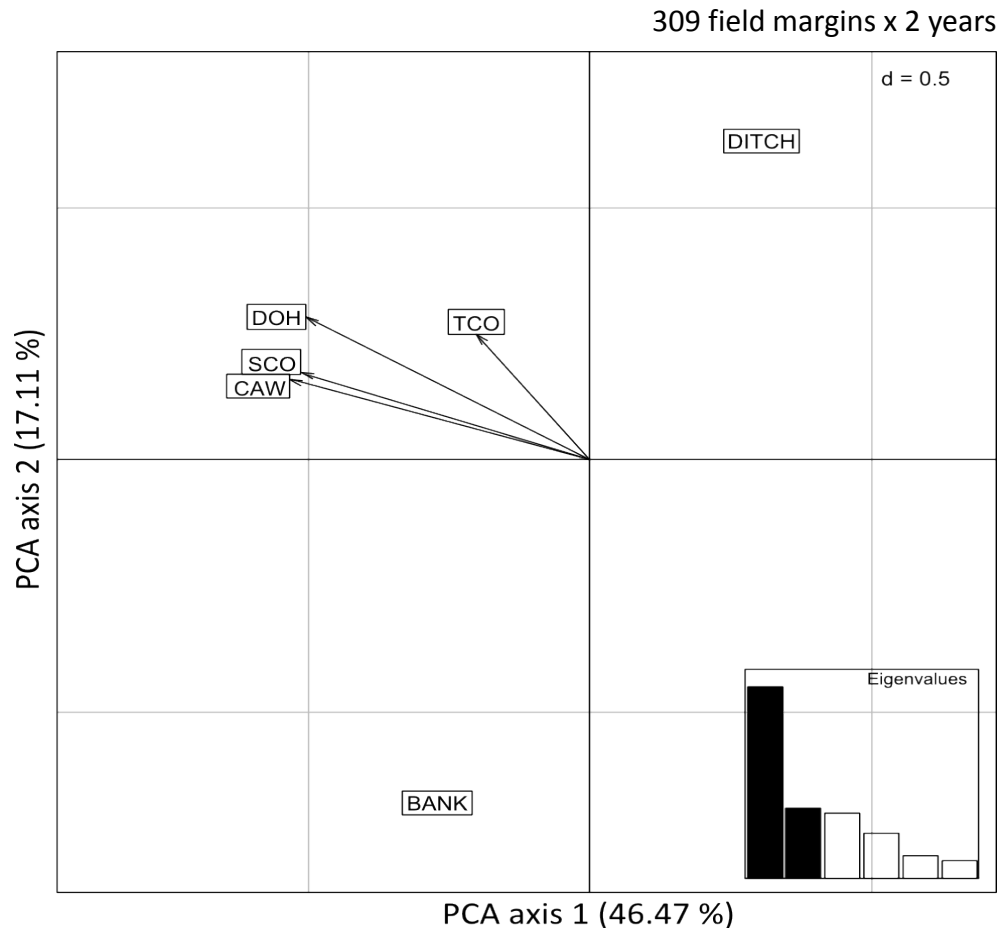


Change in 'management' = scores of field margins in 2015 – scores of field margins in 1994

# Explanatory variables: structural condition

Information about structural condition, summarized by the two first axes of the mixed Principal Component Analysis

- Presence of a ditch (DITCH)
- Presence of a bank (BANK)
- Dominant height of the vegetation (DOH)
- Tree cover (%) (TCO)
- Shrub cover (%) (SCO)
- Canopy width (CAW)





# Explanatory variables: structural condition

Information about structural condition, summarized by the two first axes of the mixed Principal Component Analysis

Presence of a ditch (DITCH)  
Presence of a bank (BANK)  
Dominant height of the vegetation (DOH)  
Tree cover (%) (TCO)  
Shrub cover (%) (SCO)  
Canopy width (CAW)



Change in 'structure' = scores of field margins in 2015 – scores of field margins in 1994

# Changes in species diversity components

---

# Changes in species composition

## Beta diversity:

Multi-site Sorensen dissimilarity  
= 0.99 (in 1994 and 2015)

Temporal dissimilarity (between  
1994 and 2015) =  $0.64 \pm 0.09$

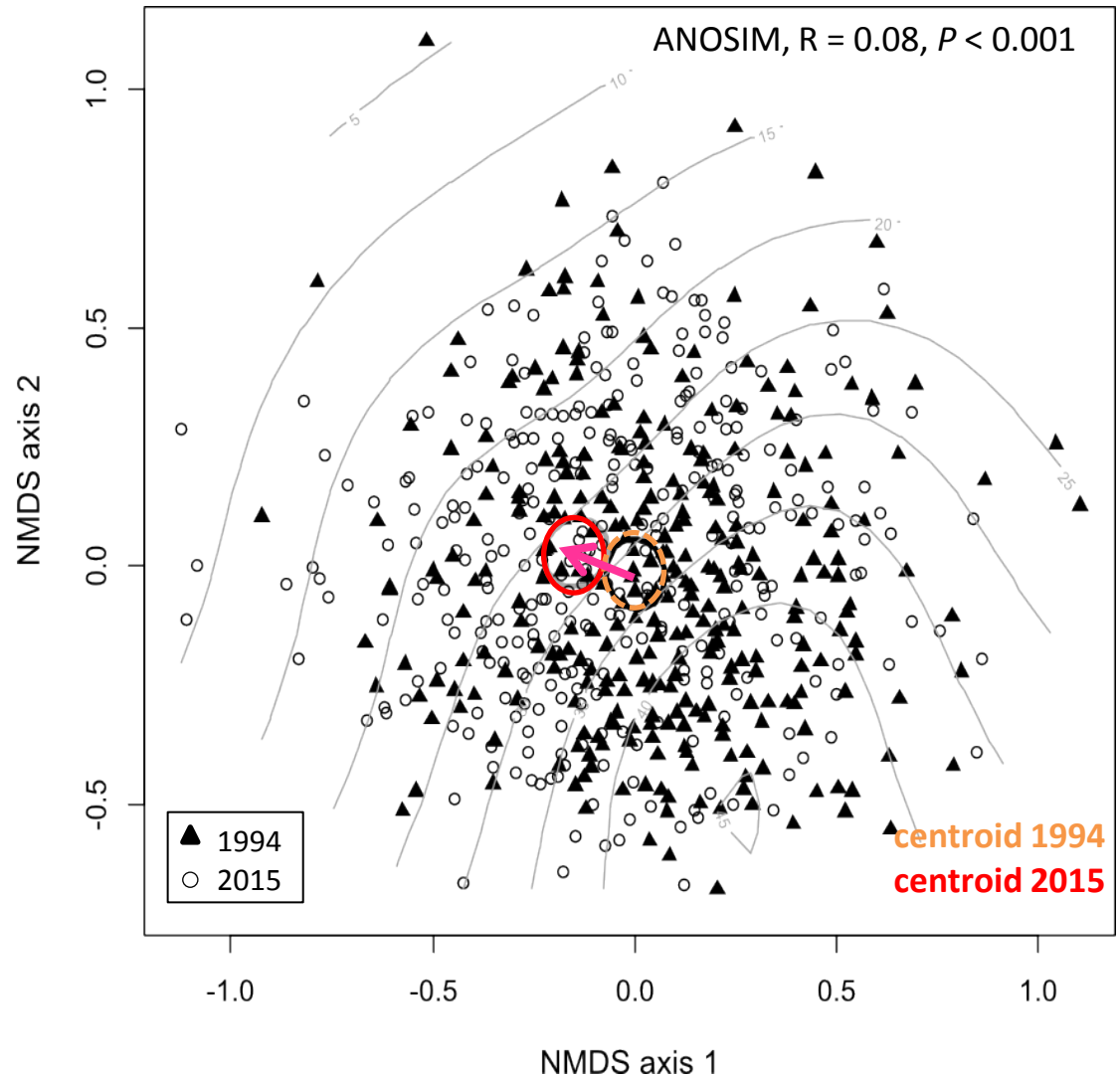
Not explained by changes in  
management and structure

## NMDS (Bray-Curtis distance):

Significant shift in species  
composition

$M_{1994} < M_{2015}$ : no biotic  
homogenization

(M = mean distance to centroid)



# Changes in metacommunity structure and traits

No change in metacommunity structure (Clementsian)

---



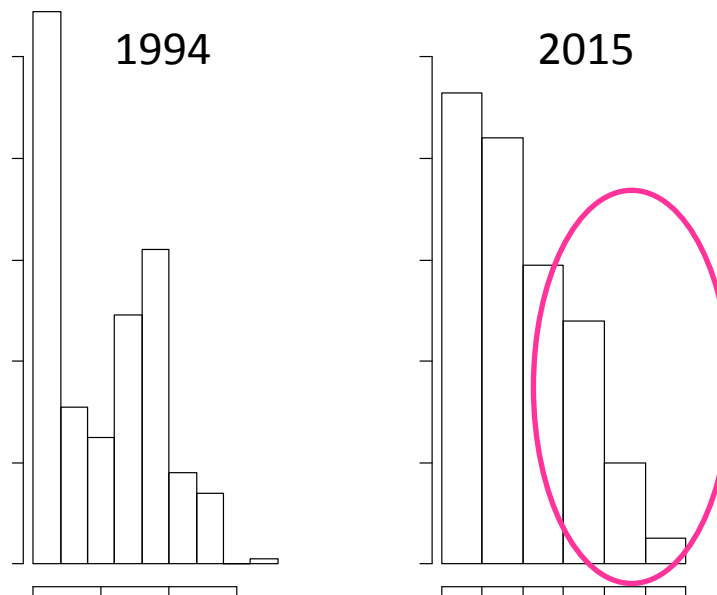
# Back to hypotheses

Unexpected lack of a **decline in total species richness** (gamma diversity)

**Mean species richness (alpha diversity) increased** between 1994 and 2015: field margins with higher initial species richness gaining fewer species or losing species.



Richness appeared to benefit from the recent increase of shrub cover and dominant height of trees (PCA axis 1)



# Back to hypotheses

Unexpected lack of a **decline in total species richness** (gamma diversity)

**Mean species richness (alpha diversity) increased** between 1994 and 2015: field margins with higher initial species richness gaining fewer species or losing species.



Richness appeared to benefit from the recent increase of shrub cover and dominant height of trees (PCA axis 1)

A **shift in species composition** but no biotic homogenization

Maintenance of high beta diversity (high turnover of species)

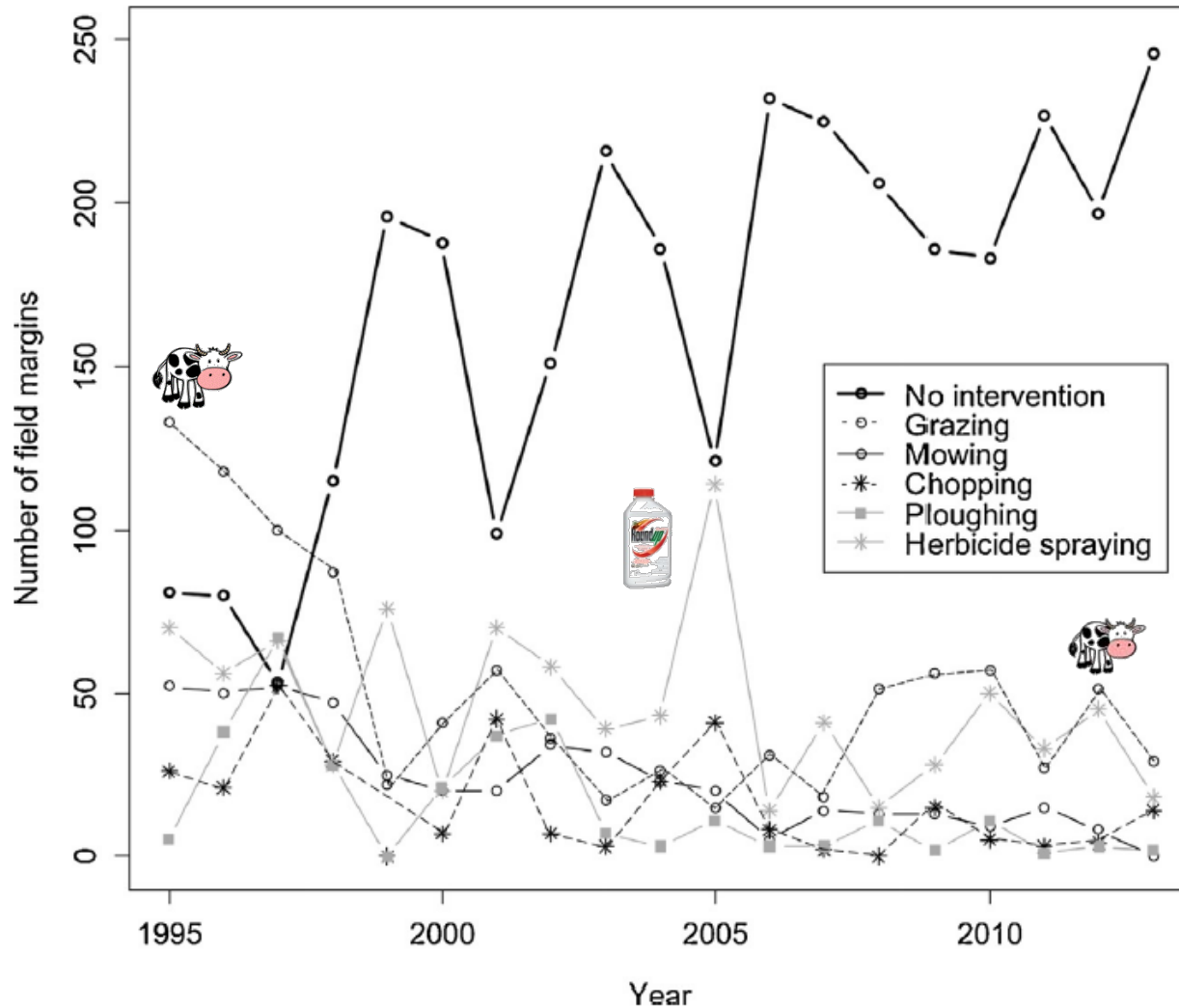
Directional change in species composition especially in field margins with fewer species richness

Species with different attributes showed different temporal trends, with an increase of shade-tolerant species



In line with observed changes in management practices

# Back to hypotheses



# Back to hypotheses

Unexpected lack of a **decline in total species richness** (gamma diversity)

**Mean species richness (alpha diversity) increased** between 1994 and 2015: field margins with higher initial species richness gaining fewer species or losing species.



Richness appeared to benefit from the recent increase of shrub cover and dominant height of trees (PCA axis 1)

A **shift in species composition** but no biotic homogenization

Maintenance of high beta diversity (high turnover of species)

Directional change in species composition especially in field margins with fewer species richness

Species with different attributes showed different temporal trends, with an increase of shade-tolerant species



In line with observed changes in management practices

**Stability of metacommunity structure**



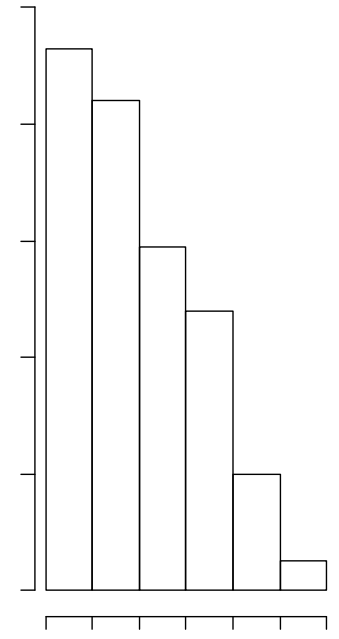
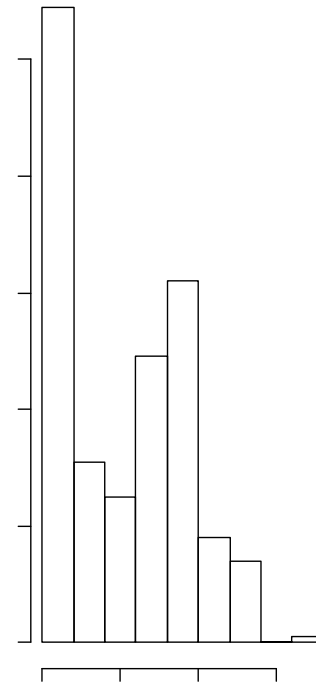
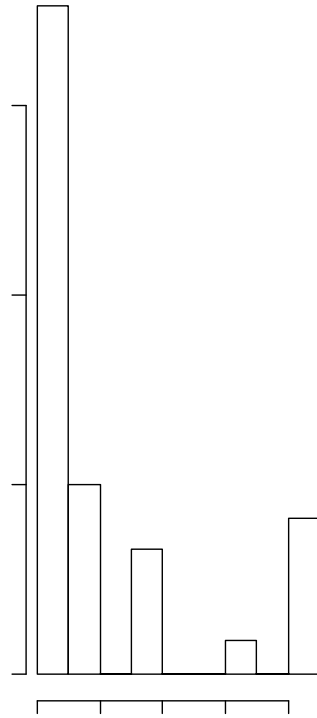
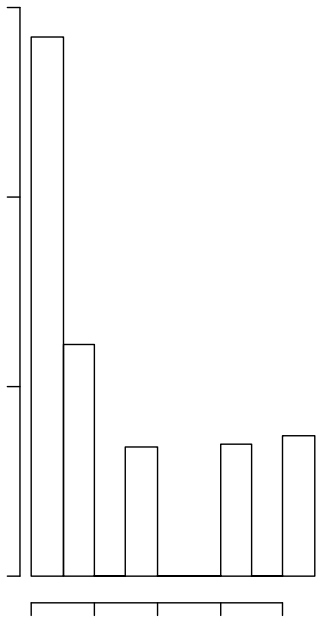
A photograph showing three people from behind, walking away from the camera across a lush green field towards a dense line of trees. The person on the left is wearing a light-colored shirt and pants, a wide-brimmed hat, and is holding a long pole. The person in the middle is wearing a light-colored shirt and pants, a straw hat, and is holding a long pole. The person on the right is wearing a blue polo shirt, dark pants, and a cap, and is carrying a large orange and black bag. The background is a thick forest of green trees under a clear blue sky.

Thanks for your attention

Special thanks to Elven Lanoë, Jean-Luc Roger and Gerard Savary for their help during fieldwork and to farmers for their cooperation.



# Structural condition of field margins between 1994 and 2015



More field margins with a shrub cover (0-10%) in 2015

Higher trees in 2015 compared with 1994

## Winners / Losers

N = 29

| Species                     | n1994 | n2015 | $\Delta n$ |
|-----------------------------|-------|-------|------------|
| <i>Epilobium tetragonum</i> | 8     | 114   | 106        |
| <i>Galium aparine</i>       | 189   | 237   | 48         |
| <i>Urtica dioica</i>        | 182   | 225   | 43         |
| <i>Elymus repens</i>        | 119   | 161   | 42         |
| <i>Euonymus europaeus</i>   | 34    | 74    | 40         |
| <i>Stellaria holostea</i>   | 191   | 231   | 40         |
| <i>Hedera helix</i>         | 163   | 199   | 36         |
| <i>Sonchus asper</i>        | 23    | 56    | 33         |
| <i>Galeopsis tetrahit</i>   | 14    | 44    | 30         |
| <i>Moehringia trinervia</i> | 13    | 43    | 30         |
| ...                         |       |       |            |

N = 58

| Species                      | n1994 | n2015 | $\Delta n$ |
|------------------------------|-------|-------|------------|
| <i>Ranunculus repens</i>     | 226   | 157   | -69        |
| <i>Rumex crispus</i>         | 88    | 30    | -58        |
| <i>Rumex acetosa</i>         | 190   | 133   | -57        |
| <i>Polygonum persicaria</i>  | 85    | 35    | -50        |
| <i>Teucrium scorodonia</i>   | 228   | 178   | -50        |
| <i>Leucanthemum vulgare</i>  | 70    | 21    | -49        |
| <i>Stellaria graminea</i>    | 62    | 14    | -48        |
| <i>Chenopodium album</i>     | 61    | 14    | -47        |
| <i>Conopodium majus</i>      | 107   | 63    | -44        |
| <i>Lonicera periclymenum</i> | 115   | 71    | -44        |
| ...                          |       |       |            |

New species in 2015: *Rumex sanguineus* (34), *Sherardia arvensis* (4), *Scrophularia aquatica* (4), *Potentilla anglica* (3), *Zea mays* (1),...

'Lost species' in 2015: *Viola arvensis* (12), *Sinapis arvensis* (11), *Setaria viridis* (10), *Trifolium campestre* (5) ,...

# Changes in traits of vegetation communities between 1994 and 2015

Few significant changes when considering all plants:

- significant decrease of species with a SR strategy

- significant decrease of species intolerant to grazing