



Plant diversity in farmlands: Disentangling the effects of field position and, landscape composition and configuration

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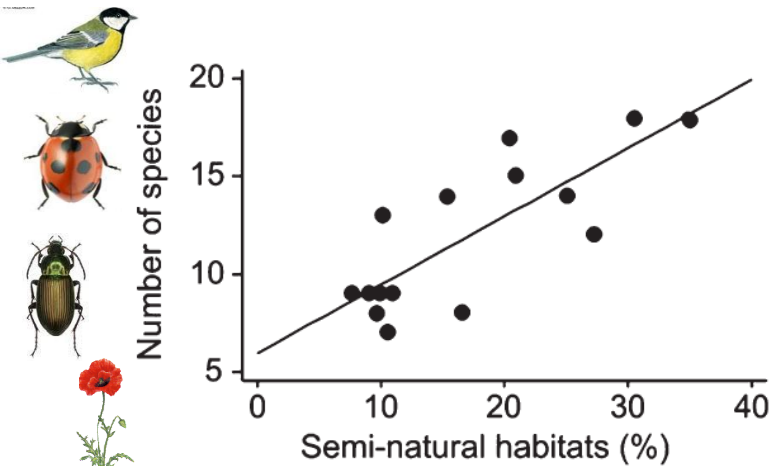
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Plant diversity in farmlands : Disentangling the effects of field position and, landscape composition and configuration

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Habitat heterogeneity, a key for farmland biodiversity ?

Habitat heterogeneity is often assumed to stop or reverse declines of farmland biodiversity



Tscharntke *et al.* (2005)



Hedgerows and sown grass strip bordering a wheat field, Brittany - France

Increasing heterogeneity of non-crop habitats is often too costly and not always acceptable in terms of agricultural production...

... what about crop mosaic heterogeneity ?

Environmental heterogeneity within fields, does it matter?



Field boundary Toward inner field

Field centres are disturbed recurrently by cropping activities.

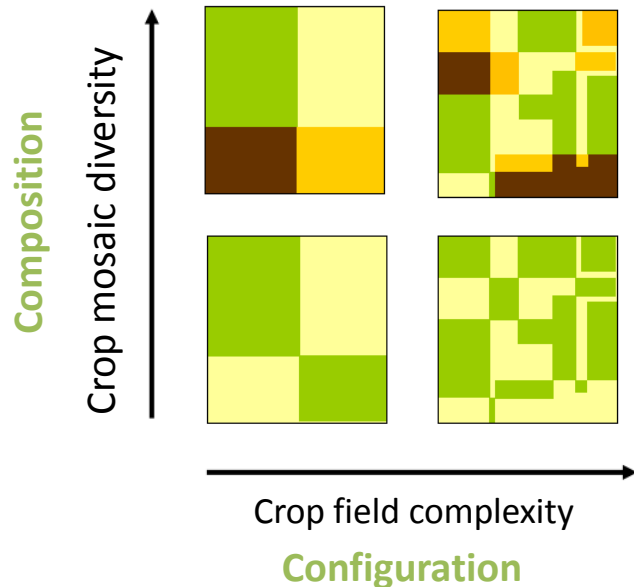
Field boundaries i.e. hedgerows are less (frequently and intensively) disturbed. They represent more stable habitats for plant populations.

Field borders received the same management as field centres but are physically and biotically influenced by neighbouring less-disturbed habitats.

Field position is expected to influence plant diversity.

Research questions and hypotheses

Landscape heterogeneity
Fahrig et al. (2011)



- How crop mosaic composition and configuration influence vegetation diversity at the field scale?
- Are these relationships dependant on the field position ?

We hypothesize that:

increasing **compositional** heterogeneity increases vegetation diversity by providing different niches, independently of the field position

increasing **configurational** heterogeneity, by increasing field border length and thus, connectivity and refugia, increases vegetation diversity, especially at field border

Rapid overview of sampling effort



+ Ontario

8 regions

435 landscapes

1526 fields

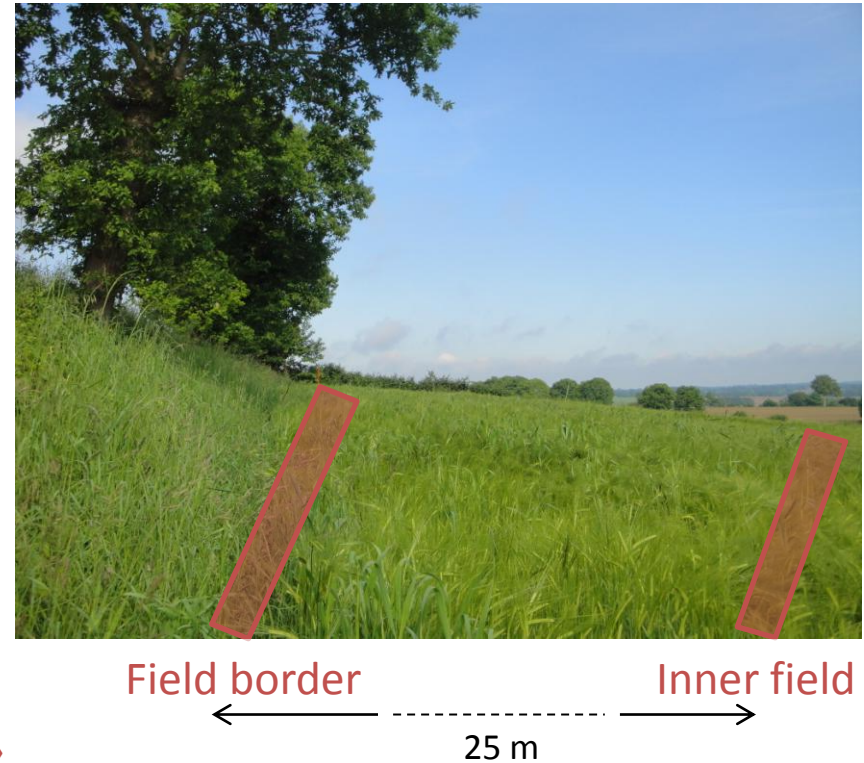
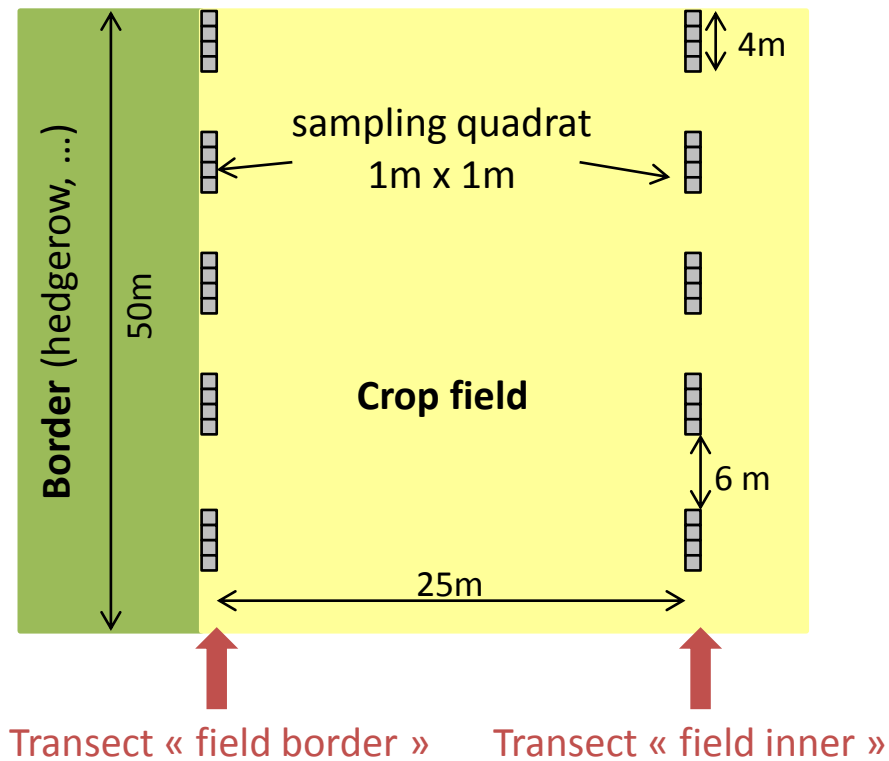
3088 transects



For plants:

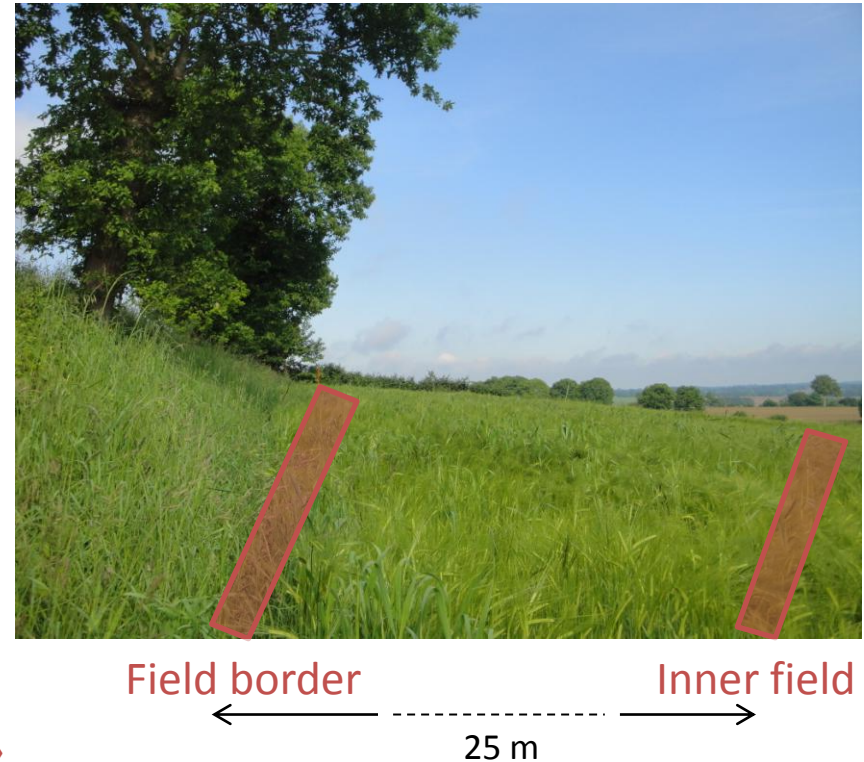
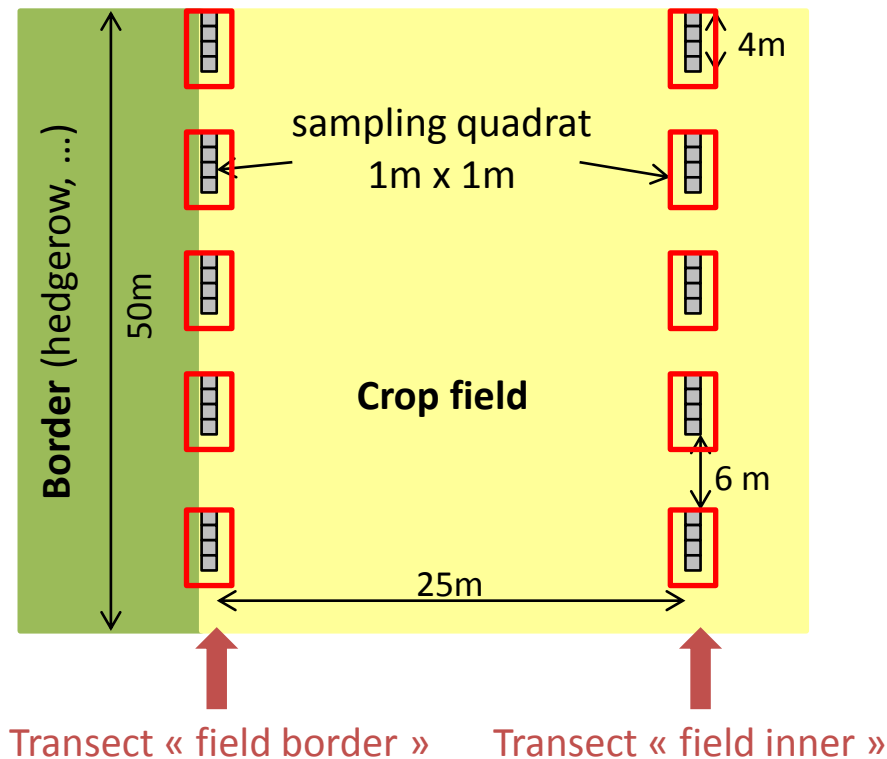
Region	Year	Landscape	Field	Transect
Armorique	2013	30	90	180
Armorique	2014	10	30	60
Camargue	2013	32	96	192
Camargue	2014	8	24	46
Coteaux	2013	20	60	120
Coteaux	2014	12	35	70
EastAnglia	2012	30	119	206
EastAnglia	2013	30	119	215
Goettingen	2013	32	96	285
Goettingen	2014	20	59	159
Lleida	2013	25	75	150
Lleida	2014	15	45	88
Ontario	2011	46	185	370
Ontario	2012	47	193	381
PVDS	2013	48	182	364
<i>PVDS</i>	<i>2014</i>	<i>30</i>	<i>118</i>	<i>202</i>

Vegetation sampling



Percent cover of all plant species (except bryophytes)
Sampling between 2011 and 2014 according to regions.

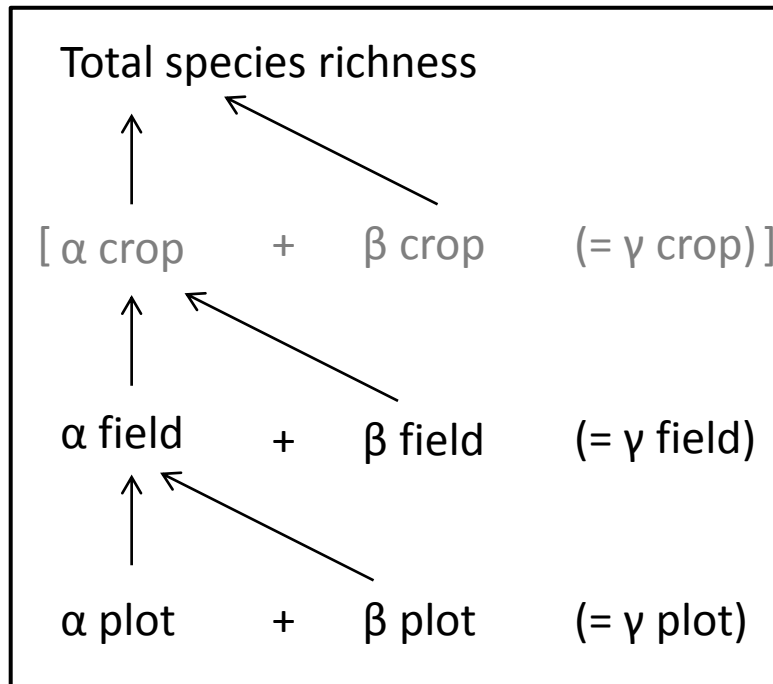
Vegetation sampling



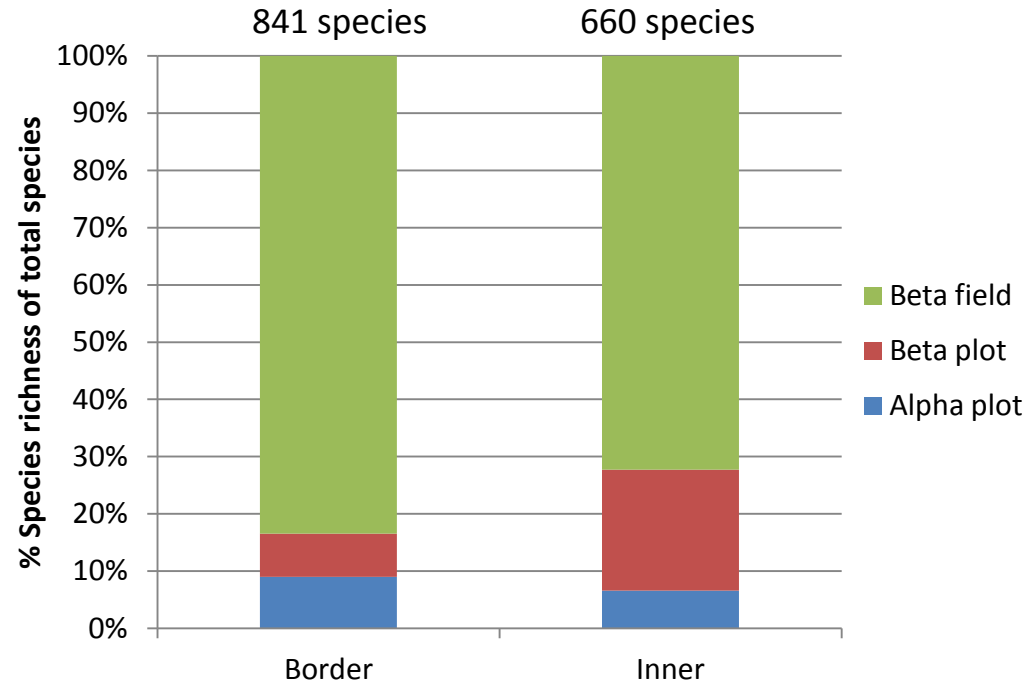
Percent cover of all plant species (except bryophytes)
Sampling between 2011 and 2014 according to regions.

**Pooling data per « plot » to overcome differences in
sampling protocols**

Diversity partitioning according to field position

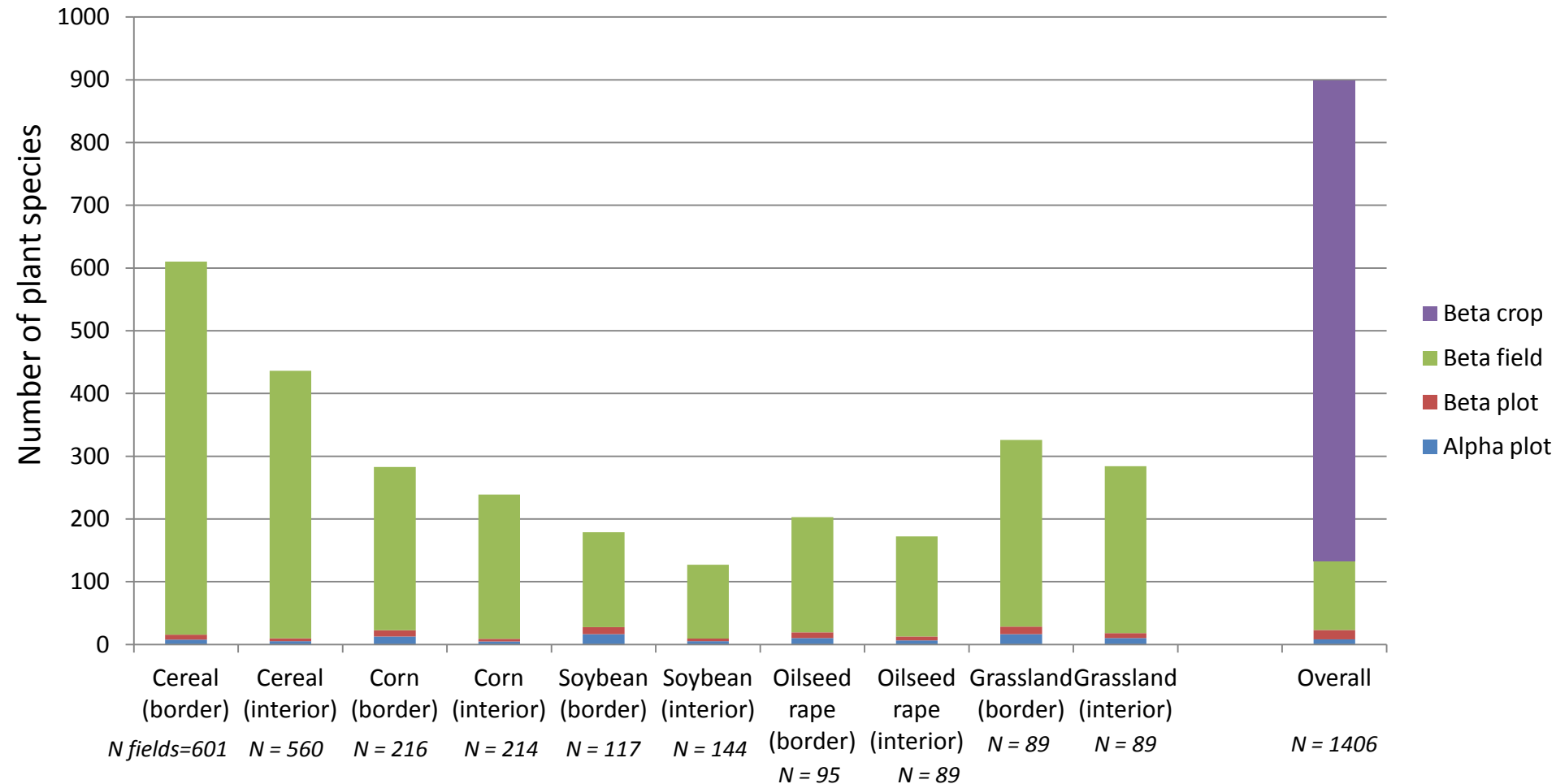


Adapted from Wagner *et al.* 2000



- ✓ Higher species richness at field border
- ✓ Different patterns between « field border » and « field inner » transects
- ✓ Plant diversity was largely made up of beta field diversity

Diversity partitioning according to crop types



✓ Plant diversity was largely made up of beta field diversity

Landscape effect and field position on diversity

Generalized mixed effect model as:

Alpha diversity ~ Crop Shannon + Crop TBL + Field position + % NonCoverCrop +
Crop Shannon:Field position + CropTBL:Field position + (1 | Landscape/Region/Year)

Response variable	Crop Shannon	Crop TBL	Field position	Shannon: position	TBL: position
Gamma	+	-	+	+	+
Alpha	+	-	+	+	+
Beta	+	-	+	+	+

1 value of gamma per transect
5 values of alpha per transect (1 per plot)
beta= gamma – alpha ; 5 values of beta

Shannon: Shannon habitat diversity
TBL = total border length

- ✓ Plant diversity was higher at field border
- ✓ Landscape modulates field position effect on plant diversity

To conclude

Beta field diversity is the major contributor to overall species richness. Differences in management practices between fields (even within crop) may explain these results.

Field position influences the diversity of plants in farmland mosaics.

- Higher diversity at field border
- Landscape effect on species diversity is higher in field inner than in field border

Unexpectedly, crop mosaic **configuration** had a **negative effect** on plant diversity.

➡ Perspective: Deepening results with a functional approach

See next talk !

Thanks for attention

