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## Effects of landscape heterogeneity on functional gamma diversity

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# Agricultural Landscape & Biodiversity

## Effects of landscape heterogeneity on functional gamma diversity

Duflot R.<sup>1,2</sup>, Georges R.<sup>1</sup>, Aviron S.<sup>2</sup>, Ernoult A.<sup>1</sup>, Burel F.<sup>1</sup>

### Research questions

#### What we know and pitfalls

- **Landscape heterogeneity** is a key factor in maintaining **biodiversity**
  - ↳ The two components of heterogeneity should be taken into account: **compositional** and **organizational** heterogeneity
- **Semi-natural habitats** play an important role in biodiversity conservation
  - ↳ The **cultivated land** is usually **ignored** but is potentially important

#### Questions

- What are the relative effects of landscape composition and organisation ?
- How important are the farmlands for agricultural biodiversity ?
  - ↳ Describe life history traits distribution along landscape gradients (**dispersion**, **phenology** and **reproduction**)
  - ↳ Look at the diversity of two very different taxonomic groups:



carabid beetles

and herbaceous plants

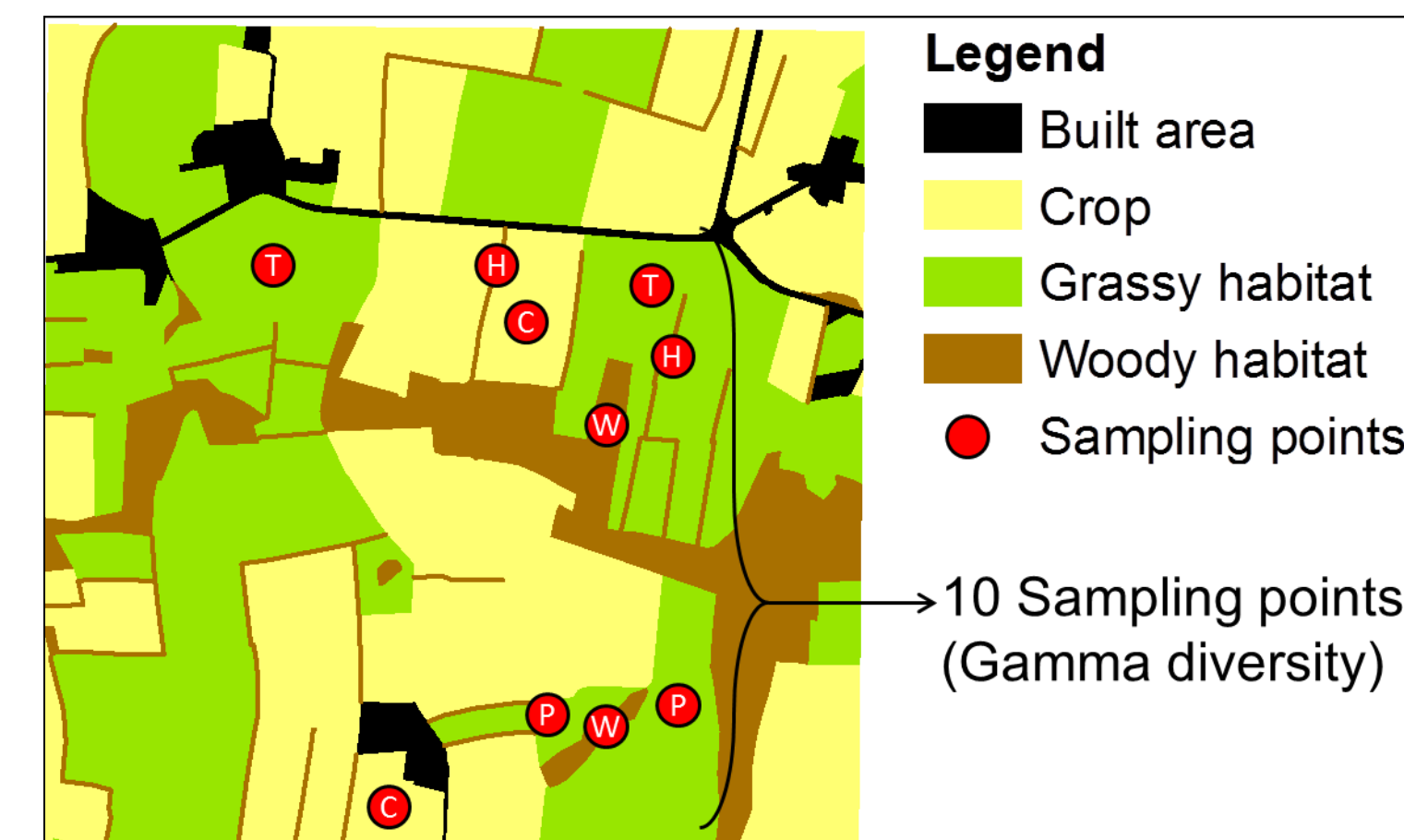


↳ Measure diversity at the landscape scale = **gamma diversity**

### Sampling, Mapping & Statistics

#### Sampling design

- Selection of **20 landscapes** of 1 km<sup>2</sup>
- Assess gamma diversity with a **hierarchical sampling design**



Sampled cover types:

- Hedgerow (H)
- Woodlot (W)
- Permanent grassland (P)
- Temporary grassland (P)
- Cereal crop (C)

#### Landscape descriptors

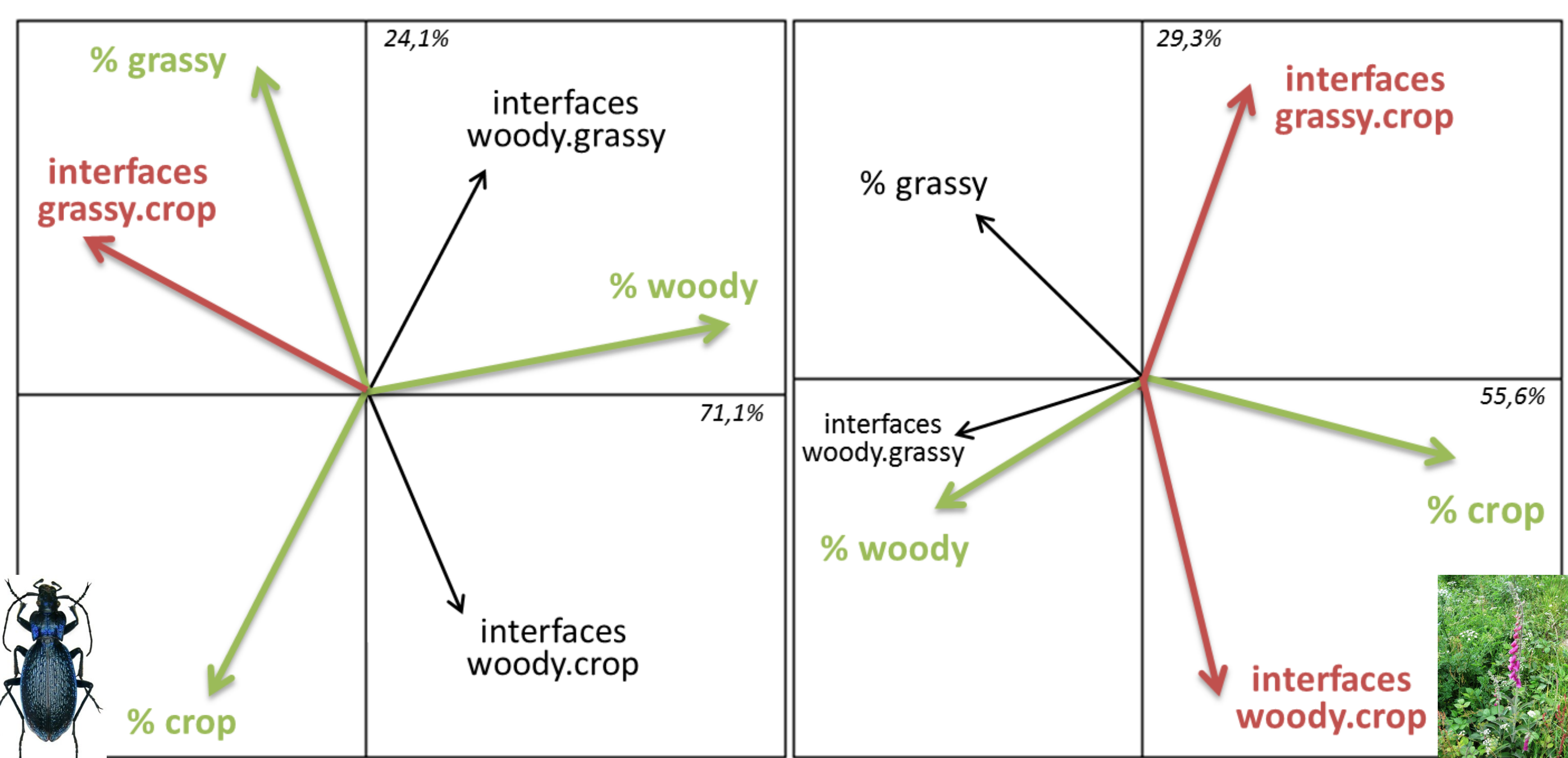
- **Landscape composition** is defined by three cover classes: woody habitats / grasslands / crops (here cereal fields)
- Spatial organisation evaluated as the **length of interfaces**

#### Statistical analyses

- Relate three tables: landscape descriptors, species, functional traits
- **RLQ**: simultaneous ordination of the three tables
- **Fourth Corner (FC)**: correlation between trait categories and descriptors

## Influence of landscape characteristics on traits distribution

#### Landscape effects on community composition (RLQ)



- **Composition** and **organisation** drive life history traits distributions
- **Organisation** effects are greater on carabids than on plants

#### Landscape influence on species phenology (FC)

- Plants and carabid beetles show similar responses

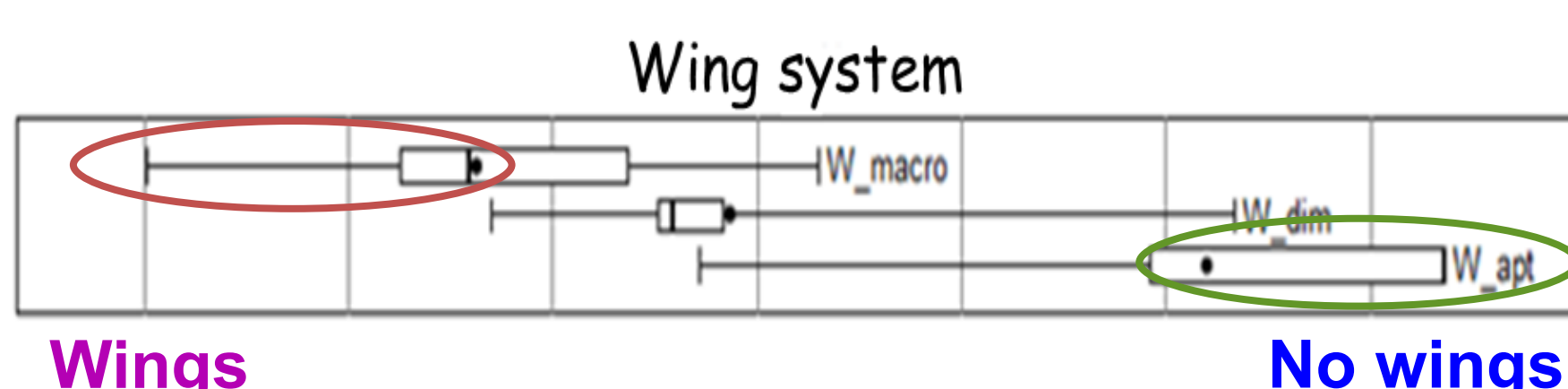
	"Open" landscapes High inter. grassy / crop	Wooded landscapes High % woody
Spring breeders	+	-
Autumn breeders	-	+
Flowering period May - June	+	-
Flowering period July - Sept.	-	+
	<b>Early species</b>	<b>Late species</b>

"Open" landscapes are usually associated with more disturbance. **Early species** can reproduce before most of agricultural interventions in spring (mowing, plough, harvest...).

#### Landscape influence on carabid dispersal abilities (RLQ)

- "Open" landscapes ↗ carabids with **high dispersal** abilities
  - Can adapt to fast changing and ephemeral vegetation covers
- Wooded landscapes** ↗ availability of more stable habitats
  - Less detrimental for carabids with **lower dispersal** abilities

#### High dispersal



#### Low dispersal



"Open" landscapes  
High inter. grassy / crop

← Axis 1 of RLQ

**Wooded landscapes**  
High % woody

## Conclusions

1. Variations in compositional and organisational heterogeneity change the dominance of functional traits at landscape scale.
2. Plants are mostly affected by the compositional heterogeneity while the spatial organisation of farmlands seems to be of great importance for carabid beetles.
3. Because different landscape types favour different functional traits, a diversity of landscape type at the regional scale will ensure a functional diversity.



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