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Stéphanie Aviron, Sylvain Poggi, Nicolas Parisey, Remi Dufлот, Hugues Boussard, Etienne Lalechère

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Terre, Écosystèmes et Sociétés

Observatoire
des Sciences de l'Univers
de Rennes



Contribution of annual crops vs. semi-natural habitats to landscape connectivity for different types of carabid beetle communities

Aviron S., Poggi S., Parisey N., Duflot R.,
Boussard H., **Lalechere E.**

INRA SAD-Paysage, UMR IGEPP, UMR Ecobio CNRS –
Université Rennes 1, France

etienne.lalechere@irstea.fr

stephanie.aviron@rennes.inra.fr

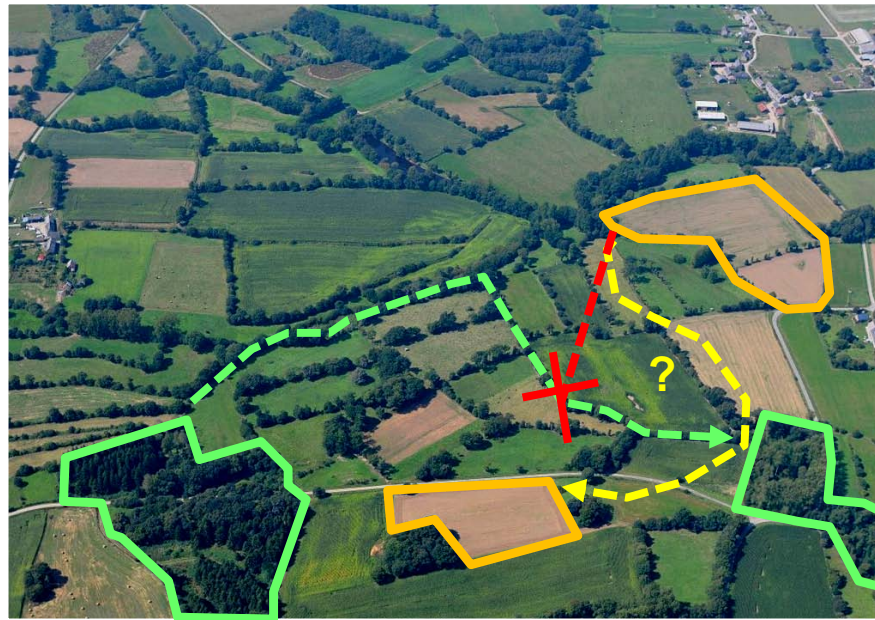


Landscape connectivity in agricultural landscapes

- “The degree to which the landscape facilitates or impedes movements between resources patches”

(Taylor et al. 1993)

Forest species
Connectivity of
hedgerow and
woodlots



Crop species
*Barrier effect of
woody elements.
Crop connectivity ?*

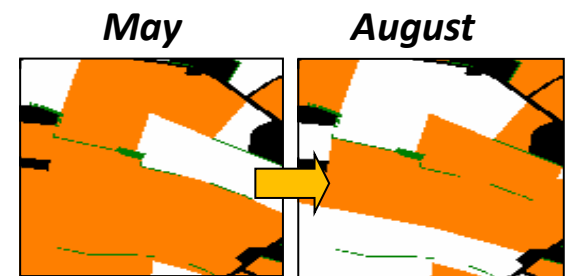
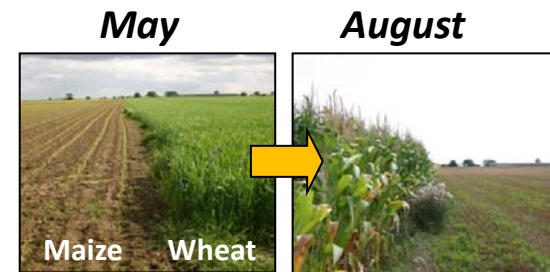


Spatio-temporal dynamics of resources in the cultivated mosaic



□ For crop species :

- **The availability of resources** depends on crop cover state and farming practices => **asynchronous** in crops sown and harvested at different times.
- It results in a **fast-changing distribution of resources** at the landscape scale



□ Bare sol

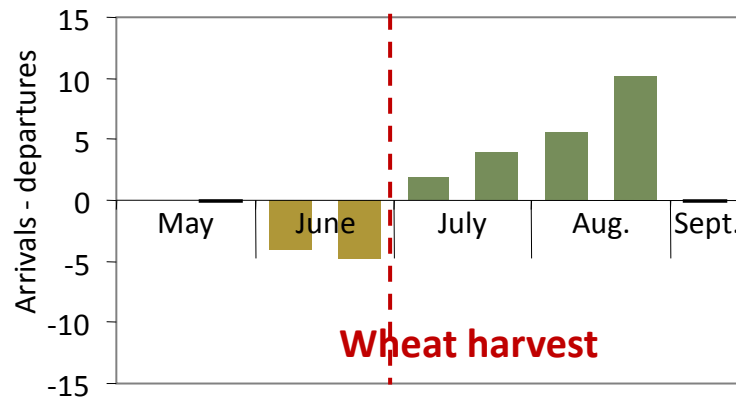
■ Dense cover

Effect of resource dynamics on insect movements



- Orientation of carabid movements at edges between asynchronous crops (winter vs. spring crops) :

Movements toward winter cereals



Movements toward spring maize

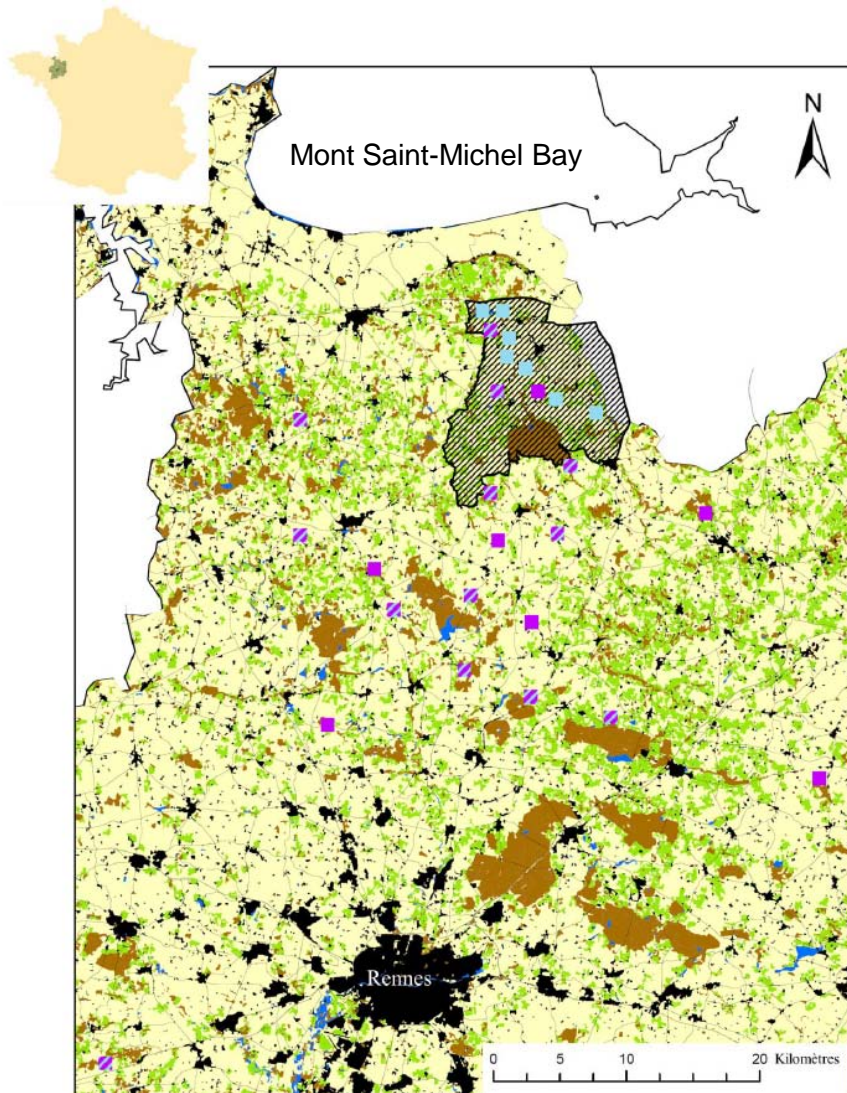


- Complementation processes between asynchronous crops
- Effect of connectivity of complementary crops at large scales?

Aims of the study

- ❑ To investigate the effects of crop connectivity on carabid communities, relative to those of connectivity of semi-natural habitats.
 - Positive effect of connectivity of asynchronous crops on crop species ?
 - Antagonist effects of connectivity of forest habitats on crop and forest species ?

Study area and data collection



Carabid sampling in 27 landscapes (1km²)

- Hedgerows, woodlots, permanent and temporary grasslands (2011)
- Wheat, maize (2012)

N = 240 (2 replicates / landscape)

Data analysis



Carabid communities

Indicator species

Forest

Grassl.

Wheat

Maize

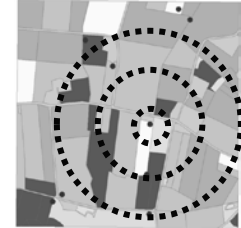
IndVal method

Random forest



Best model GLMm

Landscape metrics (50m, 250m, 500m)



- Habitat amount (% woody, grassl., wheat, maize)
- Habitat connectivity :
 - Edge length between habitats (m)
 - Connectivity metric

$$C = \sum e^{-d_{pq}} \times A_q$$

(Hanski & Thomas 1994)

- Shannon diversity index

Results : Effect of landscape metrics on indicator species

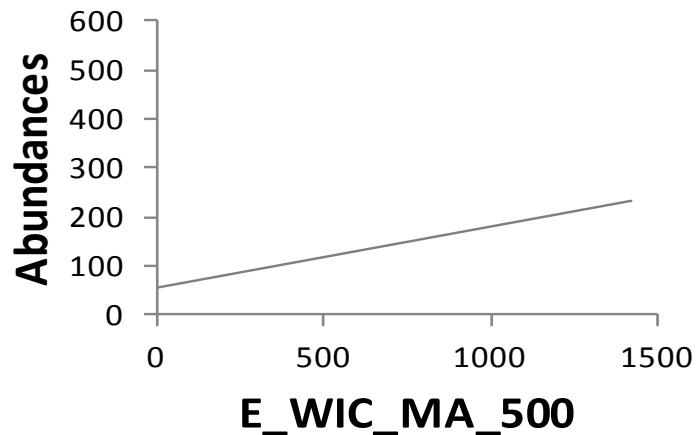


Maize species

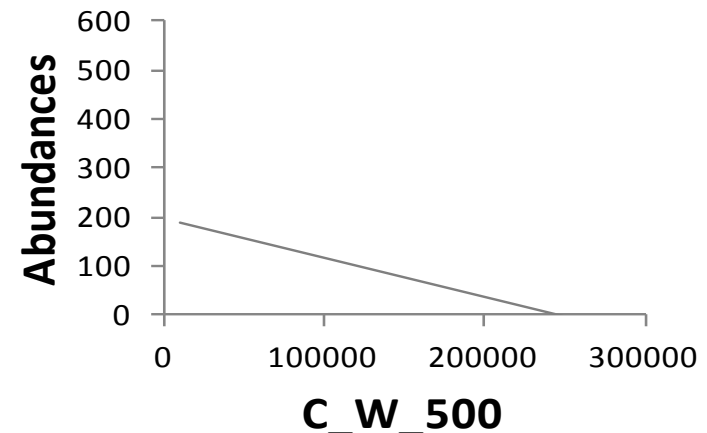
Best model (GLMM)

Variable	P-value	<i>AICc</i> model	<i>AICc</i> null	Pseudo <i>R</i> ²
(intercept)				
C_W_500	<0.001	440.43	462.58	0.48
E_WIC.MA_500	<0.001			

Positive effect of edge length
winter crops-maize (500m)



Negative effect of woody
habitats connectivity (500m)



Results : Effect of landscape metrics on indicator species

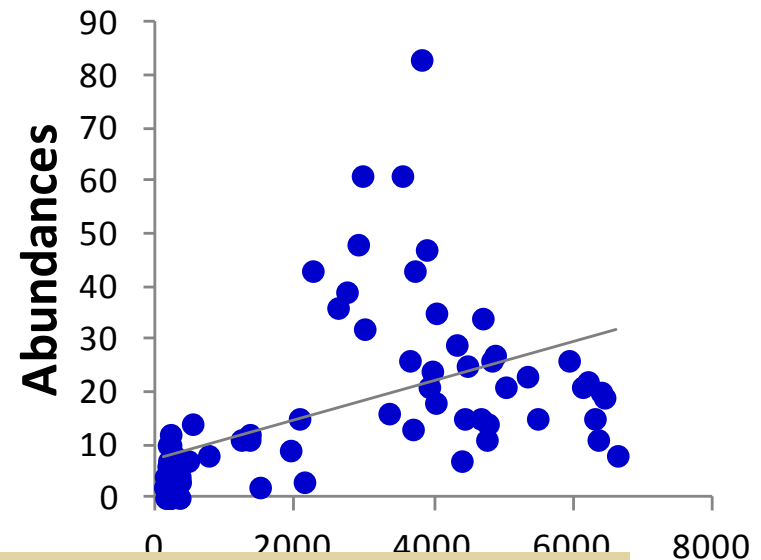


Forest species

Best model (GLMM)

Variable	P-value	AICc model	AICc null model	Pseudo R ²
(intercept)				
C_GR_50	NS	566.1	612.98	0.484
C_W_50	<0.001			
SHDI_50	<0.001			

Positive effect of woody habitats connectivity (50m)



Wheat and grassland species : no significant effect of tested landscape metrics

Conclusions

- ❑ **Connectivity of crops matters for maize carabid species**
 - ❑ Adjacencies between asynchronous crops (spring vs. winter crops) at large scales (500m) : complementation processes
- ❑ **Antagonist effects of connectivity of semi-natural habitats?**
 - ❑ Promotes forest species at local scales (50m) but reduces crop species at large scales (500m)
 - ❑ But the role of semi-natural habitats (hedgerows) remains important for crop species locally (refuge, overwintering...)
- ❑ **Management perspectives: Green and blue networks policies**
 - ❑ Different types of ecological continuities depending on targeted species and services (conservation vs. regulation)

Thank you

