

Les réseaux d'interactions entre plantes et pollinisateurs

Organisation, fonctionnement et réponses aux perturbations

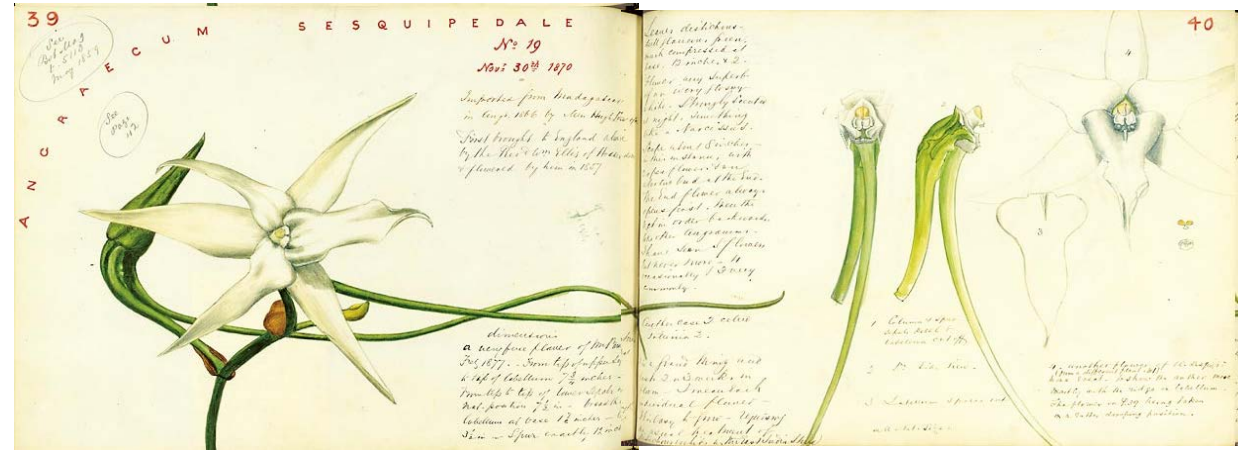
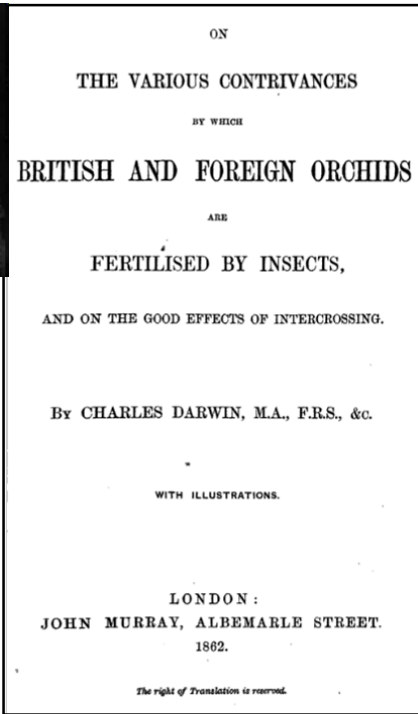
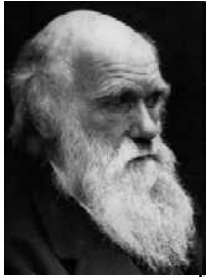
Colin Fontaine

CNRS

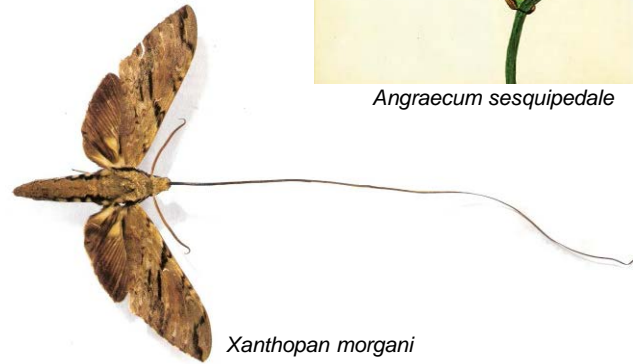
Centre d'Ecologie et des Sciences de la Conservation



Interaction plantes-pollinisateurs



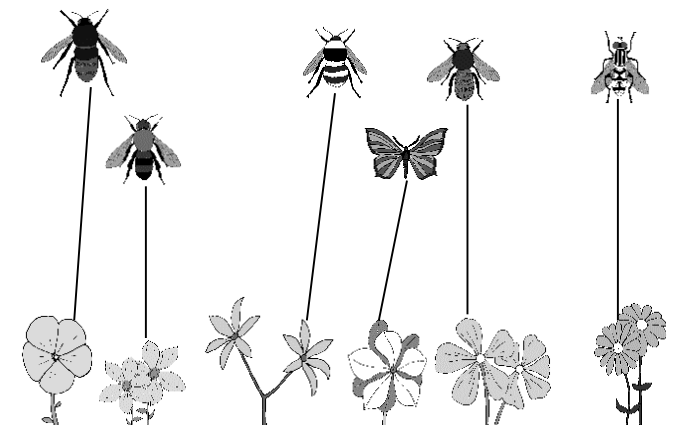
Angraecum sesquipedale



Xanthopan morgani

The flowers of each species are adapted in shape, structure, color, and odor to the particular pollinating agents on which they depend . . . Evolving together, the plants and their pollinators become more finely tuned to each other's peculiarities . . .

Keeton and Gould 1993:476



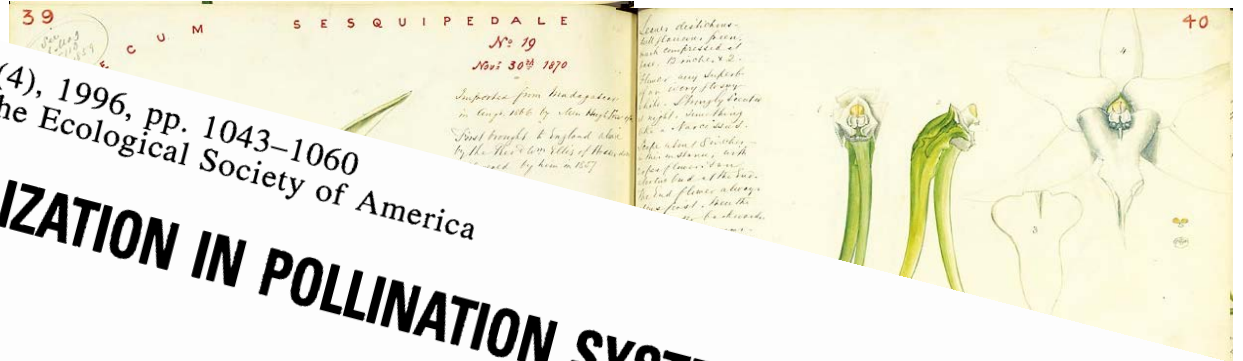
Interaction plantes-pollinisateurs



ON
THE VARIOUS CONTRIVANCES
BY WHICH
FOREIGN ORCHIDS
INSECTS,

TREE vol. 15, no. 4 April 2000

REVIEWS



Ecology, 77(4), 1996, pp. 1043-1060
© 1996 by the Ecological Society of America

GENERALIZATION IN POLLINATION SYSTEMS, AND WHY IT MATTERS¹

Nickolas M. Waser,^{2,3} Lars Chittka,^{4,5} Mary V. Price,^{2,3}
Neal M. Williams,⁴ and Jeff Ollerton⁶

Generalization versus specialization in plant pollination systems

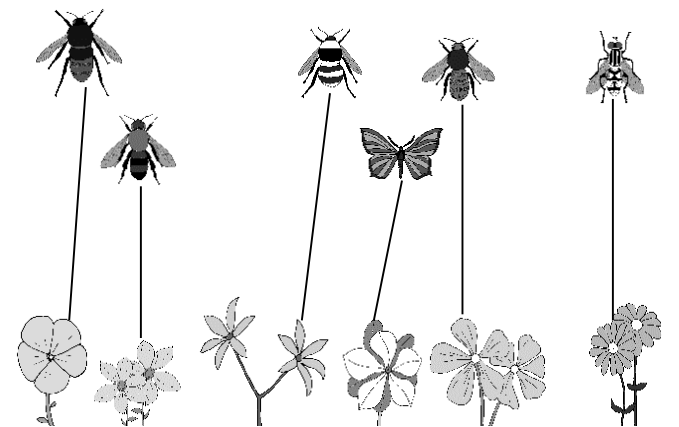
Steven D. Johnson and Kim E. Steiner

Journal of Ecology 1996,
84, 767-769

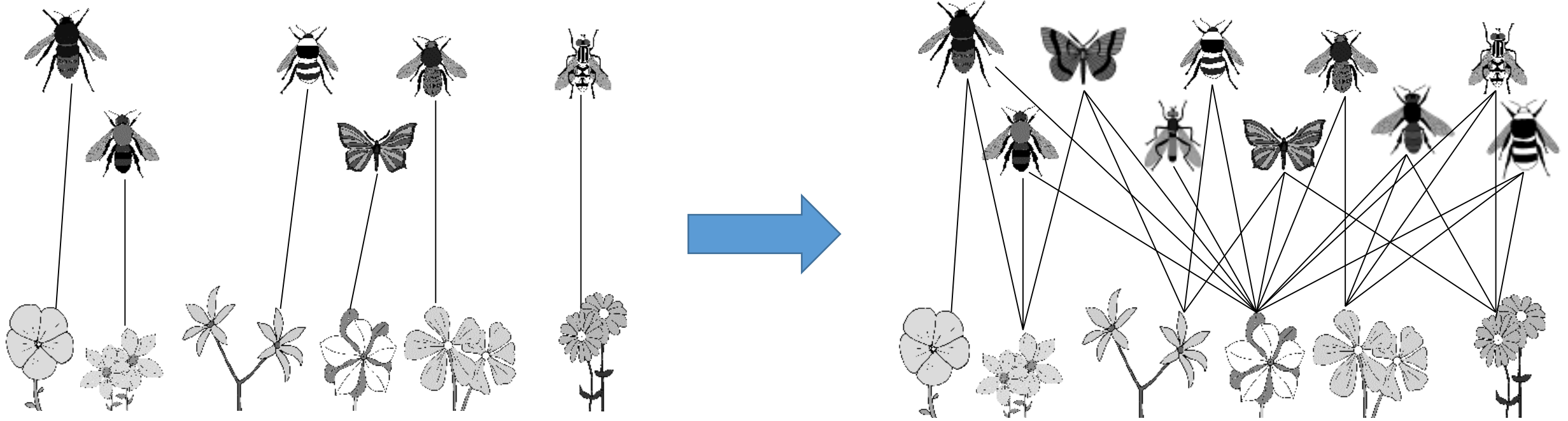
The flowers of each species
structure, color, and
nating agent
together
more fu

Reconciling ecological processes with phylogenetic patterns: the apparent paradox of plant-pollinator

Journal of Ecology 1993:476



Réseaux plantes-pollinisateurs

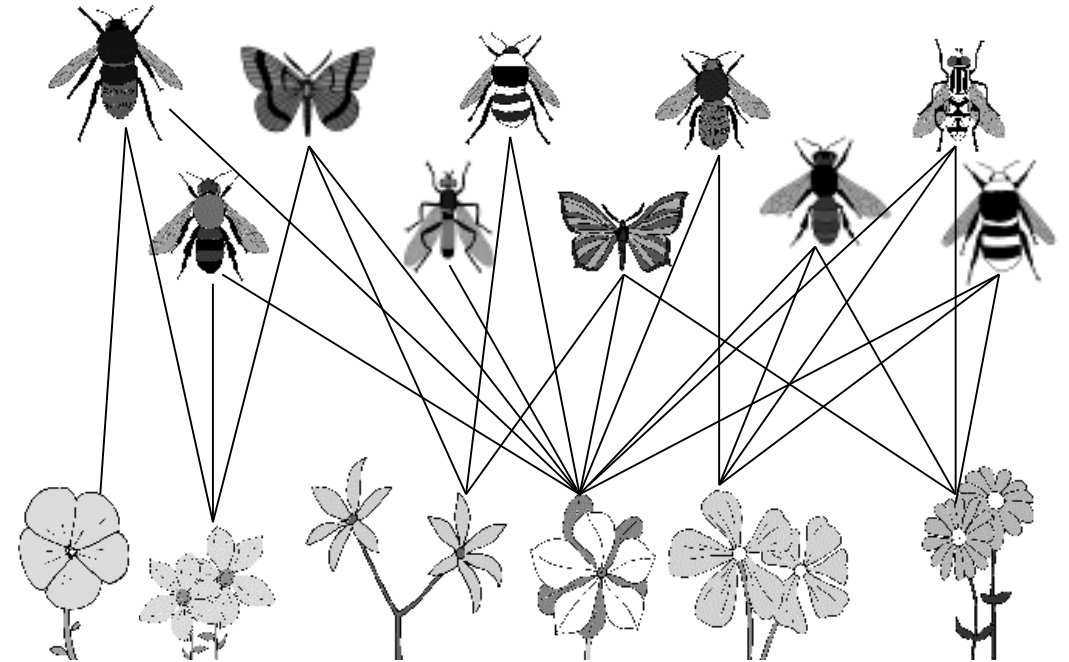


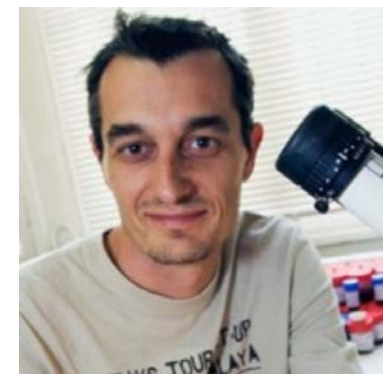
Réseaux plantes-pollinisateurs

Dynamiques spatiales et temporelles

Interdépendances entre espèces, le cas de la pollinisation des cultures

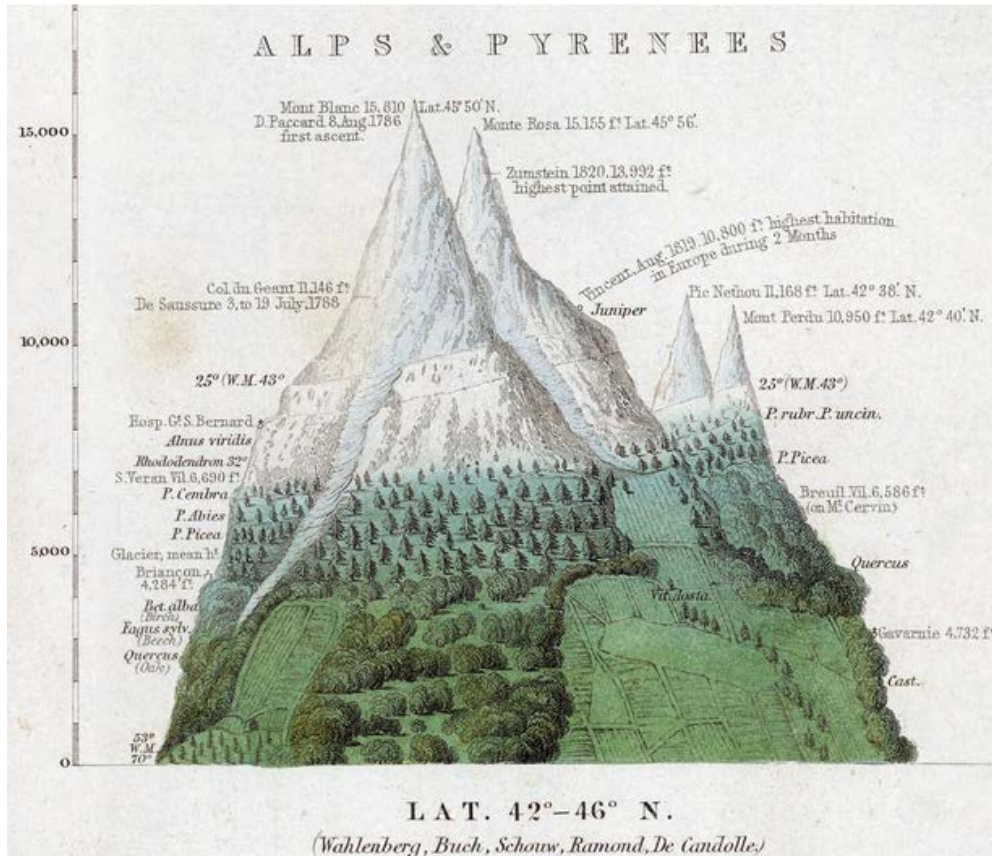
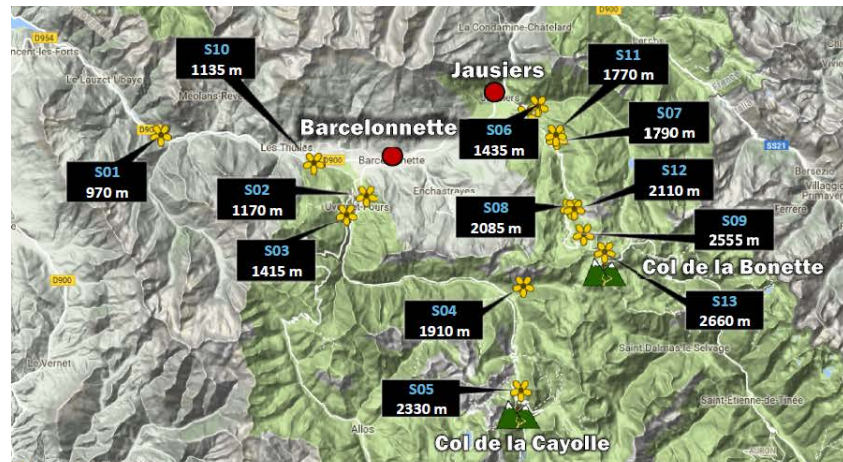
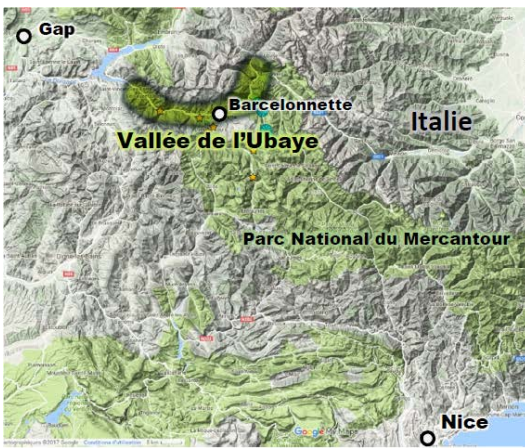
Propagation de perturbations, le cas de la pollution lumineuse





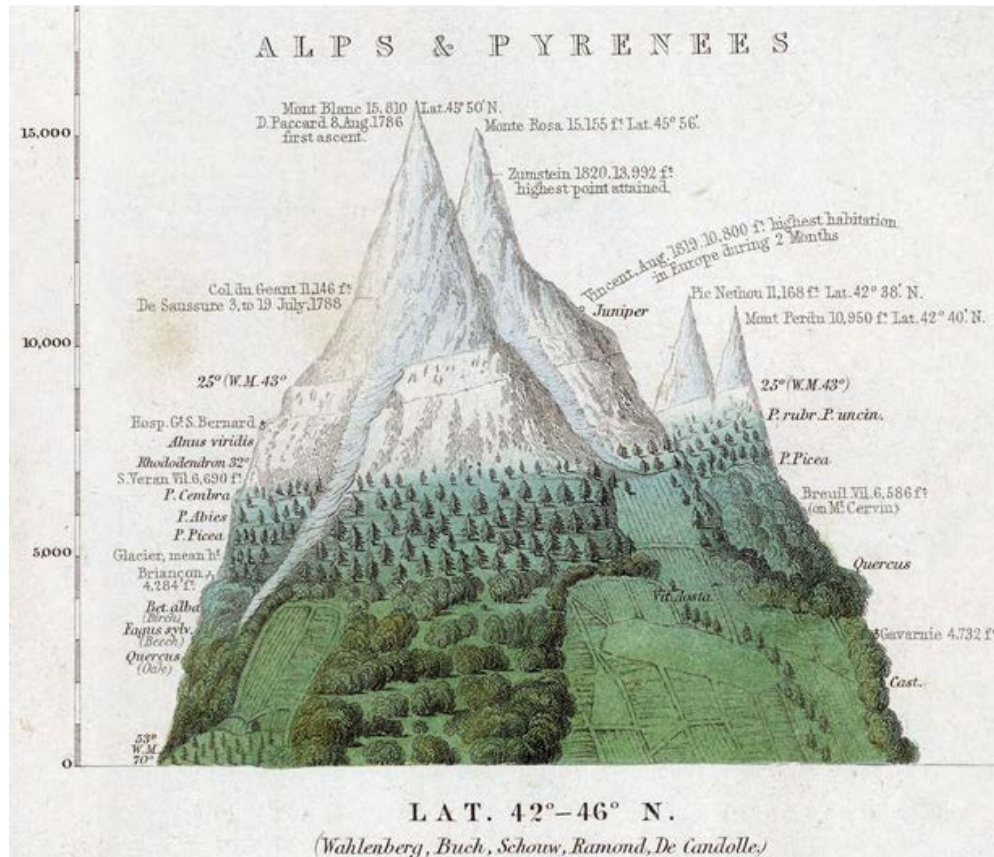
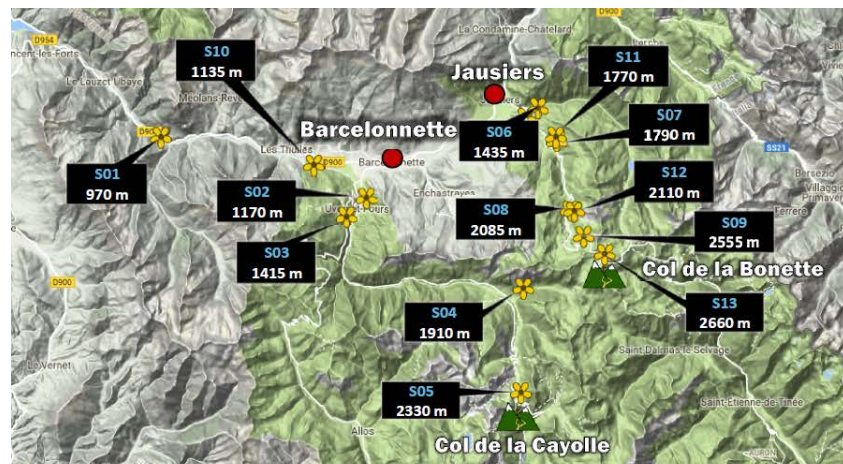
Claire Villemant Christophe Daugeron Vincent Lefebvre

Variations spatiales et temporelles des communautés plantes-pollinisateurs



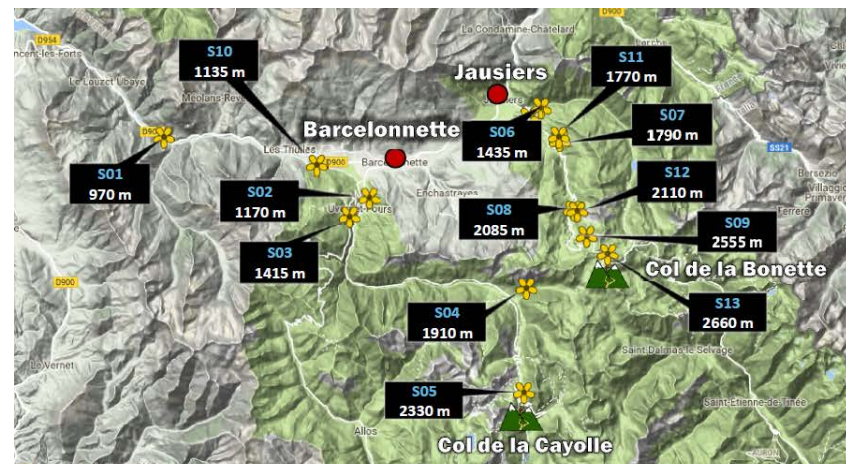
2 600 mètres
 $\Delta \sim 11^\circ\text{C}$
 900 mètres

Alexander von Humbolt

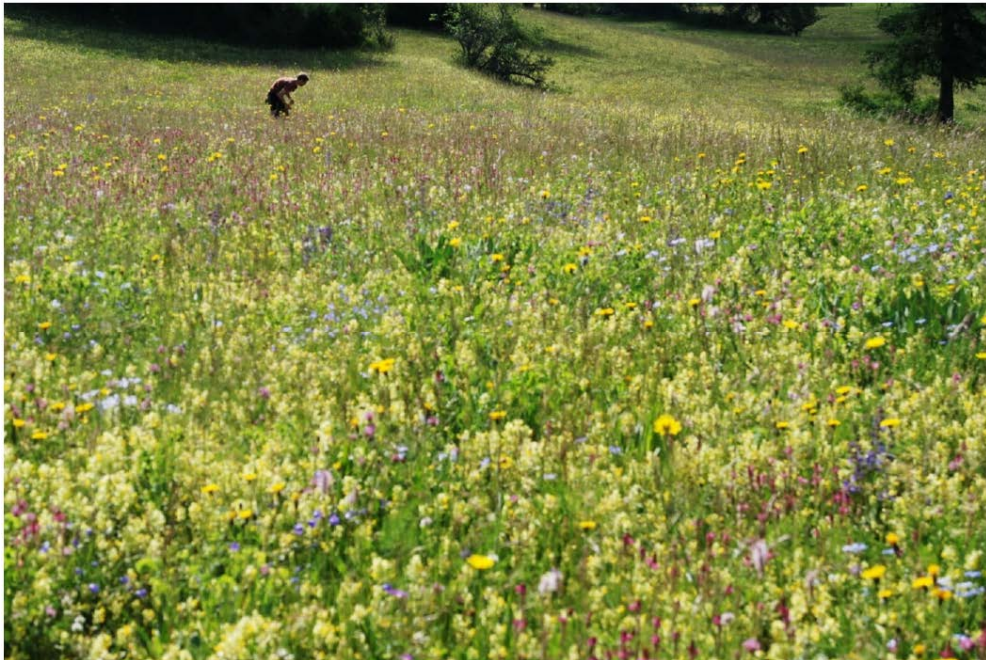


2 600 mètres
 $\Delta \sim 11^{\circ}\text{C}$
 900 mètres

Alexander von Humboldt



Echantillonnage de 13 prairies, de mai à juillet toutes les 2 semaines, en 2014 et 2015.
4 transects de 60 mètres de long par session.



(b)



5502 interactions entres plantes et pollinisateurs impliquant :

- 521 espèces de pollinisateurs, appartenant à 206 genres de 69 familles
- 118 espèces de plantes appartenant à 83 genres de 18 familles



Hymenoptera
28%



Diptera
49%

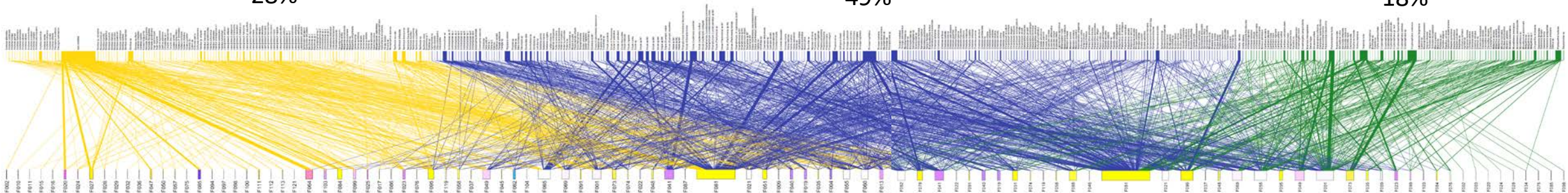


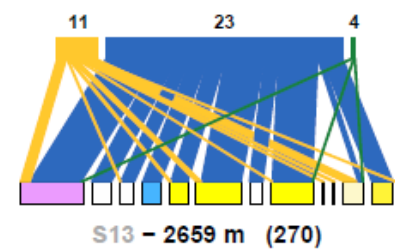
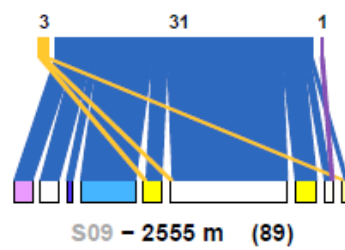
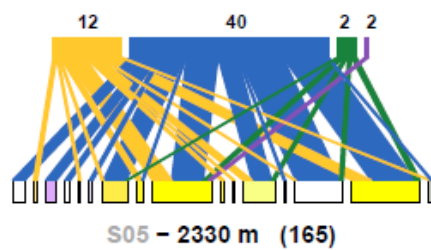
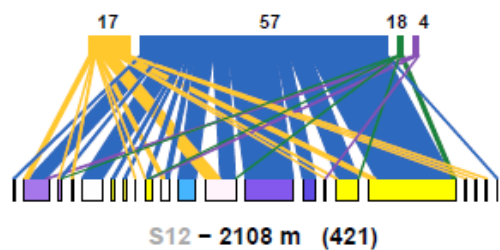
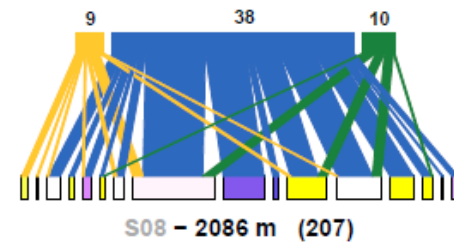
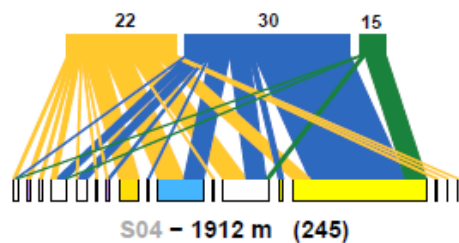
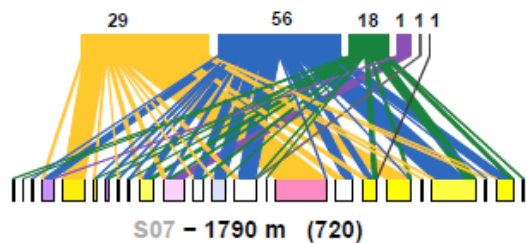
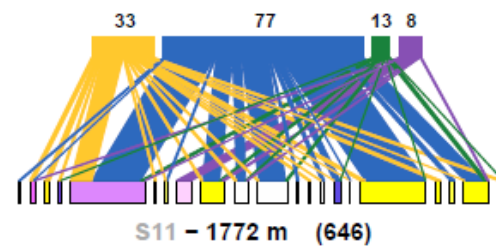
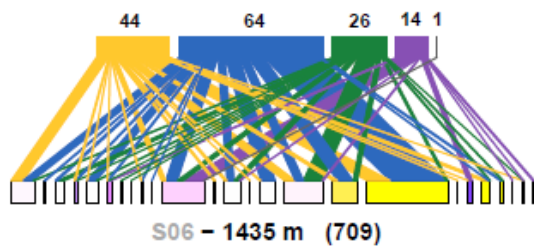
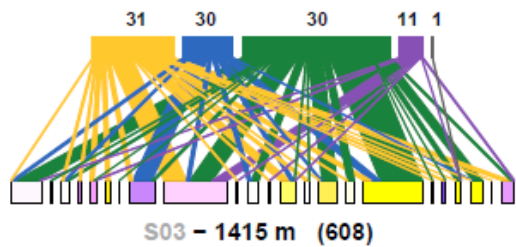
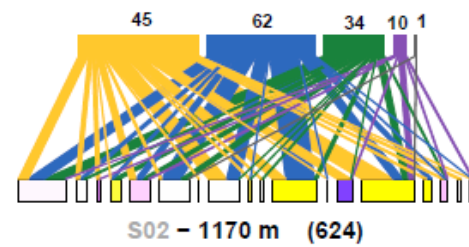
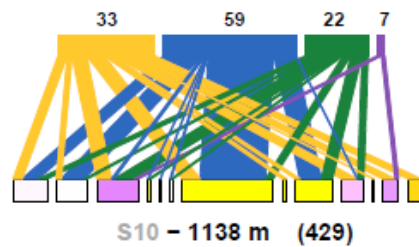
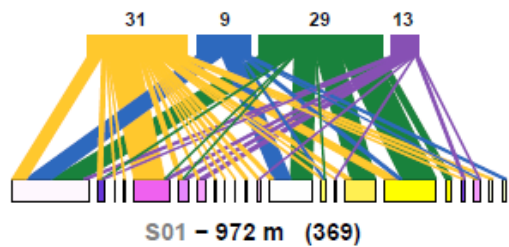
Coleoptera
18%



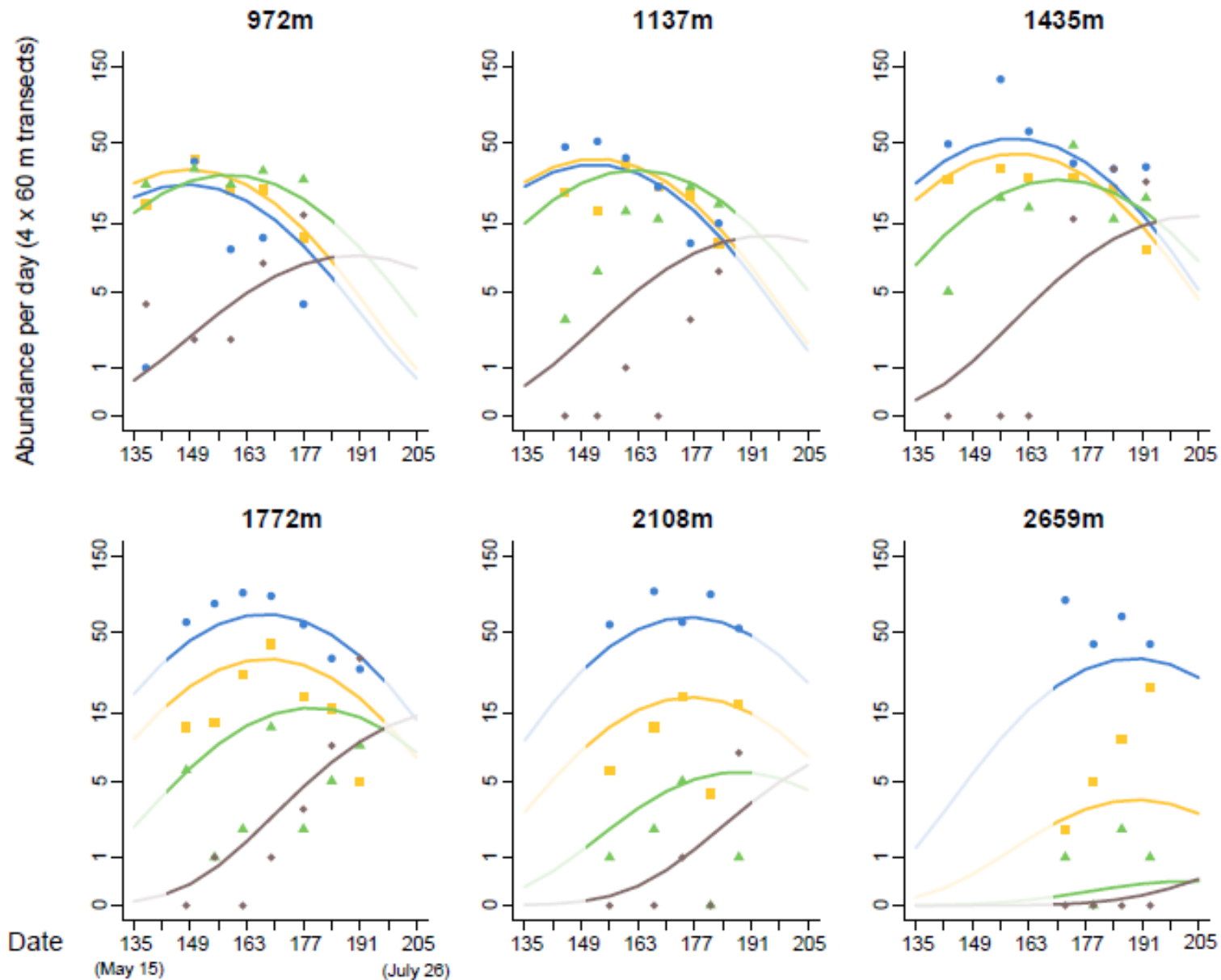
Lepidoptera
5%

Hymenoptera-Diptera





Insect order ■ Hymenoptera ■ Diptera ■ Coleoptera ■ Lepidoptera ■ Heteroptera ■ Neuroptera



Insect order



Hymenoptera



Diptera



Coleoptera



Lepidoptera

Zaphne ambigua



J. Lindsey

Musca autumnalis



J. Lindsey

Empis sp.

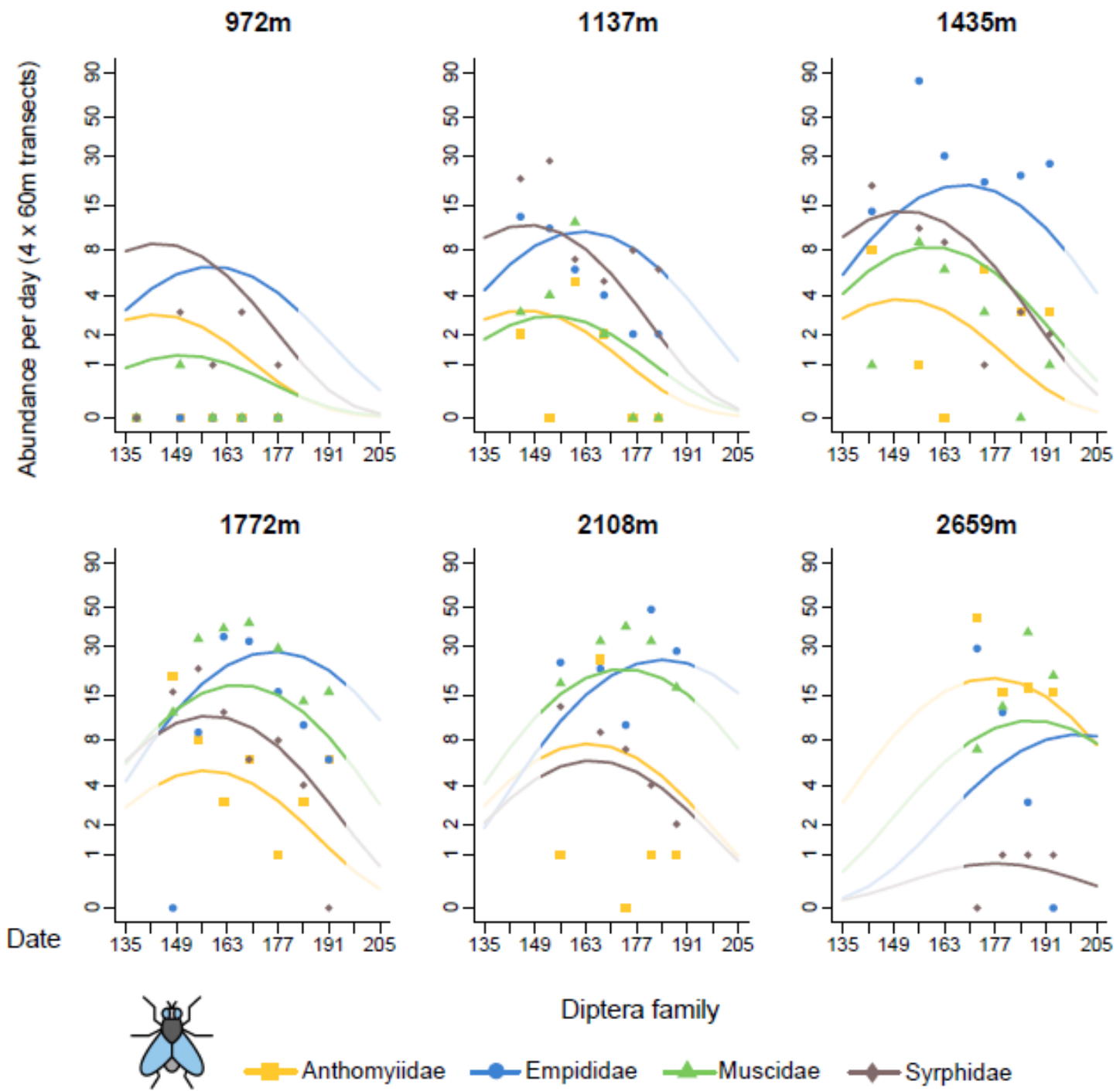


V. Lefebvre

Episyrphus balteatus



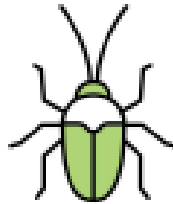
Alvesgaspar



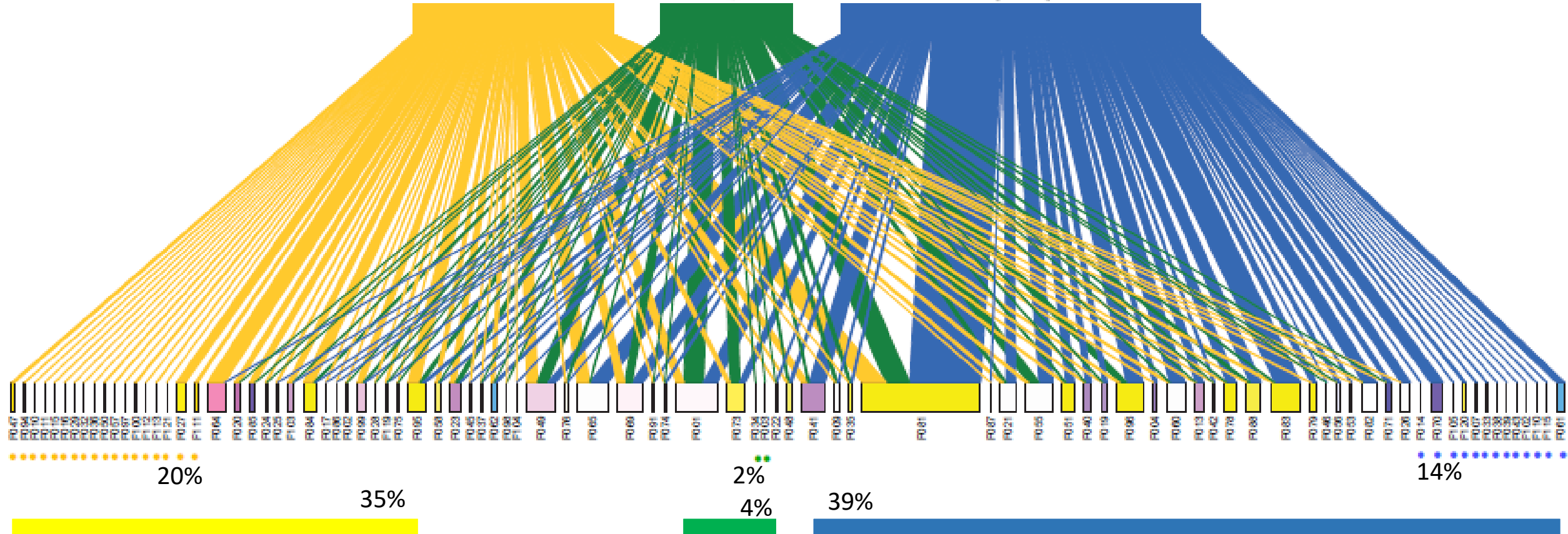
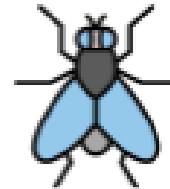
Hymenoptera



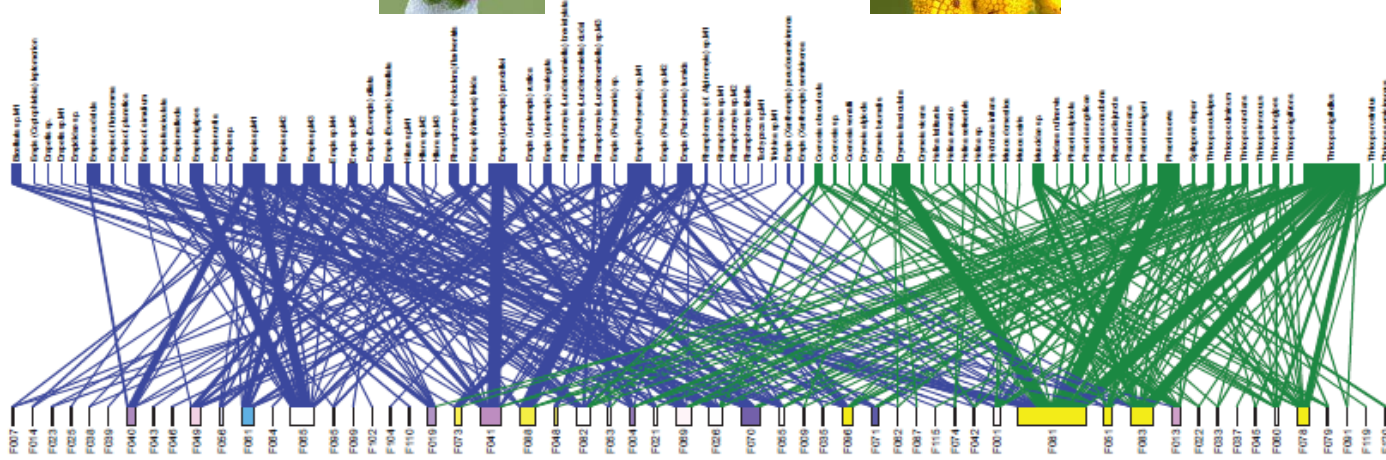
Coleoptera



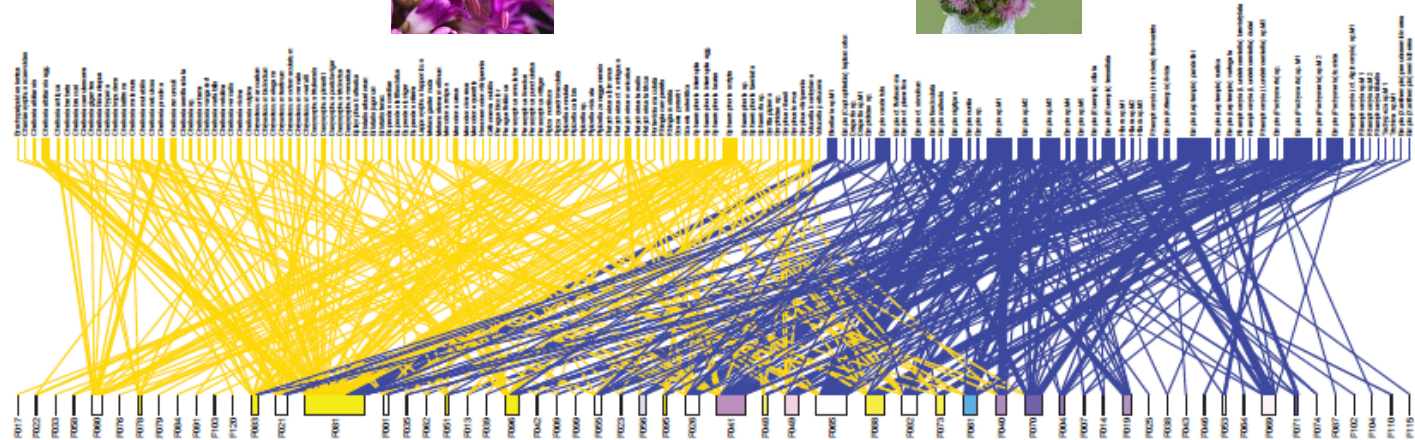
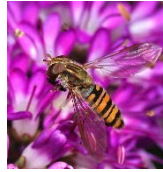
Diptera



Empididae-Muscidae

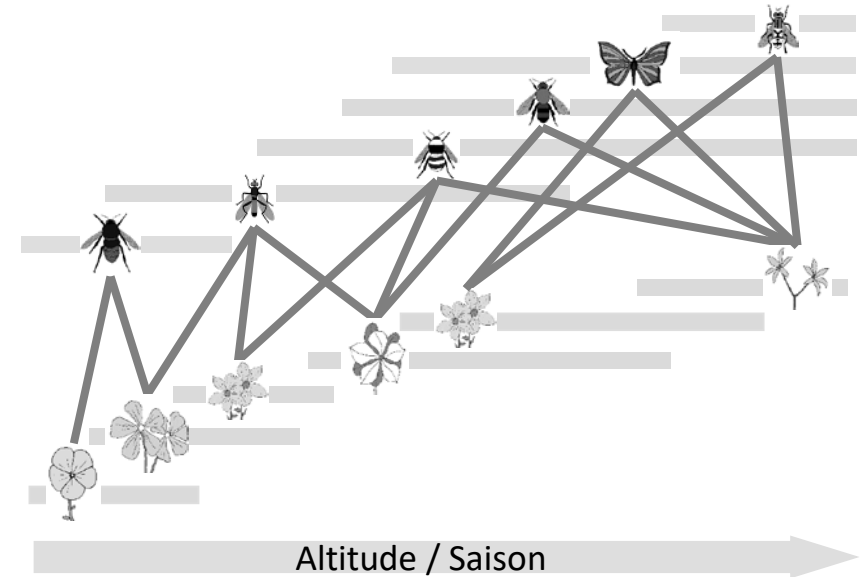


Syrphidae-Empididae

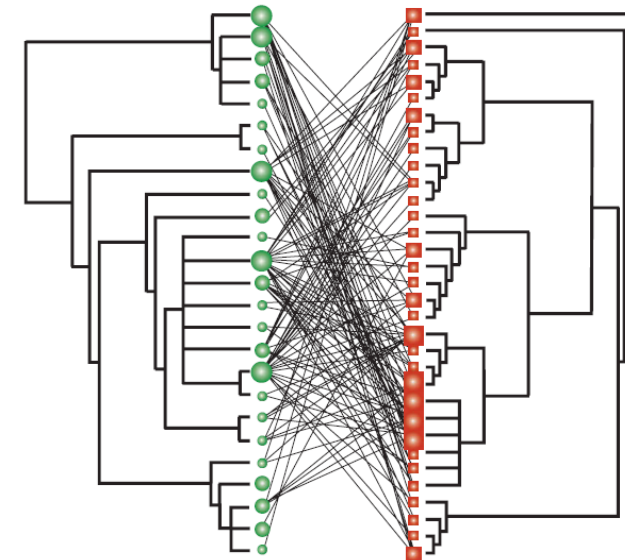


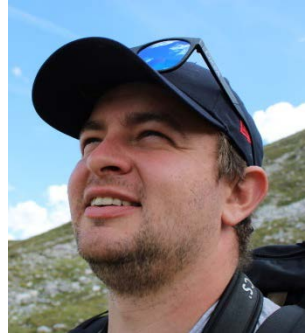
- **Les réseaux plantes-pollinisateurs sont dynamiques**

- Ils varient dans l'espace, en fonction des conditions environnementales
- Ils varient dans le temps, au cours de la saison



- **Les interactions entre plantes et pollinisateurs sont structurées par groupe taxonomique**





Ludovic Crochard



Mathilde Baude



Romain Julliard



Sabrina Gaba



Vincent Bretagnolle

Dépendance de la pollinisation des cultures et envers les « mauvaises herbes »



2/3 des plantes cultivées dépendent
de la pollinisation animale

1/3 de la production agricole
dépend de la pollinisation animale

Klein et al (2007)

Parmi ces cultures certaines ont des
floraison massives

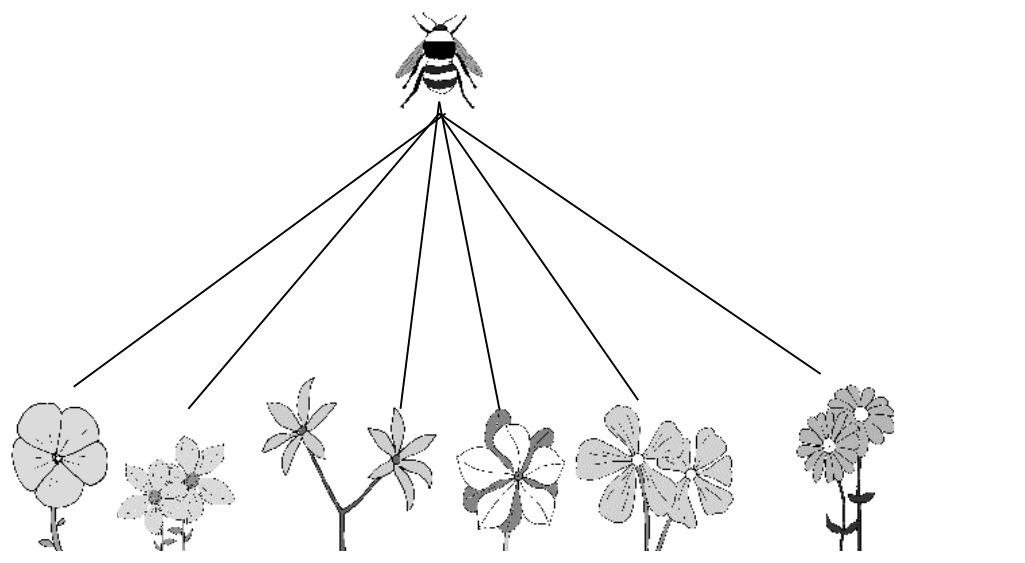


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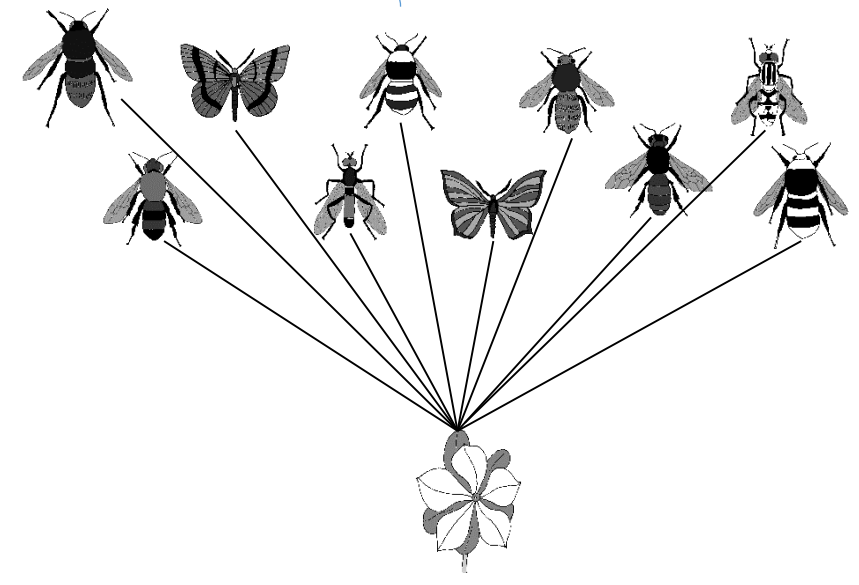
Année précédente

Année en cours

reproduction



adventices
du colza colza adventices
du tournesol tournesol



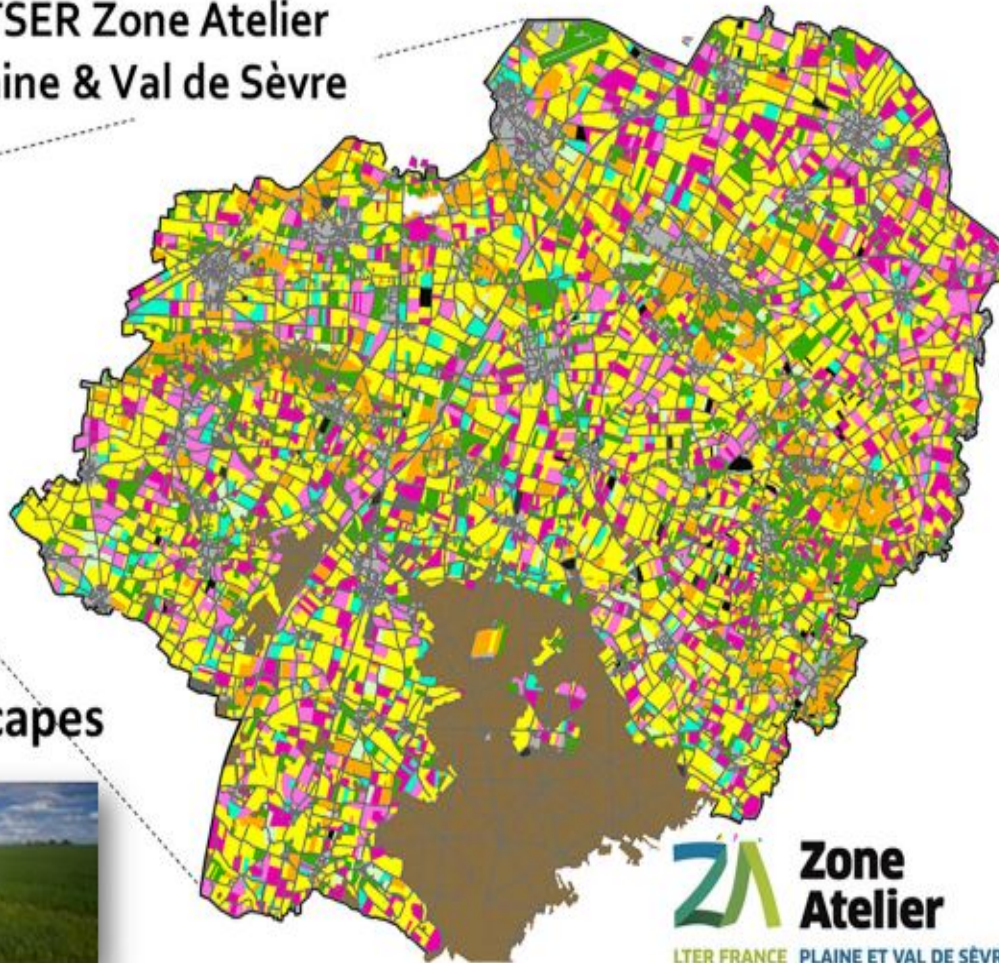
colza



FRANCE

Nouvelle Aquitaine

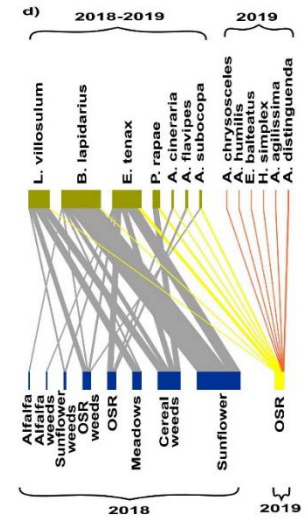
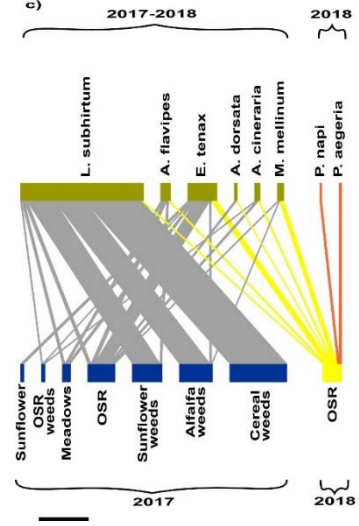
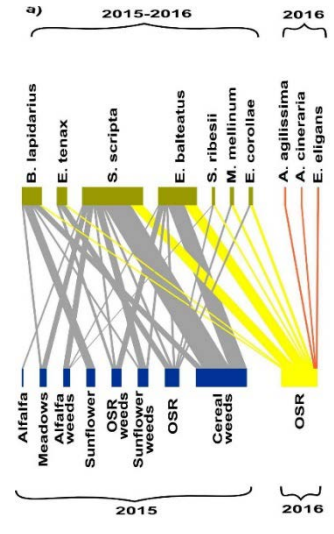
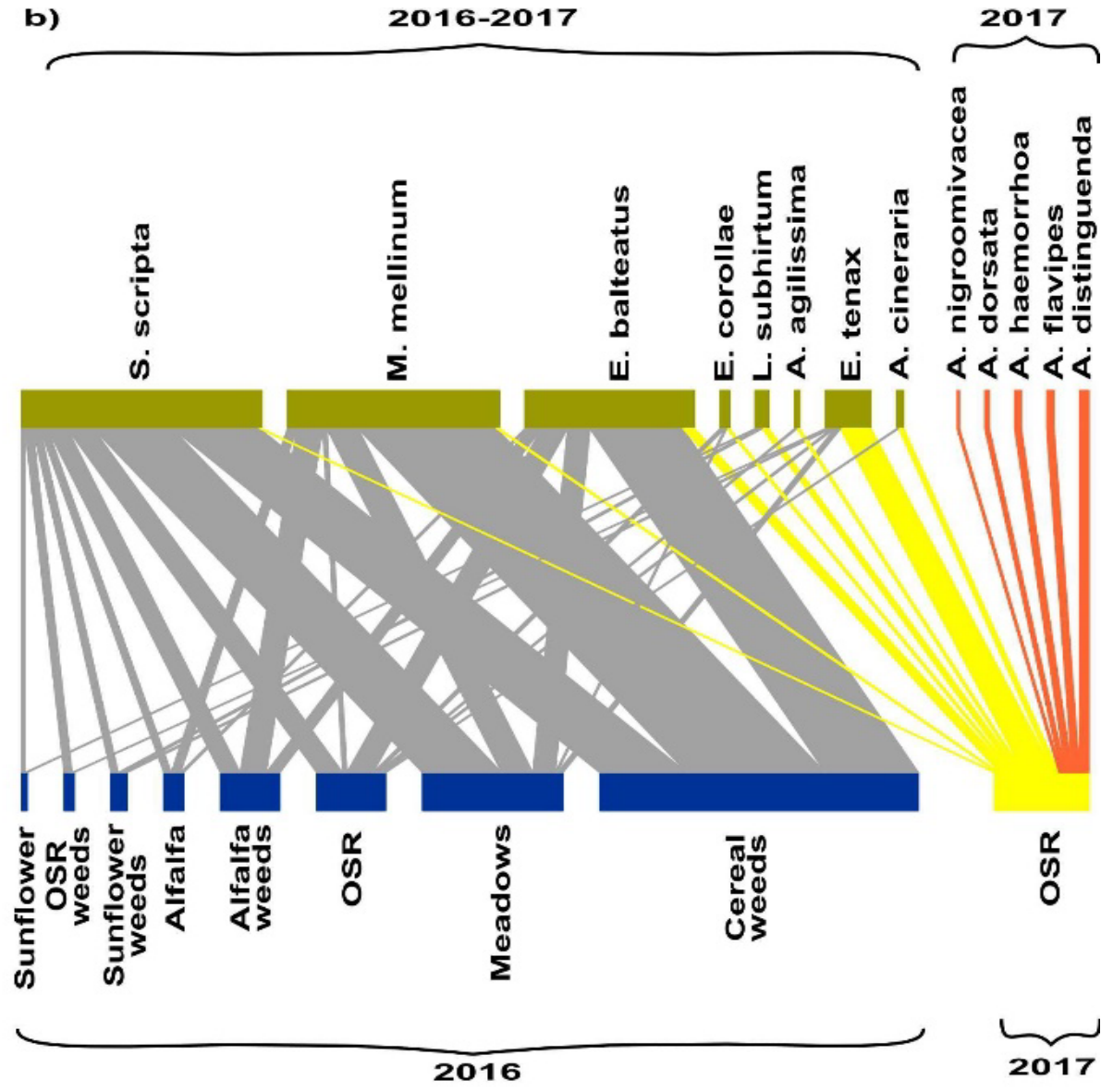
LTSER Zone Atelier
Plaine & Val de Sèvre

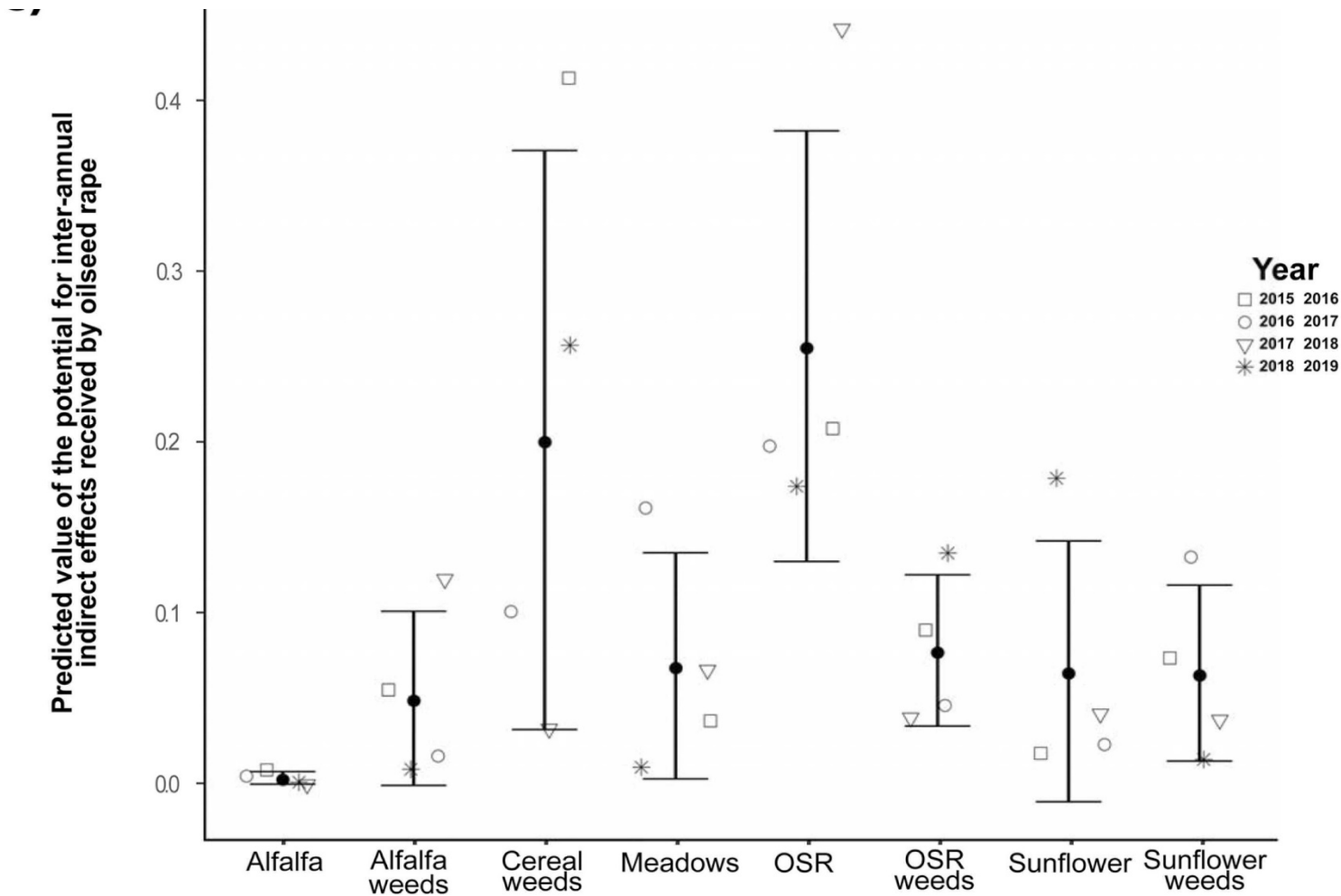
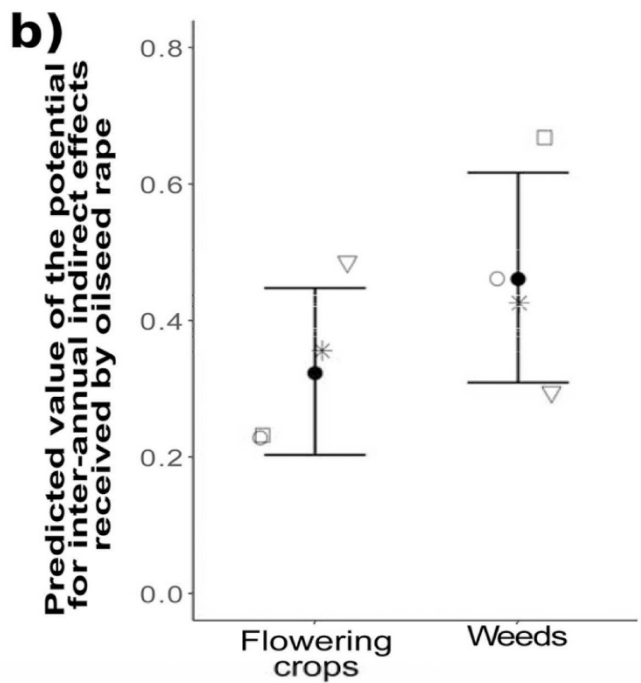
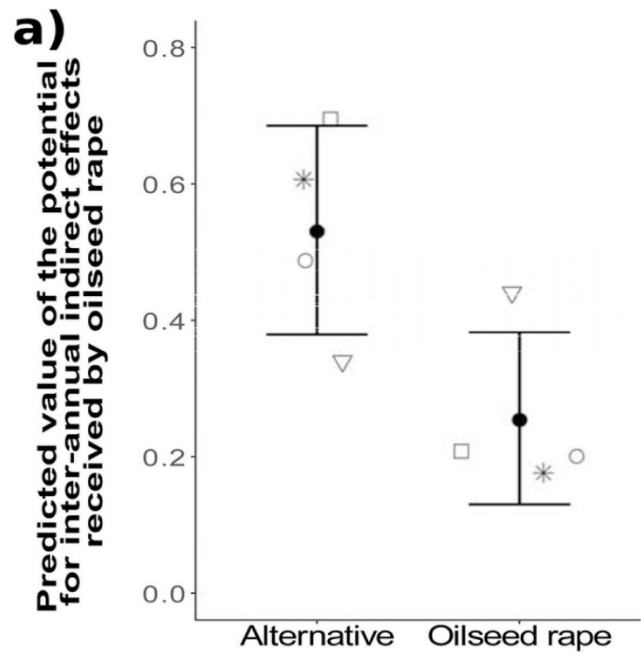


Typical landscapes

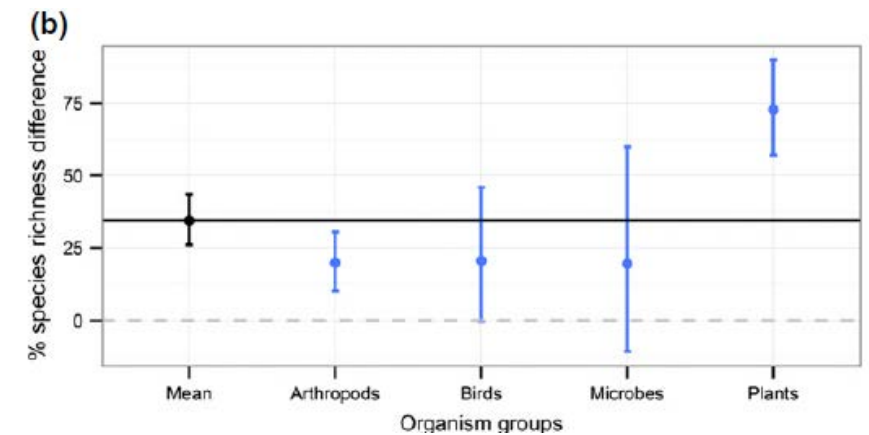
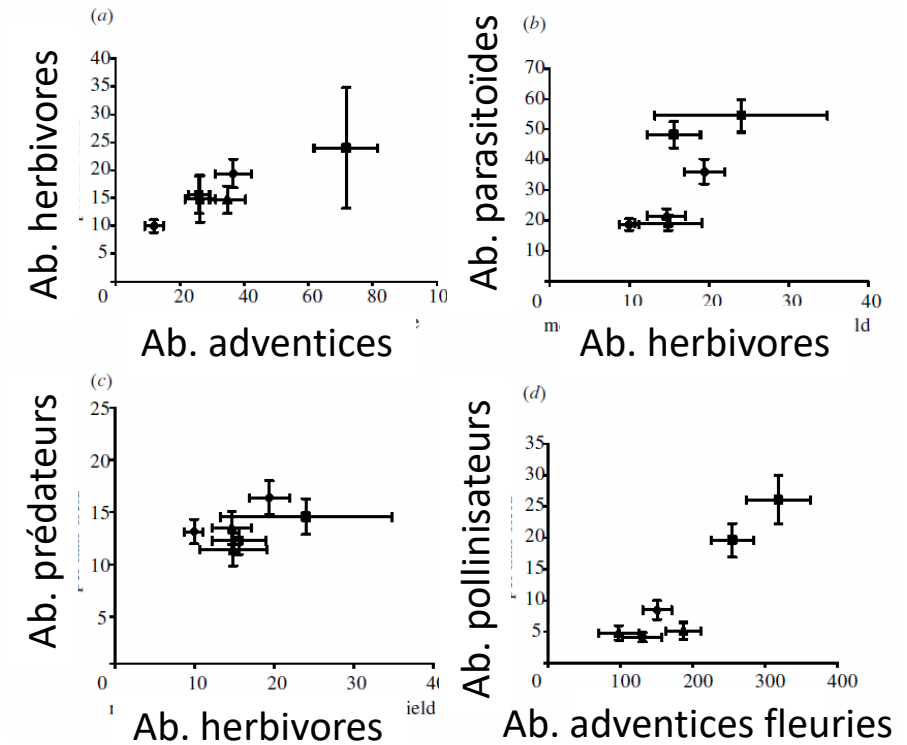
ZA Zone
Atelier
LTER FRANCE PLAINE ET VAL DE SEVRE

- ~400 km² dont 75% de surface cultivée
- Céréales, colza, luzerne, prairies, tournesol
- Suivi des interaction plantes pollinisateurs dans ~150 parcelles par an entre 2015 et 2018
- Seules les abeilles et les syrphes sont étudiés





- La pollinisation du colza dépend des ressources alimentaires produites par les plantes adventices.
- Les pratiques agricoles dans les champs de céréales affectent la pollinisation des cultures qui en ont besoin





Eva Knop



Remo Ryser



Leana Zoller



Maurin Hörler



Christopher Gerpe



Myles Menz

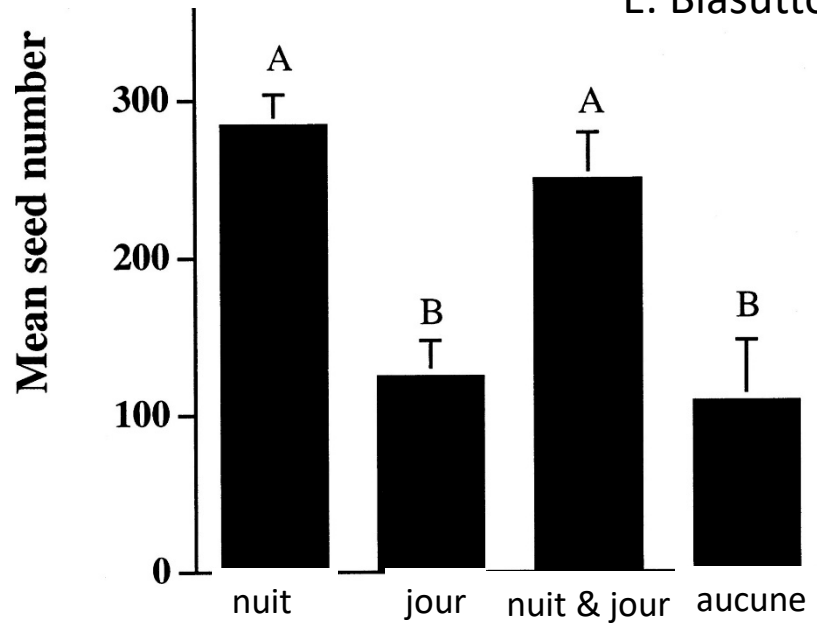
Pollinisation nocturne, pollution lumineuse et propagation des perturbations

Knop, E., Gerpe, C., Ryser, R., Hofmann, F., Menz, M. H., Trösch, S., Ursenbacher S., Zoller L. & Fontaine, C. (2018). Rush hours in flower visitors over a day–night cycle. *Insect Conservation and Diversity*, 11(3), 267-275.

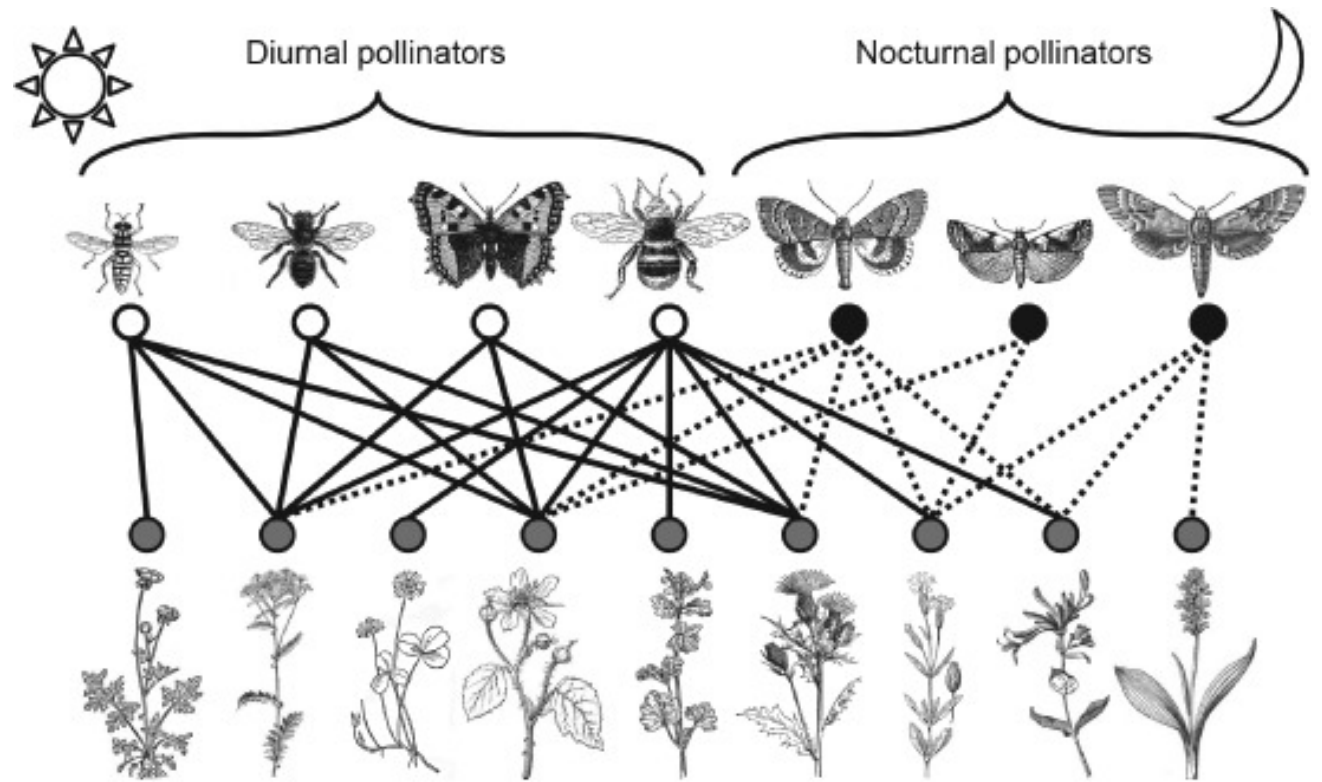
Knop, E., Zoller, L., Ryser, R., Gerpe, C., Hörler, M., & Fontaine, C. (2017). Artificial light at night as a new threat to pollination. *Nature*, 548(7666), 206-209.



E. Blasutto



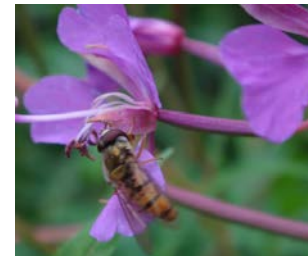
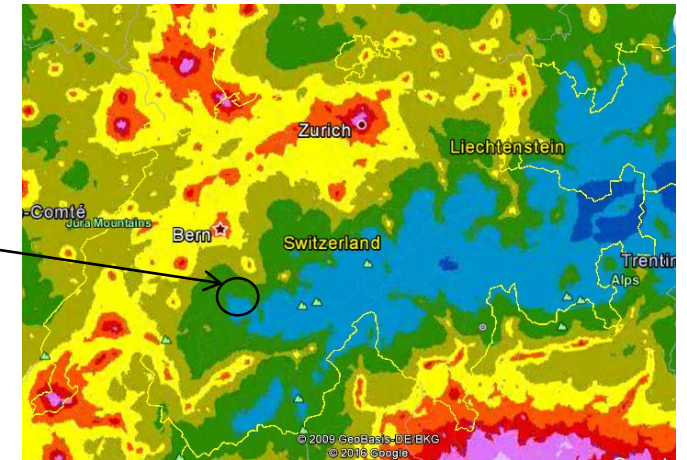
Young (2002) $N = 43$ $N = 22$ $N = 28$ $N = 10$

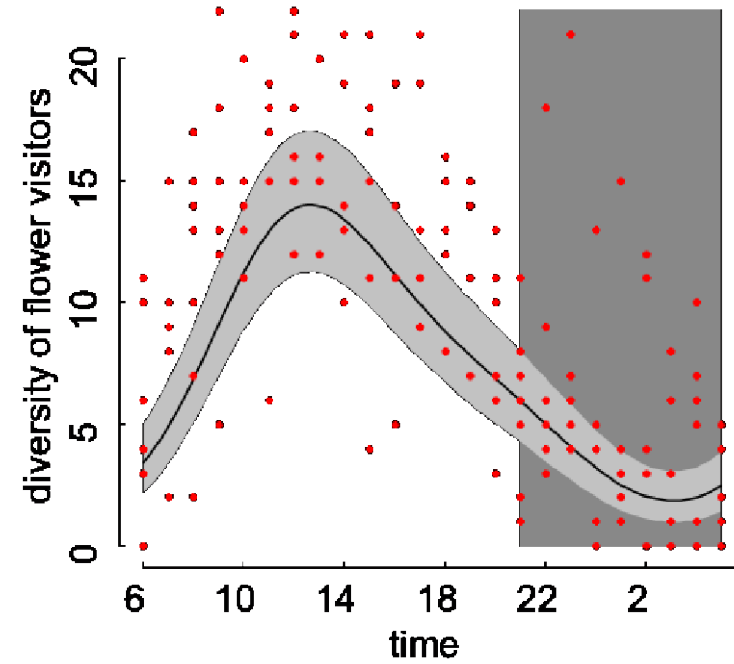
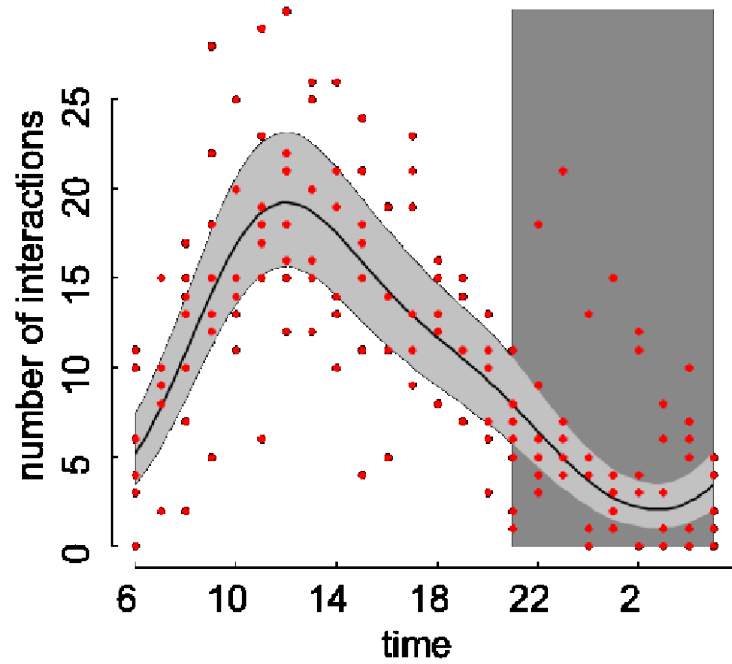


McGregor et al. (2015)

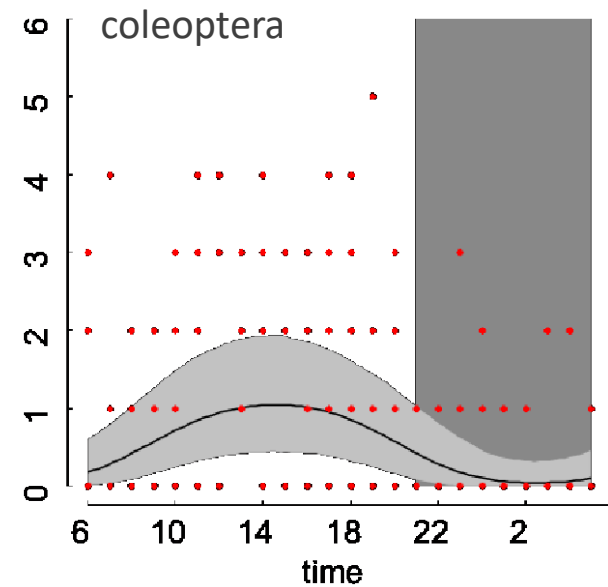
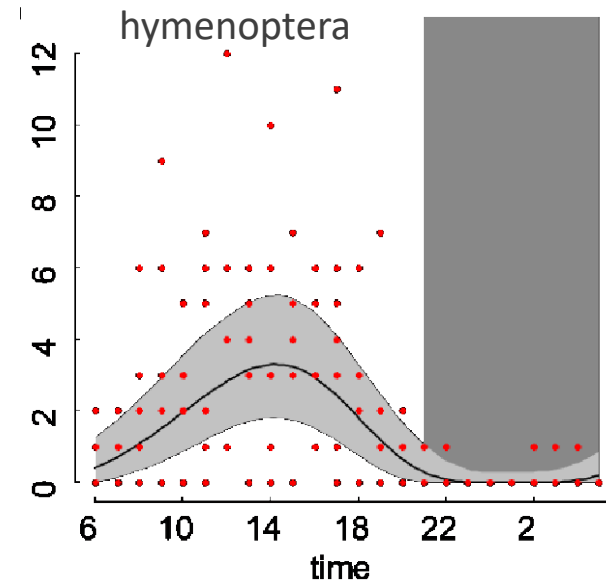
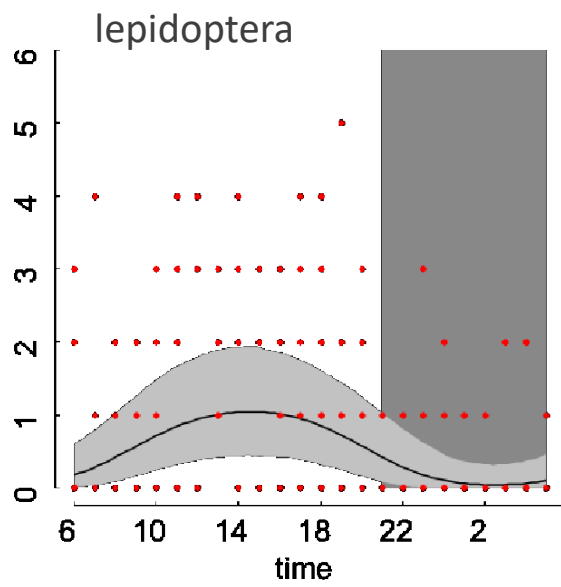
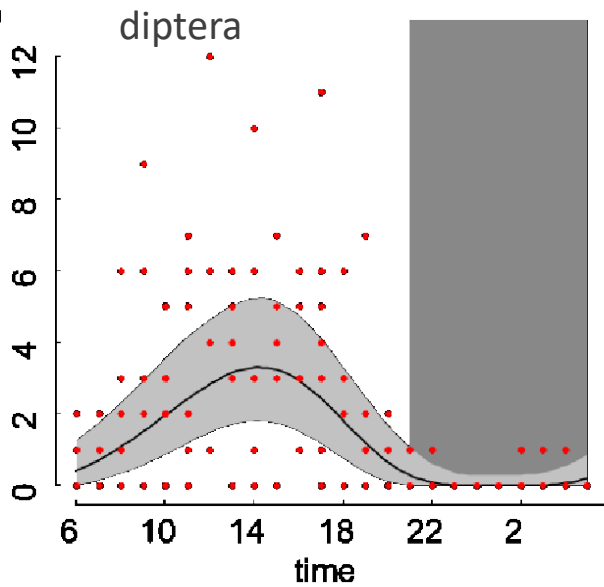
4 prairies localisées dans le canton de Bern

1 transect de 50 mètres échantillonné toutes les 30 minutes pendant 24 heures, 2 fois par site, en juillet 2014.





79.5% de visites diurnes et 20.5% de visites nocturnes





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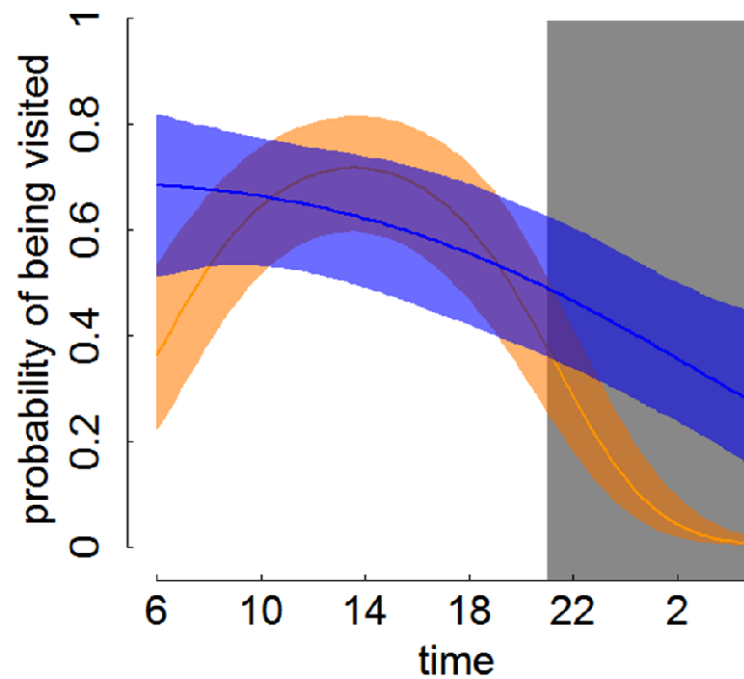


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Centaurea sp.
Daucus carota
Erigeron annuus
Heracleum sphondylium

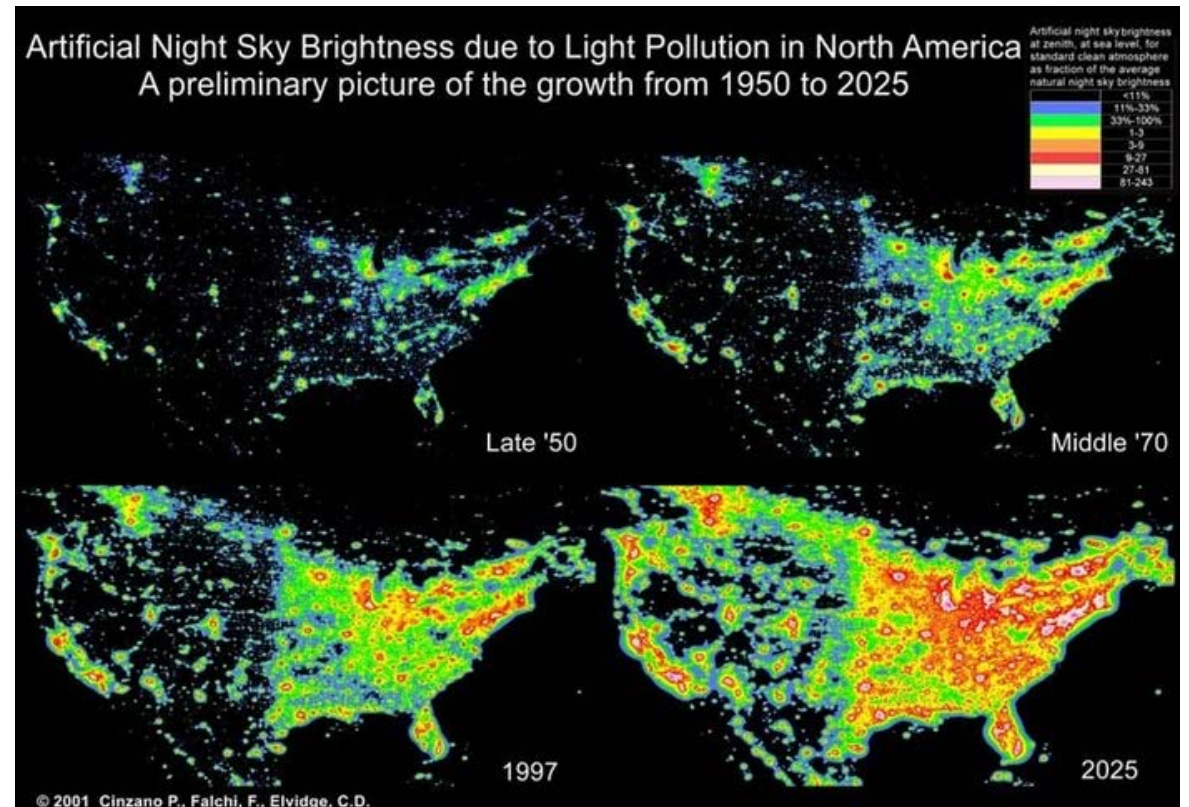
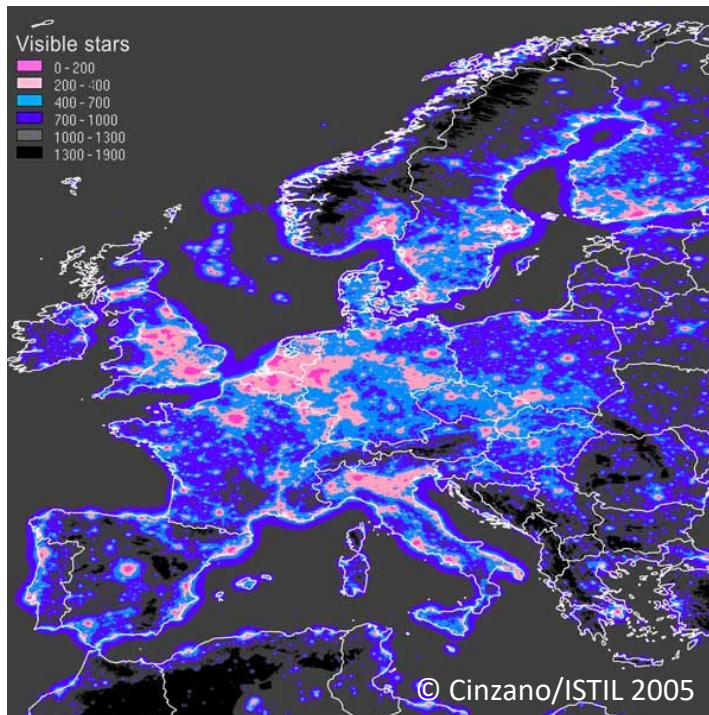


Aruncus dioicus
Cirsium oleraceum
Valeriana officinalis





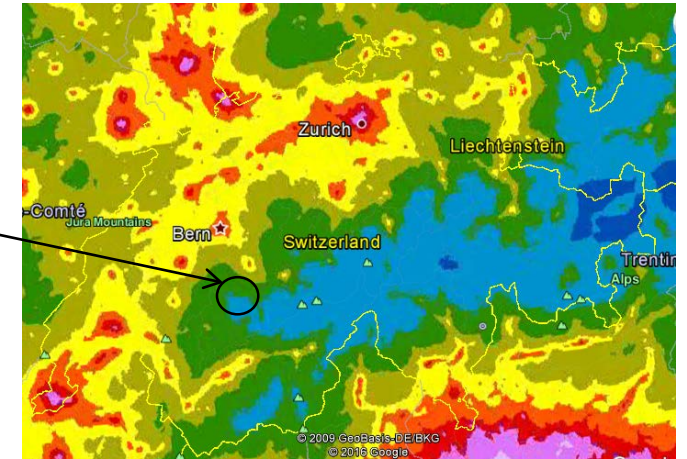
- La lumière artificielle nocturne affecte les papillons de nuits
- La pollution lumineuse affecte 99% des européens
- La pollution lumineuse augmente de 6% par an à l'échelle mondiale



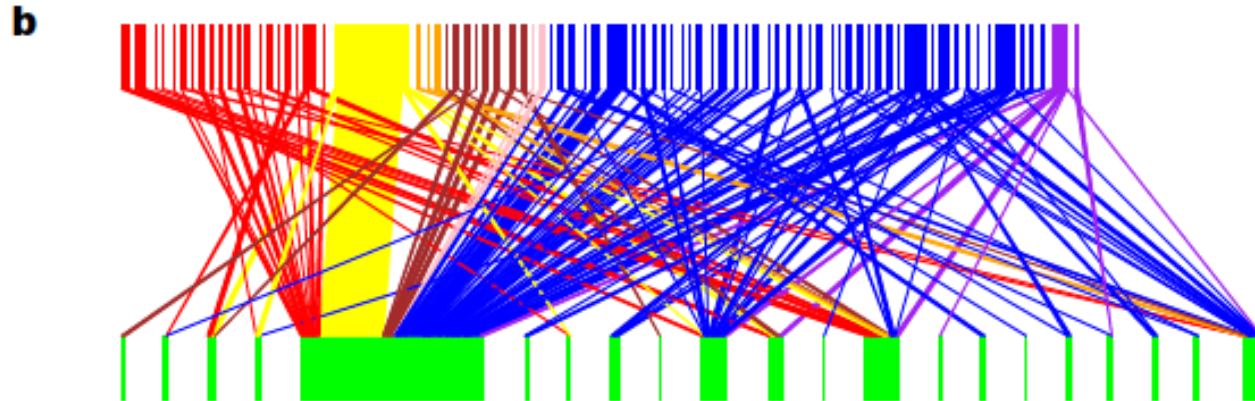
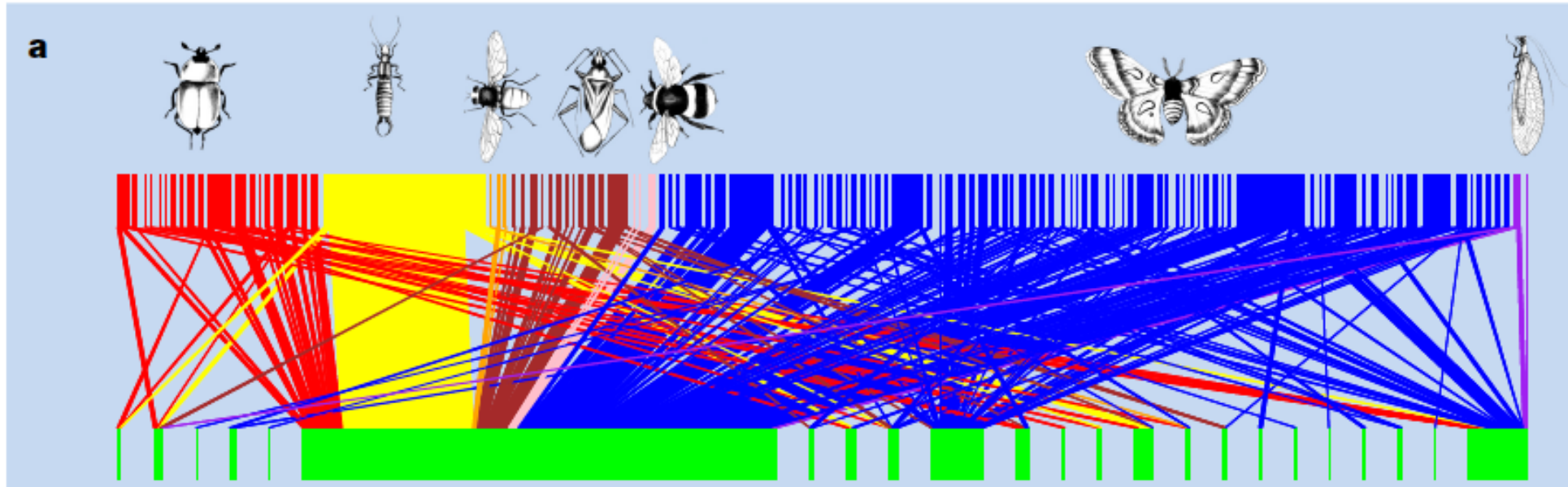
7 prairies localisées dans le canton de Bern

2 sites par prairie éloignés de 500 m équipés d'un lampadaire

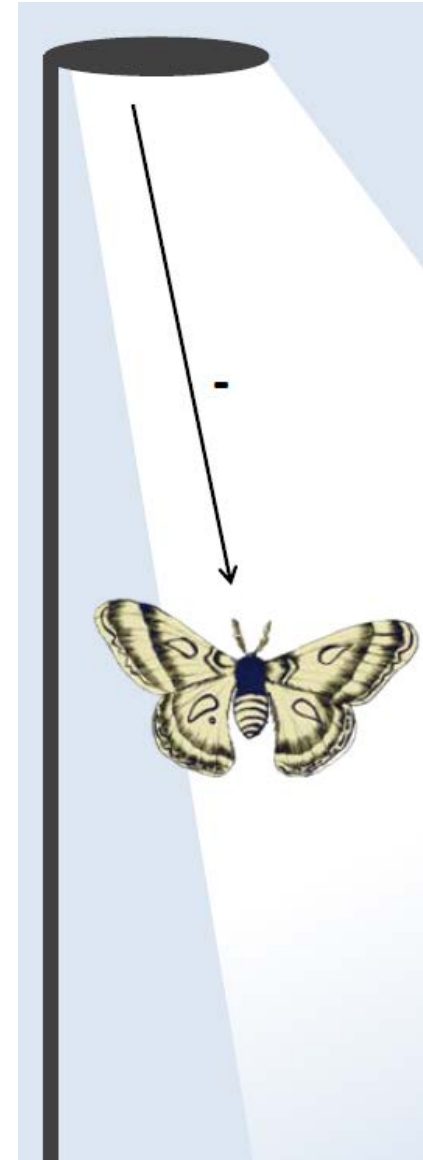
1 transect de 100 mètres échantillonné toutes les 30 minutes la nuit, toutes les 2 semaines entre juin et septembre 2015

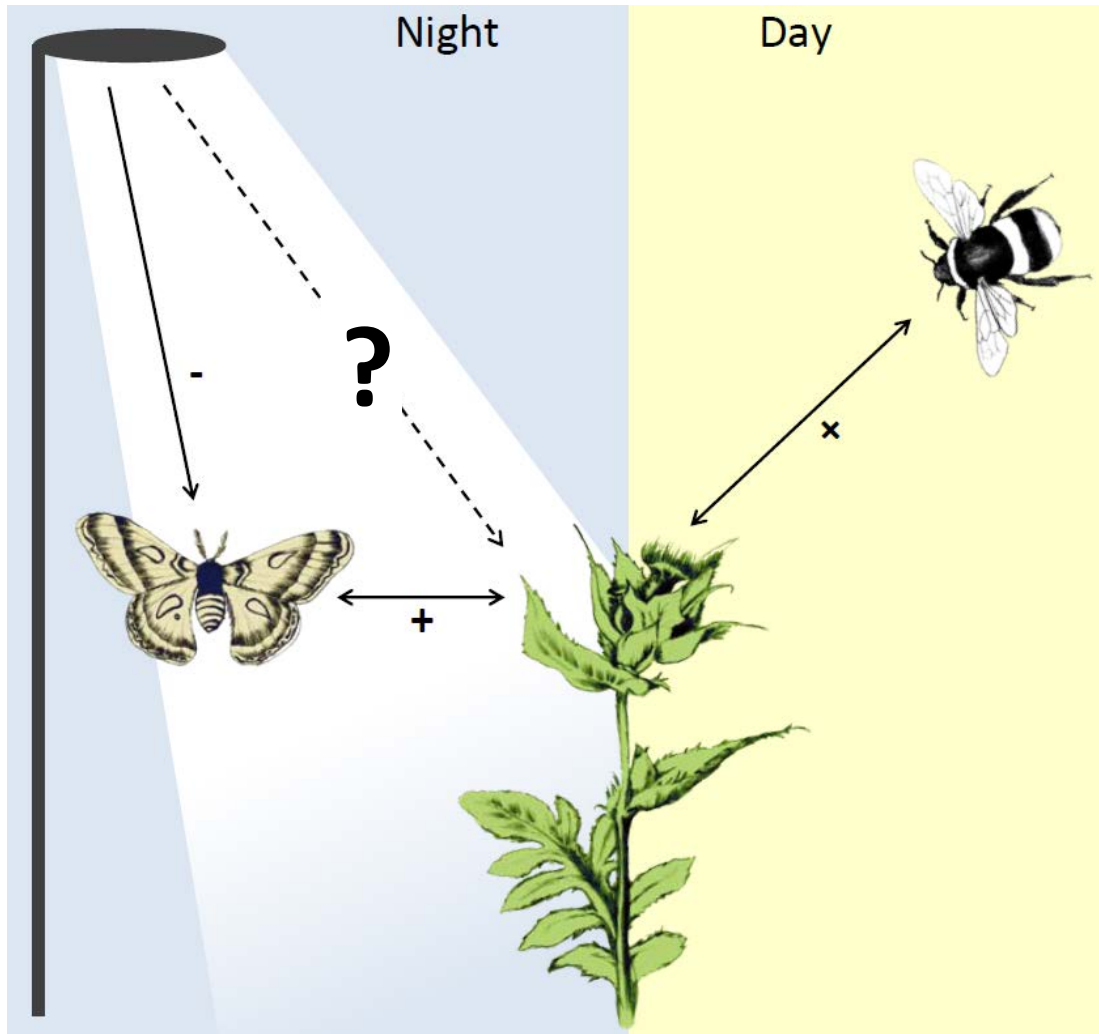


site non éclairé



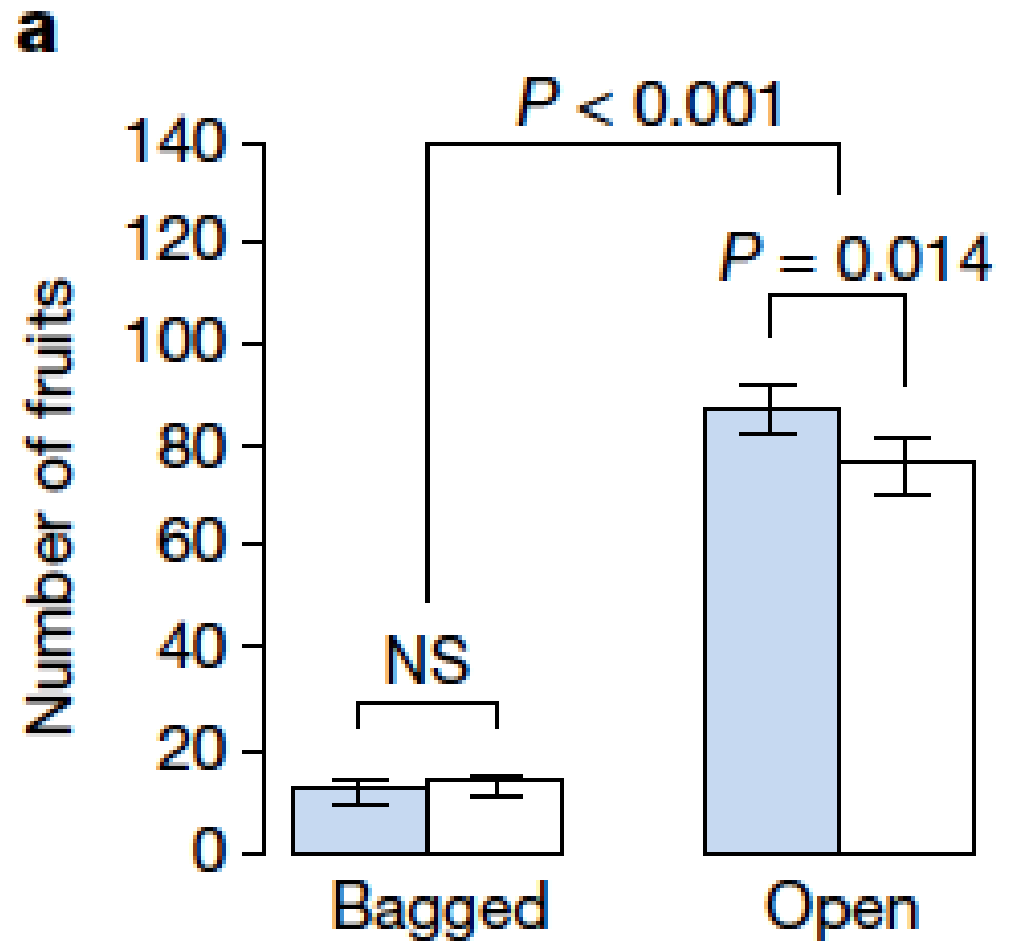
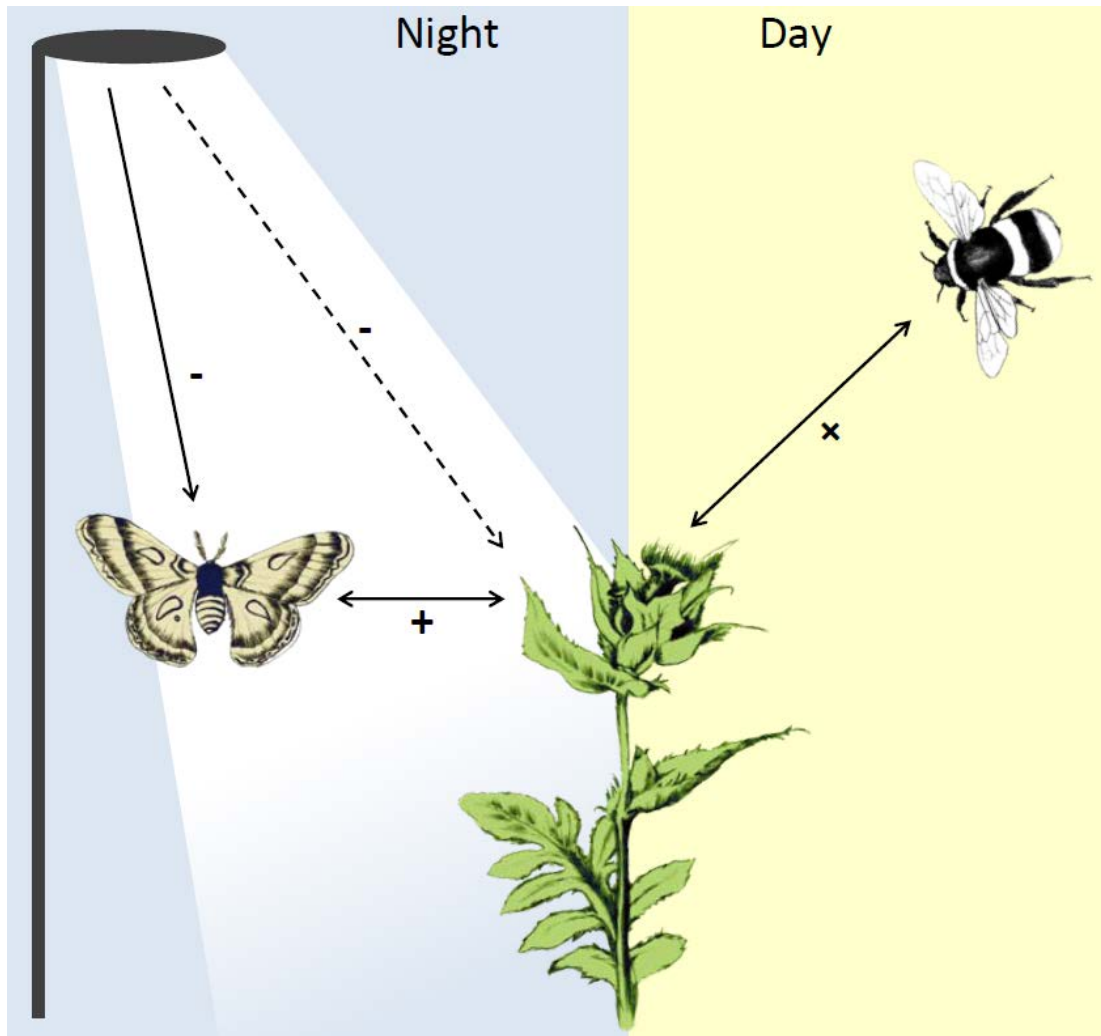
site éclairé



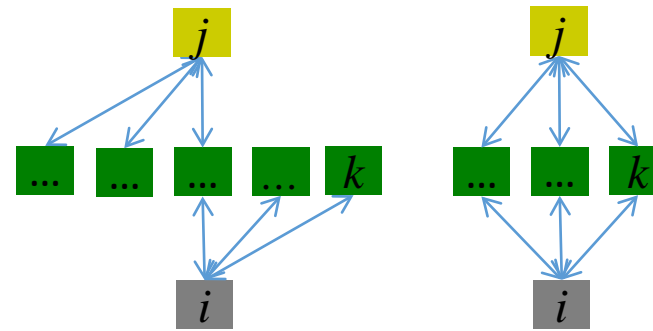
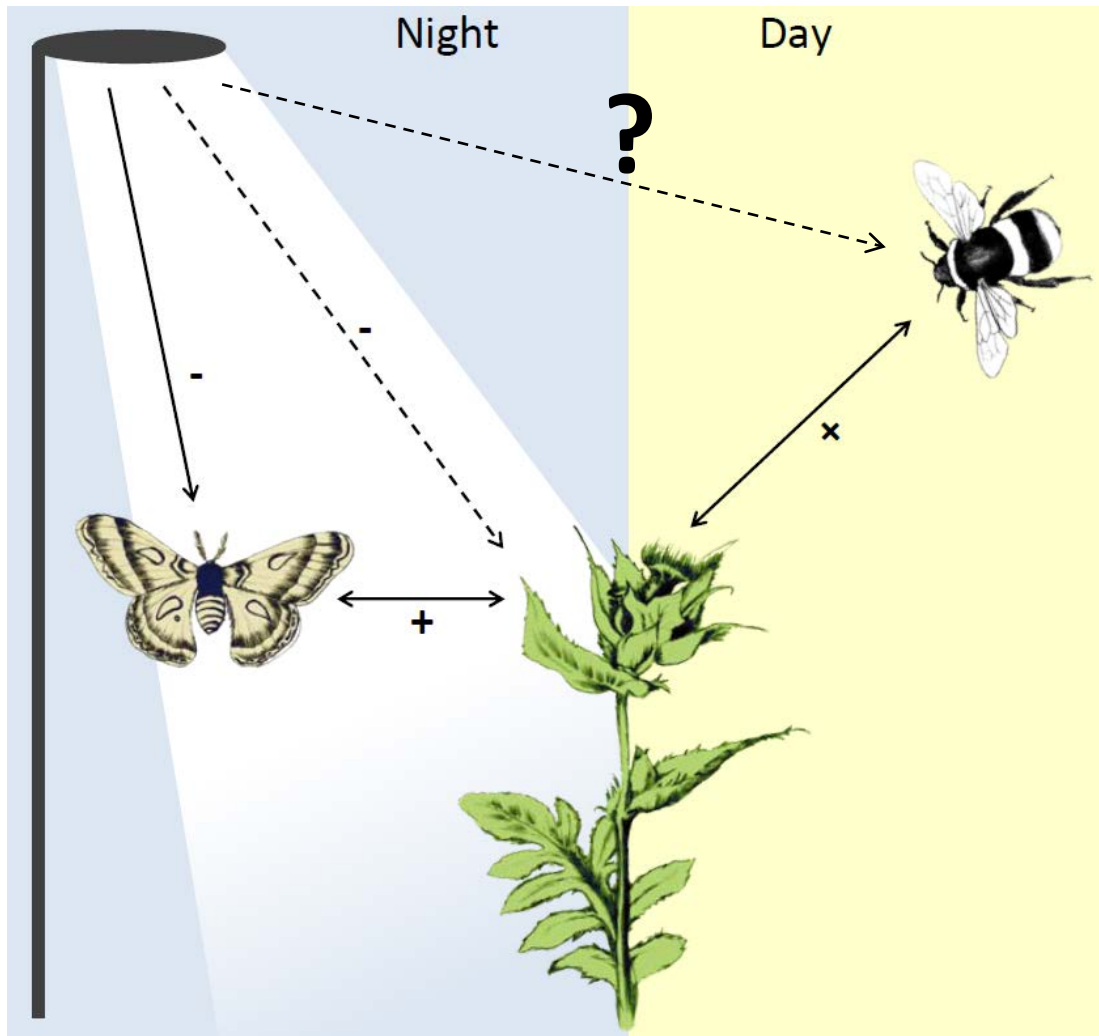


5 prairies, 4 pieds de *C. oleraceum*, 2 ensachés 2 non
 Présence de lampadaire vs. Absence de lampadaire





13% de réduction
de production de
fruits

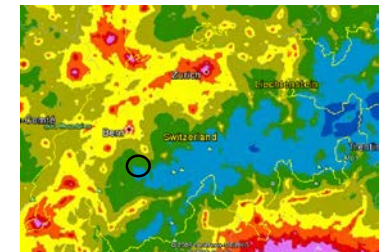


Pollinisateurs diurnes

Plantes

Pollinisateurs nocturnes

8 prairies localisées dans le canton de Bern



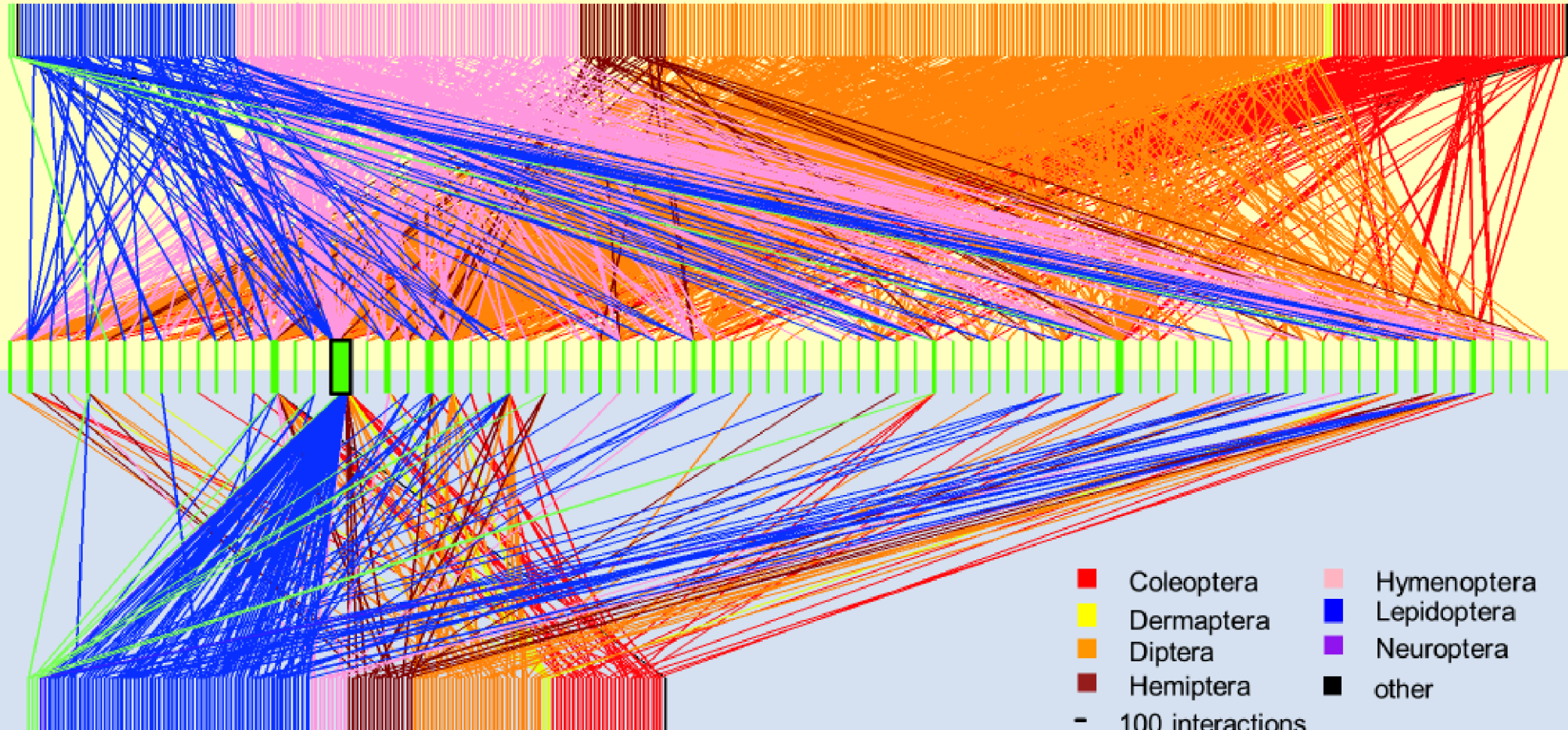
1 transect de 50 mètres échantillonné toutes les 30 minutes pendant 24 heures, 4 fois par site en juillet 2016

Lampe frontale



Lunette vision nocturne

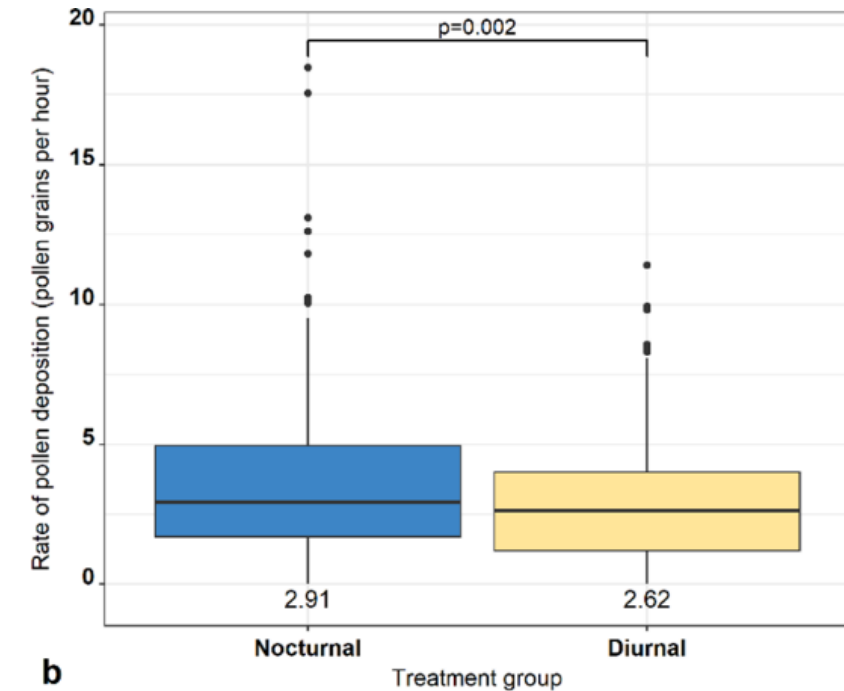




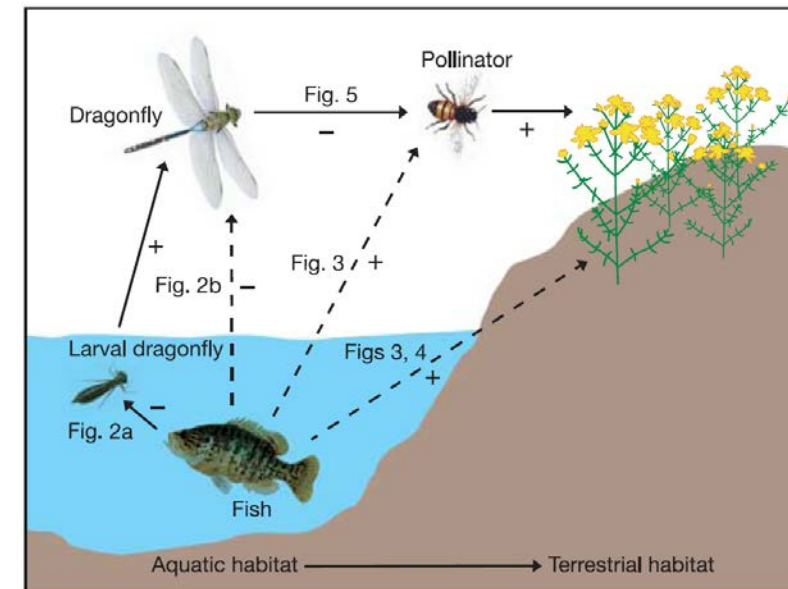


- Les pollinisateurs nocturnes assurent une part non-négligeable de la pollinisation, non substituable par celle effectuée par les pollinisateurs diurnes.

- Pollinisateurs nocturnes et diurnes sont liés, et la structure du réseau d'interaction rend probable la propagation des perturbations entre eux.



b



En connaitre plus sur les communautés plantes-pollinisateurs...

Participer au Spipoll, c'est très simple ! Explication en 6 étapes.



1 JE CHOISIS UNE ESPECE VÉGÉTALE EN FLEUR



2 JE PHOTOGRAPHE TOUS LES INSECTES BUTINANT LA FLEUR



3 CHEZ MOI, JE TRIE ET RECADRE MES PHOTOS



4 J'IDENTIFIE LES INSECTES AVEC LA CLÉ



5 JE POSTE MES PHOTOS SUR LE SITE

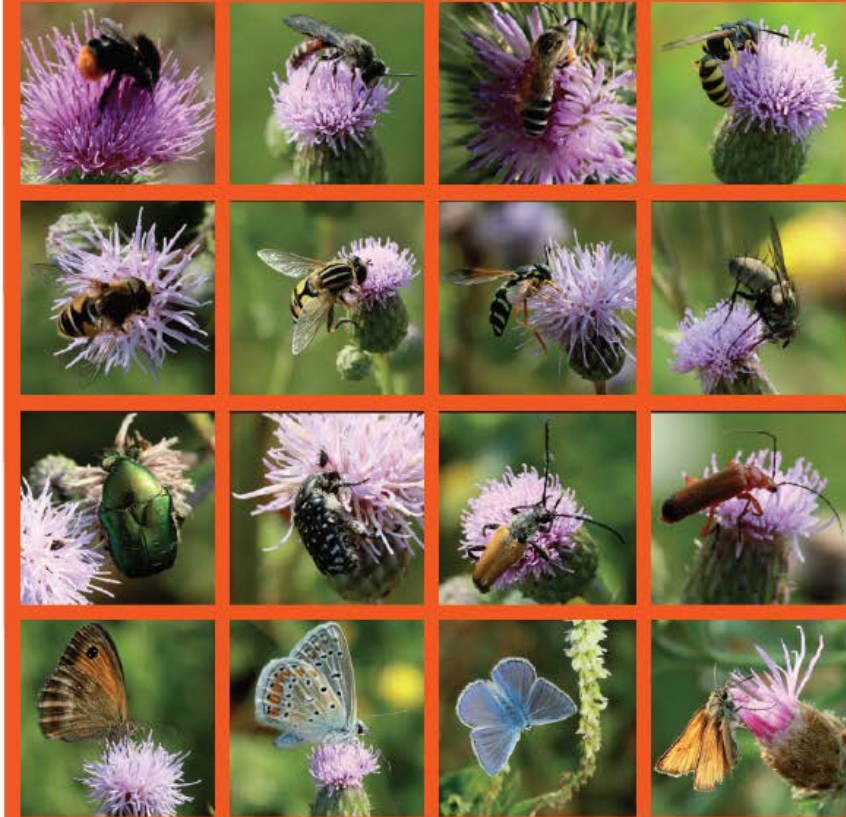


6 MES PHOTOS SONT COMMENTÉES ET VALIDÉES

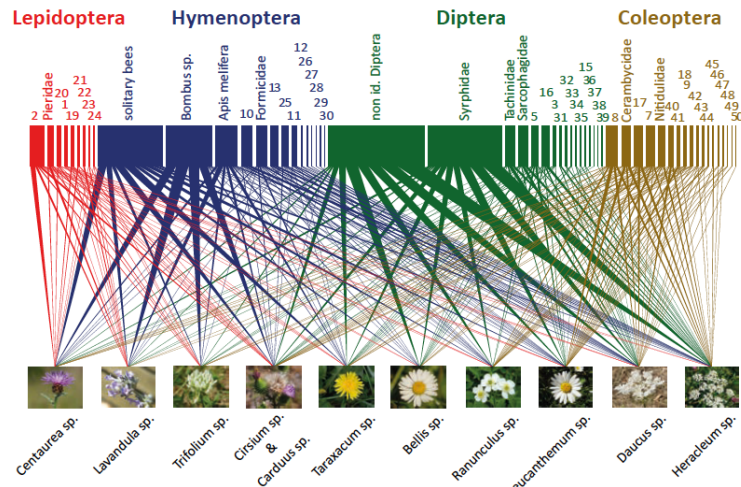
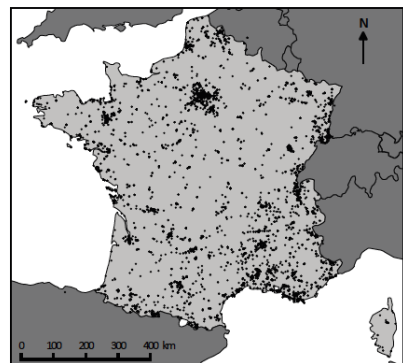


SPIPOLL

www.spipoll.org



Collection « Pornichet terrain friche chardon »
21/07/13 par Michel Marly



En connaitre plus sur les communautés plantes-pollinisateurs...

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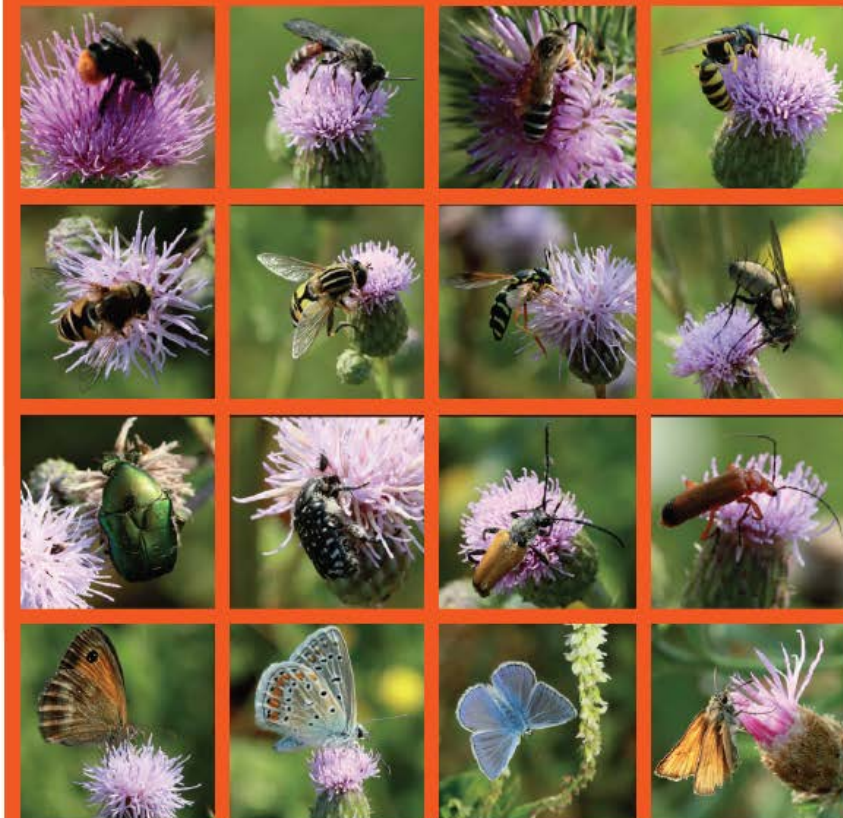


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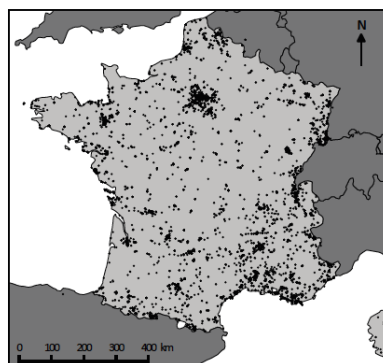


SPIPOLL

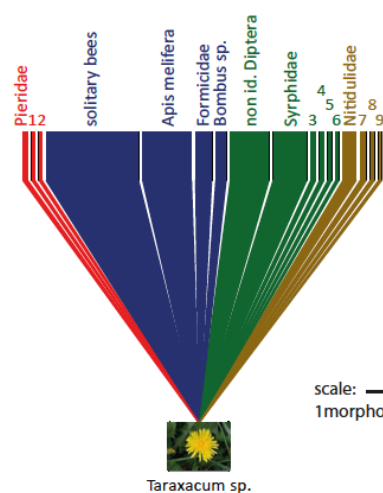
www.spipoll.org



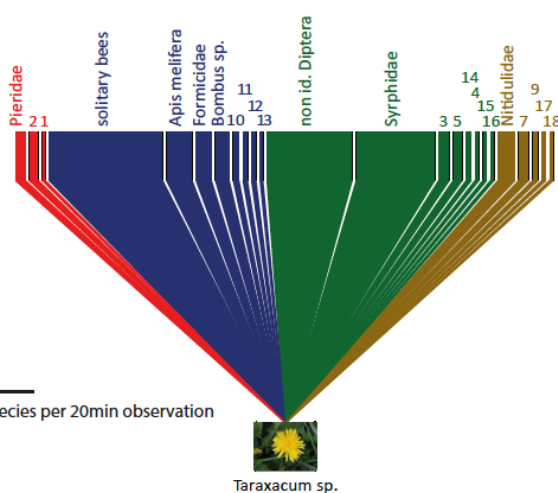
Collection « Pornichet terrain friche chardon »
21/07/13 par Michel Marly



Urbanisation within 500m > 10%



Urbanisation within 500m < 10%



scale: _____
1 morphospecies per 20min observation



Merci de votre attention