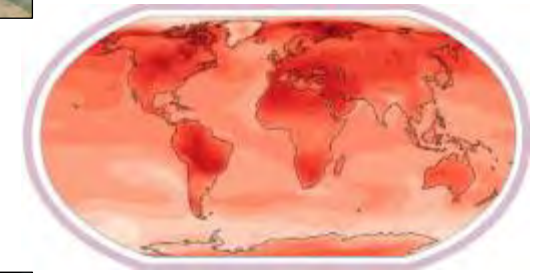


Conséquences de l'urbanisation pour les insectes pollinisateurs - perspectives de mitigation.

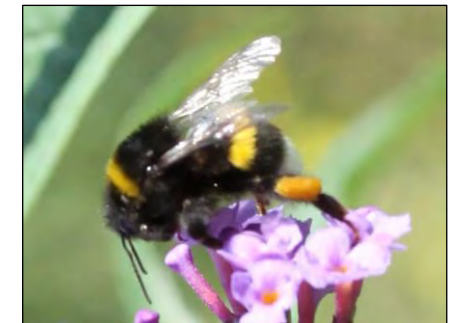


Menaces sur les pollinisateurs

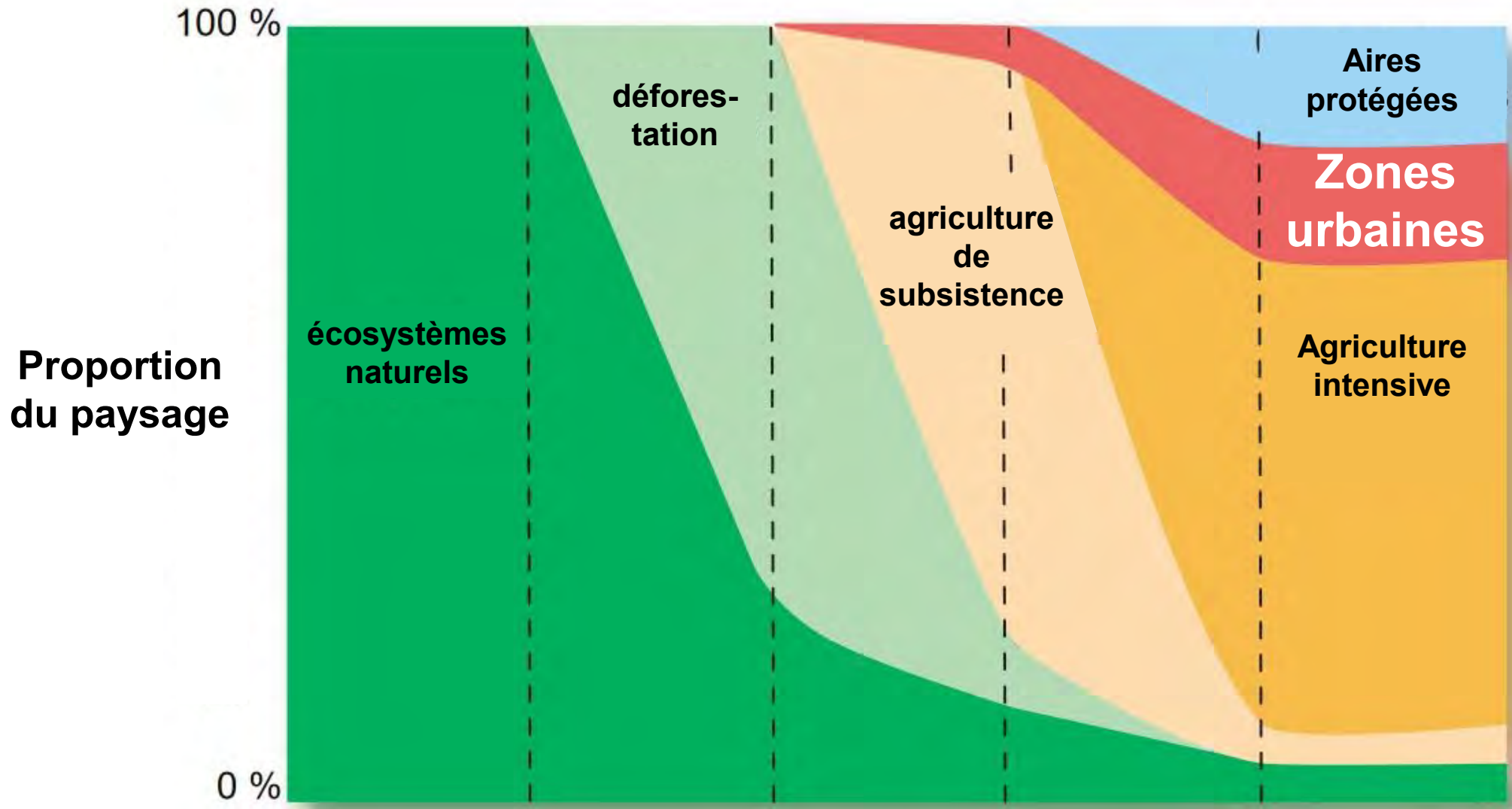
- **Changements d'usage des sols**
- Changements climatiques
- Pollutions (dont les pesticides)
- Introductions d'espèces



© IPCC 2023 (world at +3°C)



Dynamique de changements d'usage des sols



Etapes (possibles) de transition d'usage des sols par les sociétés humaines

- **Expansion** des zones urbaines
- **Densification** des zones urbaines



Adapté de Foley *et al.* 2005

- **Expansion** des zones urbaines
- **Densification** des zones urbaines

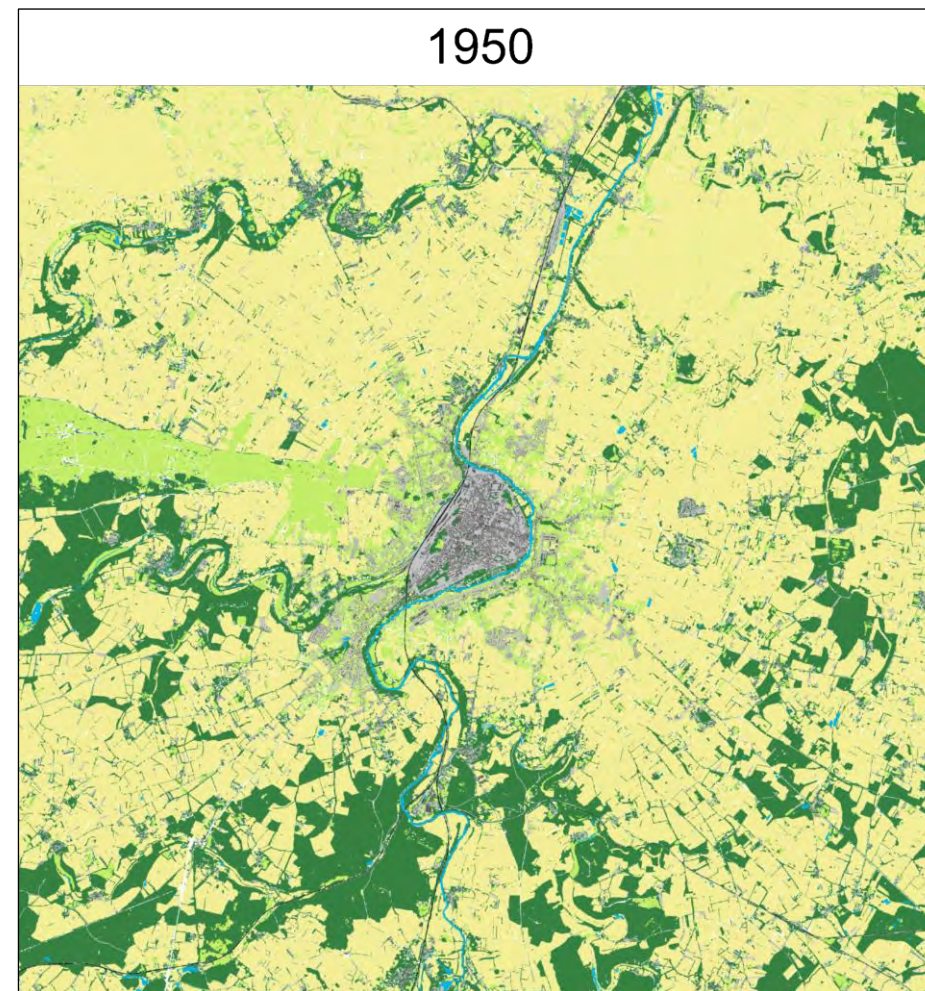


Adapté de Foley *et al.* 2005

➔ **1^{er} changement d'usage des sols (France, Europe)**

- **Expansion** des zones urbaines
- **Densification** des zones urbaines

→ **1^{er} changement d'usage des sols (France, Europe)**



Poitiers



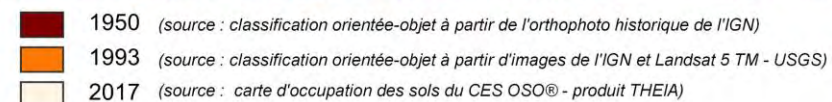
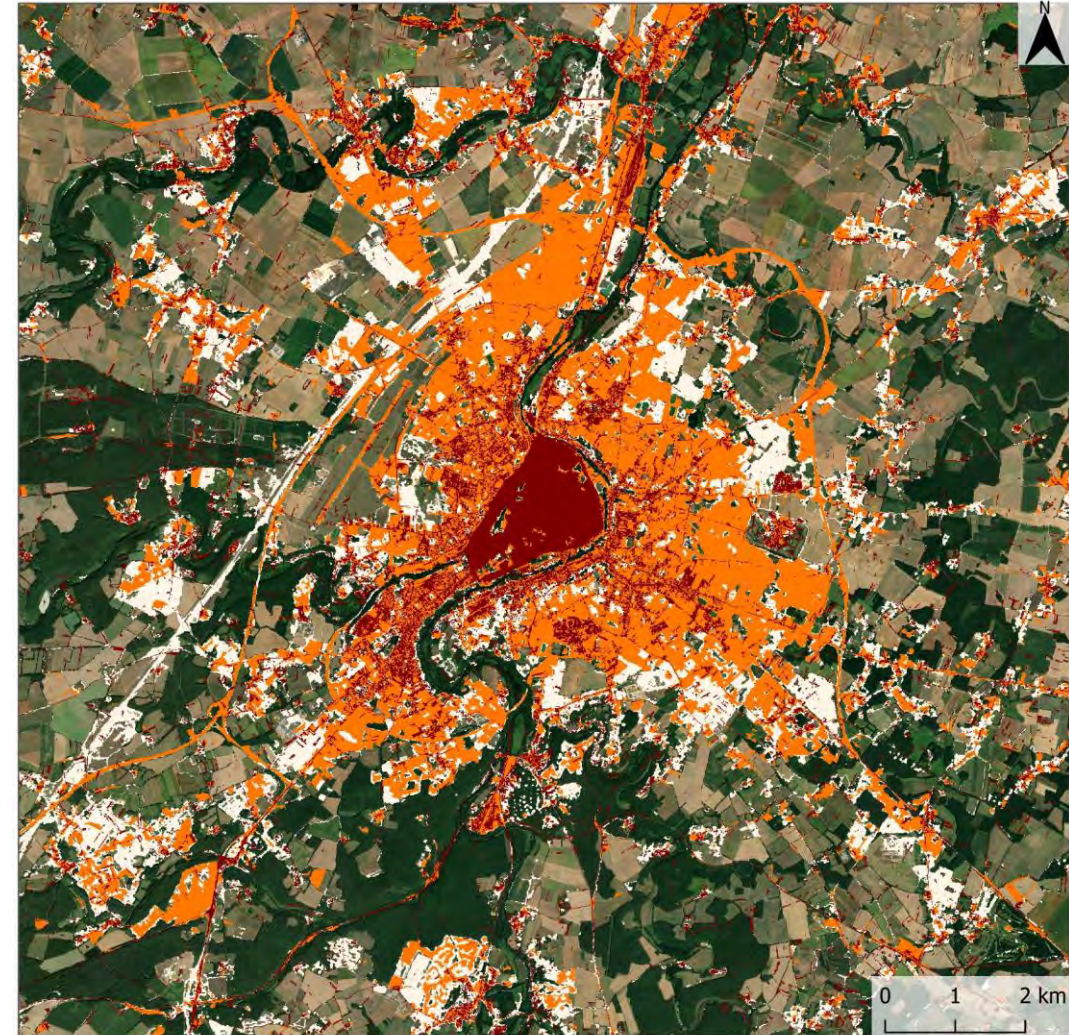
PictaMap

L'urbanisation : changement d'usage des sols majeur

7

- **Expansion** des zones urbaines
- **Densification** des zones urbaines

→ **1^{er} changement d'usage des sols (France, Europe)**



Le milieu urbain a connu une forte expansion entre 1950 et 2017.
Les surfaces urbaines occupaient 1800 ha en 1950, 4465 ha en 1993 et 6637 ha en 2017.



- **Imperméabilisation des sols européens entre 2000 – 2018**

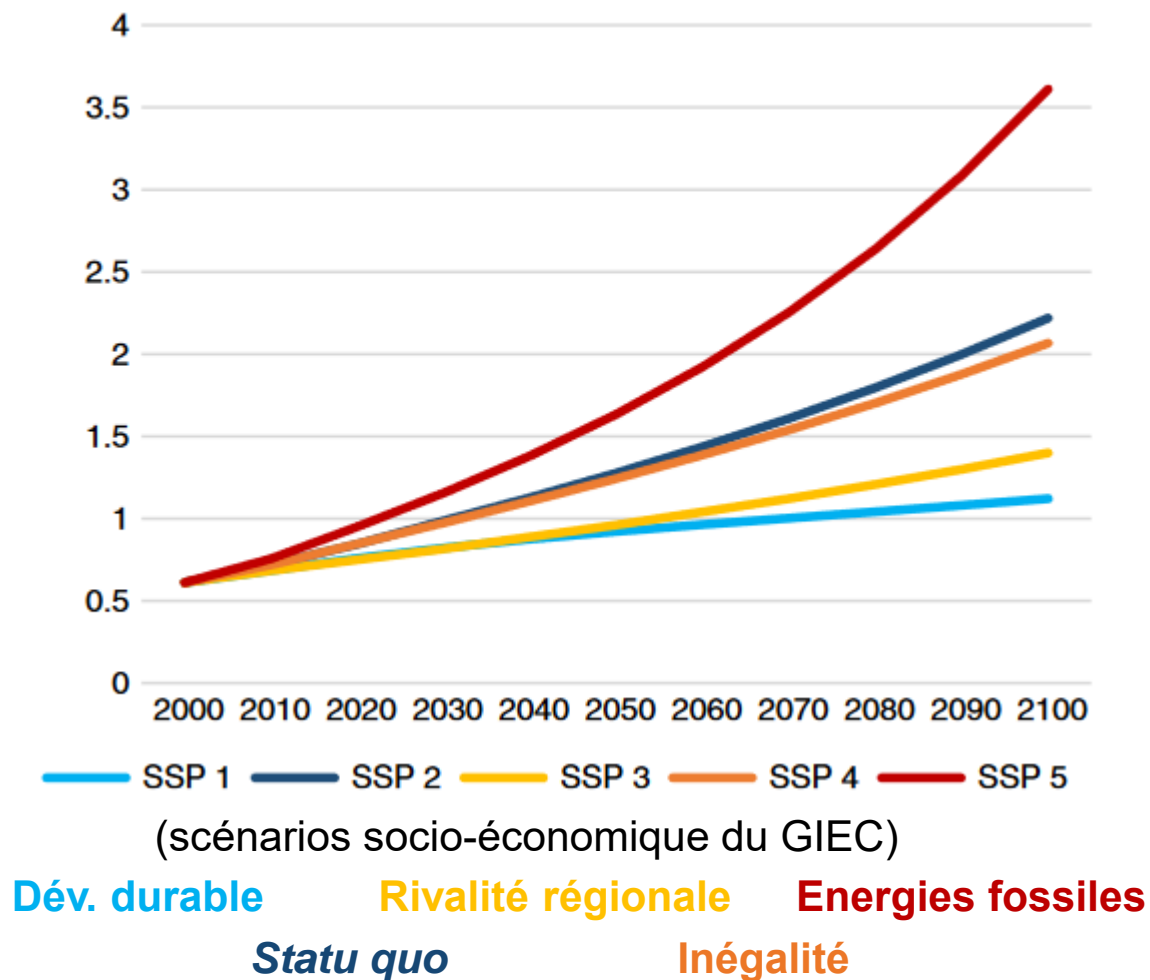
16 607 km²
(soit ~4/5 de la Slovénie)



➔ **recouvrent 4,3% de l'Europe (hors Russie)**

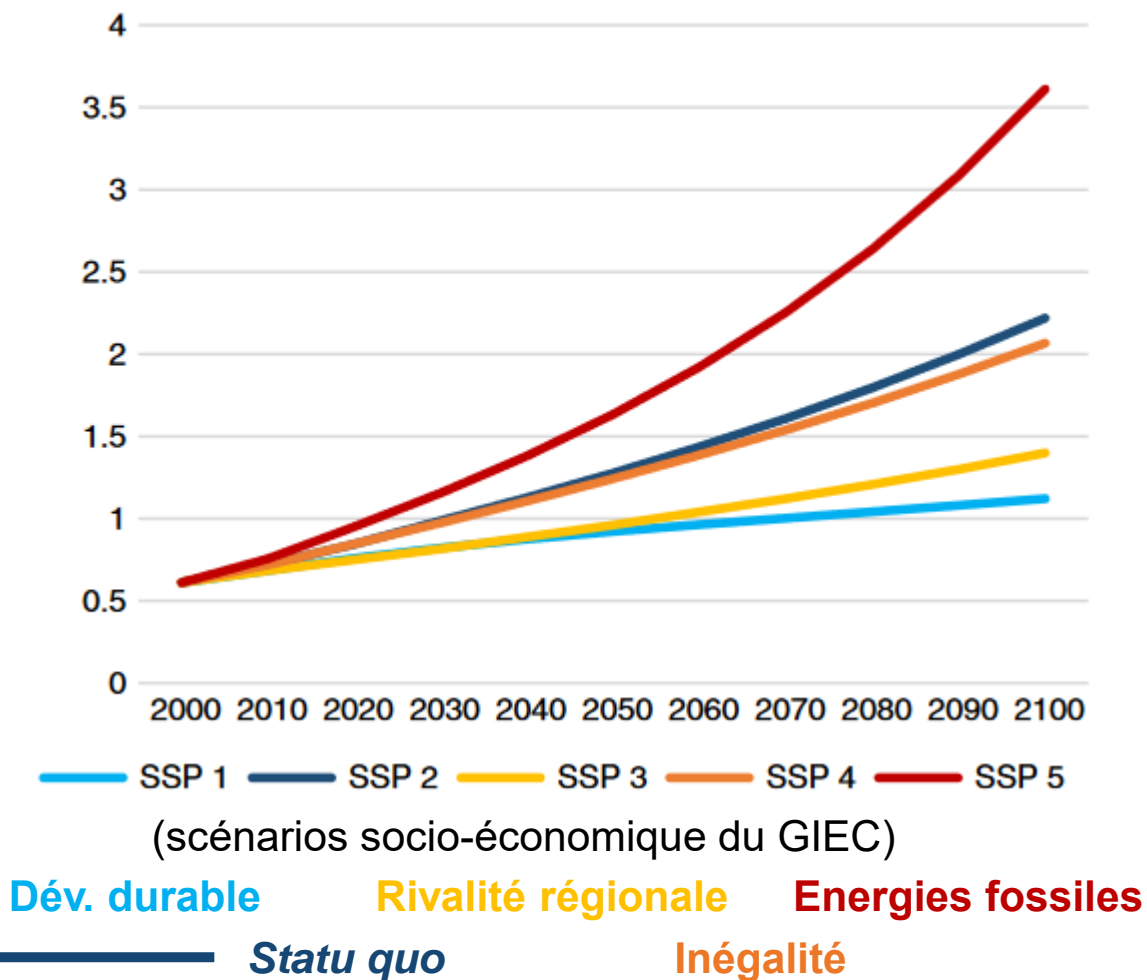
- **Prédictions mondiales**

**Surfaces urbaines
(millions de km²)**



- **Prédictions mondiales**

Surfaces urbaines
(millions de km²)



Statu quo en Europe :

- **+275 000 km² en 2100**
- **x2 la surface de 2018**

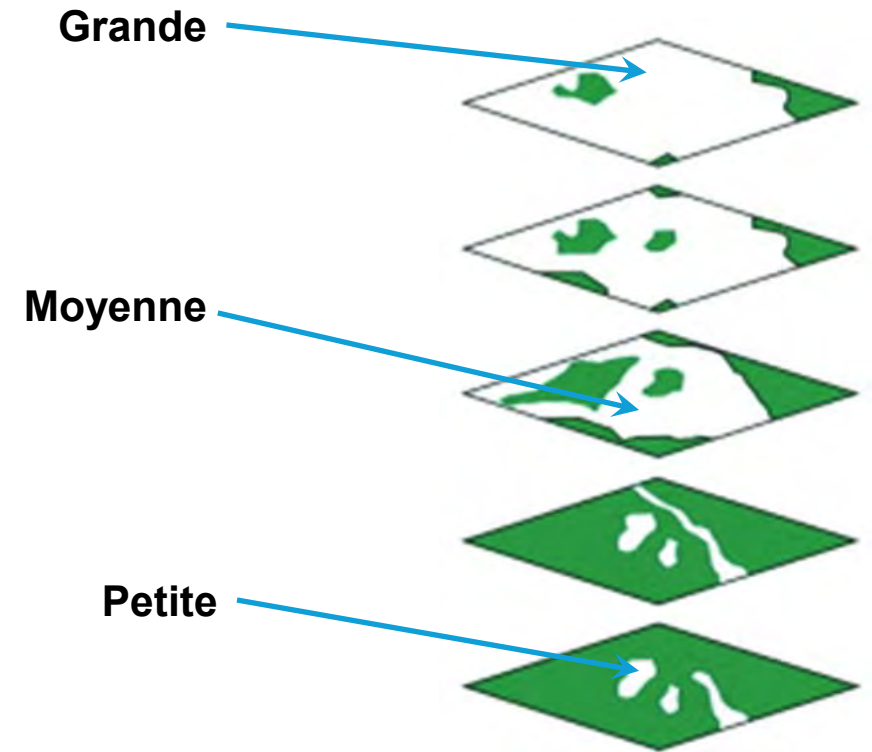
- **Imperméabilisation des sols, dé-végétalisation**
- **Fragmentation des habitats**



- **Imperméabilisation des sols, dé-végétalisation**
- **Fragmentation des habitats**
- **Îlot de chaleur urbain**
- **Pollutions (air, sol, eau ; éclairage nocturne)**



- **Taille**



- Taille
- Organisation

Chicago,
USA



Houston,
USA



- Taille
- Organisation



Manhattan

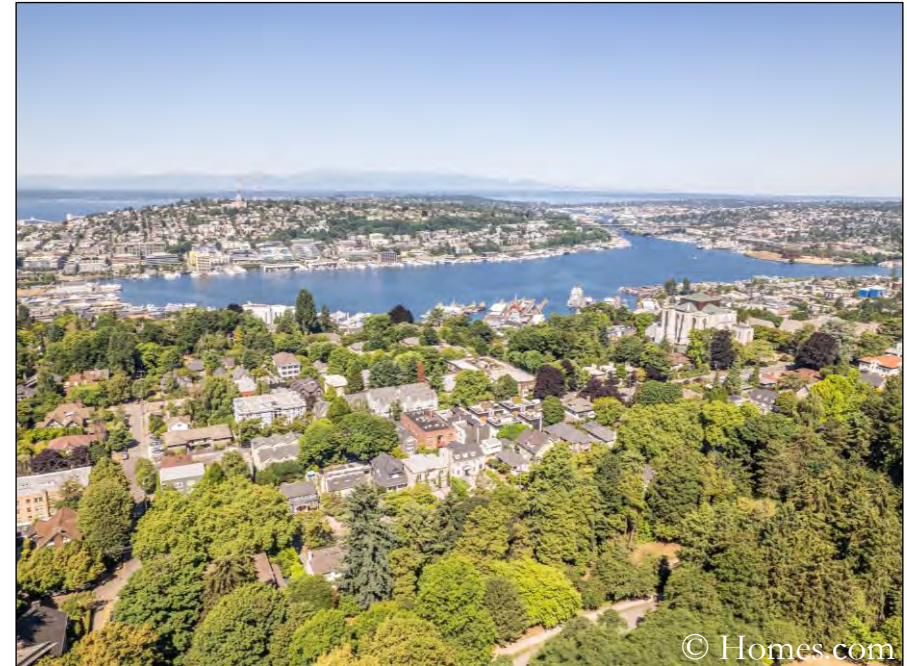


Seattle

- Taille
- Organisation, Centre vs. Périphérie, Végétation

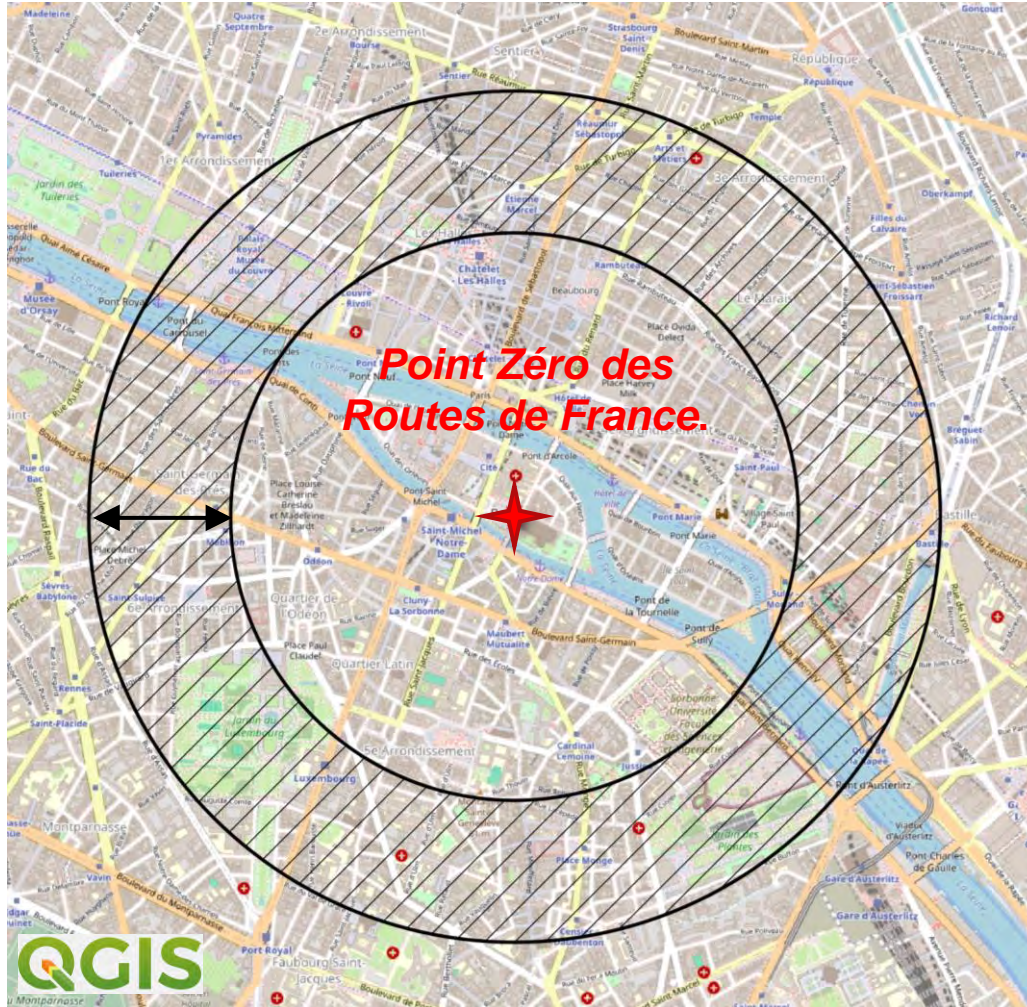


Manhattan



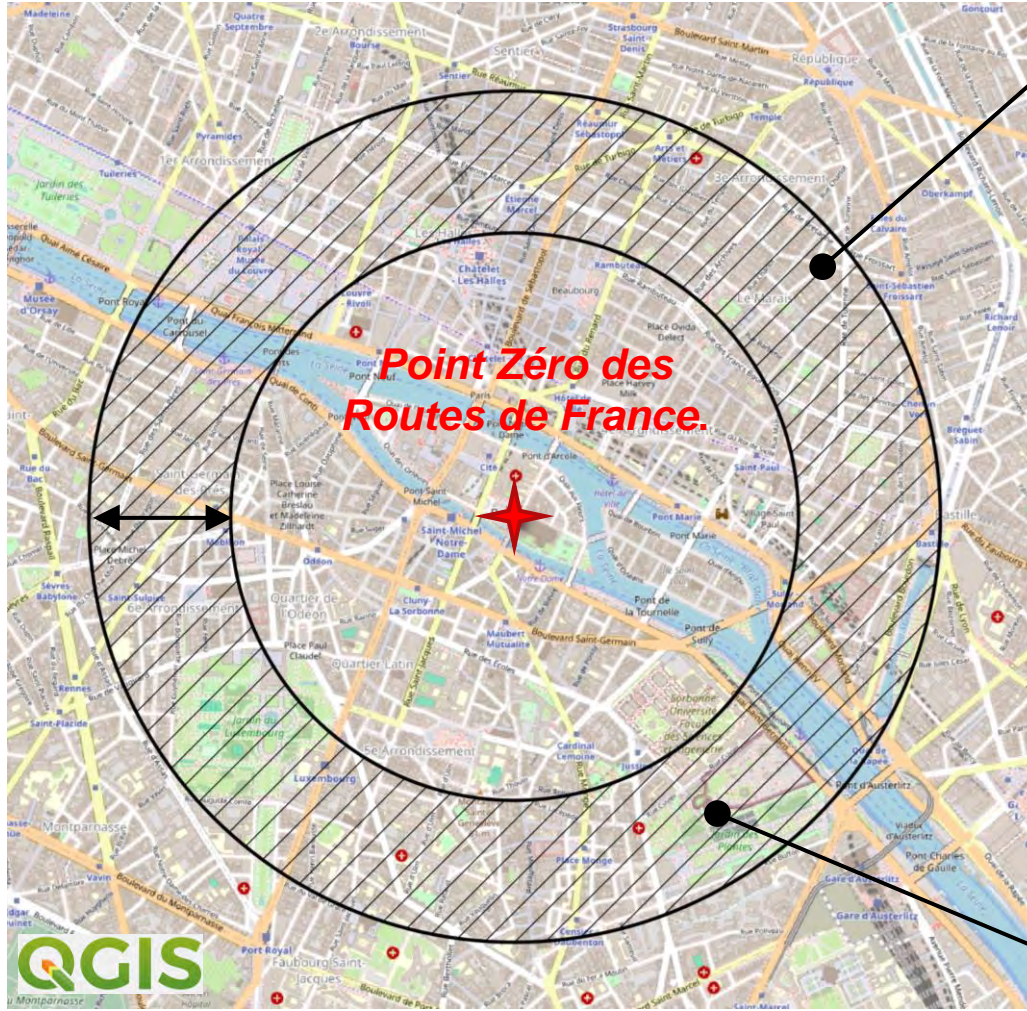
Seattle

Approximation par la *Distance au centre*



1000-1500m
du « **centre** »

Approximation par la *Distance au centre*



1000-1500m
du « centre »

Rue de
Poitou



© Chabe01

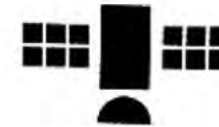
Jardin alpin du
Muséum national
d'Histoire naturelle



© Jean-Pierre Dalbéra

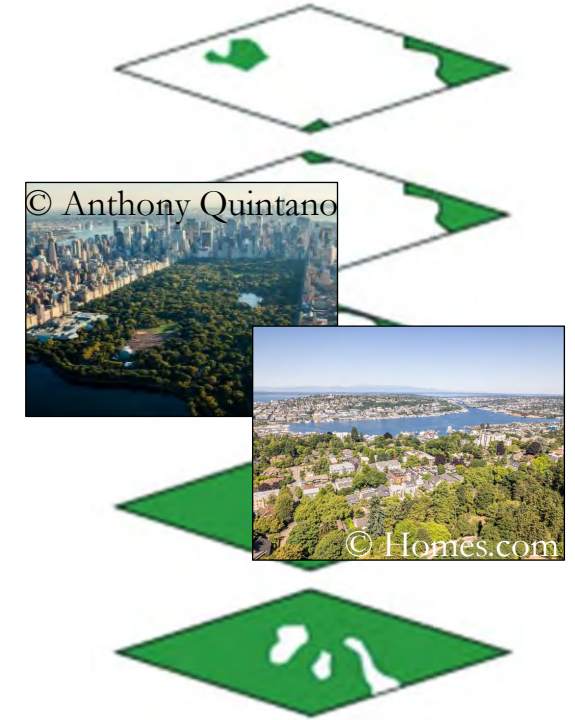
→ Mesures fines de multiples aspects :

- ✓ % de surfaces imperméables
- ✓ Hétérogénéité du paysage
- ✓ Hauteur/type de végétation
- ✓ Hauteur du bâti
- ✓ Température
- ✓ Eclairage artificiel
- ✓ Qualité de l'air
- ✓ ...



- Taille
- Organisation, Centre vs. Périphérie, Végétation

→ **Mouvement des individus / colonisation de ces milieux**



- Taille
- Organisation, Centre vs. Périphérie, Végétation

→ **Mouvement des individus / colonisation de ces milieux**

- Traits des espèces



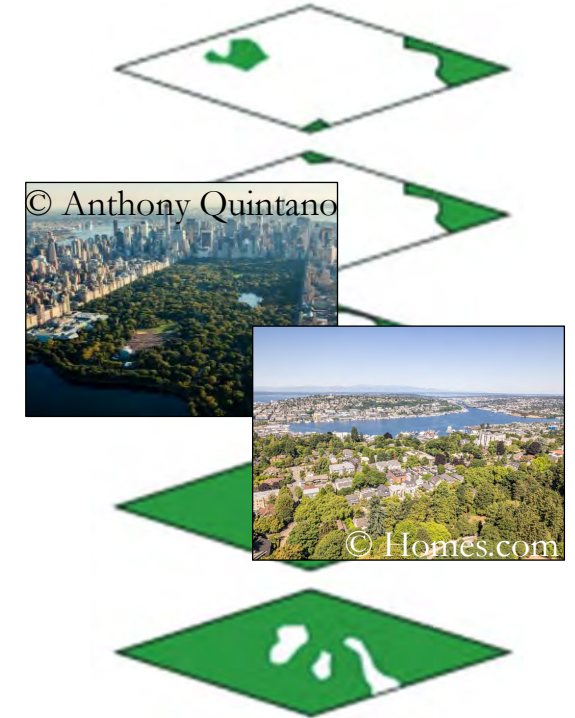
© Nicolas Bech



© Spipoll

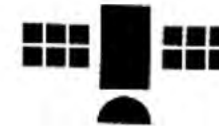


© STOC





- ✓ % de surfaces imperméables
- ✓ Hétérogénéité du paysage
- ✓ Hauteur/type de végétation
- ✓ Hauteur du bâti
- ✓ Température
- ✓ Eclairage artificiel
- ✓ Qualité de l'air
- ✓ ...





- ✓ % de surfaces imperméables
- ✓ Hétérogénéité du paysage
- ✓ Hauteur/type de végétation
- ✓ Hauteur du bâti
- ✓ Température
- ✓ Eclairage artificiel
- ✓ Qualité de l'air
- ✓ ...



Quels insectes pollinisateurs subsistent ?

Quels assemblages résultent de ces filtres ?



Combien d'espèce(s) d'abeille(s) vive(nt) en France ?

 1 env. 10 env. 100 env. 1000

Associez le bon nom aux 6 insectes :

- l'Abeille mellifère
- l'Abeille charpentière
- un Bourdon
- une Guêpe
- une Osmie
- un Syrpe



1



2



3



4



5



6

Combien d'espèce(s) d'abeille(s) vive(nt) en France ?

 1 env. 10 env. 100 env. 1000

Associez le bon nom aux 6 insectes :

- ⑥ l'Abeille mellifère
- ③ l'Abeille charpentière
- ④ un Bourdon
- ② une Guêpe
- ⑤ une Osmie
- ① un Syrpe



①



②



③



④



⑤



⑥

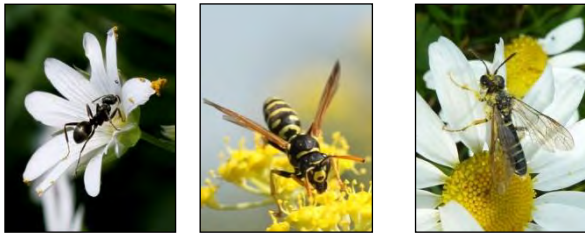
- **Abeilles** (Hymenoptera, Apoidea)



- **Mouches** (Diptera)



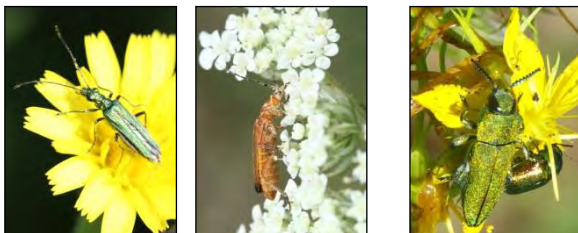
- **Fourmis, guêpes, tenthrèdes, ...**
(autres Hymenoptera)



- **Papillons** (Lepidoptera)



- **Coléoptères** (Coleoptera)



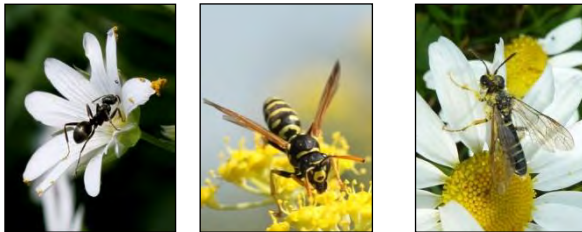
- **Abeilles** (Hymenoptera, Apoidea)



- **Mouches** (Diptera)



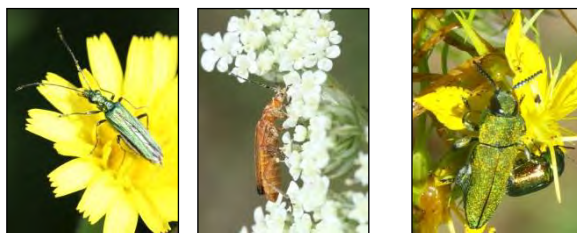
- **Fourmis, guêpes, tenthrèdes, ...**
(autres Hymenoptera)



- **Papillons** (Lepidoptera)



- **Coléoptères** (Coleoptera)



Ecologies variables :

- Nourriture (pollen, nectar, feuilles, proies, hôtes...)
- Sites de nidification (cavités, sol, hôtes, ...)
- Réponses physiologiques aux stress
- Mobilité Phénologie Socialité

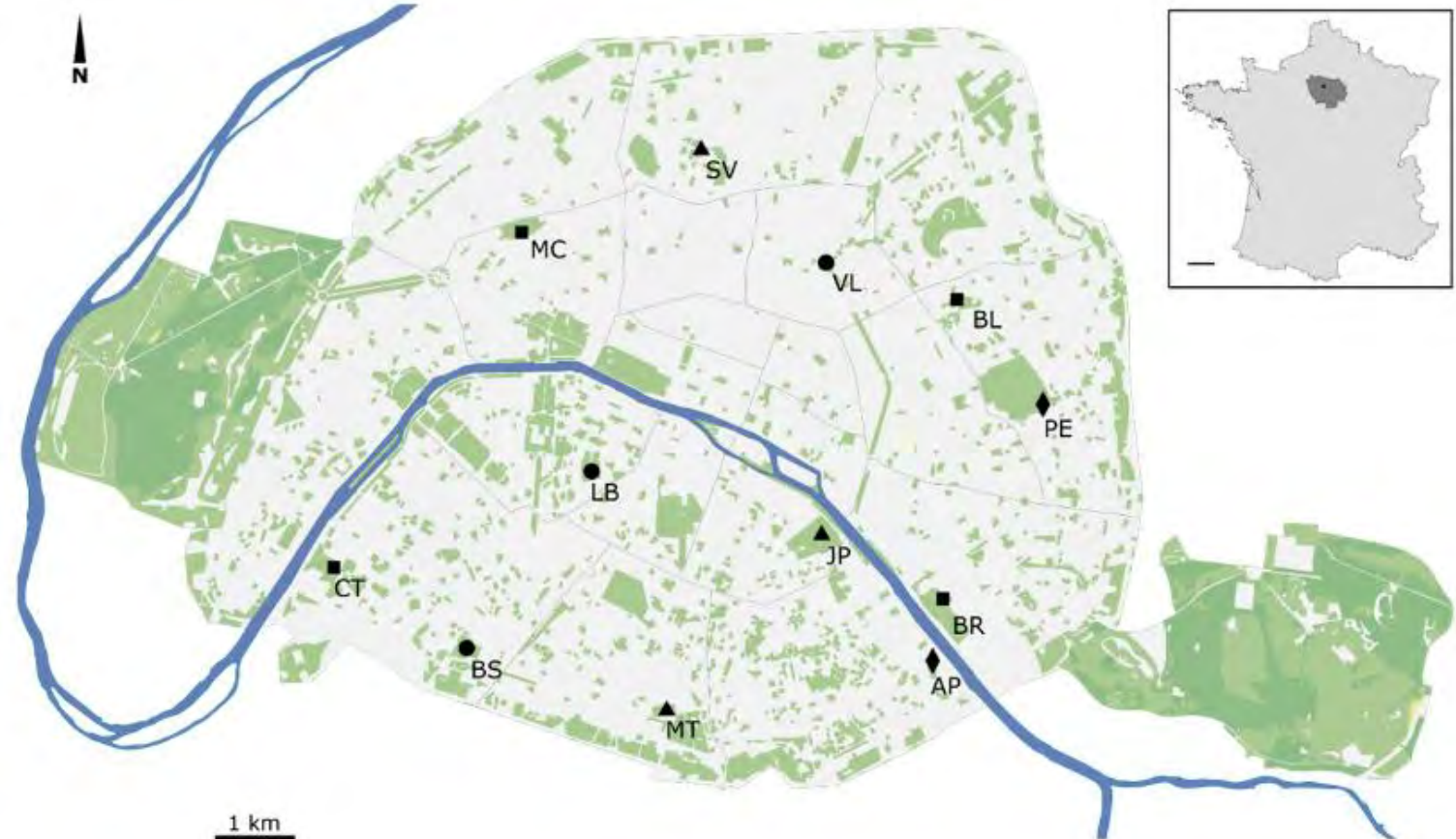
- Paris



145 espèces
(43% des
espèces d'I-d-F)



53 espèces
(25% des
espèces d'I-d-F)



Les villes ne sont pas vides d'insectes pollinisateurs

- **Paris**



145 espèces
(43% des
espèces d'I-d-F)



53 espèces
(25% des
espèces d'I-d-F)

- **Ailleurs ?**

Ville	Nb. espèces d'abeilles
Angers	91
La Roche-sur-Yon	120
Lille	102
Nantes	134
Marseille	114

Les villes ne sont pas vides d'insectes pollinisateurs

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Zurich (Suisse)	164
Chicago (USA)	83
New-York City (USA)	98

Les villes ne sont pas vides d'insectes pollinisateurs

- **Paris**



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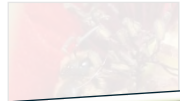


53 espèces
(25% des
espèces d'I-d-F)

- **Ailleurs ?**

Ville	Nb. espèces d'abeilles	Nb. espèces de syrphes
Angers	91	?
La Roche-sur-Yon	120	?
Lille	102	52
Nantes	134	?
Marseille	114	?
Poznan (Pologne)	206	?
Zurich (Suisse)	164	?
Chicago (USA)	83	?
New-York City (USA)	98	?

- Paris



145 espèces



53 espèces
(25% des espèces d'I-d-F)

Conservation Biology

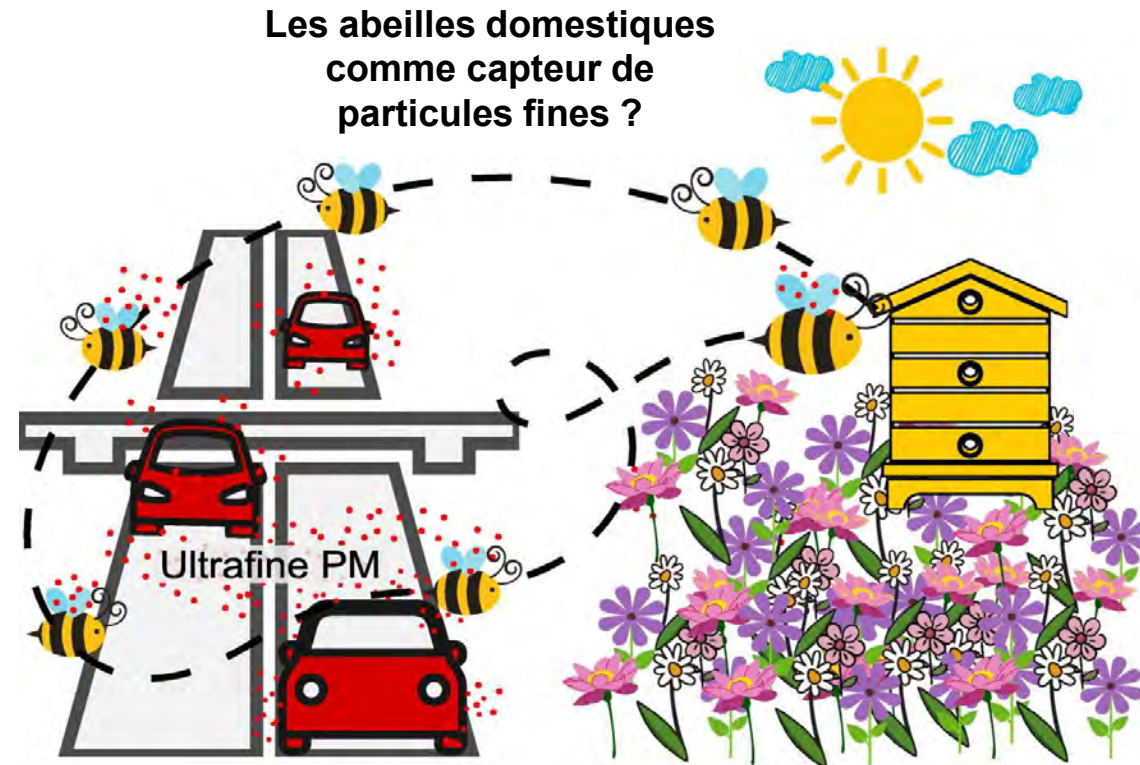
Essay

The city as a refuge for insect pollinators

Damon M. Hall,^{1*} Gerardo R. Camilo,² Rebecca K. Tonietto,¹ Jeff Ollerton,³ Karin Ahrné,⁴ Mike Arduser,⁵ John S. Ascher,⁶ Katherine C. R. Baldock,⁷ Robert Fowler,⁸ Gordon Frankie,⁹ Dave Goulson,⁸ Bengt Gunnarsson,¹⁰ Mick E. Hanley,¹¹ Janet I. Jackson,³ Gail Langellotto,¹² David Lowenstein,¹² Emily S. Minor,¹³ Stacy M. Philpott,¹⁴ Simon G. Potts,¹⁵ Muzafar H. Sirohi,³ Edward M. Spevak,¹⁶ Graham N. Stone,¹⁷ and Caragh G. Threlfall¹⁸

		Espèce de syrphes	
		?	?
		?	?
		52	?
		?	?
		?	?
		?	?
Zurich	206	164	?
Chicago		83	?
New-York City		98	?



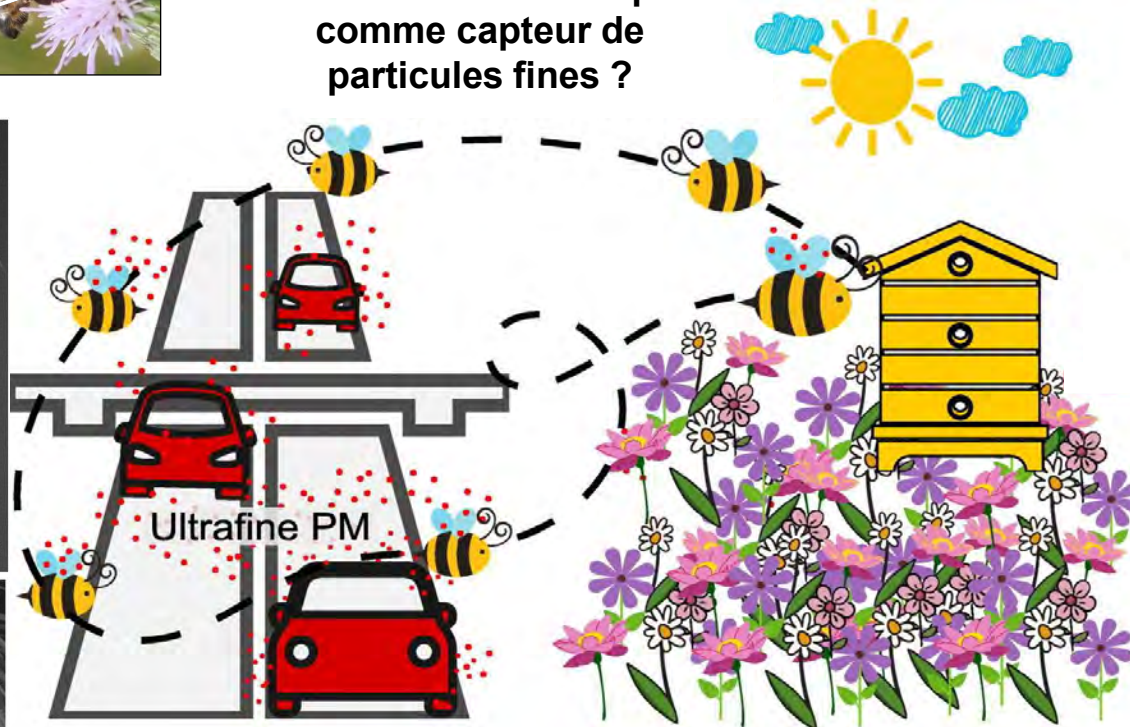
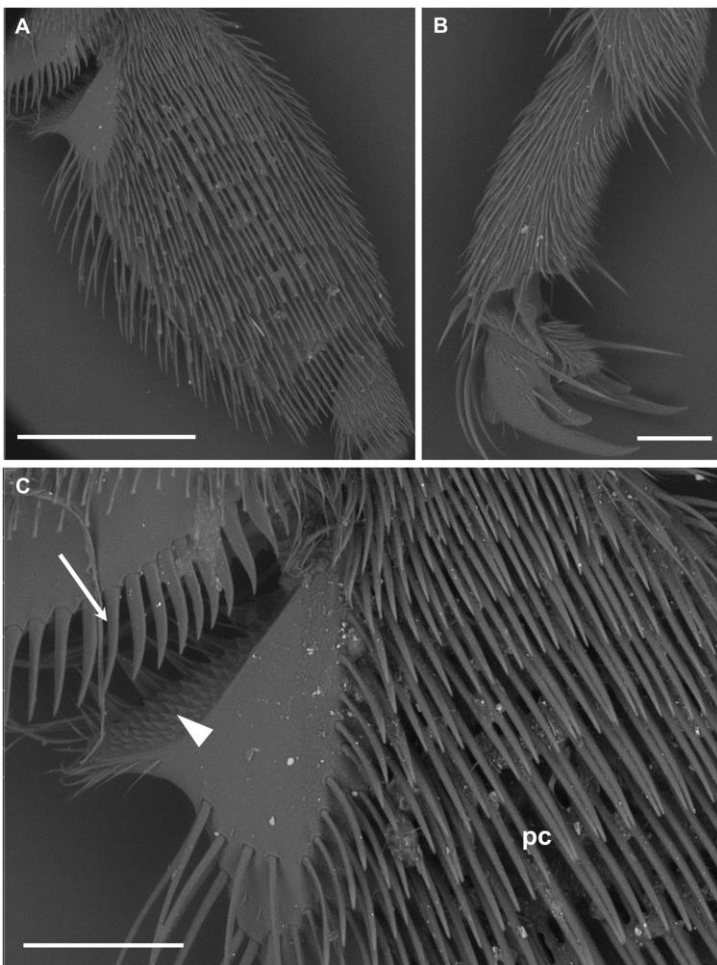


Contaminations aux particules fines

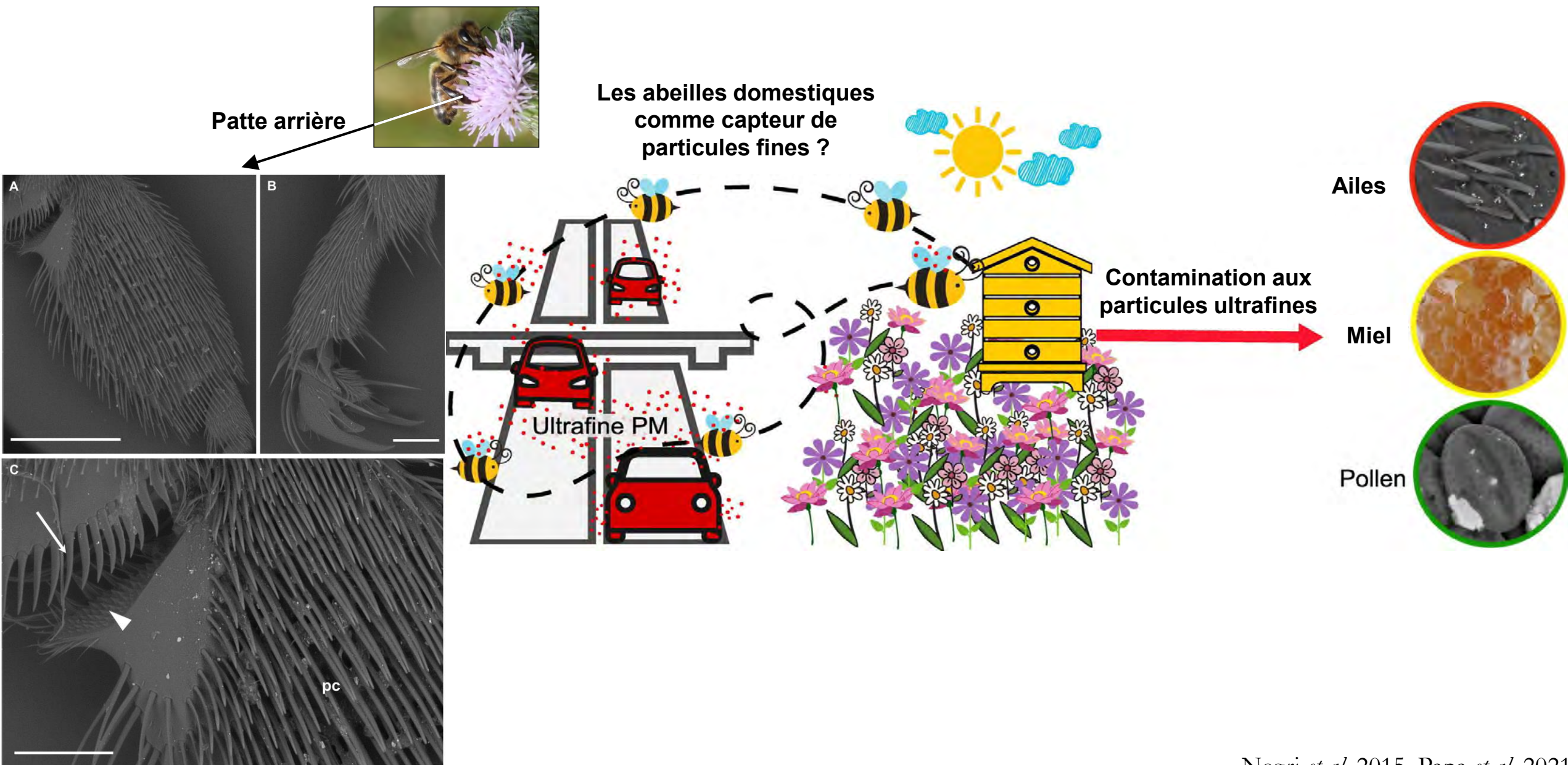
Patte arrière



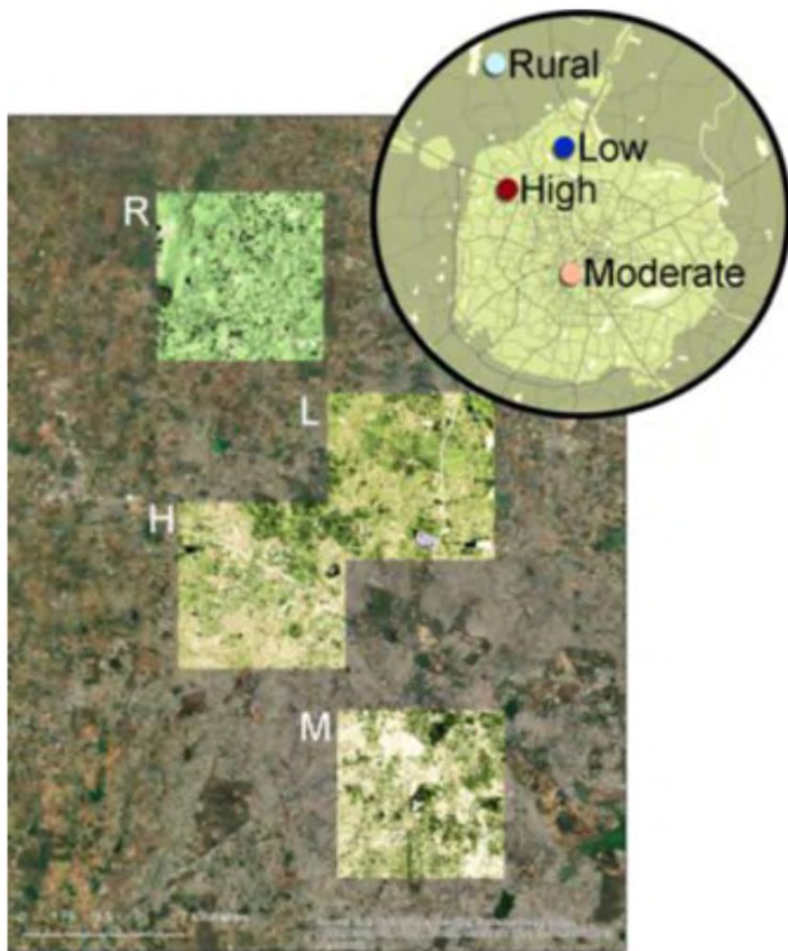
Les abeilles domestiques
comme capteur de
particules fines ?



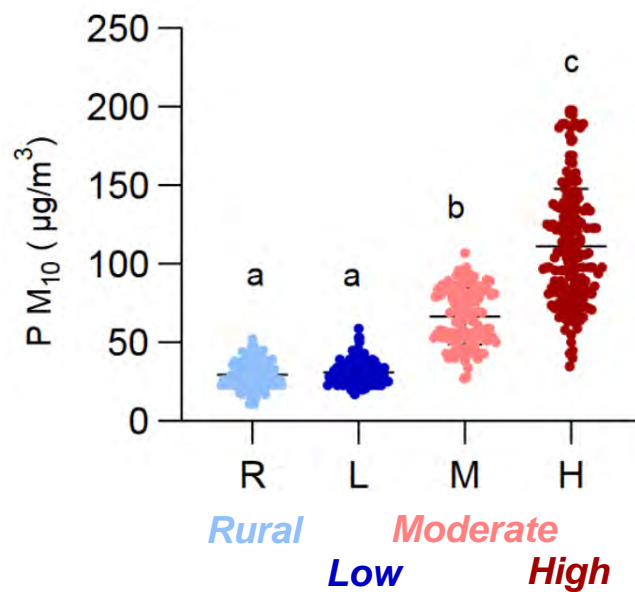
Contaminations aux particules fines



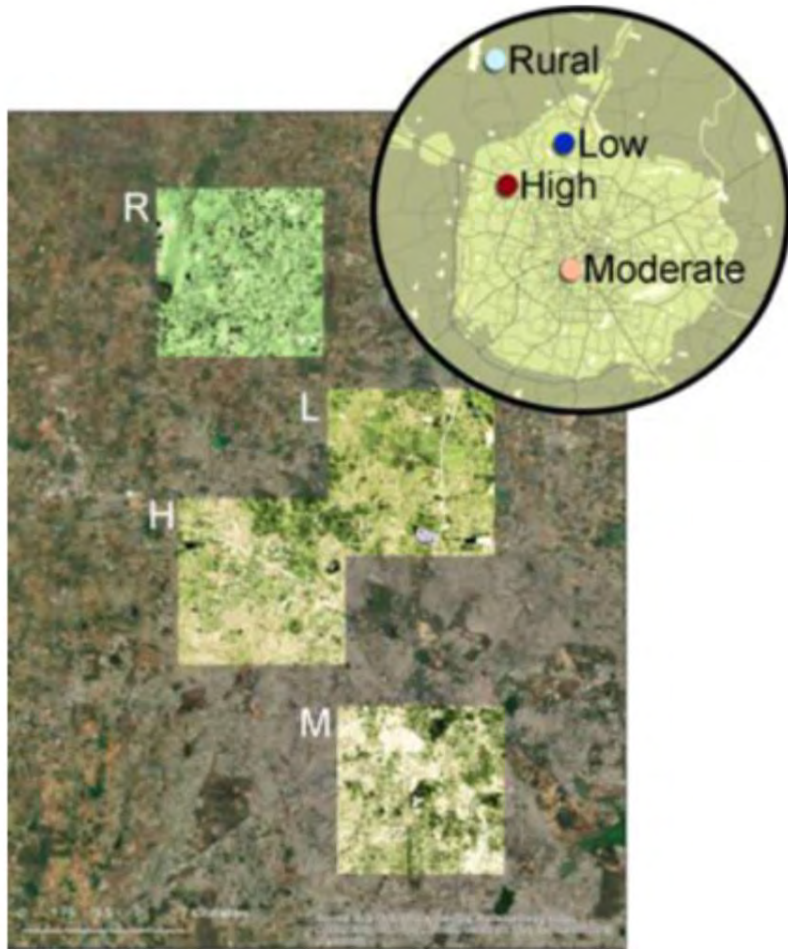
Contaminations aux particules fines



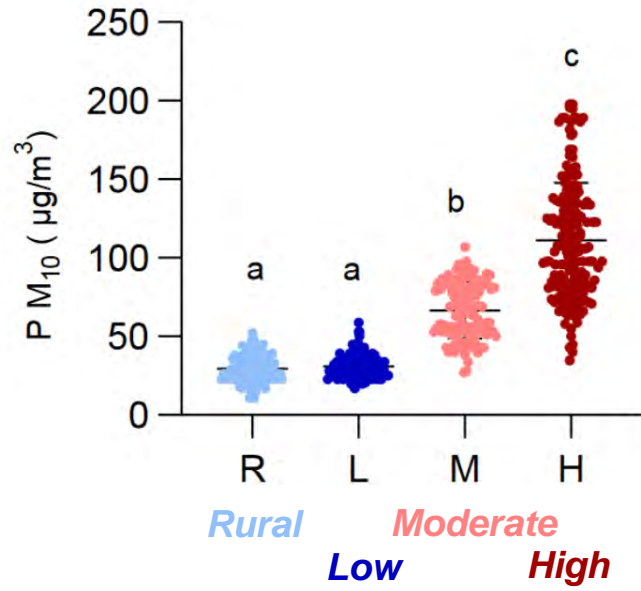
Bangalore, Inde



Contaminations aux particules fines

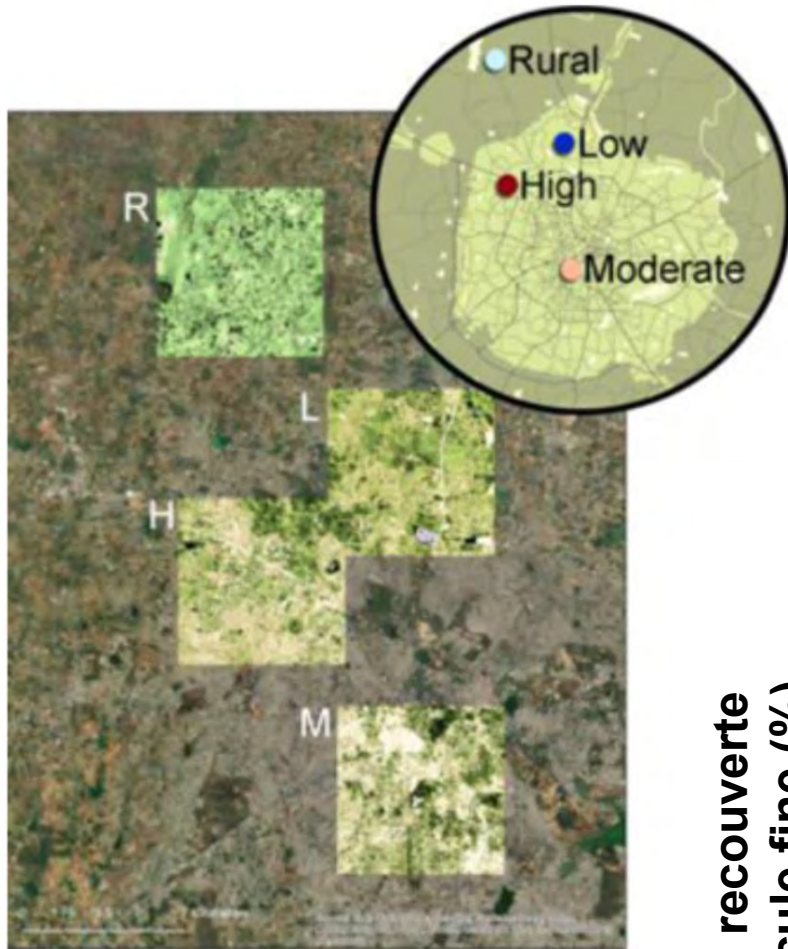


Bangalore, Inde

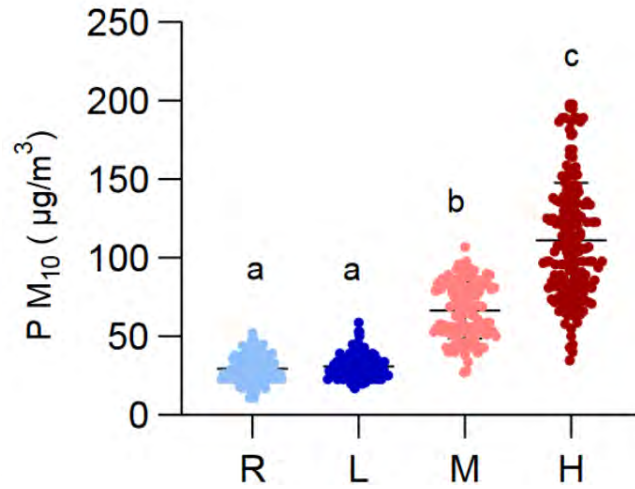


Abeille mellifère géante asiatique (*Apis dorsata*)

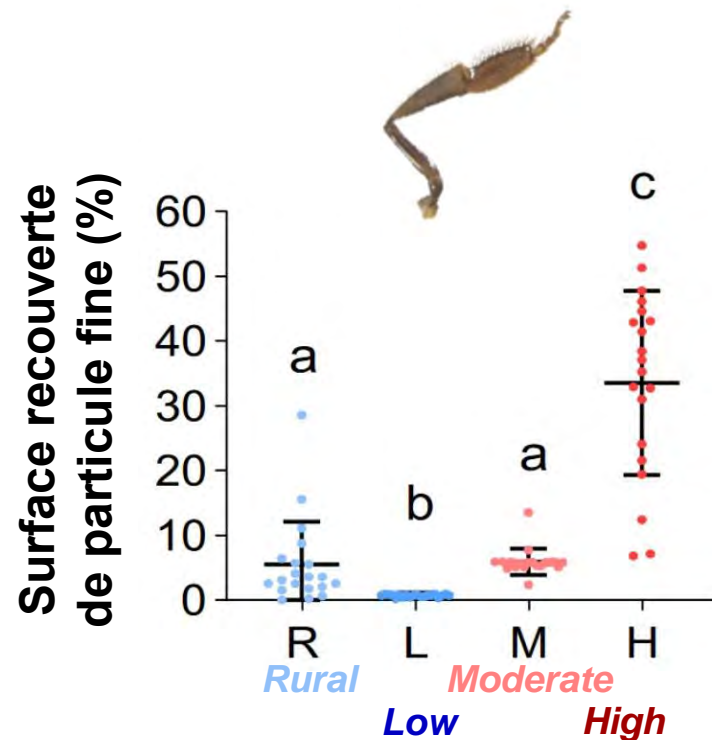
Contaminations aux particules fines



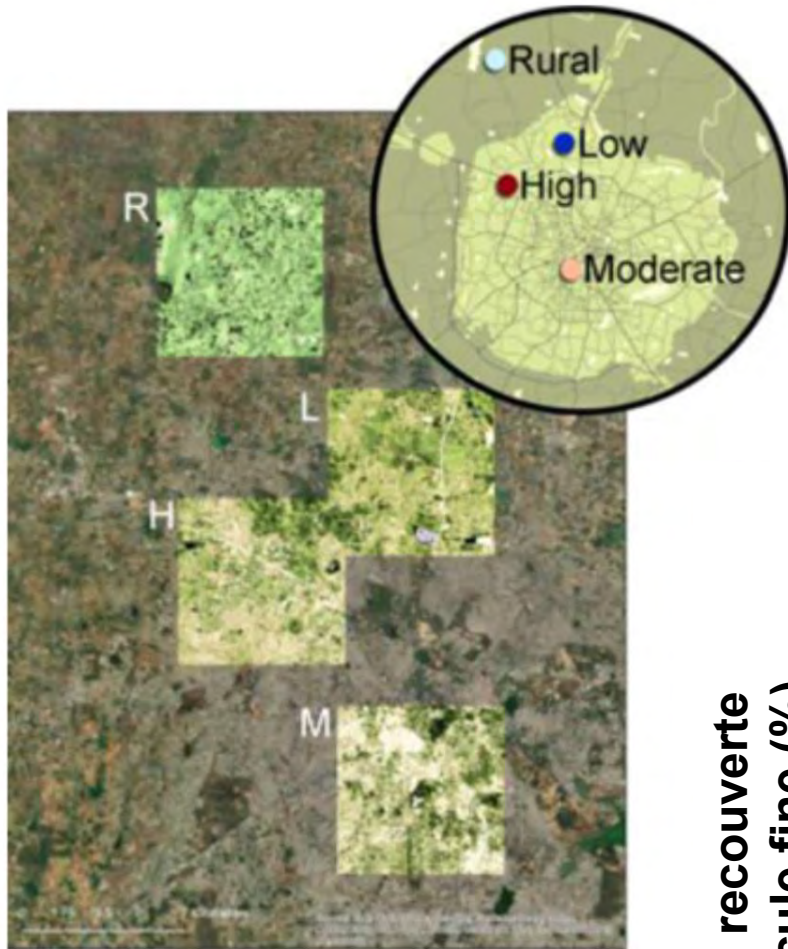
Bangalore, Inde



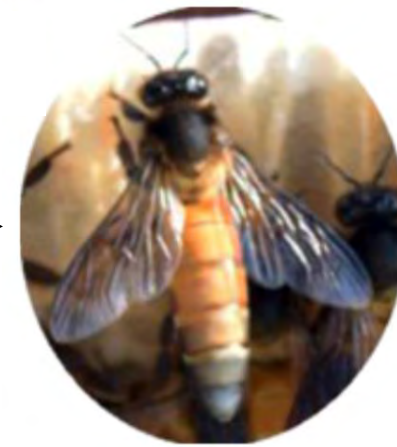
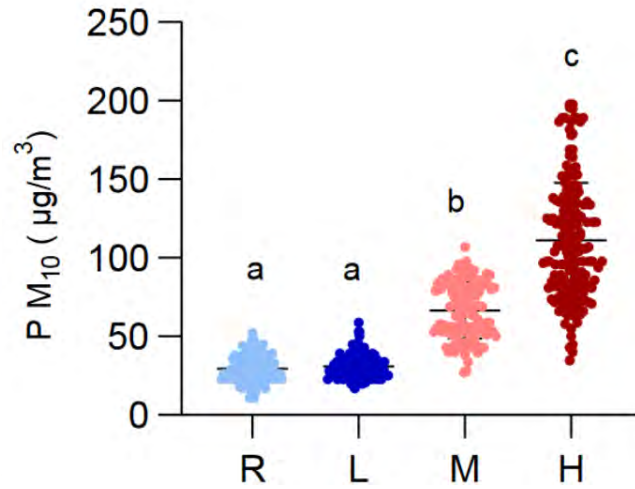
Abeille mellifère géante asiatique (*Apis dorsata*)



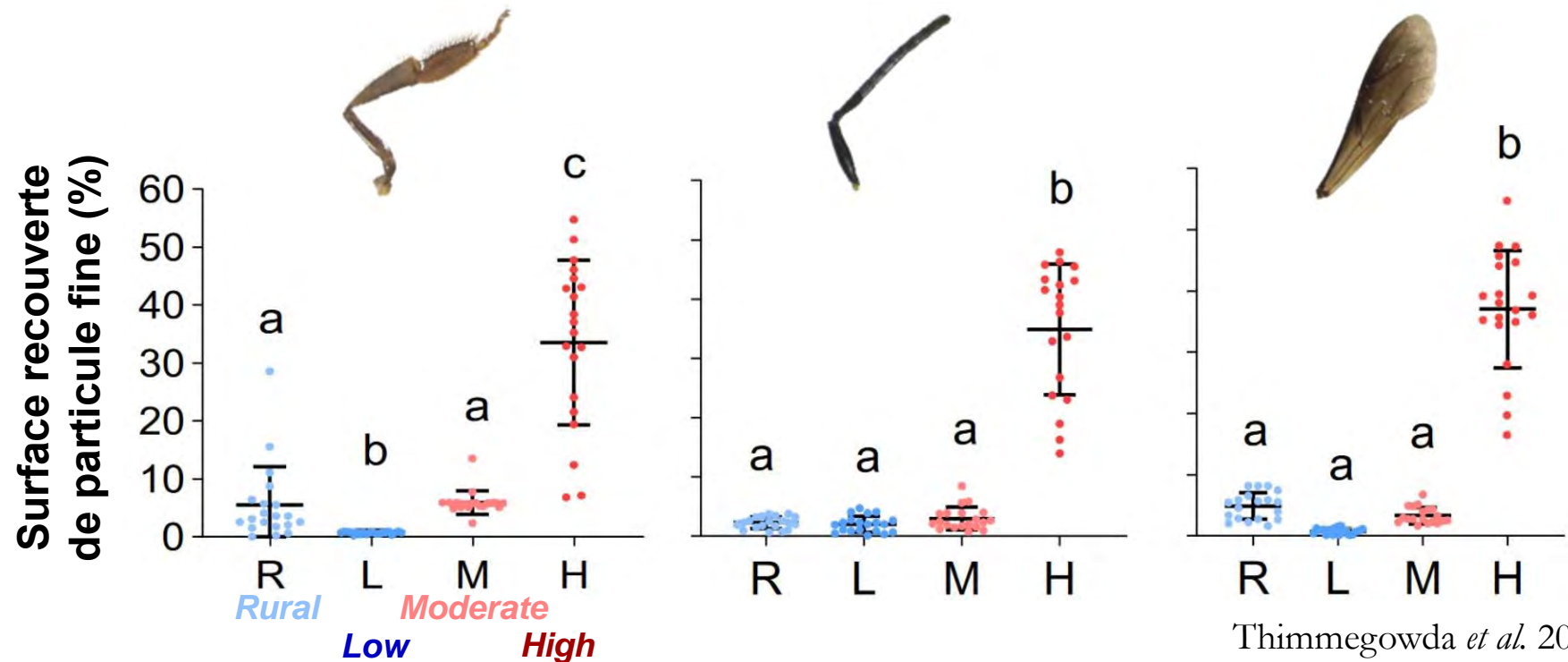
Contaminations aux particules fines



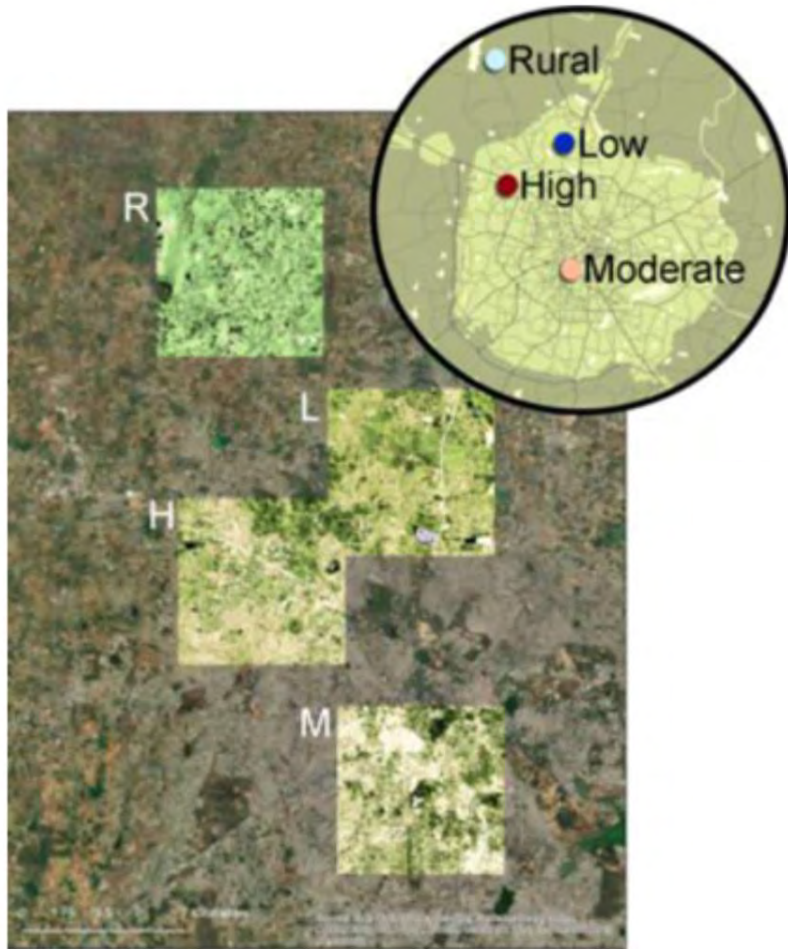
Bangalore, Inde



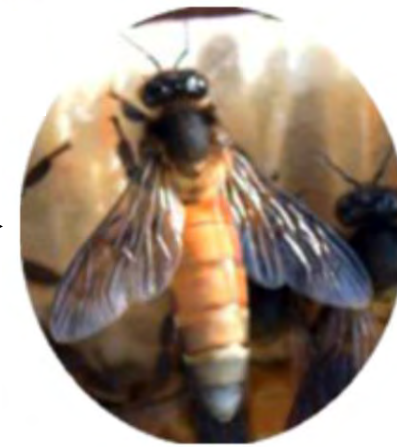
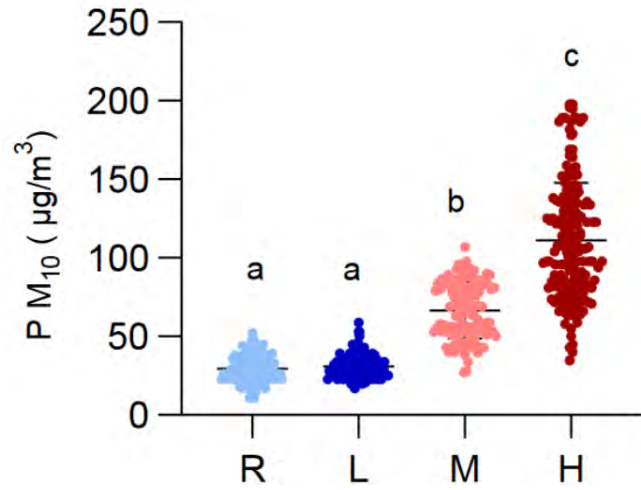
Abeille mellifère géante asiatique (*Apis dorsata*)



Contaminations aux particules fines

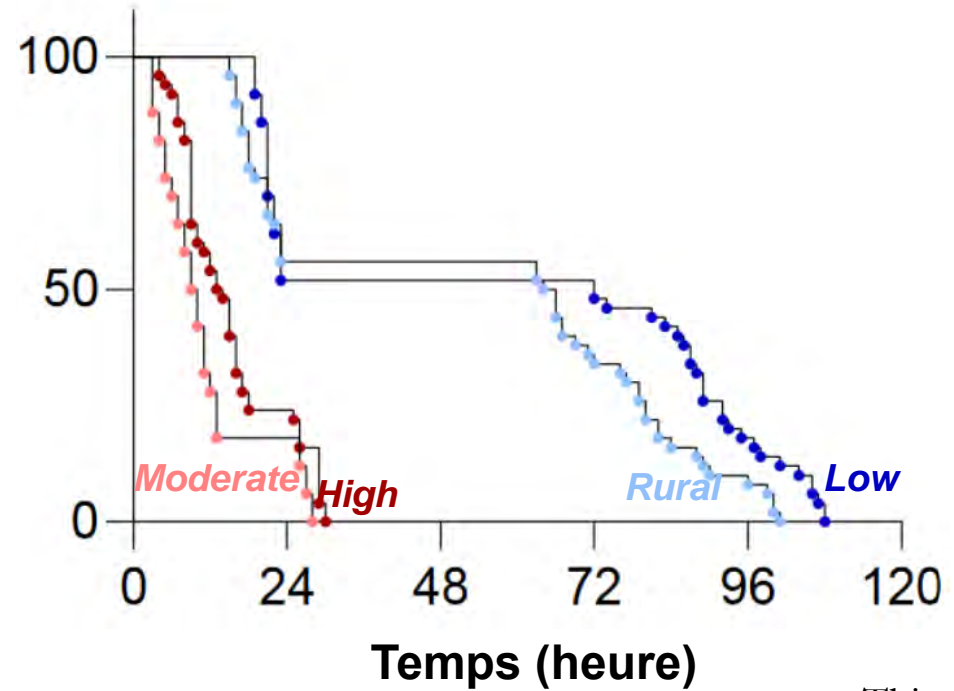


Bangalore, Inde



Abeille mellifère géante asiatique (*Apis dorsata*)

Survie des abeilles (%)

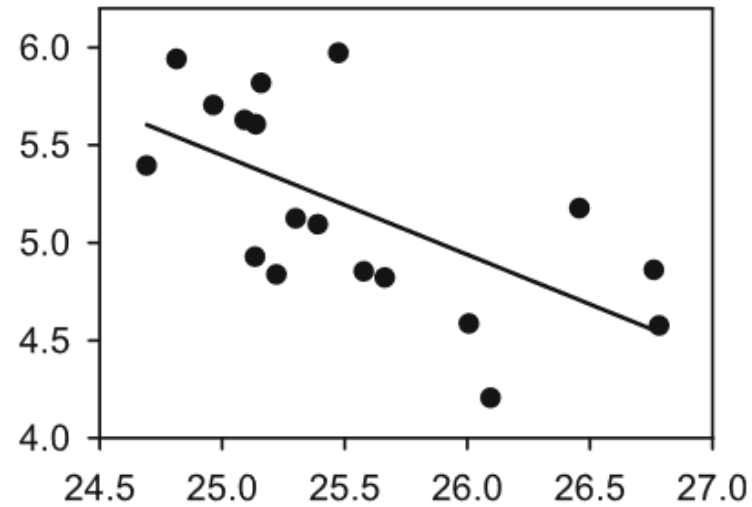


- Abeilles**

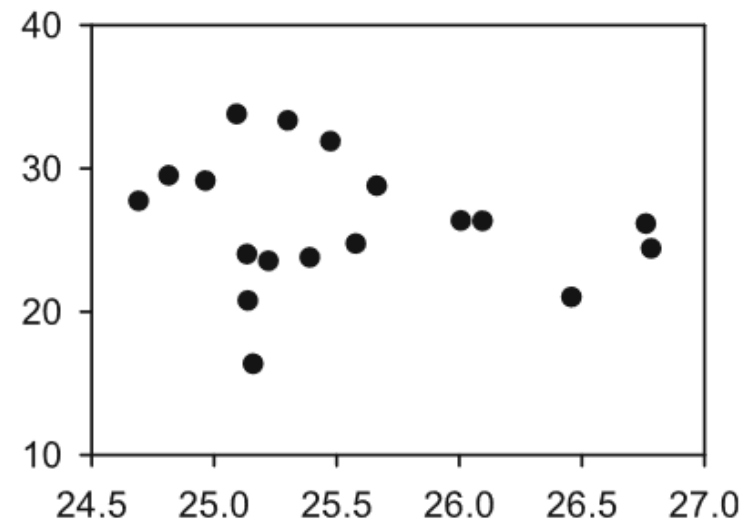
Raleigh, USA



Abondance
(log)



Nombre
d'espèces



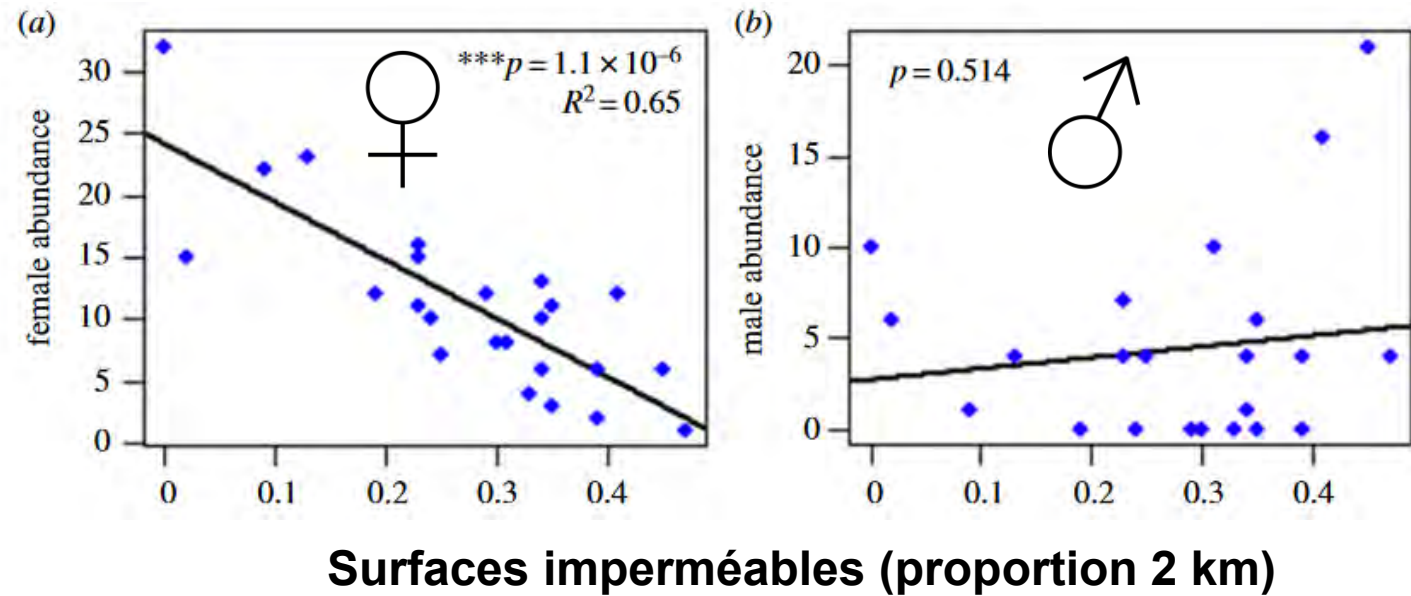
Température (°C)

- **Bourdons**

Région de Détroit,
USA



Abondance



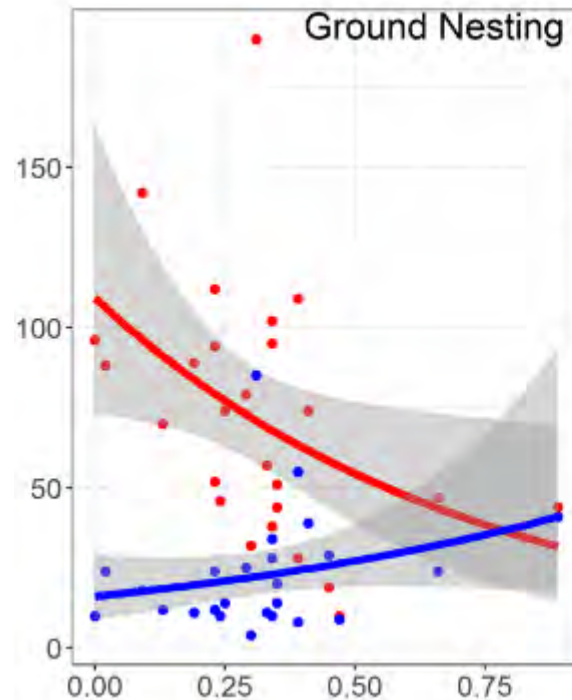
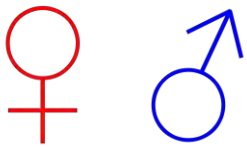
- **Abeilles solitaires**

SE Michigan, USA



Nichant au sol

Abondance



Surfaces imperméables (proportion 2 km)

- Abeilles solitaires**

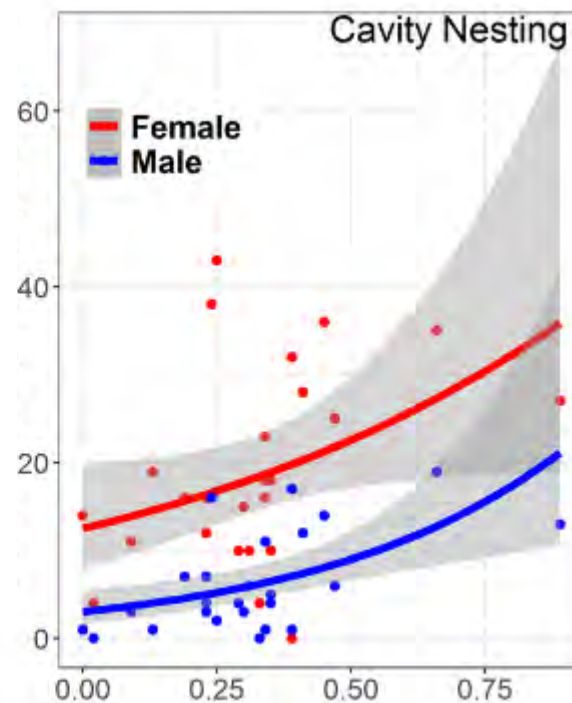
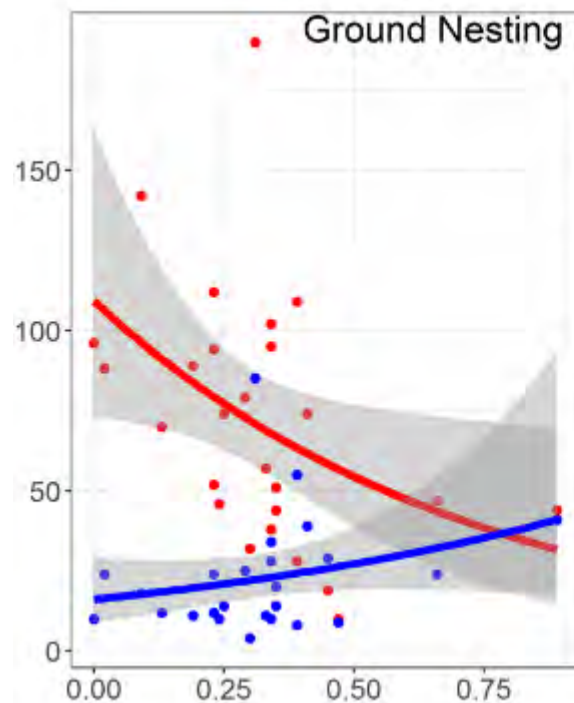
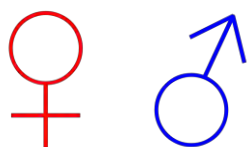
SE Michigan, USA



Nichant au sol

Nichant en cavités

Abondance



Surfaces imperméables (proportion 2 km)

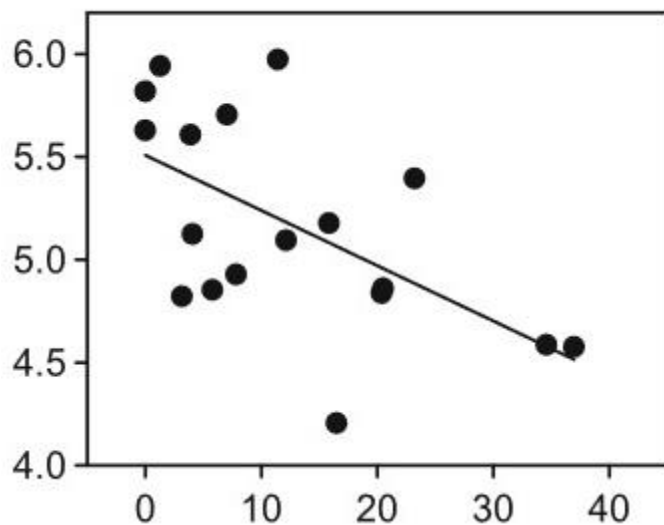
**Diminution sites
de nidification
au sol.**

- Abeilles

Raleigh, USA



Abondance
(log)



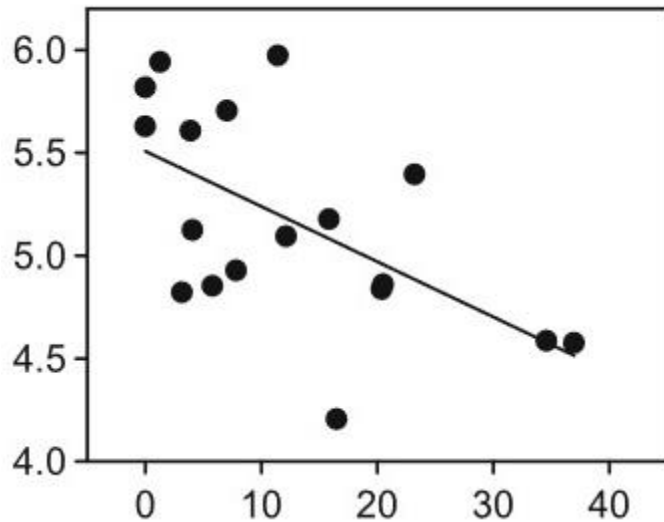
Surfaces imperméables (%)

- Abeilles**



Raleigh, USA

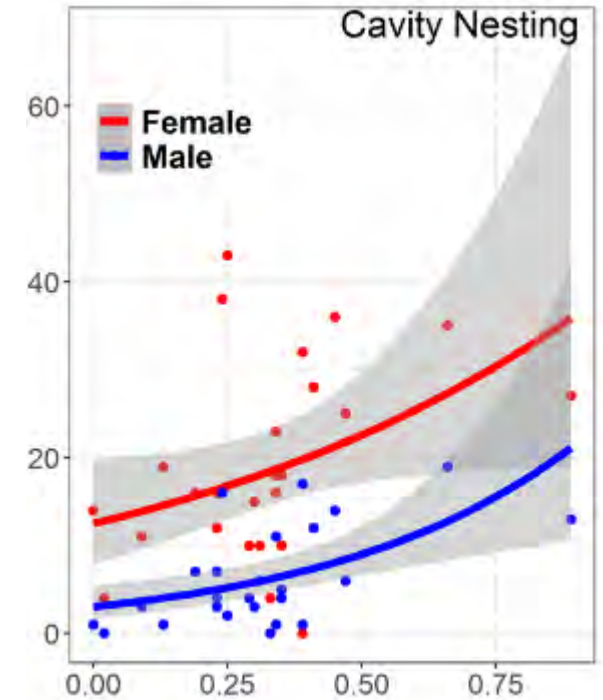
Abondance
(log)



Surfaces imperméables (%)

SE Michigan, USA

Abondance



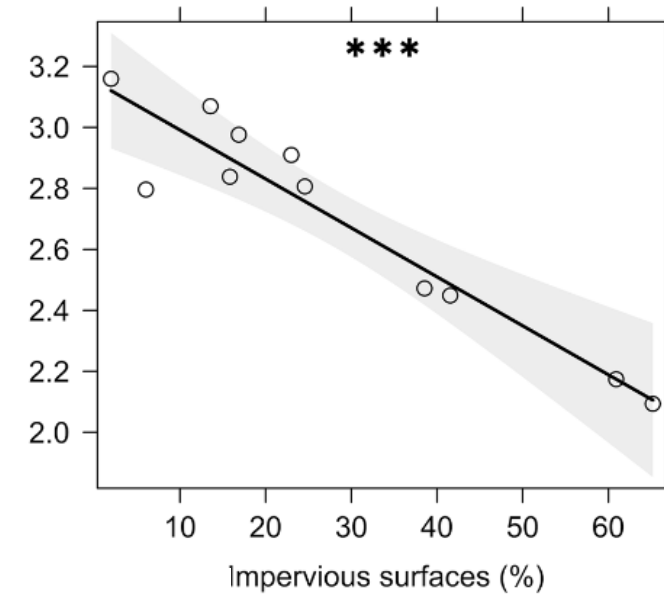
Surfaces imperméables
(proportion)

- Abeilles, Papillons**

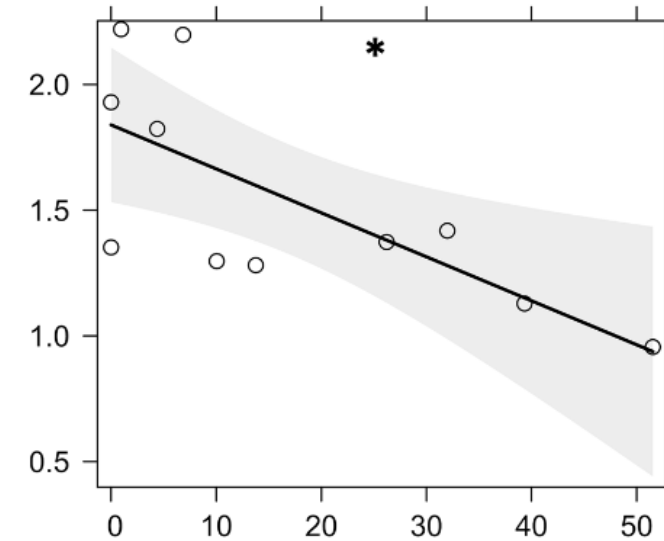
Région de Berlin,
Allemagne



**Diversité
(indice de
Shannon)**



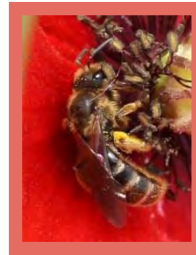
**Diversité
(indice de
Shannon)**



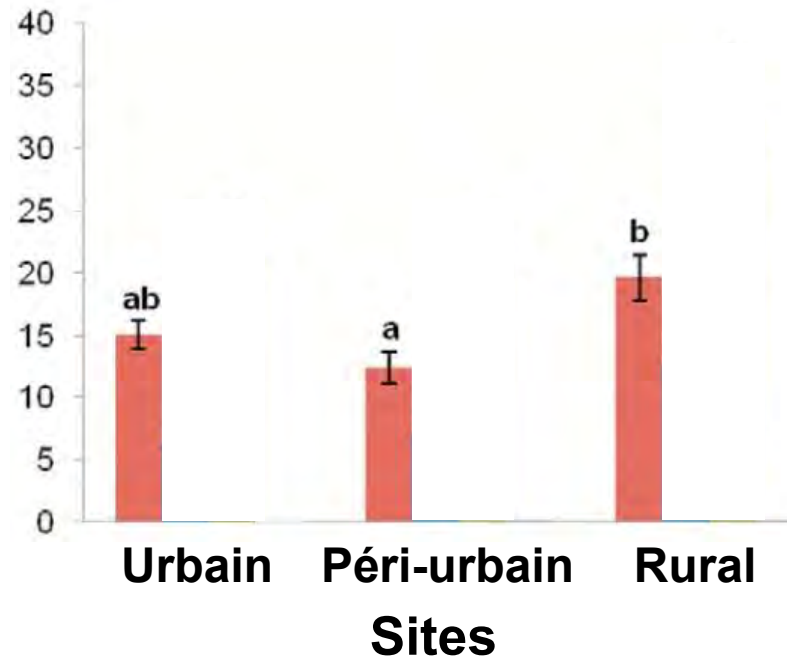
Surfaces imperméables (%)

- **Abeilles, Syrphes**

Birmingham,
Angleterre

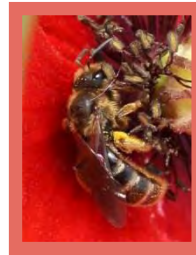


Nombre
d'espèces

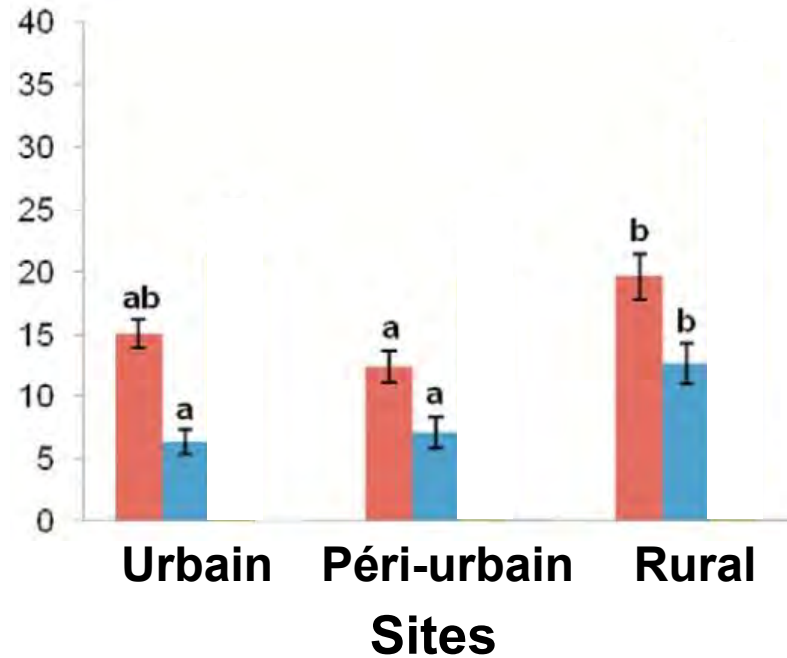


- Abeilles, Syrphes**

Birmingham,
Angleterre



Nombre
d'espèces



- **Contextes urbains différents**
- **Protocoles d'échantillonnage variables**
- **Etudes « abeilles » sur-représentées**

- Contextes urbains différents
- Protocoles d'échantillonnage variables
- Etudes « abeilles » sur-représentées

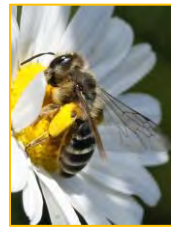
Vision d'ensemble ?





Suivi photographique des insectes pollinisateurs

- Mesurer / Comprendre les variations dans l'espace et le temps
- Tous les insectes floricoles



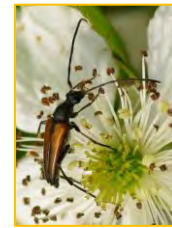
Apoides



Lépidoptères



Autres
hyménoptères



Coléoptères



Diptères



Araignées crabes

...



L'implication de volontaires dans la recherche scientifique





Protocole standardisé

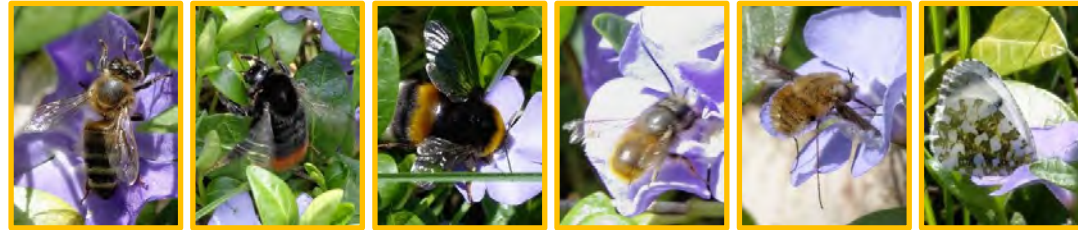


© jfcth, 2013, Pailhares





Protocole standardisé



© jfct, 2013, Pailhares

© Magali Evanno 2013



Identification sur photo par les observateurs



Longueur des antennes

La longueur des antennes se mesure d'une extrémité à l'autre.

Antennes courtes ou Antennes de taille Antennes longues à

Antennes de taille moyenne (96)
Les antennes ne dépassent pas la longueur tête + thorax.

196 Remaining taxa (species, gro...)

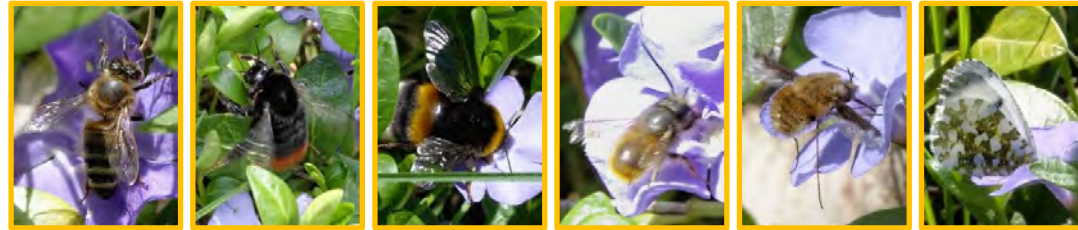
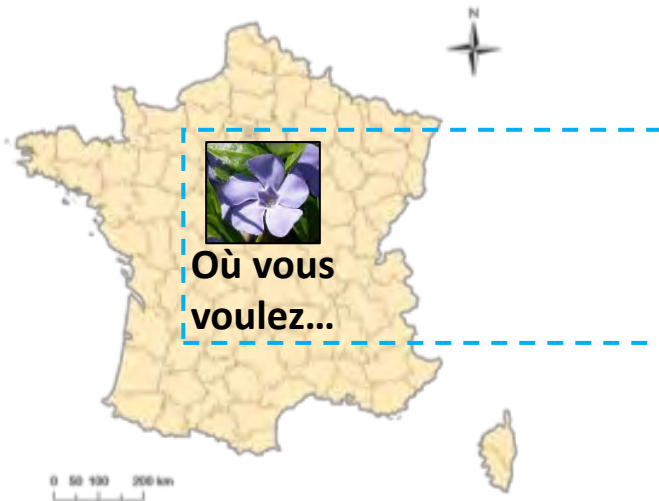
- L'Abeille Ceratina noire (*Ceratina cucurbitina*)
- L'Abeille coucou *Epeoloides* (femelle) (*Epeoloides coecutiens*)
- L'Abeille mellifère (*Apis mellifera*)
- Les Abeilles à abdomen rouge (*Sphecodes* et autres)
- Les Abeilles à culottes (*Dasypoda*)
- Les Abeilles à thorax roux (*Andrena clarkella* et autres)
- Les Abeilles Ceratina bleutées (*Ceratina*)
- Les Abeilles coucou *Melecta* (*Melecta*)

Finish this identification



Protocole standardisé

1 collection



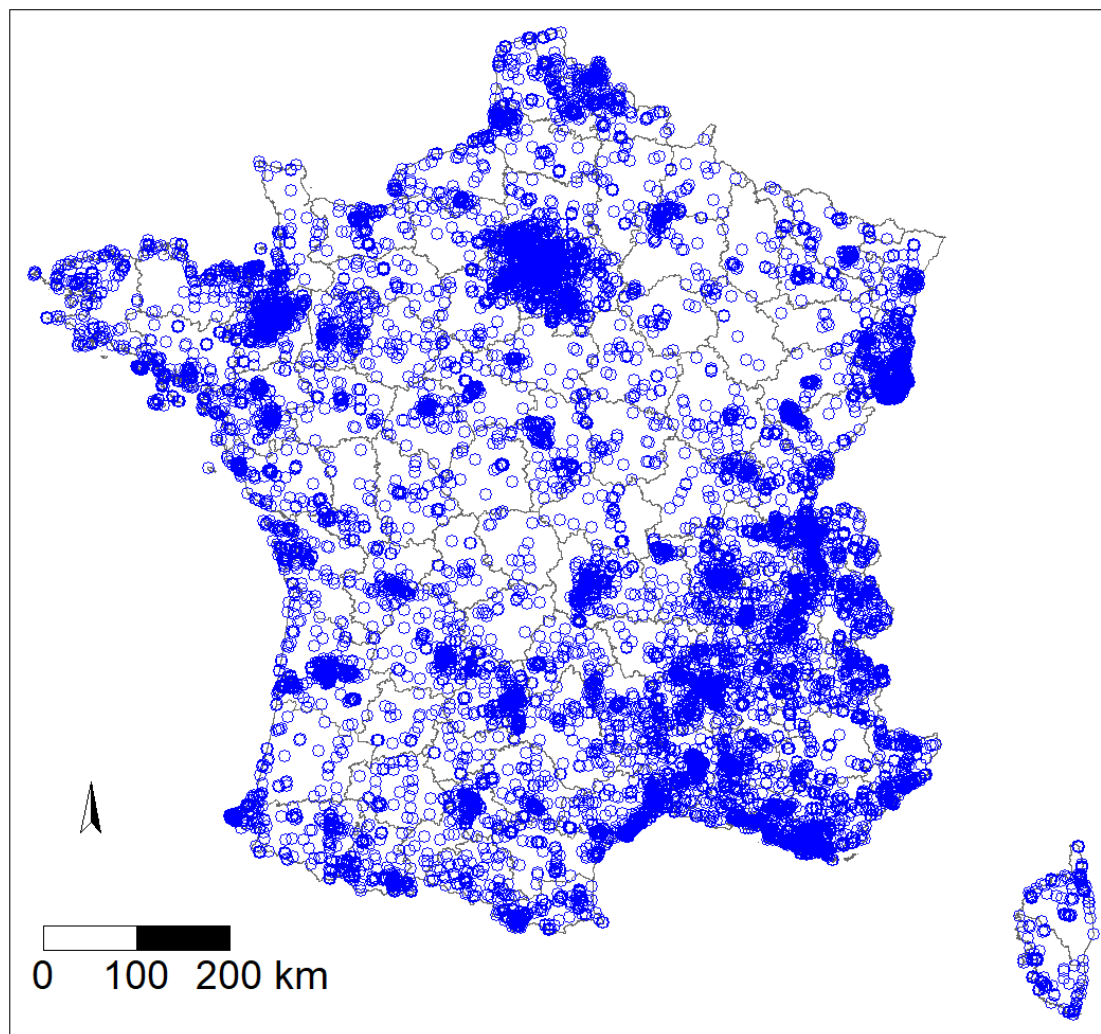
1 JE CHOISIS UNE ESPECE VÉGÉTALE EN FLEUR

2 JE PHOTOGRAPHE TOUS LES INSECTES SE POSANT SUR SES FLEURS



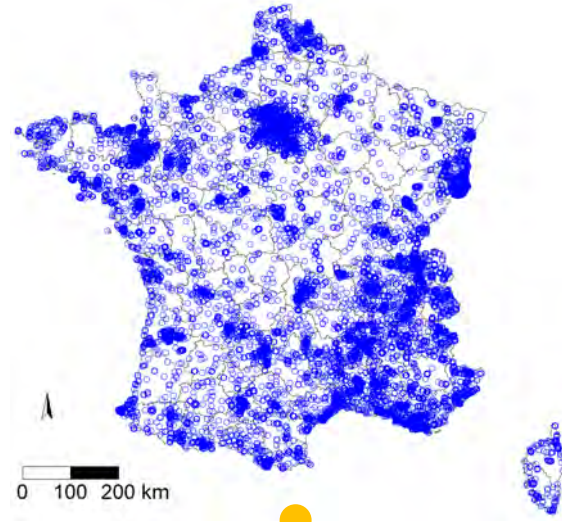
© jfcth, 2013, Pailhares





Au 29 sept 2023 :
73 807 collections





**Affinité
envers les
milieux urbains**

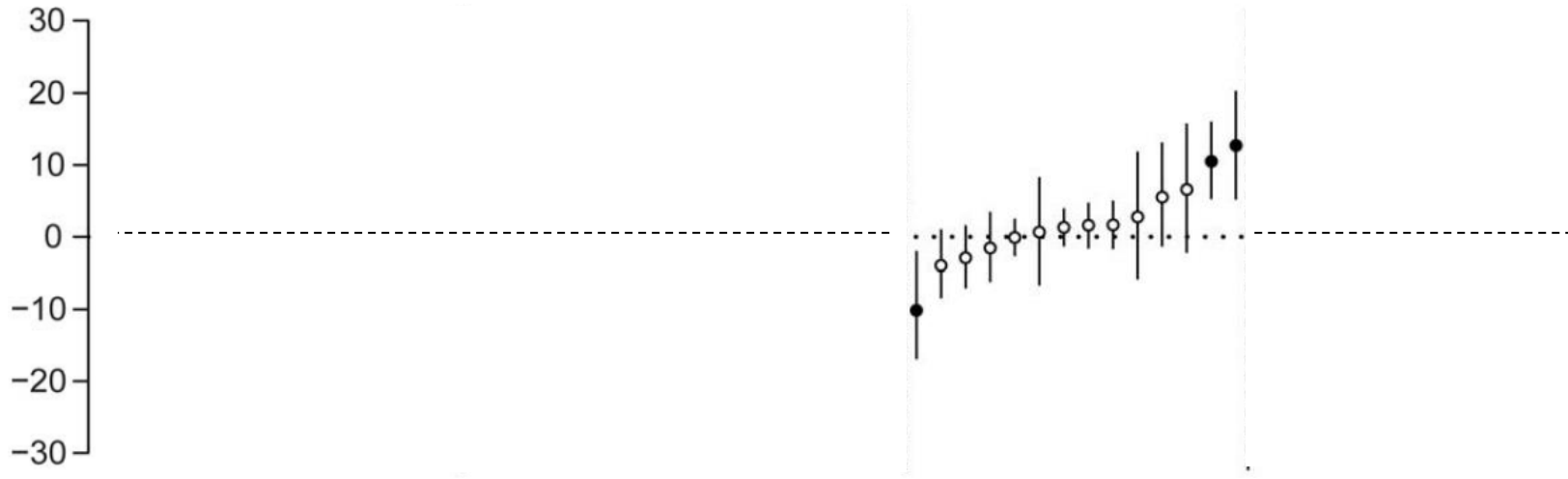


Corine Land Cover
(occupation du sol)



Hymenoptera

**Affinité
envers les
milieux urbains**



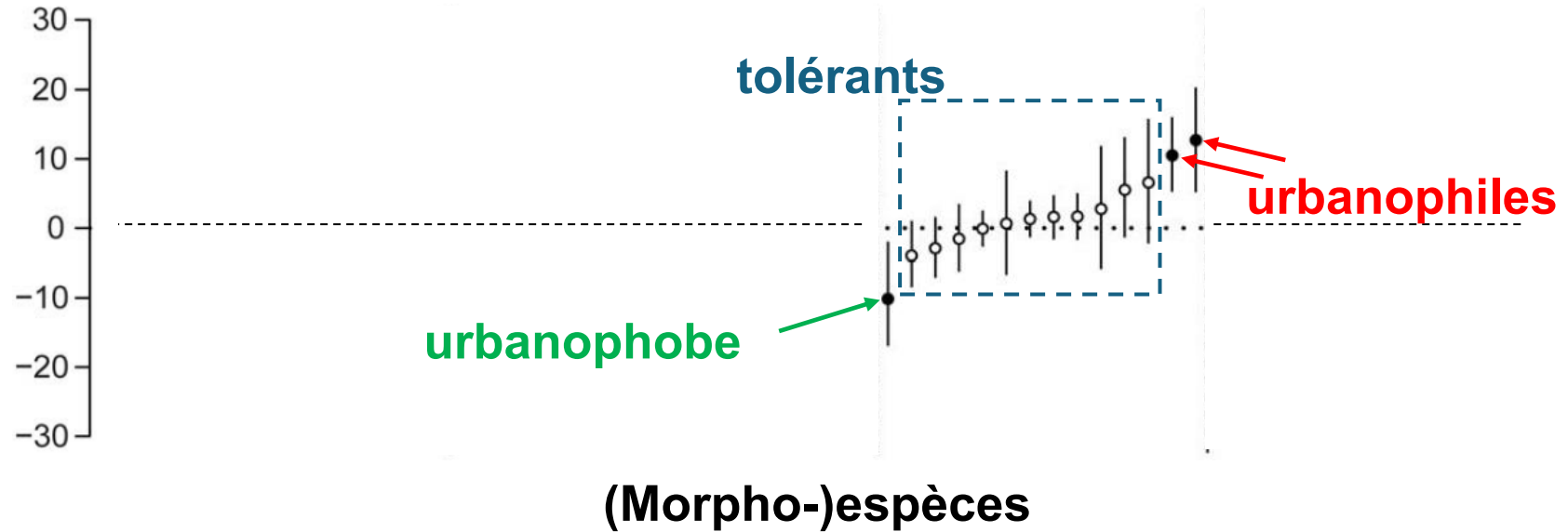
(Morpho-)espèces

Réponses à l'urbanisation variables mais négatives en moyenne



Hymenoptera

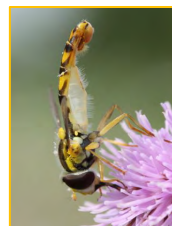
Affinité
envers les
milieux urbains



Réponses à l'urbanisation variables mais négatives en moyenne



Coleoptera



Diptera

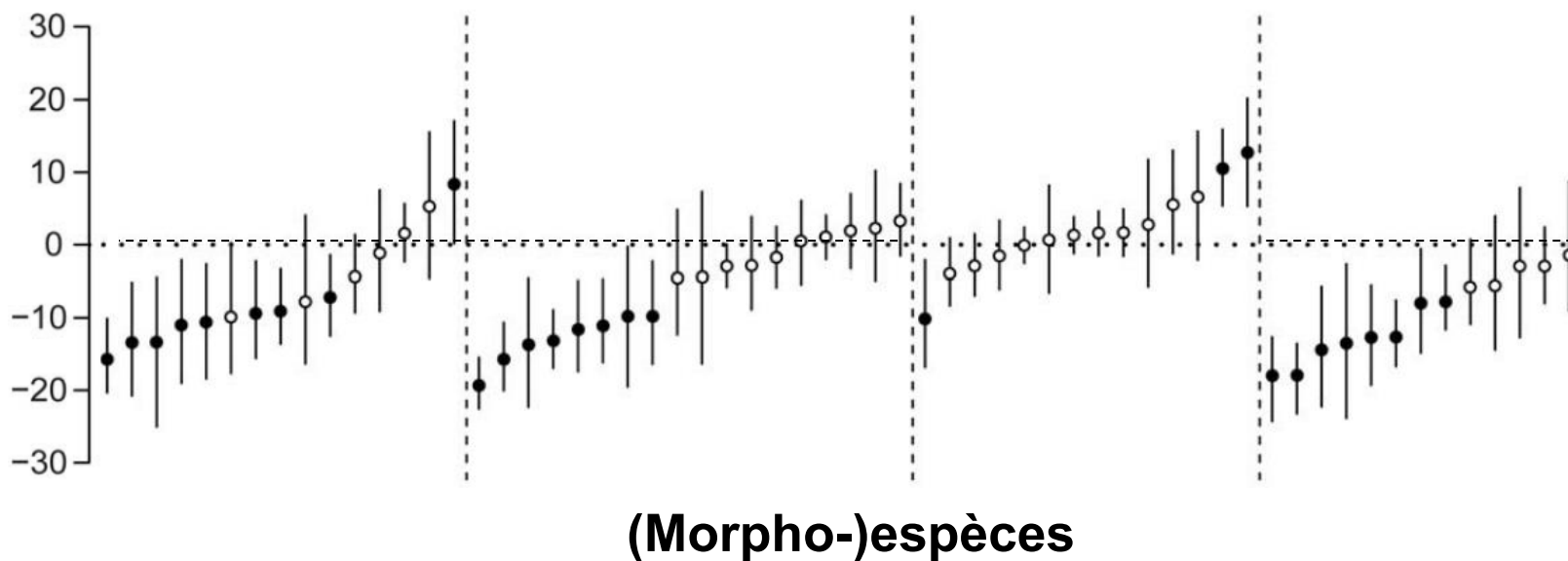


Hymenoptera



Lepidoptera

**Affinité
envers les
milieux urbains**



72% d'urbanophobes (données 2010-2022 ; sur 235 taxons)



(Sciences participatives)



**Abondance et nb. d'espèces
réduit en milieux urbains**

L'urbanisation affecte aussi les papillons de nuit



(Sciences participatives)



Abondance et nb. d'espèces
réduit en milieux urbains



Espèces vulnérables
sont plus affectées

Received: 7 June 2019

Revised: 28 February 2020

Accepted: 12 March 2020

DOI: 10.1111/geb.13107

META-ANALYSIS

Global Ecology
and Biogeography

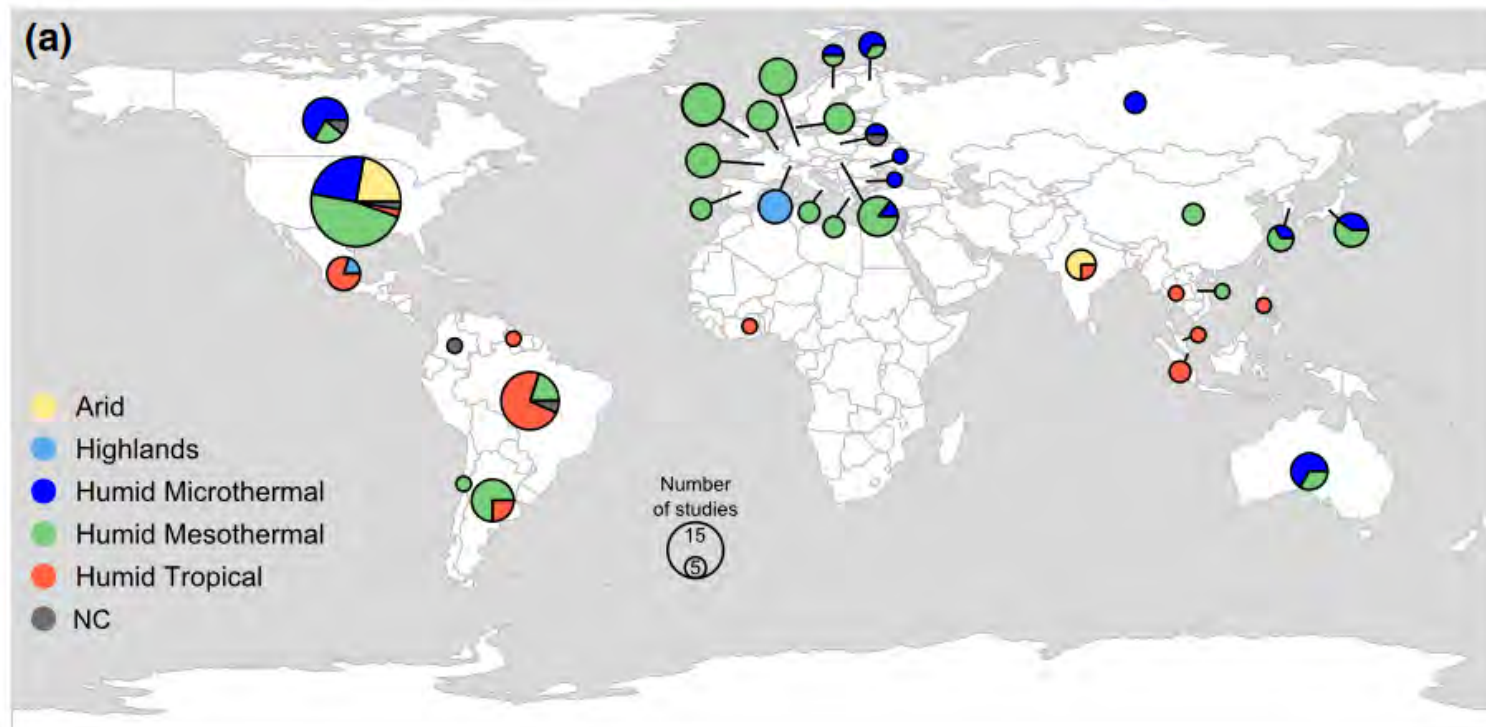
A Journal of
Macroecology

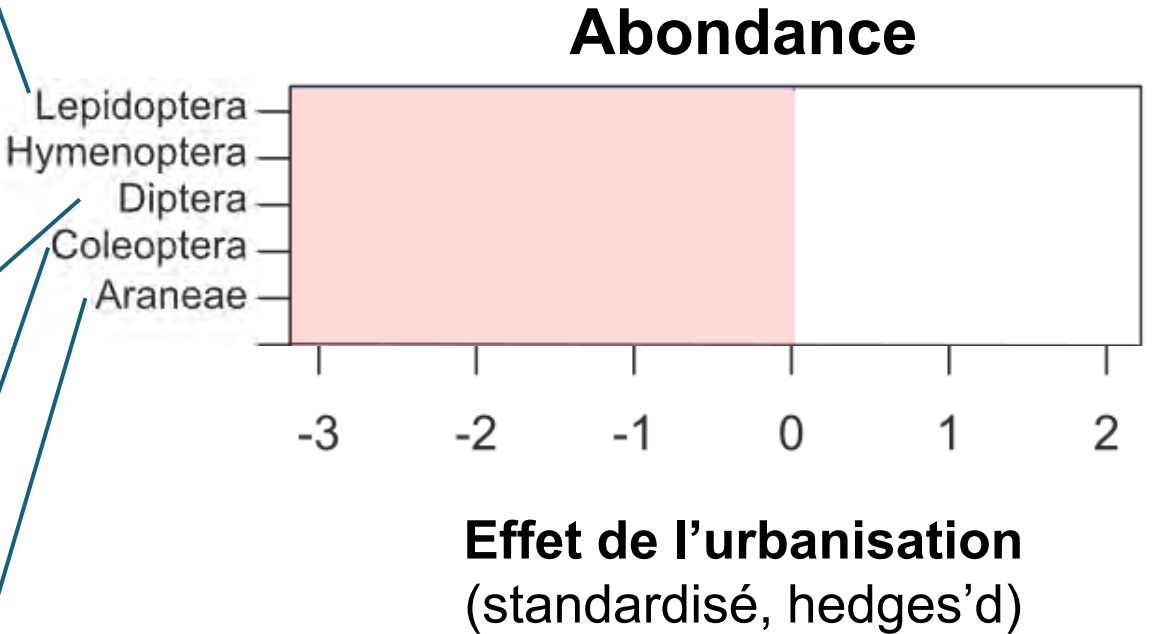
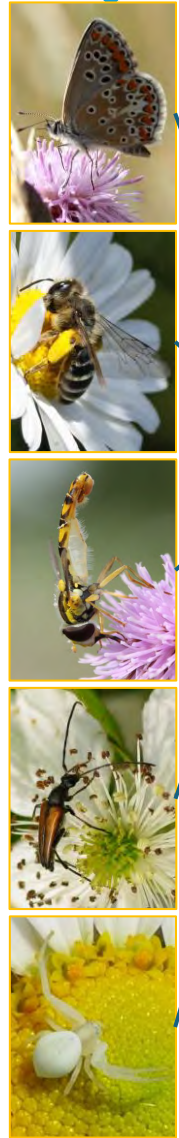
WILEY

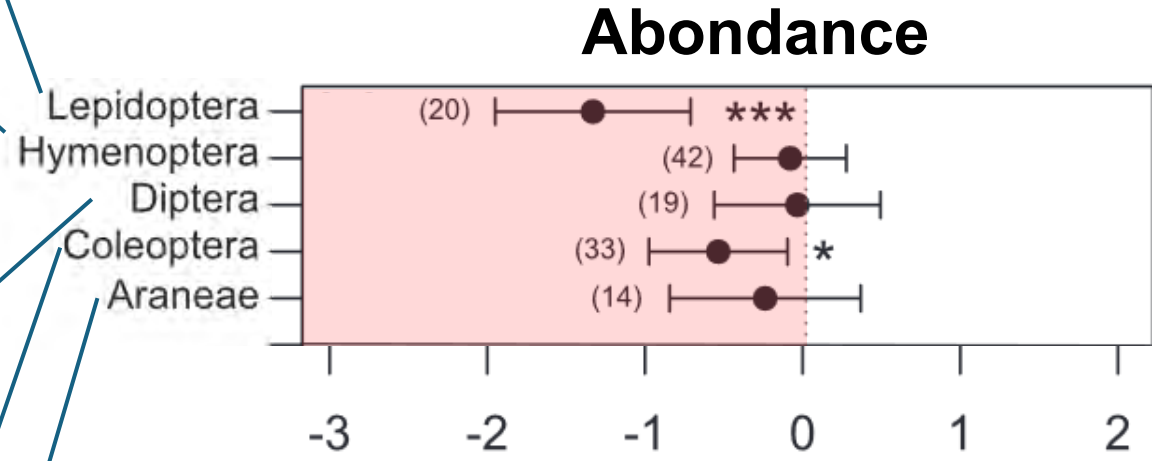
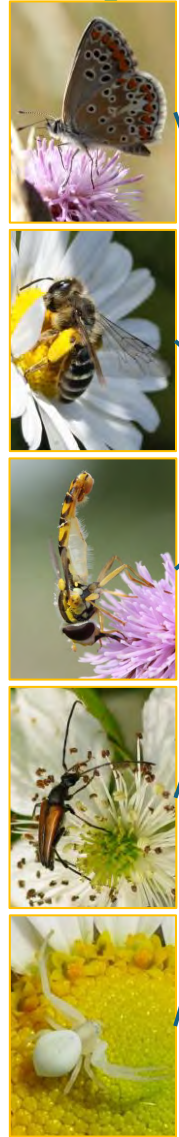
Negative effects of urbanization on terrestrial arthropod communities: A meta-analysis

María Silvina Fenoglio  | María Rosa Rossetti  | Martín Videla 

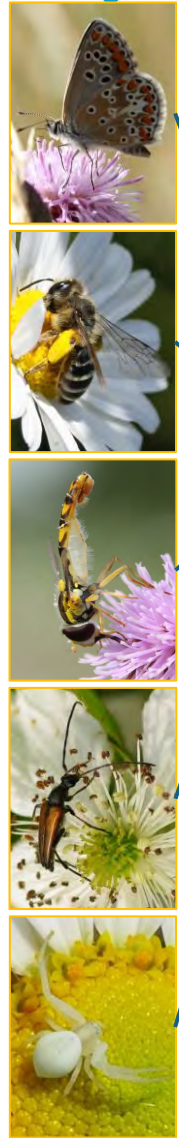
- **162 publications**
- **Arthropodes : abondance et nb. d'espèces**
- **Co-variables** : climat, taille/âge des sites, pollution de l'air, végétation





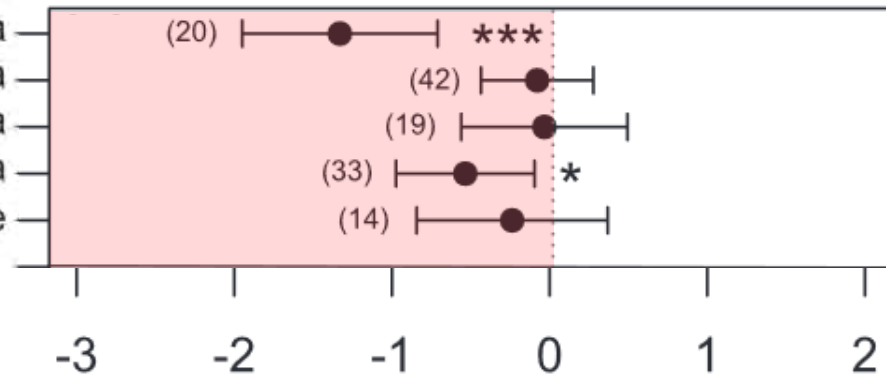


Effet de l'urbanisation
(standardisé, hedges'd)



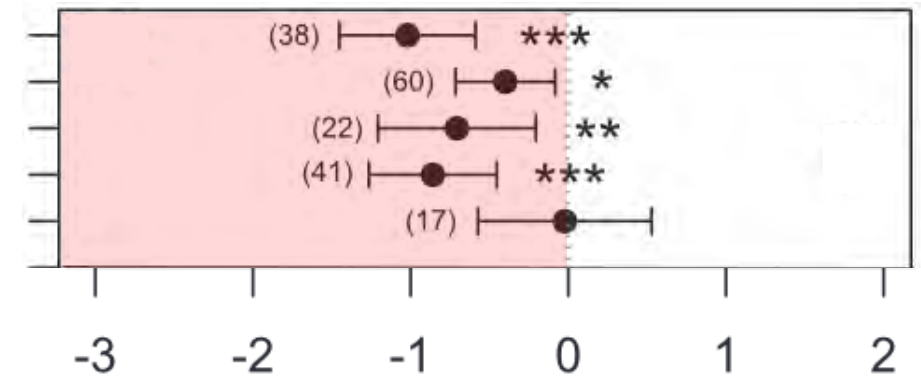
Lepidoptera
Hymenoptera
Diptera
Coleoptera
Araneae

Abondance



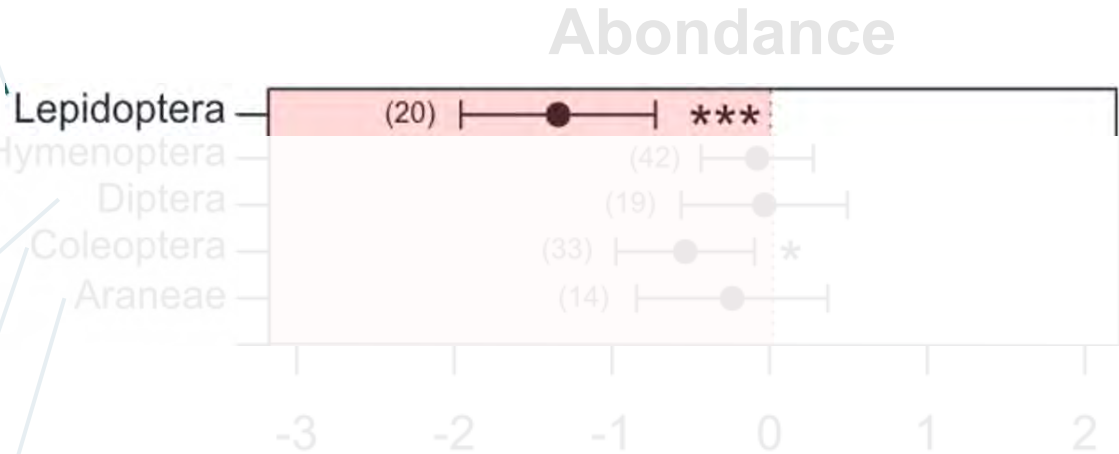
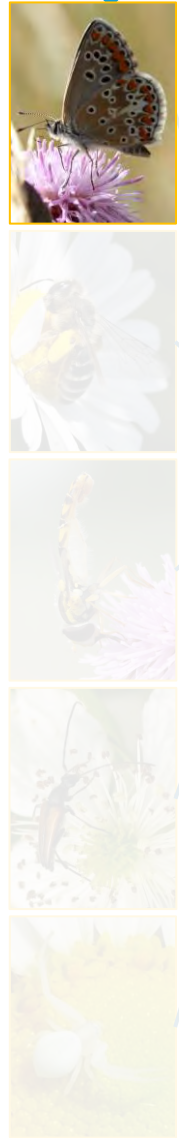
Effet de l'urbanisation
(standardisé, hedges'd)

Diversité

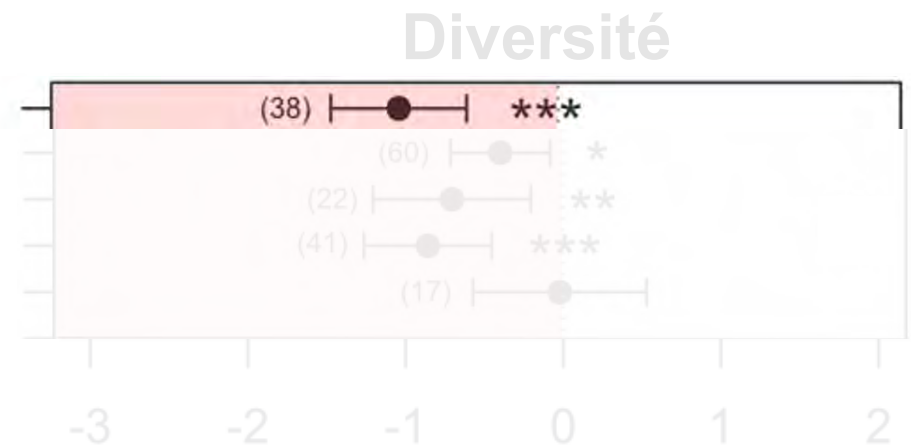


Effet de l'urbanisation
(standardisé, hedges'd)

Synthèse de centaines d'articles publiés



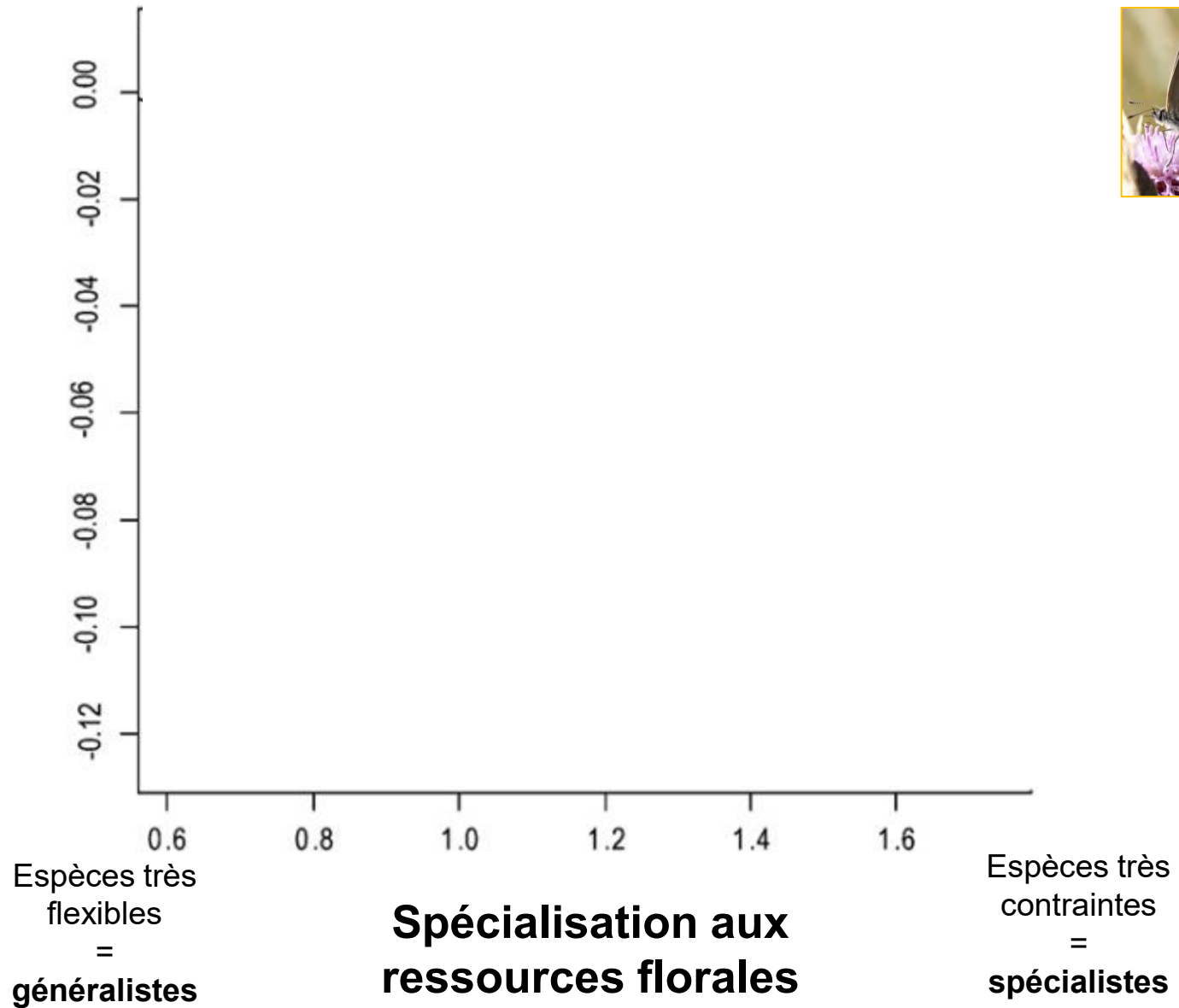
Effet de l'urbanisation
(standardisé, hedges'd)



Effet de l'urbanisation
(standardisé, hedges'd)

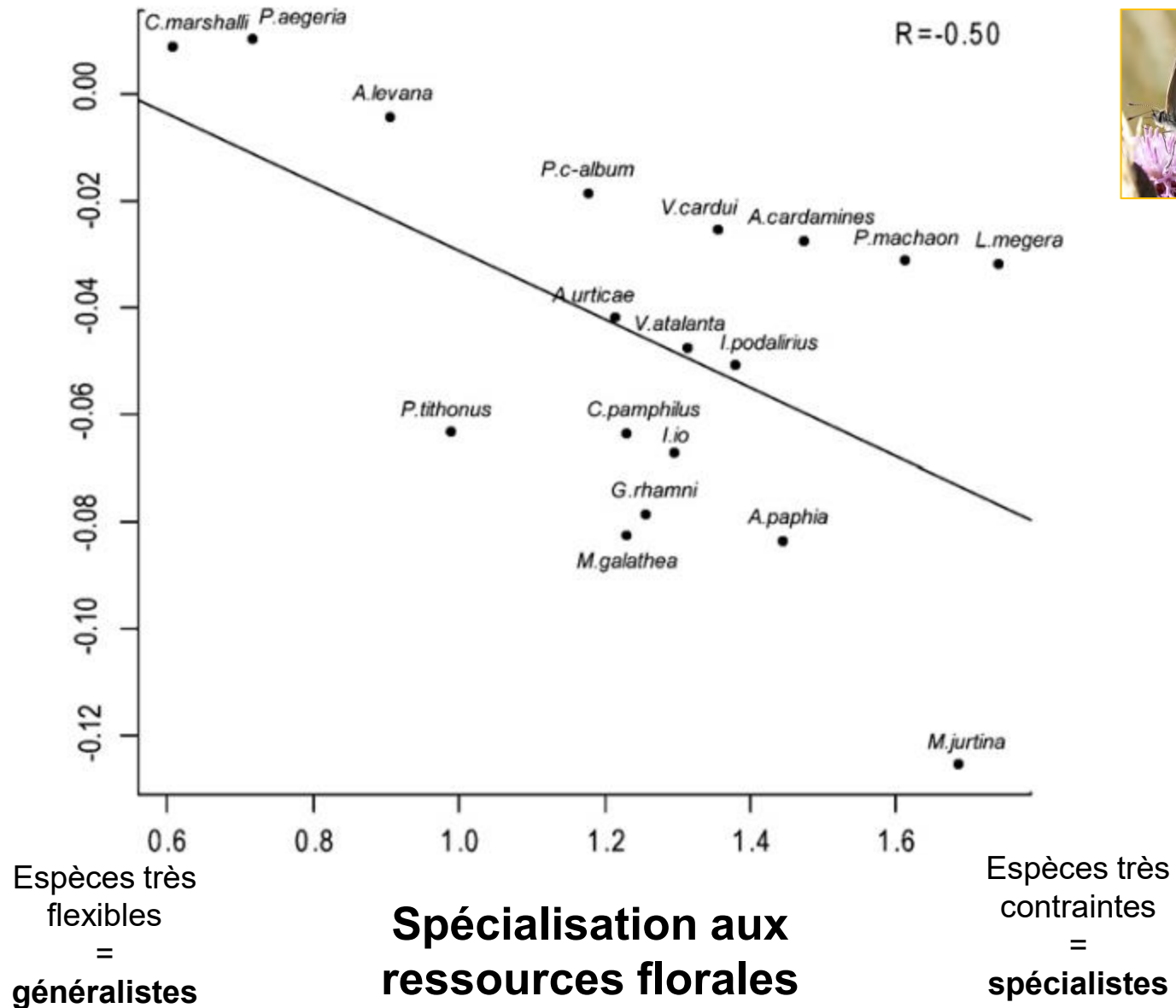
Les spécialistes sont défavorisés

Réponse à
l'urbanisation

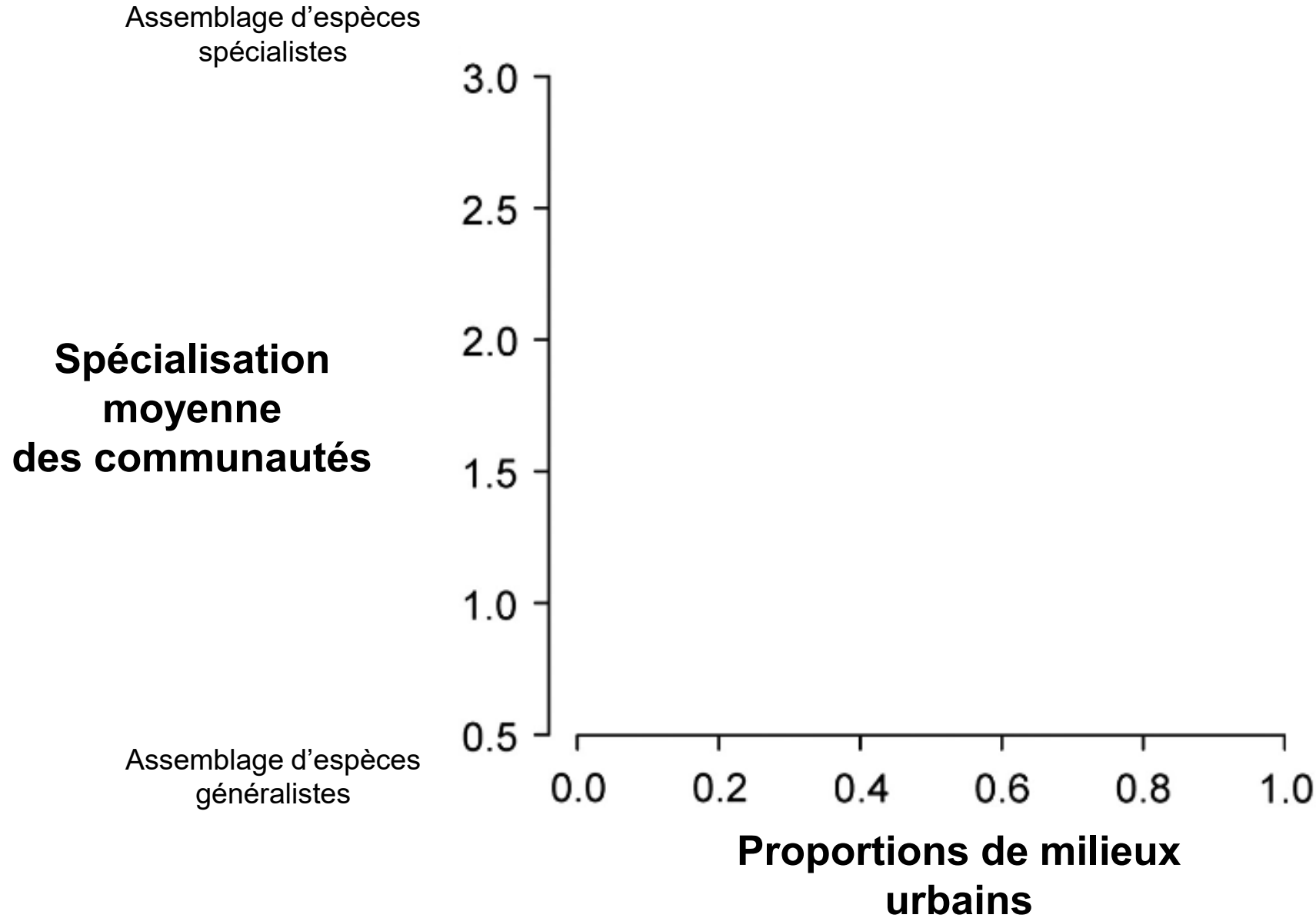


Les spécialistes sont défavorisés

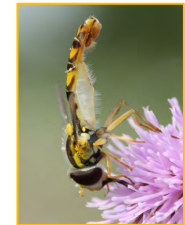
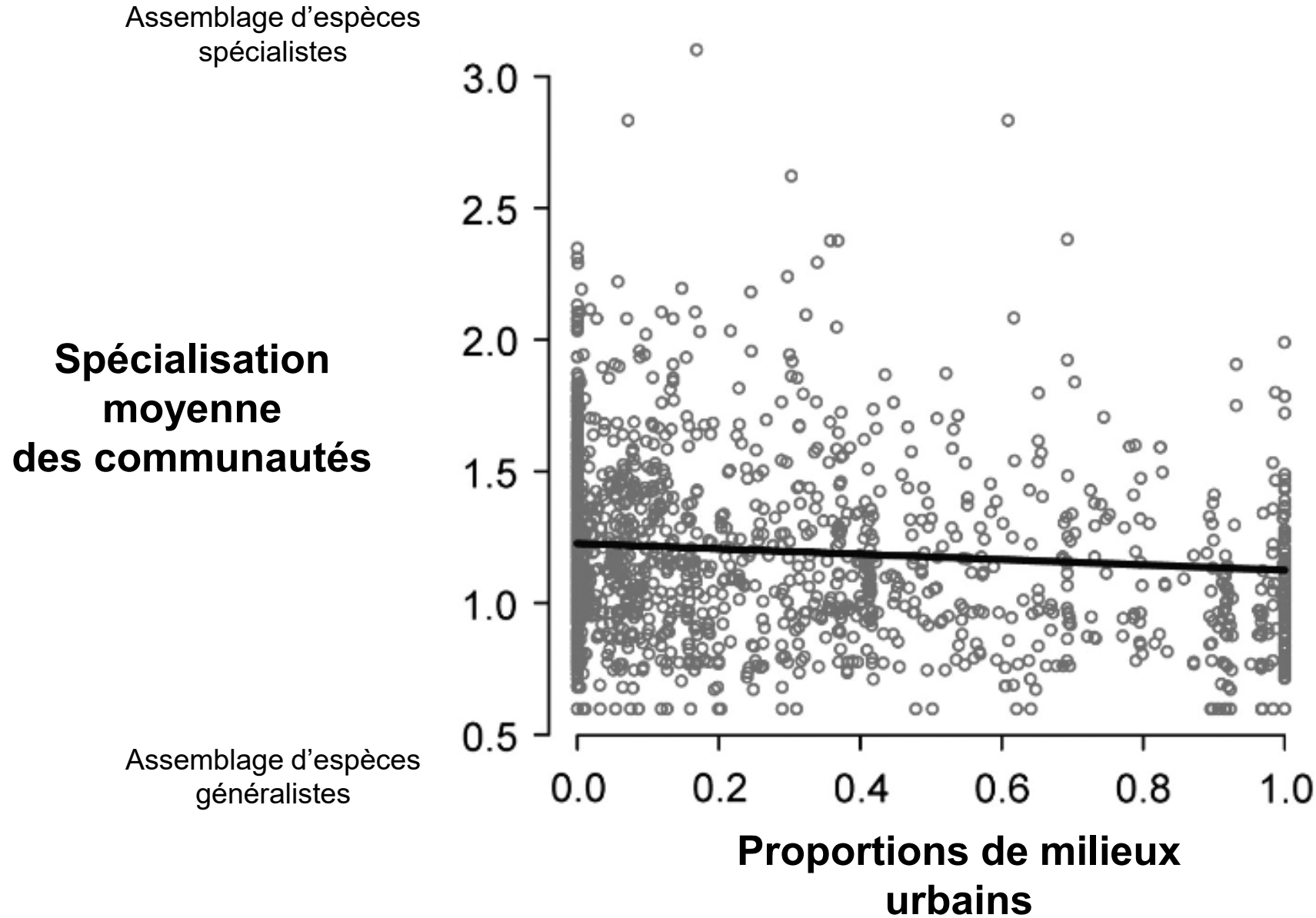
Réponse à
l'urbanisation



Les spécialistes sont défavorisés



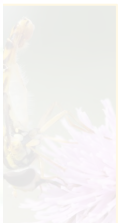
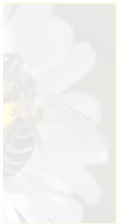
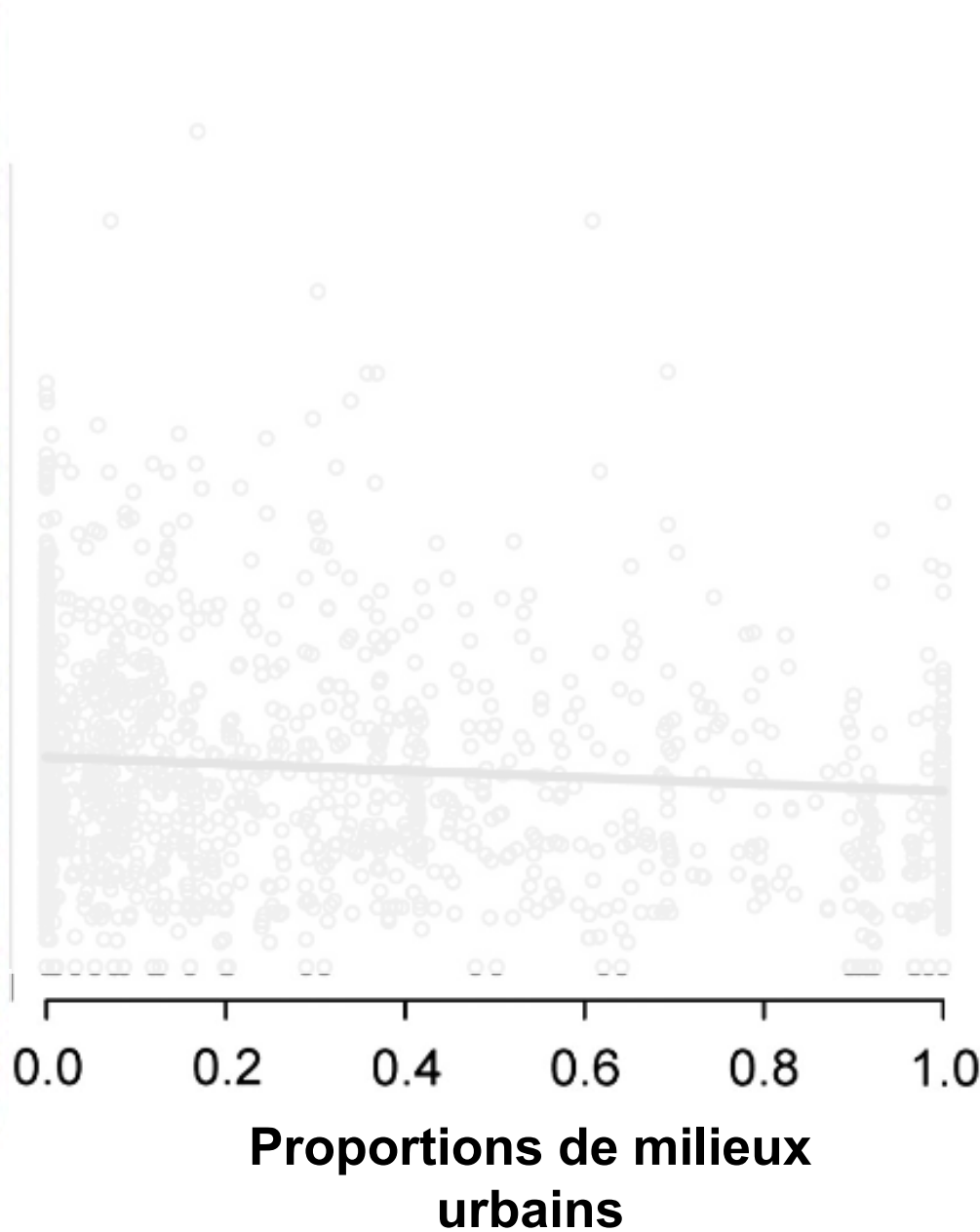
Les spécialistes sont défavorisés



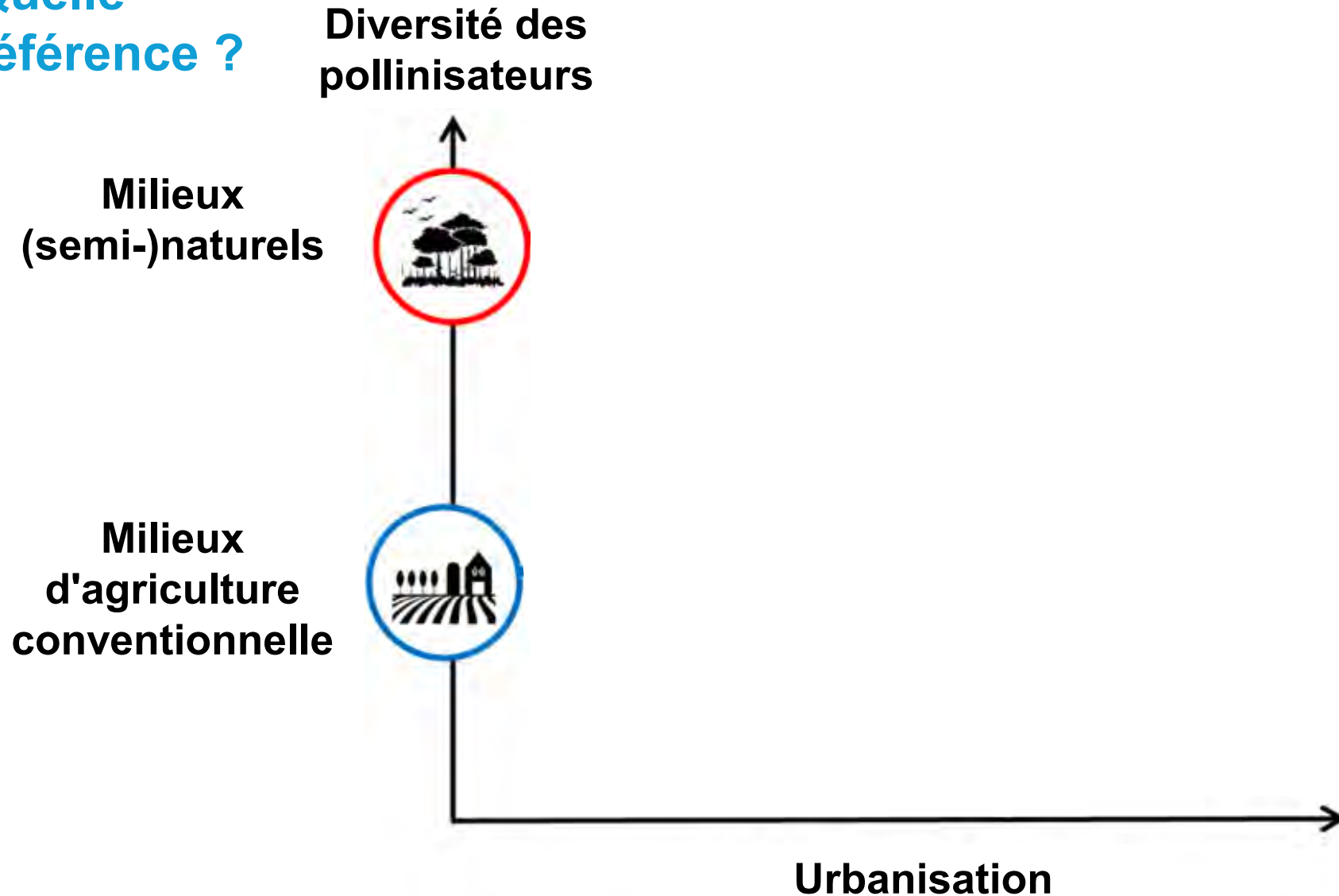
Les spécialistes sont défavorisés

Assemblée
spé

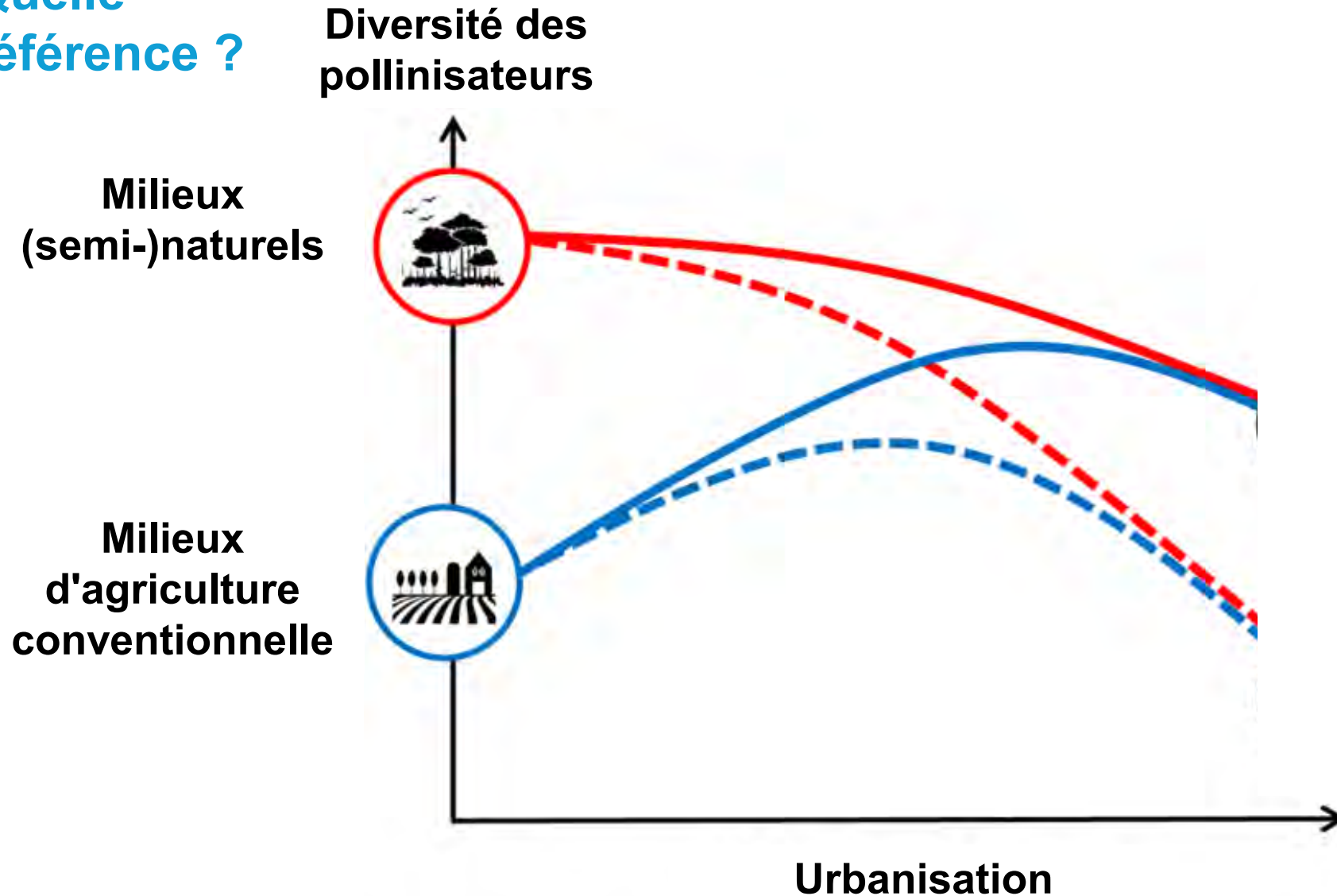
Spécialisa
moyen
des commu



- **Quelle référence ?**

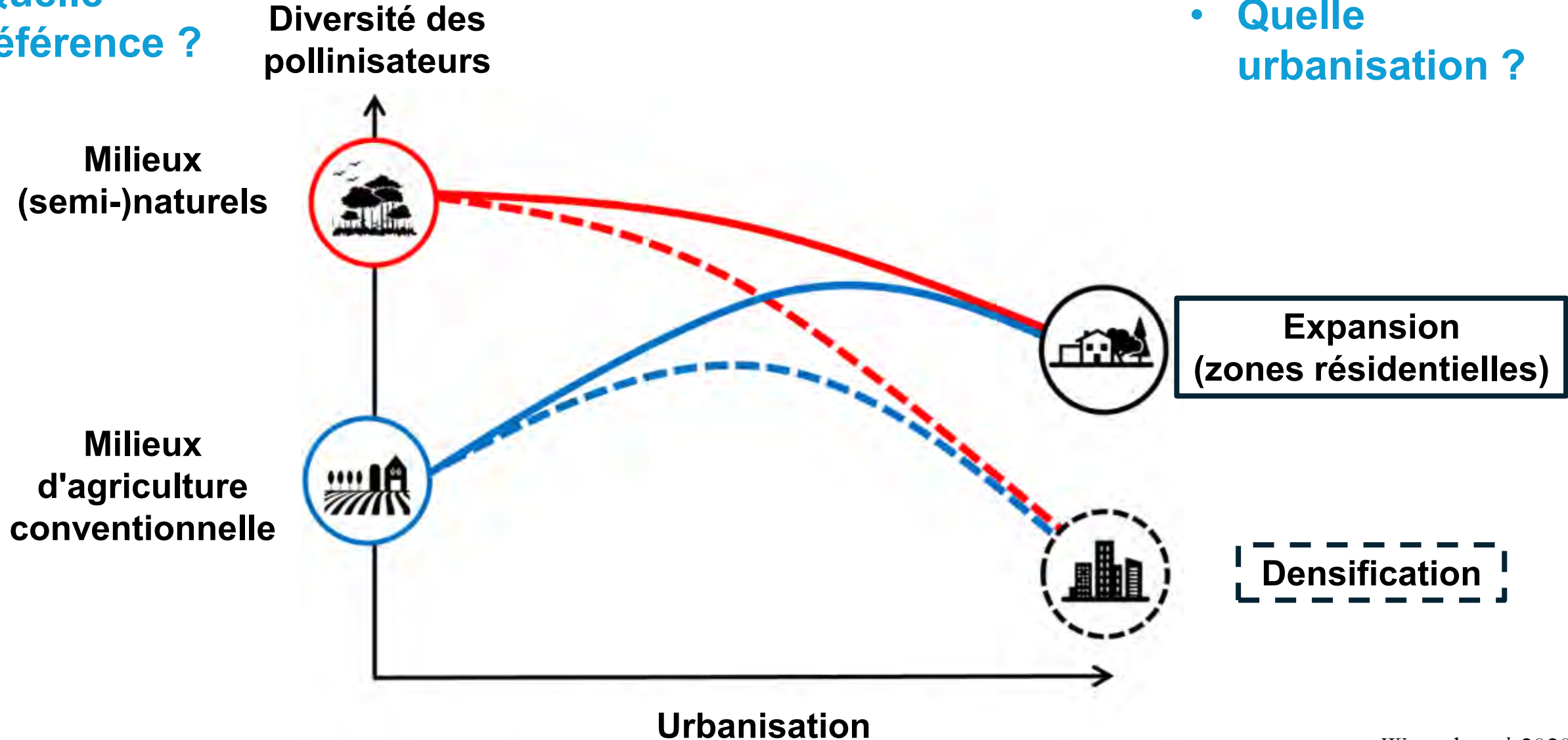


- Quelle référence ?



Hypothèses pour réconcilier les résultats divergents

- Quelle référence ?



- Quelle urbanisation ?

Hypothèses pour réconcilier les résultats divergents

• **Quelle référence ?**

Diversité des pollinisateurs

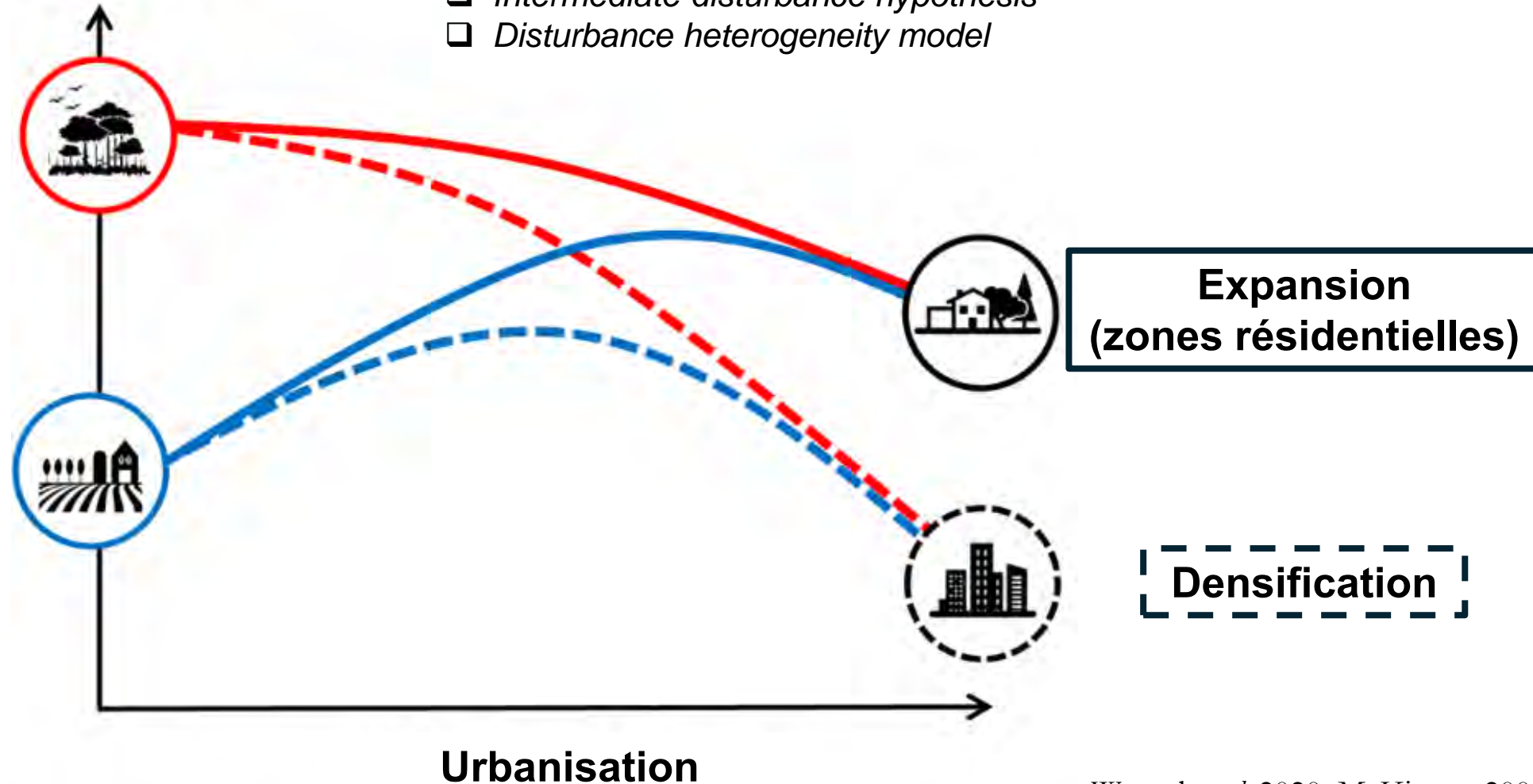
Milieux (semi-)naturels

Milieux d'agriculture conventionnelle

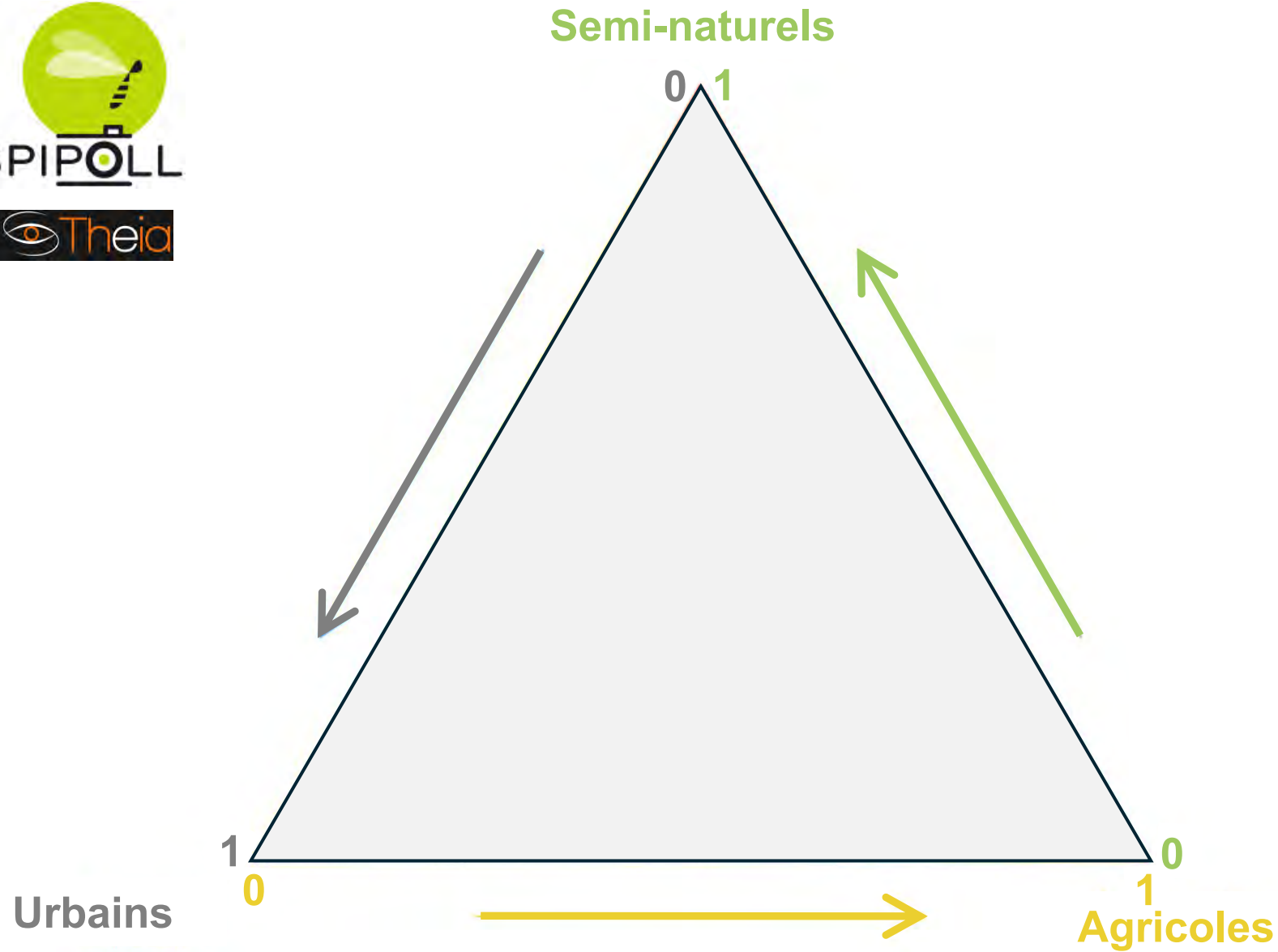
• **Non-linéarité ?**

- Intermediate disturbance hypothesis*
- Disturbance heterogeneity model*

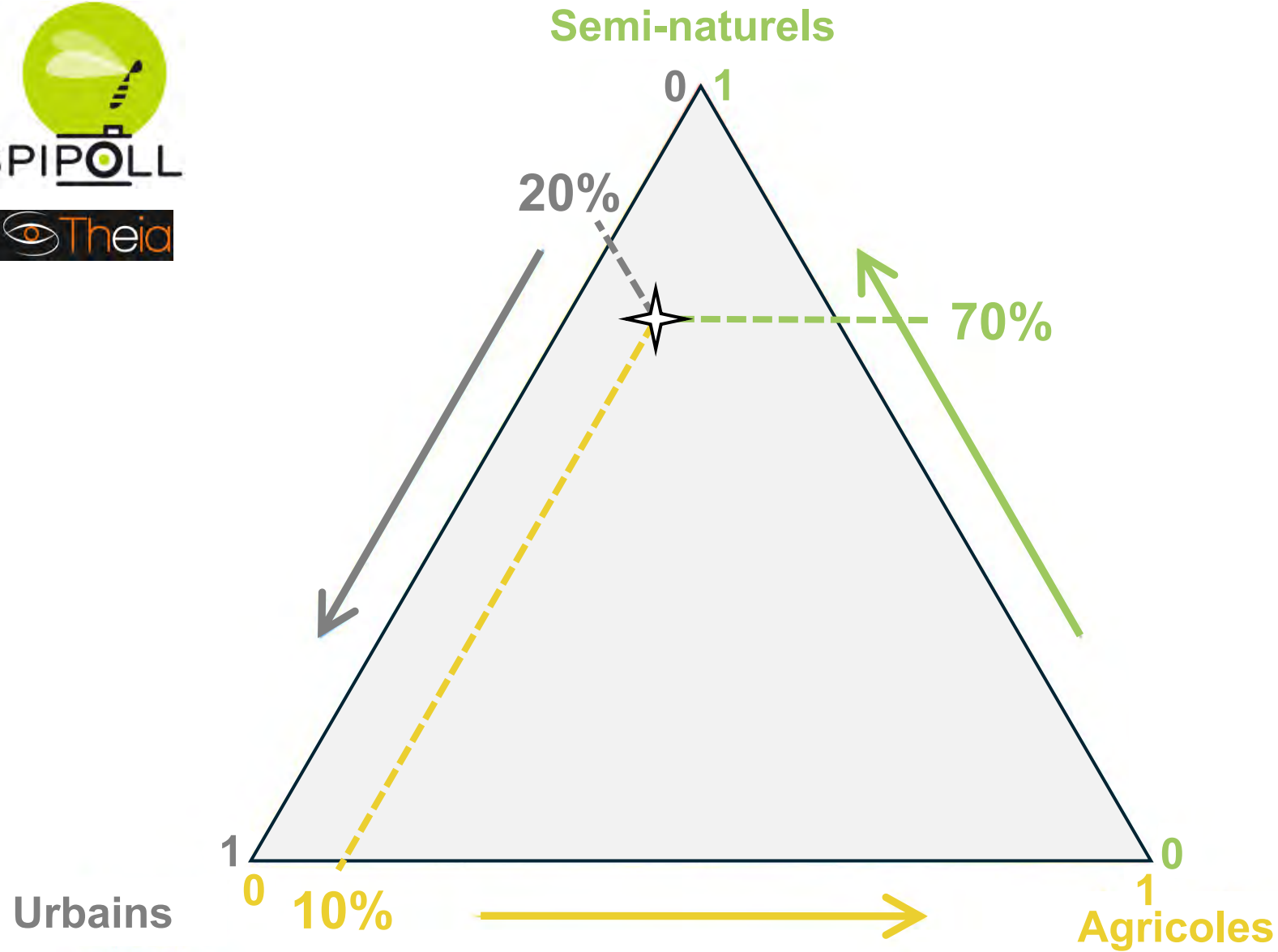
• **Quelle urbanisation ?**



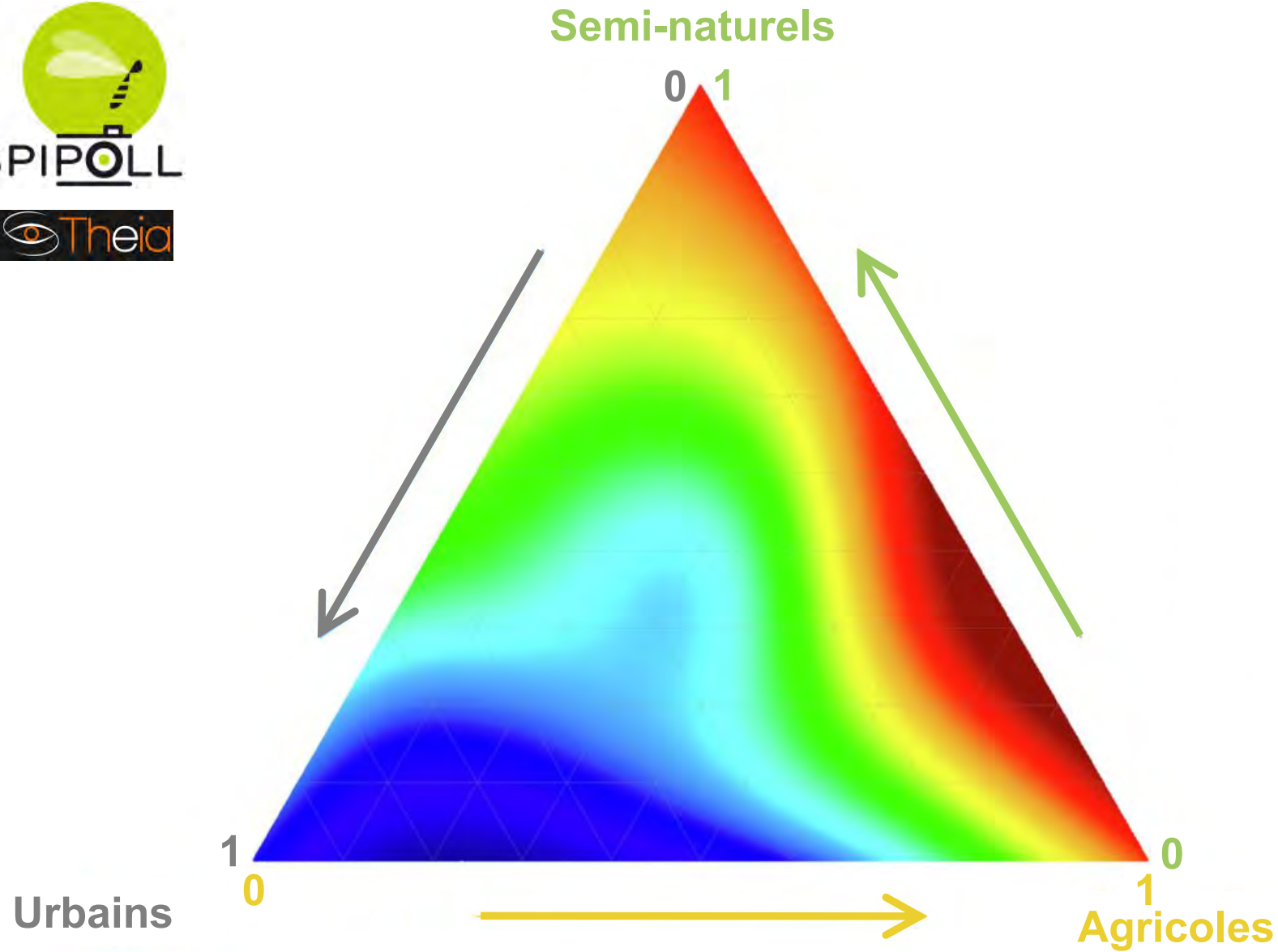
Triple gradient et différences entre taxons



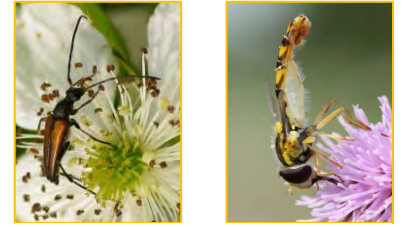
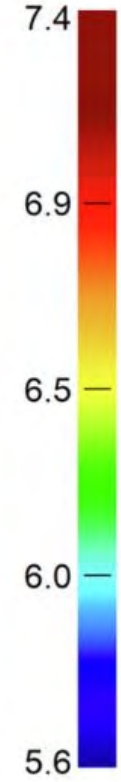
Triple gradient et différences entre taxons



Triple gradient et différences entre taxons

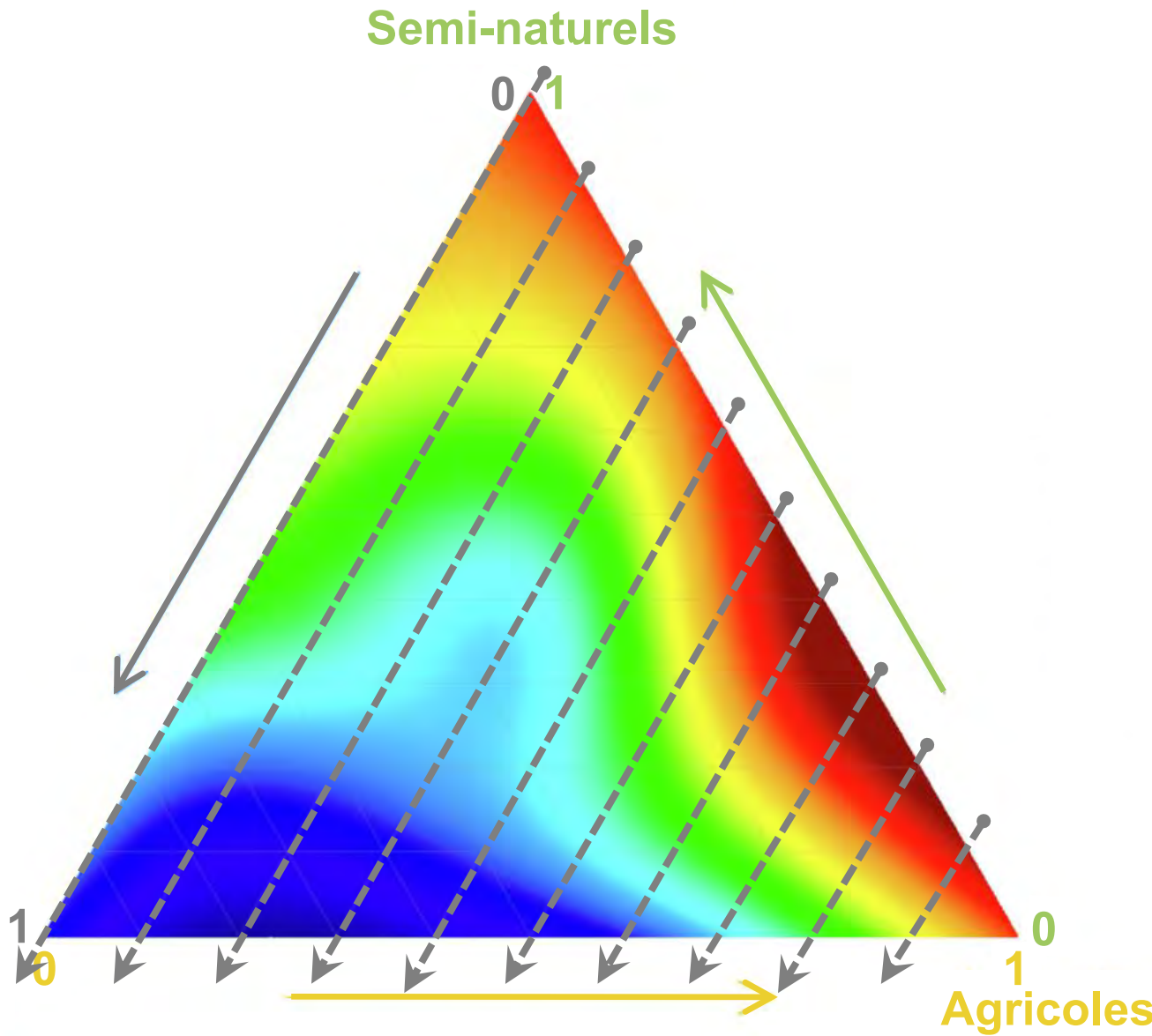


Nb. de taxons

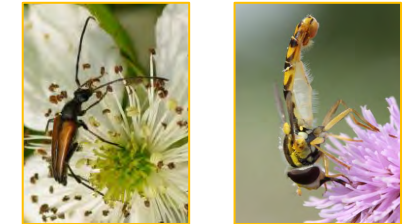
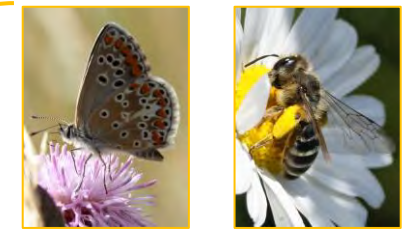
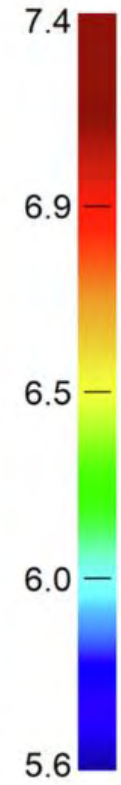


+ autres insectes

Triple gradient et différences entre taxons



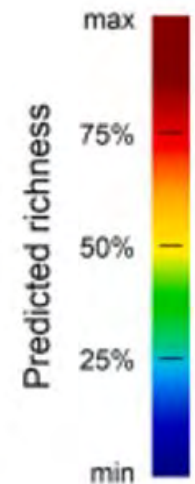
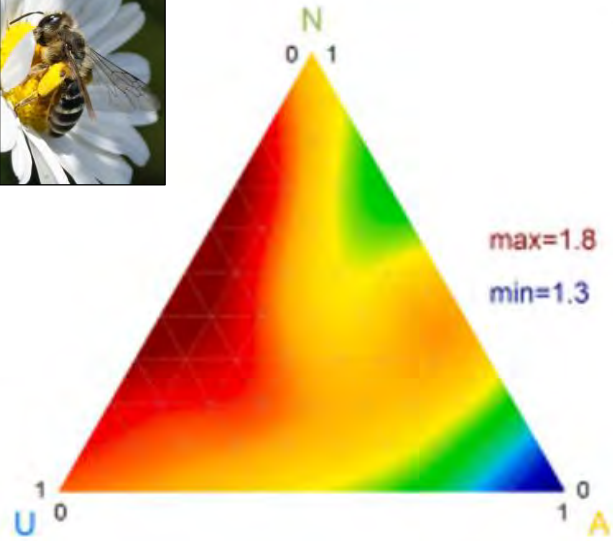
Nb. de taxons



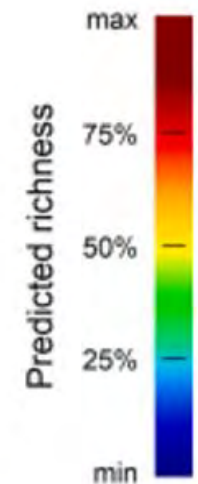
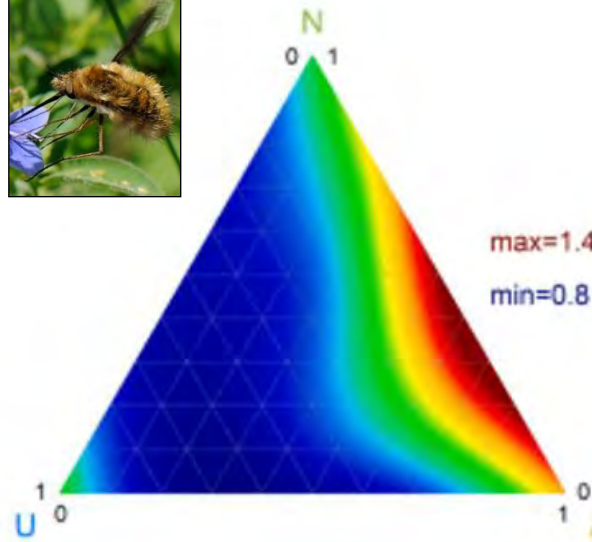
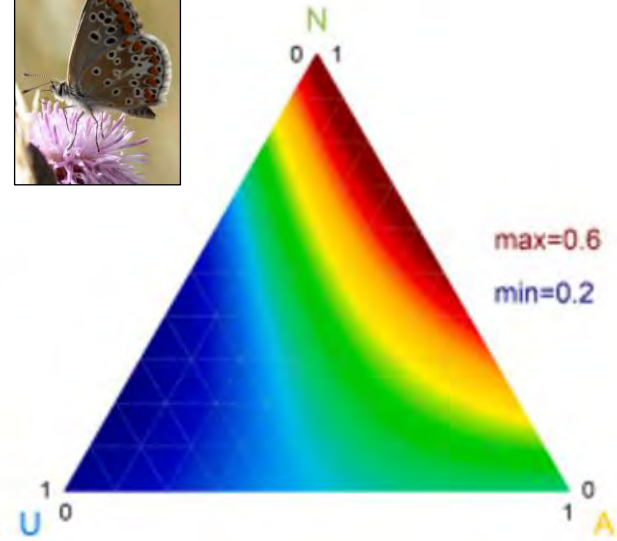
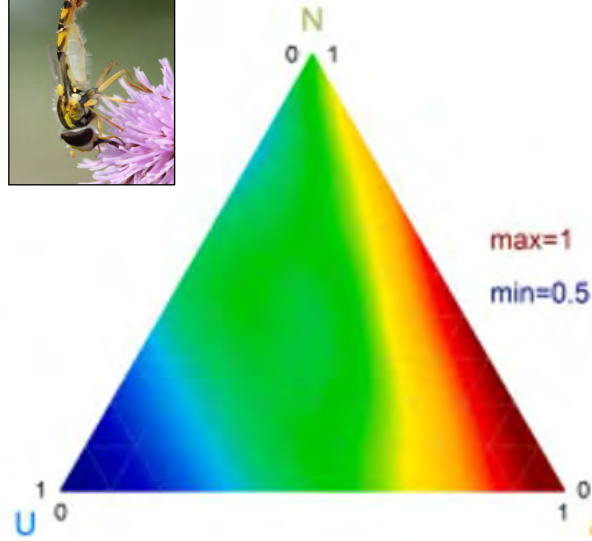
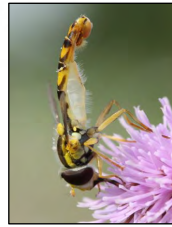
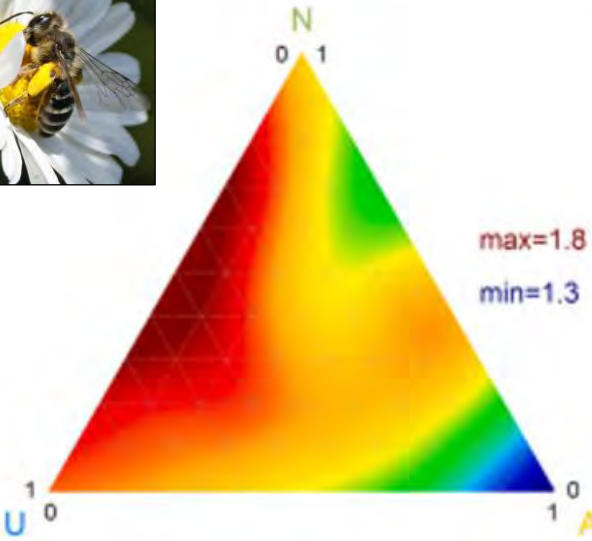
+ autres insectes

**Richesse totale
diminue
avec l'urbanisation**

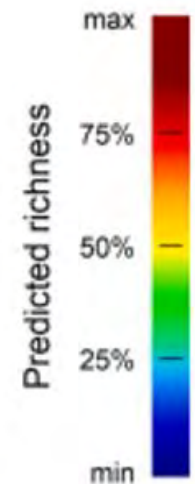
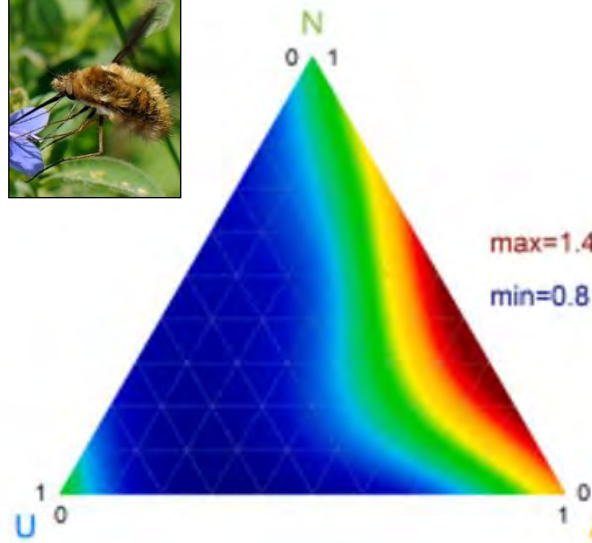
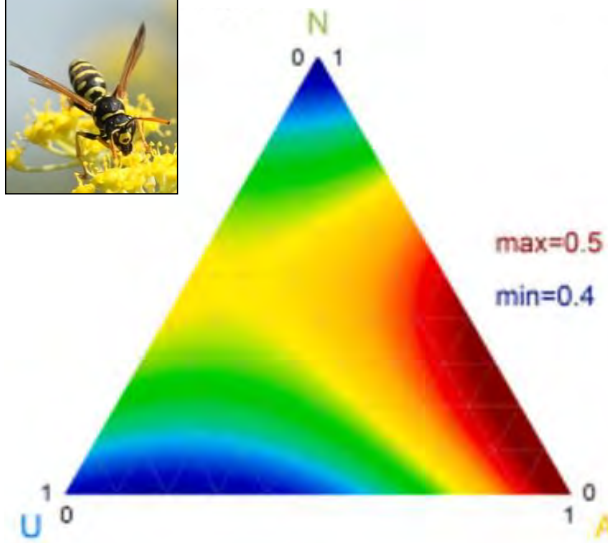
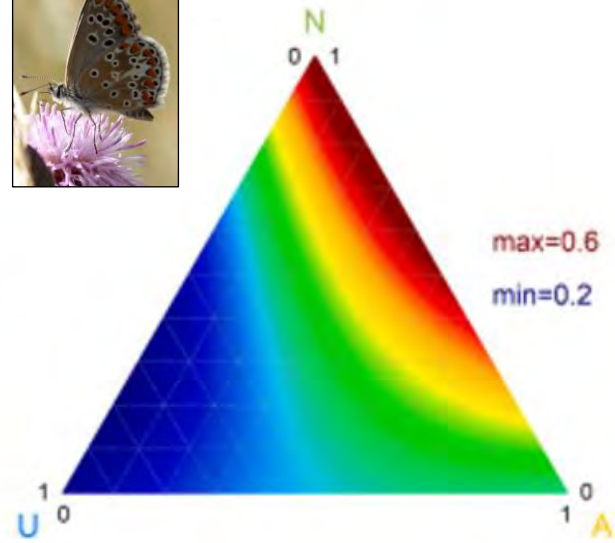
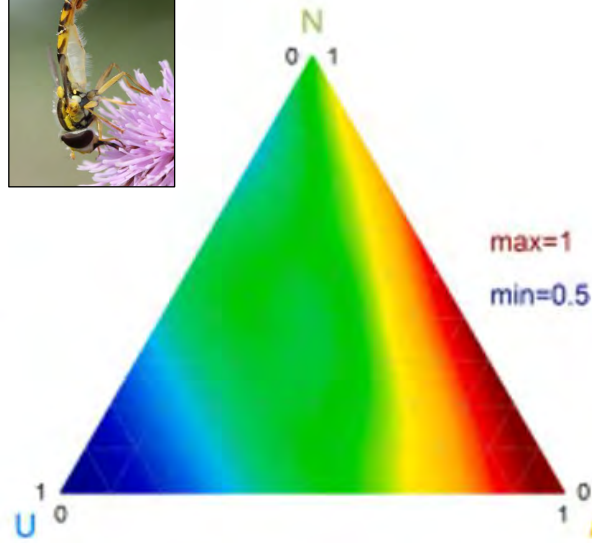
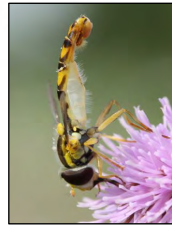
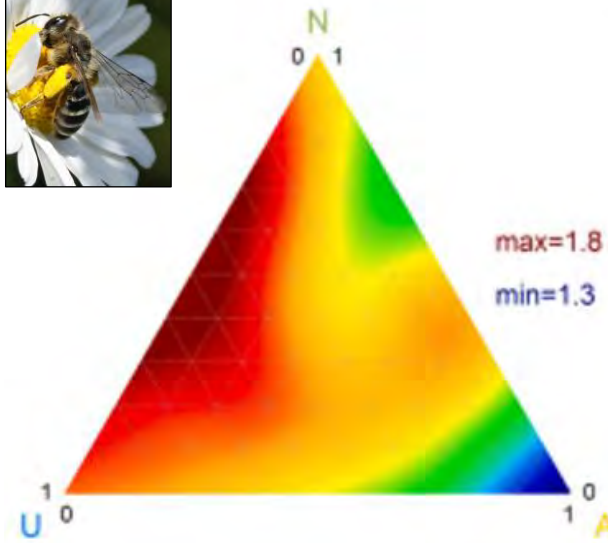
Triple gradient et différences entre taxons



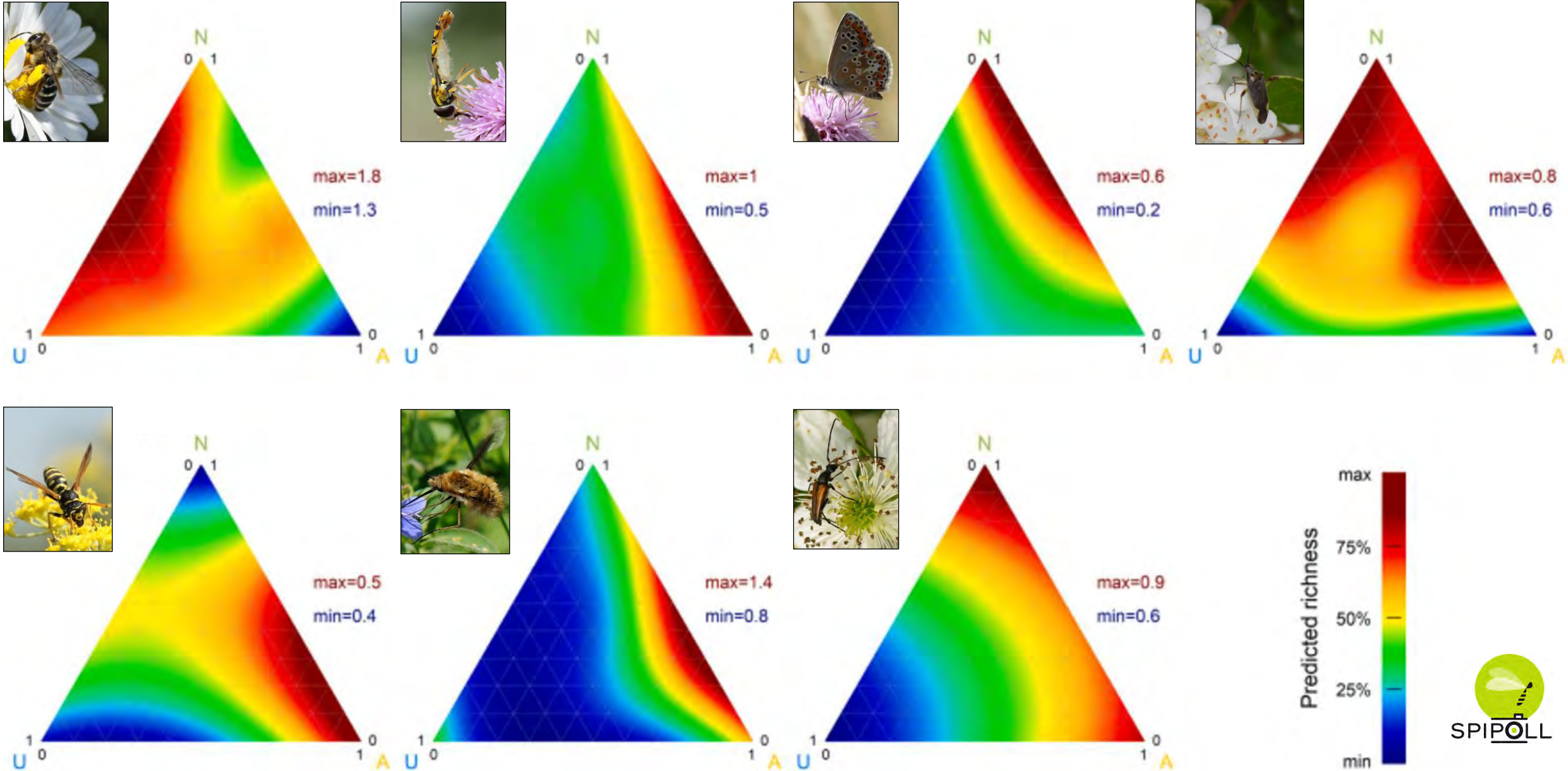
Triple gradient et différences entre taxons



Triple gradient et différences entre taxons



Triple gradient et différences entre taxons



- **Communautés diverses, mais appauvries et fonctionnellement biaisées**
- **Manque de séries temporelles**

- **Communautés diverses, mais appauvries et fonctionnellement biaisées**
- **Manque de séries temporelles**



Urban Ecosystems
<https://doi.org/10.1007/s11252-018-0773-7>



Reduction by half: the impact on bees of 34 years of urbanization

Marina Candido Cardoso¹ · Rodrigo Barbosa Gonçalves¹ 

**De 112 espèces
d'abeilles...
...à 63.**

Dette d'extinction non mesurée par les comparaisons spatiales.


- **Communautés diverses, mais appauvries et fonctionnellement biaisées**
- **Manque de séries temporelles**



Urban Ecosystems
<https://doi.org/10.1007/s11252-018-0773-7>



Reduction by half: the impact on bees of 34 years of urbanization

Marina Candido Cardoso¹ · Rodrigo Barbosa Gonçalves¹ 

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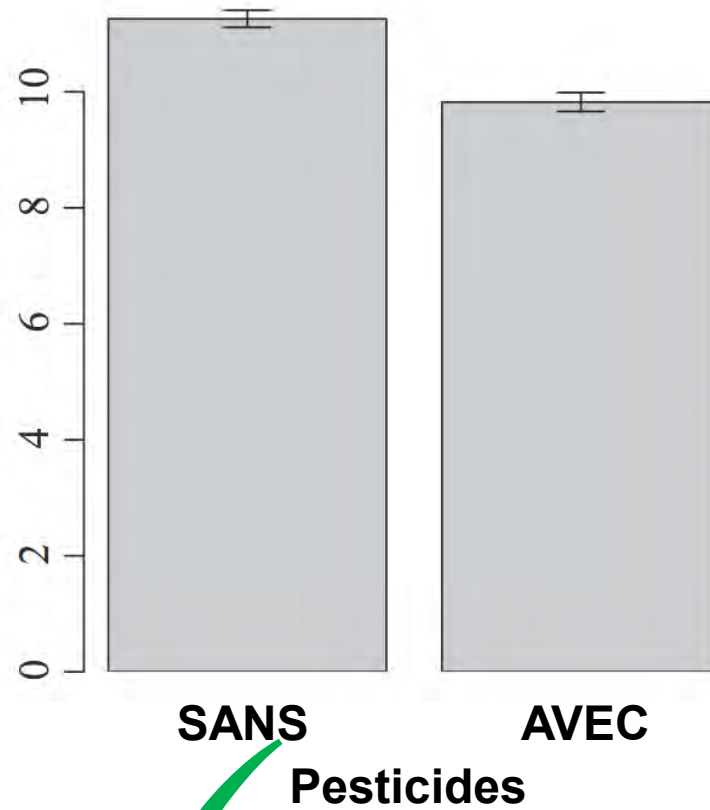
Les villes peuvent-elles devenir des refuges ?

Stopper les pesticides

Jardins de particuliers,
France



Abondance

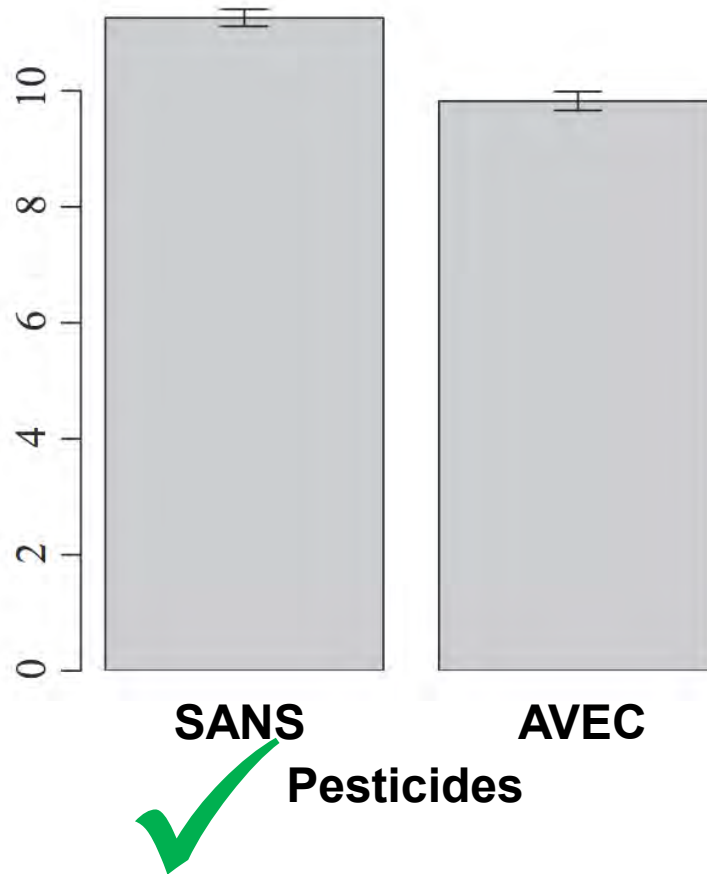


Stopper les pesticides

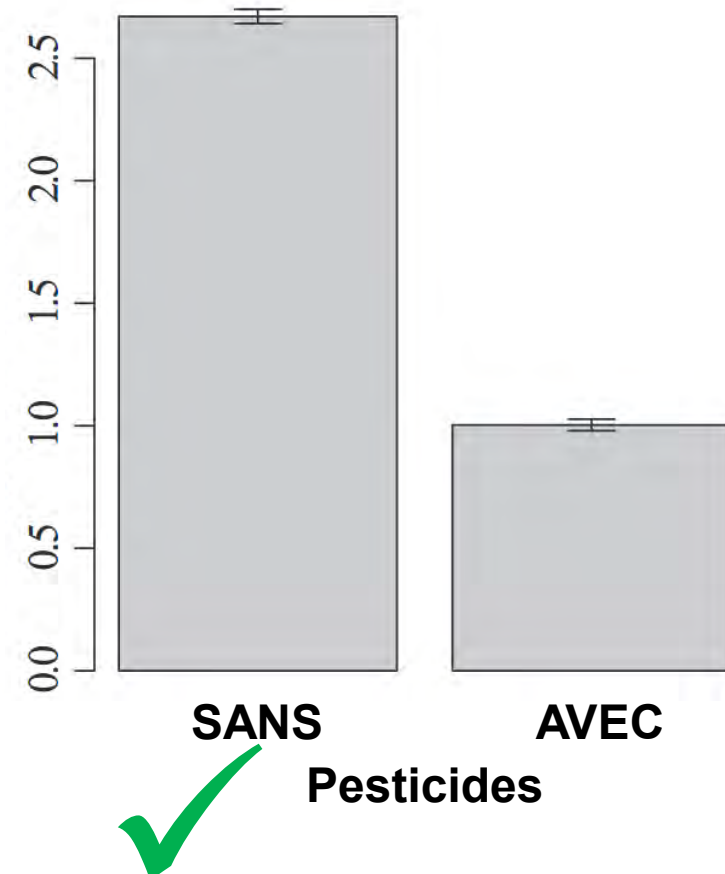
Jardins de particuliers,
France



Abondance



Nb. d'espèces

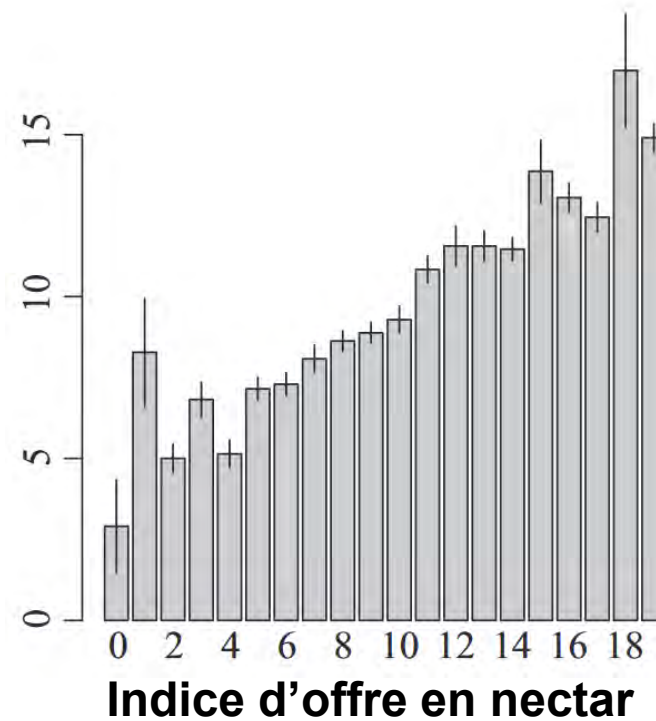


Augmenter les ressources florales

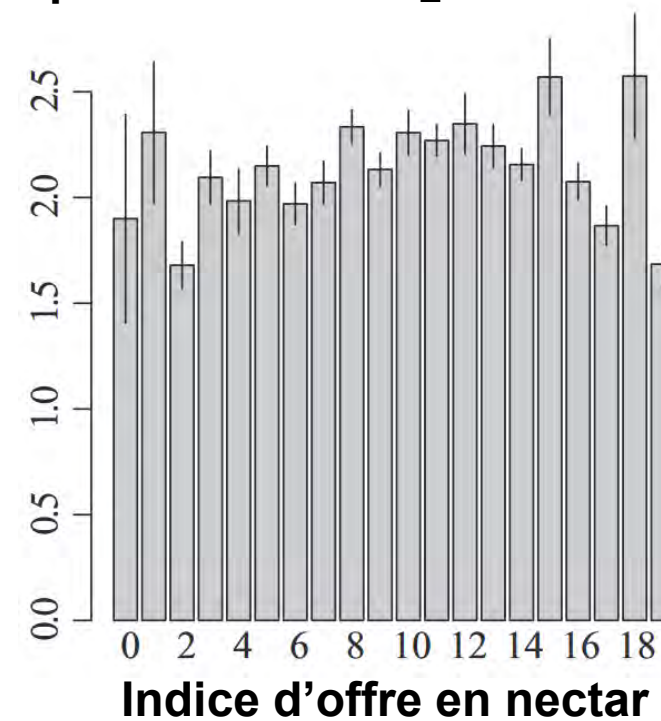
Jardins de particuliers,
France



Abondance



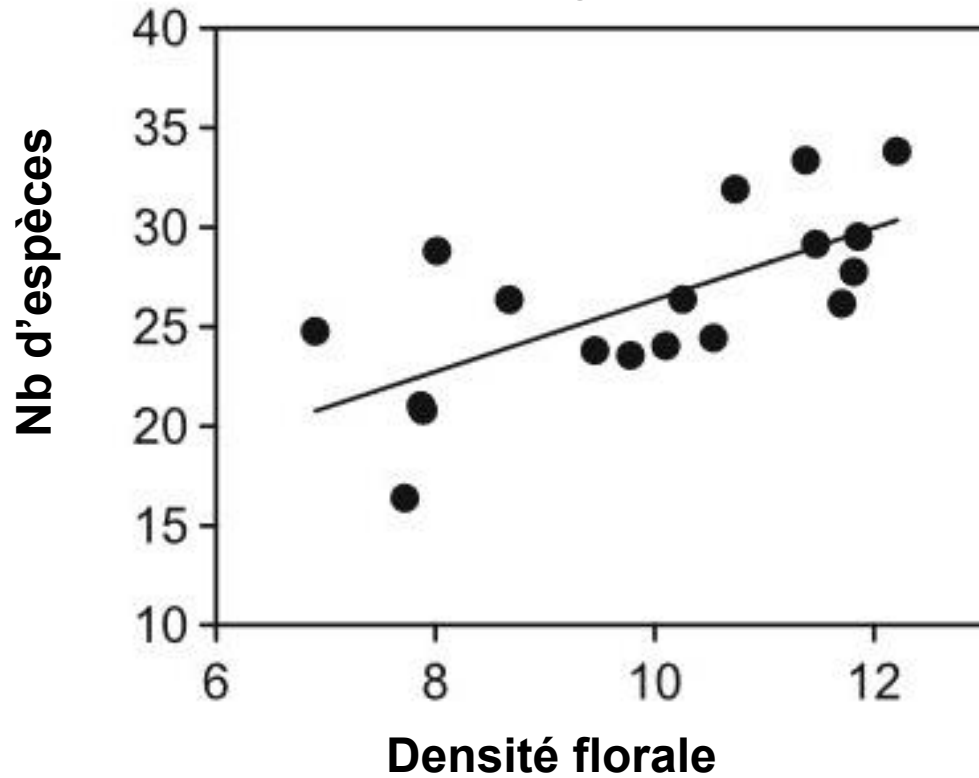
Nb. d'espèces



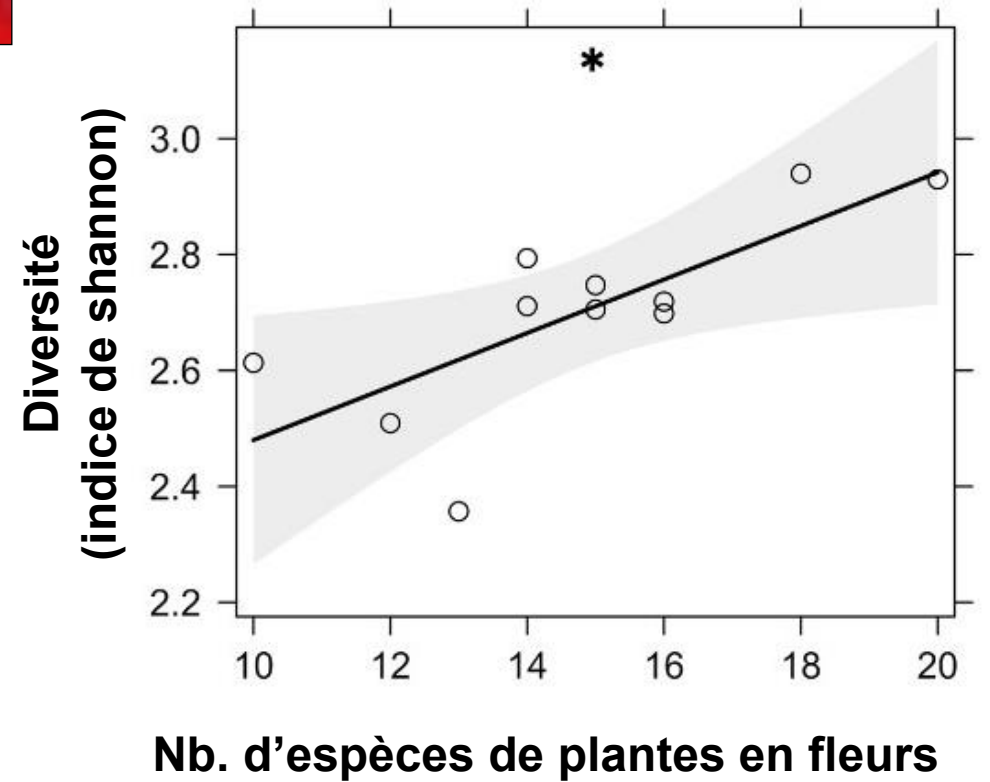
Augmenter les ressources florales



Raleigh, USA

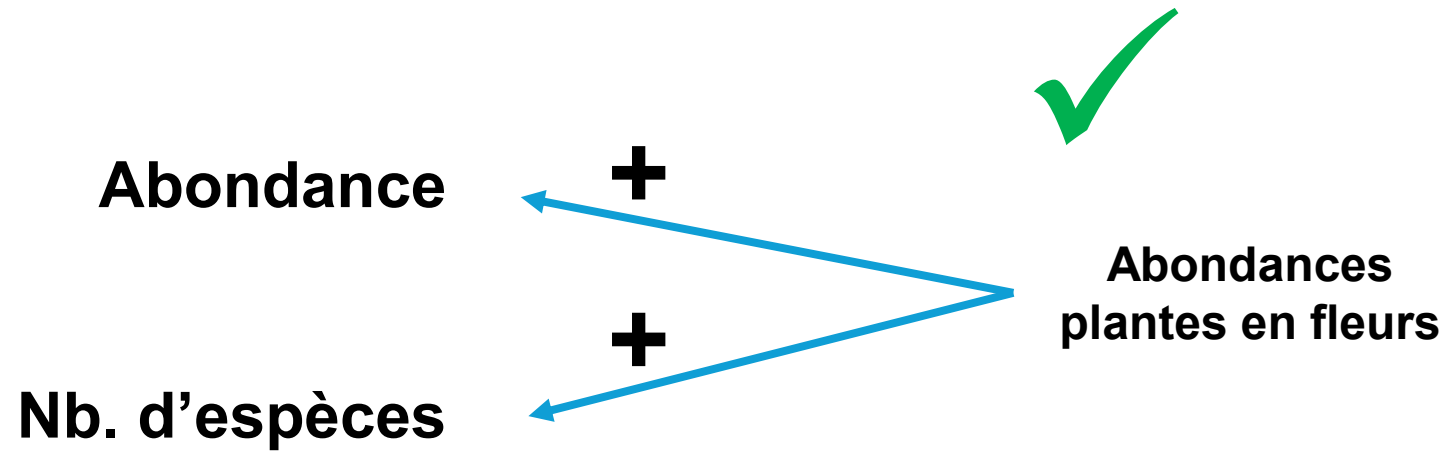
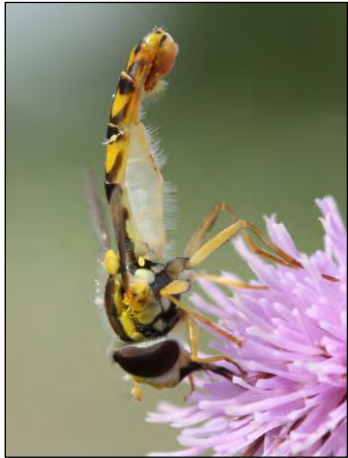


Région de Berlin, Allemagne



Augmenter les ressources florales

Birmingham,
Angleterre



Choix des plantes à fleurs : production de pollen

ANNUALS

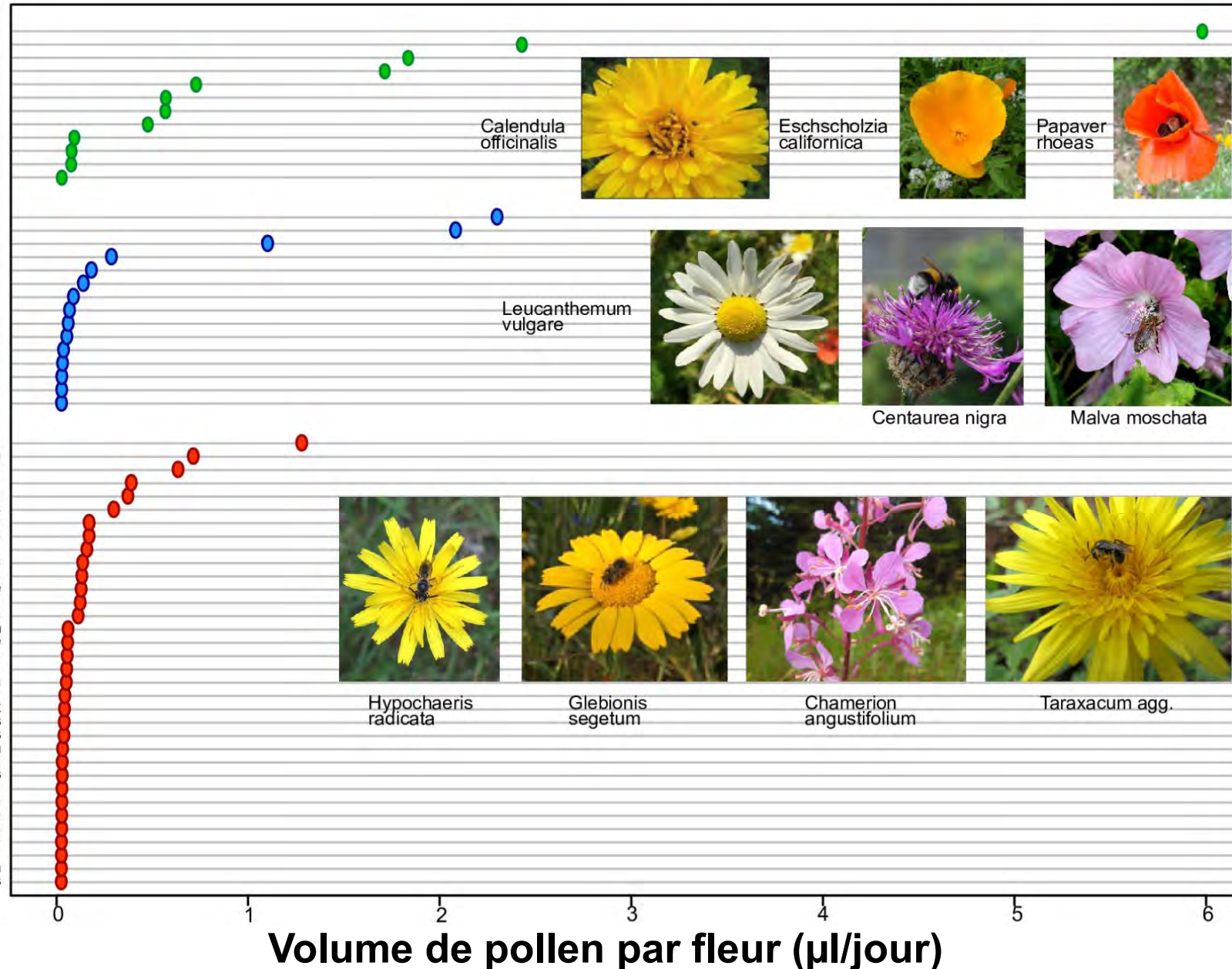
- Papaver rhoeas
- Eschscholzia californica
- Calendula officinalis
- Cosmos bipinnatus
- Linum grandiflorum
- Nigella damascena
- Centaurea cyanus
- Coreopsis tinctoria
- Gypsophila elegans
- Malcolmia maritima
- Coreopsis picta
- Lobularia maritima

PERENNIALS

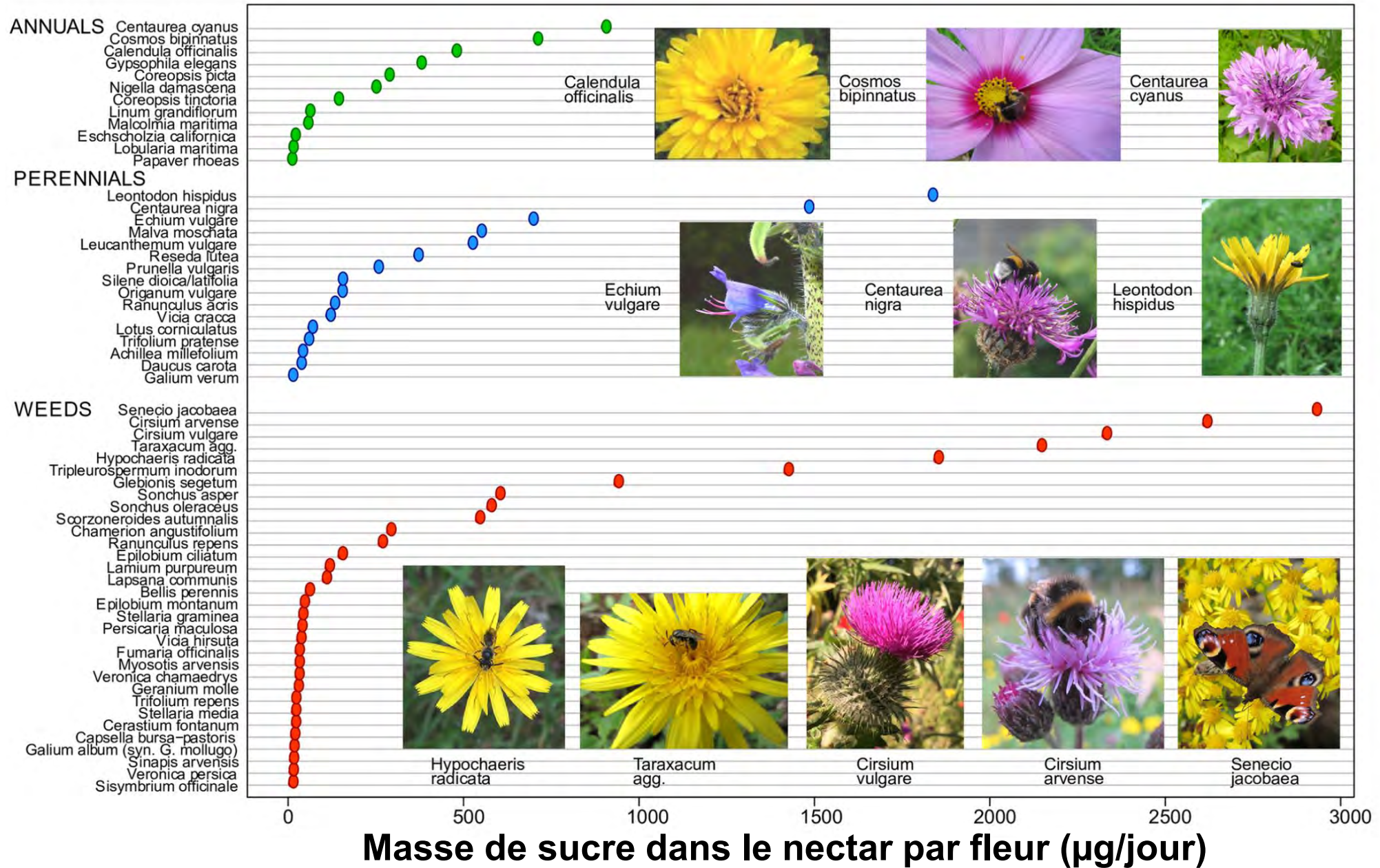
- Malva moschata
- Centaurea nigra
- Leucanthemum vulgare
- Ranunculus acris
- Leontodon hispidus
- Silene dioica/latifolia
- Echium vulgare
- Reseda lutea
- Lotus corniculatus
- Prunella vulgaris
- Trifolium pratense
- Vicia hirsuta
- Origanum vulgare
- Daucus carota
- Galium verum

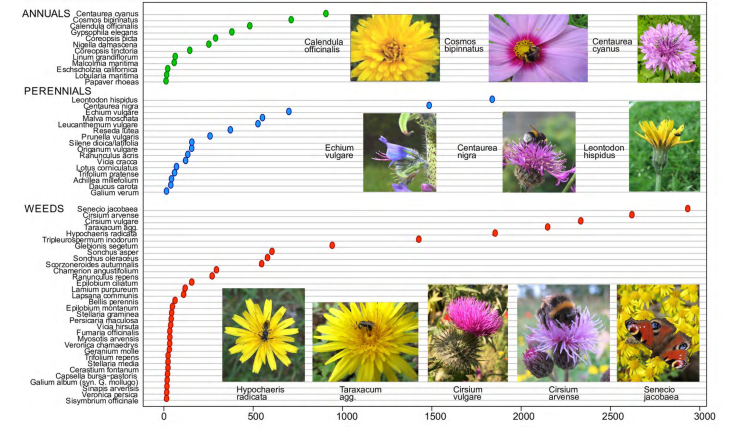
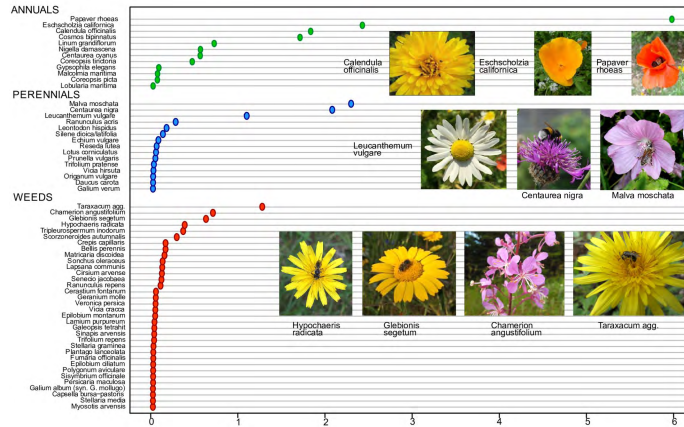
WEEDS

- Taraxacum agg.
- Chamerion angustifolium
- Glebionis segetum
- Hypochaeris radicata
- Tripleurospermum inodorum
- Scorzoneroideis autumnalis
- Crepis capillaris
- Bellis perennis
- Matricaria discoidea
- Sonchus oleraceus
- Lapsana communis
- Cirsium arvense
- Senecio jacobaea
- Ranunculus repens
- Cerastium fontanum
- Geranium molle
- Veronica persica
- Vicia cracca
- Epilobium montanum
- Lamium purpureum
- Galeopsis tetrahit
- Sinapis arvensis
- Trifolium repens
- Stellaria graminea
- Plantago lanceolata
- Fumaria officinalis
- Epilobium dilatatum
- Polygonum aviculare
- Sisymbrium officinale
- Persicaria maculosa
- Galium album (syn. G. mollugo)
- Capsella bursa-pastoris
- Stellaria media
- Mysotis arvensis



Choix des plantes à fleurs : production de nectar





Pollen + Nectar
 +
 Phénologie
 +

Compétition interspécifique
 → Identification du meilleur mix

Insect Conservation and Diversity

Insect Conservation and Diversity (2013) doi: 10.1111/icad.12033

Ivy: an underappreciated key resource to flower-visiting insects in autumn

MIHAIL GARBUZOV and FRANCIS L. W. RATNIEKS Laboratory of Apiculture & Social Insects, School of Life Sciences, University of Sussex, Brighton, UK



INSIGHTS | PERSPECTIVES

ECOLOGY

Conserving honey bees does not help wildlife

High densities of managed honey bees can harm populations of wild pollinators

By **Jonas Geldmann** and
Juan P. González-Varo

be an environmental feat persists in the media (2) and among the public (6). This lack

with honey bees for nest sites in rock cavities. The western honey bee thus unequivocally

INSIGHTS | PERSPECTIVES

ECOLOGY

Conserving honey bees does not help wildlife

High densities of managed honey bees can harm populations of wild pollinators

By Jonas Geldmann and
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INSIGHTS

10.1126/science.aat1535

Bee conservation: Inclusive solutions

In their Perspective “Conserving honey bees does not help wildlife” (26 January, p. 392), J. Geldmann and J. P. González-

David Kleijn,^{1*} Koos Biesmeijer,^{2,3} Yoko L. Dupont,⁴ Anders Nielsen,⁵ Simon G. Potts,⁶ Josef Settele⁷

Edited by Jennifer Sills

Bee conservation: Key role of managed bees

traits, landscape context, weather conditions, and on-farm management (4–6).

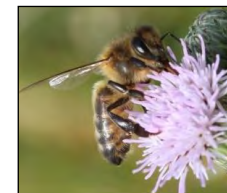
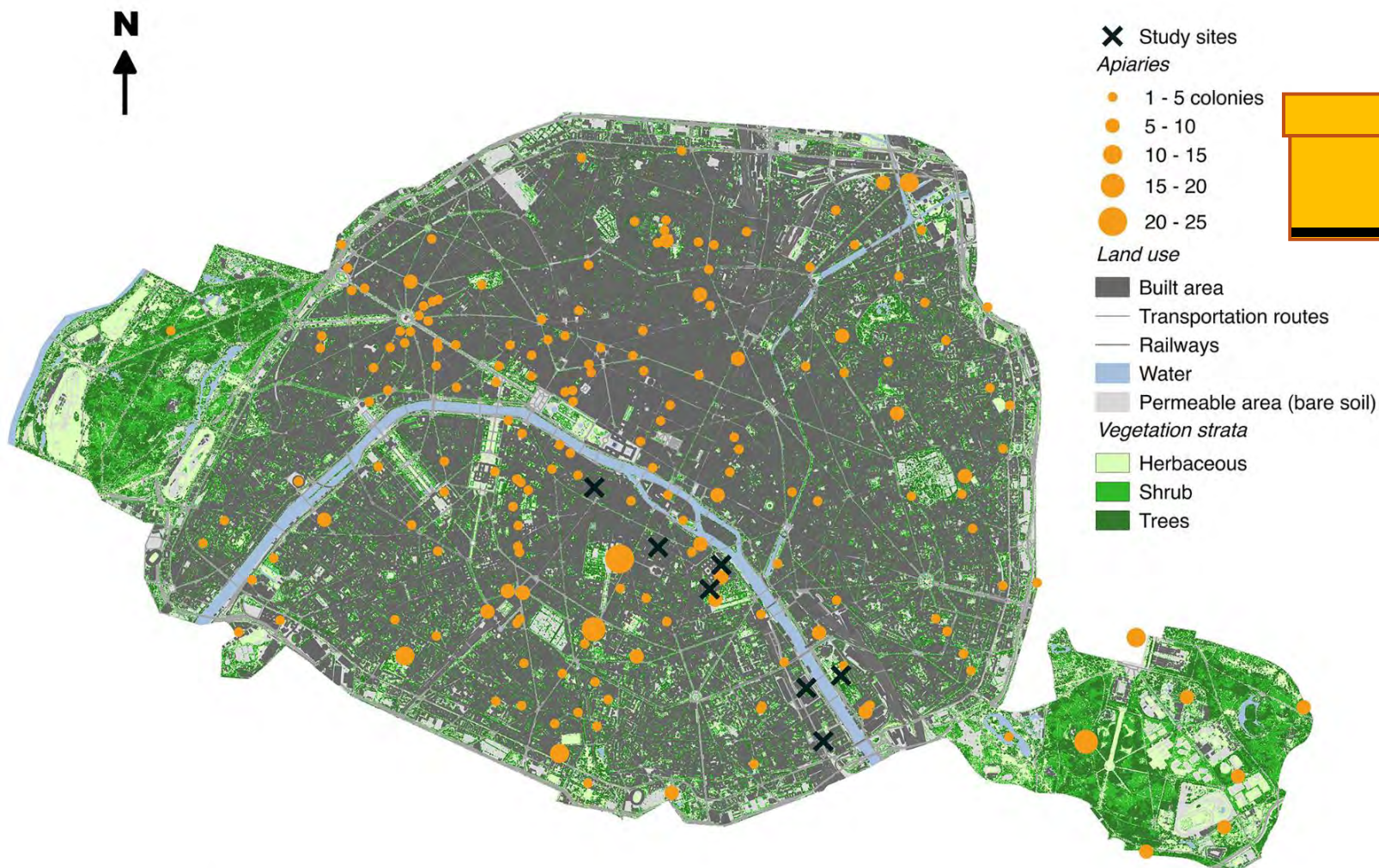
The concept of ecosystem services is not about humans passively receiving benefits from “wild” nature. Rather, it encourages mindful management and

Policies regarding managed bees, such as this bumblebee (*Bombus* spp.), affect wild pollinators as well.

We agree that, at high densities, honey bees can adversely affect wild pollinator populations. However, focusing only on the

Manu E. Saunders,^{1,2*} Tobias J. Smith,¹
Romina Rader¹

Limiter les colonies d'abeilles domestiques ?



Observations d'insectes :

- 7 parcs x 3 quadrats
- 2014, 2015, 2016
- Avril – Juillet (~13 visites)

0 1 2 km

Fig 1. Location of honey bee colonies and study sites in the city of Paris. Vegetation height and land use maps were obtained from APUR database (<http://opendata.apur.org/datasets/>).

<https://doi.org/10.1371/journal.pone.0222316.g001>

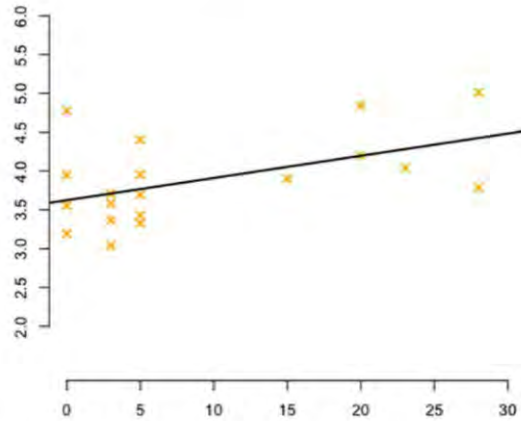
Limiter les colonies d'abeilles domestiques ?



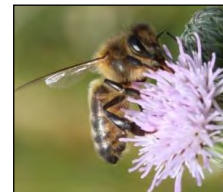
Honeybees

slope = 0.501, P = 0.020

Taux de visites



Nb. de colonies
(500 m)

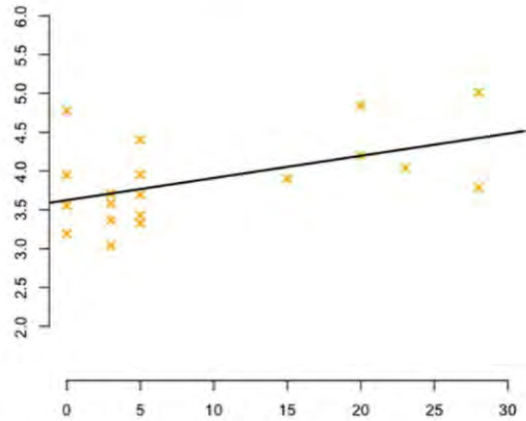


Limiter les colonies d'abeilles domestiques ?



Honeybees

slope = 0.501, P = 0.020

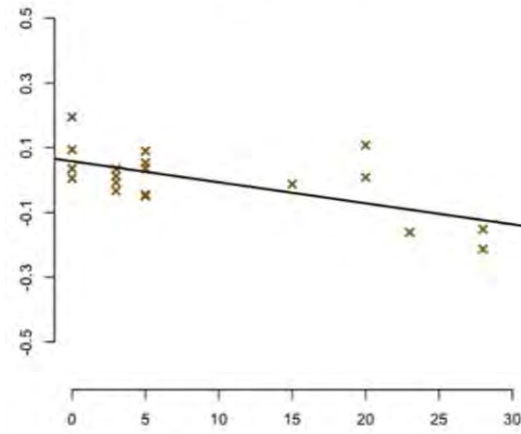


Nb. de colonies (500 m)



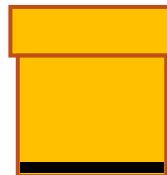
Wild pollinators

slope = -0.614, P = 0.001



Nb. de colonies (500 m)

Taux de visites



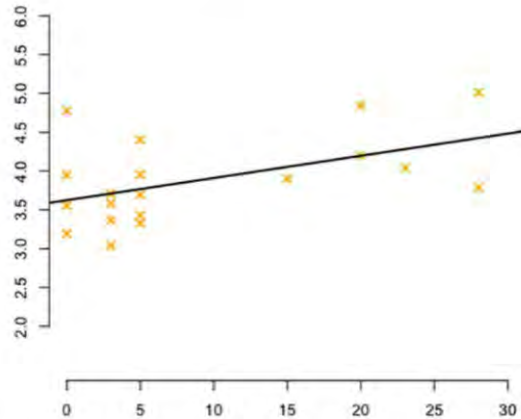
Limiter les colonies d'abeilles domestiques ?

Taux de visites



Honeybees

slope = 0.501, P = 0.020

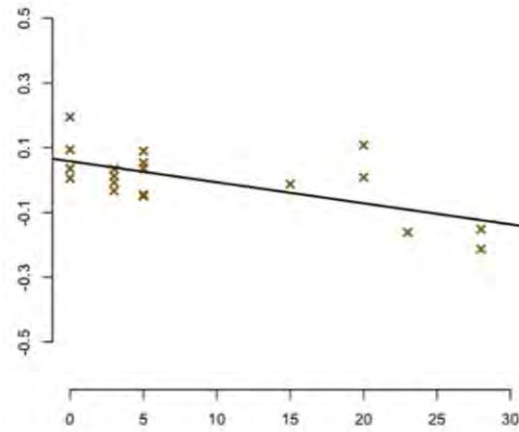


Nb. de colonies (500 m)



Wild pollinators

slope = -0.614, P = 0.001

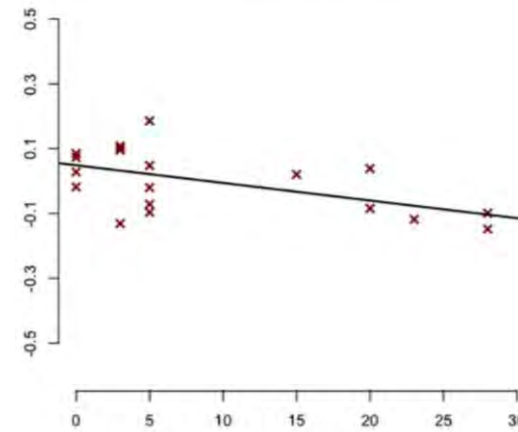


Nb. de colonies (500 m)



Large solitary bees

slope = -0.425, P = 0.007

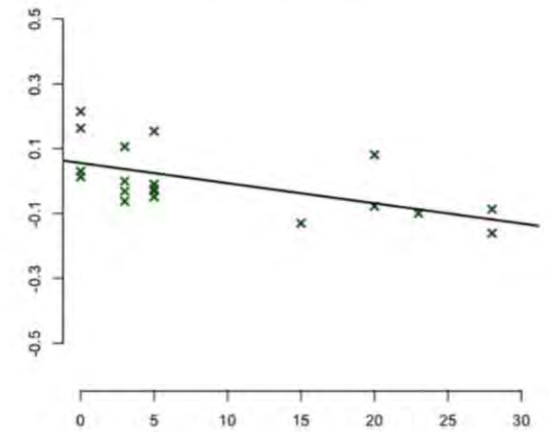


Nb. de colonies (500 m)

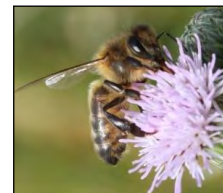


Beetles

slope = -0.671, P = 0.002



Nb. de colonies (500 m)



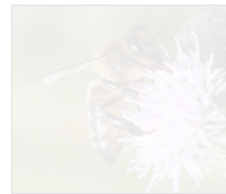
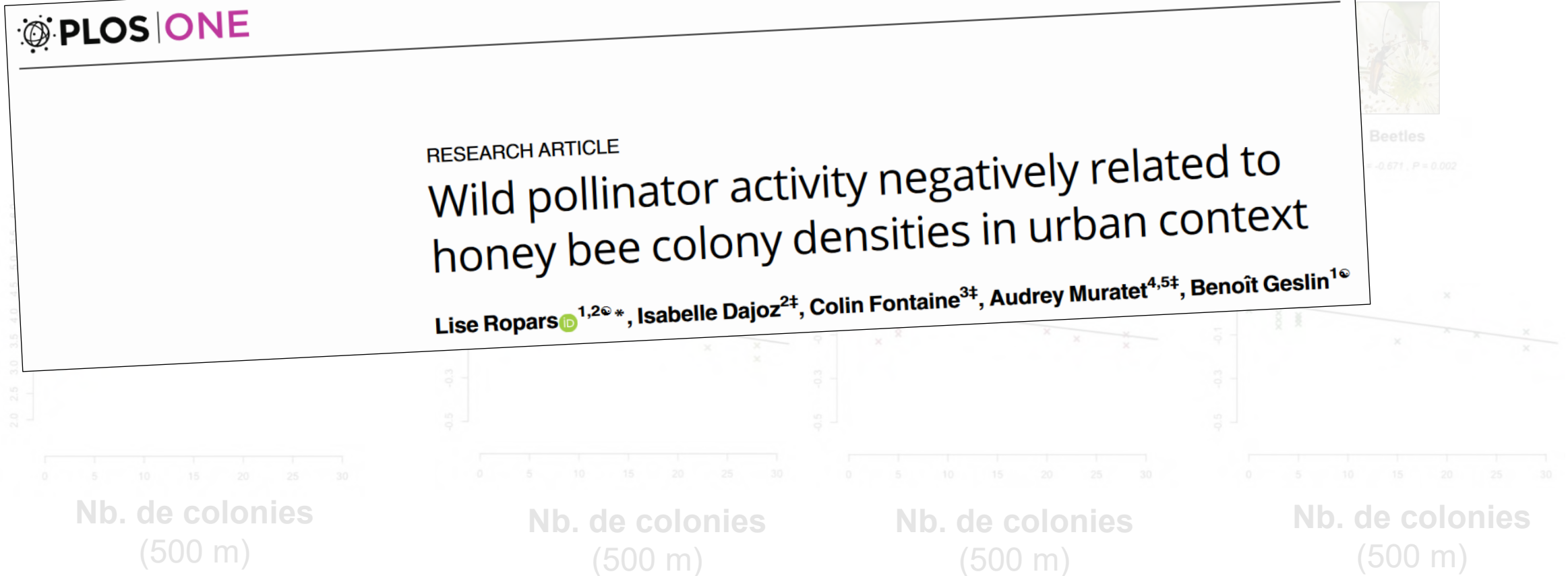
Idem pour



(1000 m)

Limiter les colonies d'abeilles domestiques ?

Taux de visites



Idem pour



(1000 m)

PLOS ONE

RESEARCH ARTICLE

Wild pollinator activity negatively related to honey bee colony densities in urban context

Lise Ropars^{1,2} ^{*}, Isabelle Dajoz² [‡], Colin Fontaine³ [‡], Audrey Muratet^{4,5} [‡], Benoît Geslin¹ [©]

Urban Ecosystems

<https://doi.org/10.1007/s11252-019-00909-y>

Response of wild bee communities to beekeeping, urbanization, and flower availability

Frédéric McCune¹ ¹ • Étienne Normandin² • Marc J. Mazerolle³ • Valérie Fournier¹



Check for updates

« *Nous ne trouvons aucune preuve de compétition entre abeilles sauvages et domestiques.* »



PeerJ

Decline in wild bee species richness associated with honey bee (*Apis mellifera* L.) abundance in an urban ecosystem

Gail MacInnis¹, Etienne Normandin² and Carly D. Ziter¹

¹Biology Department, Concordia University, Montreal, Quebec, Canada

²Institut de Recherche en Biologie Végétale, University of Montreal, Montreal, Quebec, Canada

**Avant vs. après ajout
de 3000 colonies
sur l'Île de Montréal**

Response of wild bee communities to beekeeping, urbanization, and flower availability

Frédéric McCune¹  • Étienne Normandin² • Marc J. Mazerolle³ • Valérie Fournier¹

« *Nous ne trouvons aucune preuve de compétition entre abeilles sauvages et domestiques.* »



- **Mortalité importante**
- **Essence, diamètre, ... À tester**



- Mortalité importante
- Essence, diamètre, ... À tester



- ***Megachile sculpturalis***
- **Espèce exotique appréciant les hôtels à abeilles**
- **$\varnothing < 8$ mm limite son installation**

Figure 9. Femelle de *Megachile sculpturalis* vidant les poils végétaux emmagasinés dans un tube de bambou par une abeille du genre *Anthidium*. Cliché P.-J. VANDOORNE (juillet 2018, Anglet, Pyrénées-Atlantiques, France).

Fournir de multiples gîtes très différents

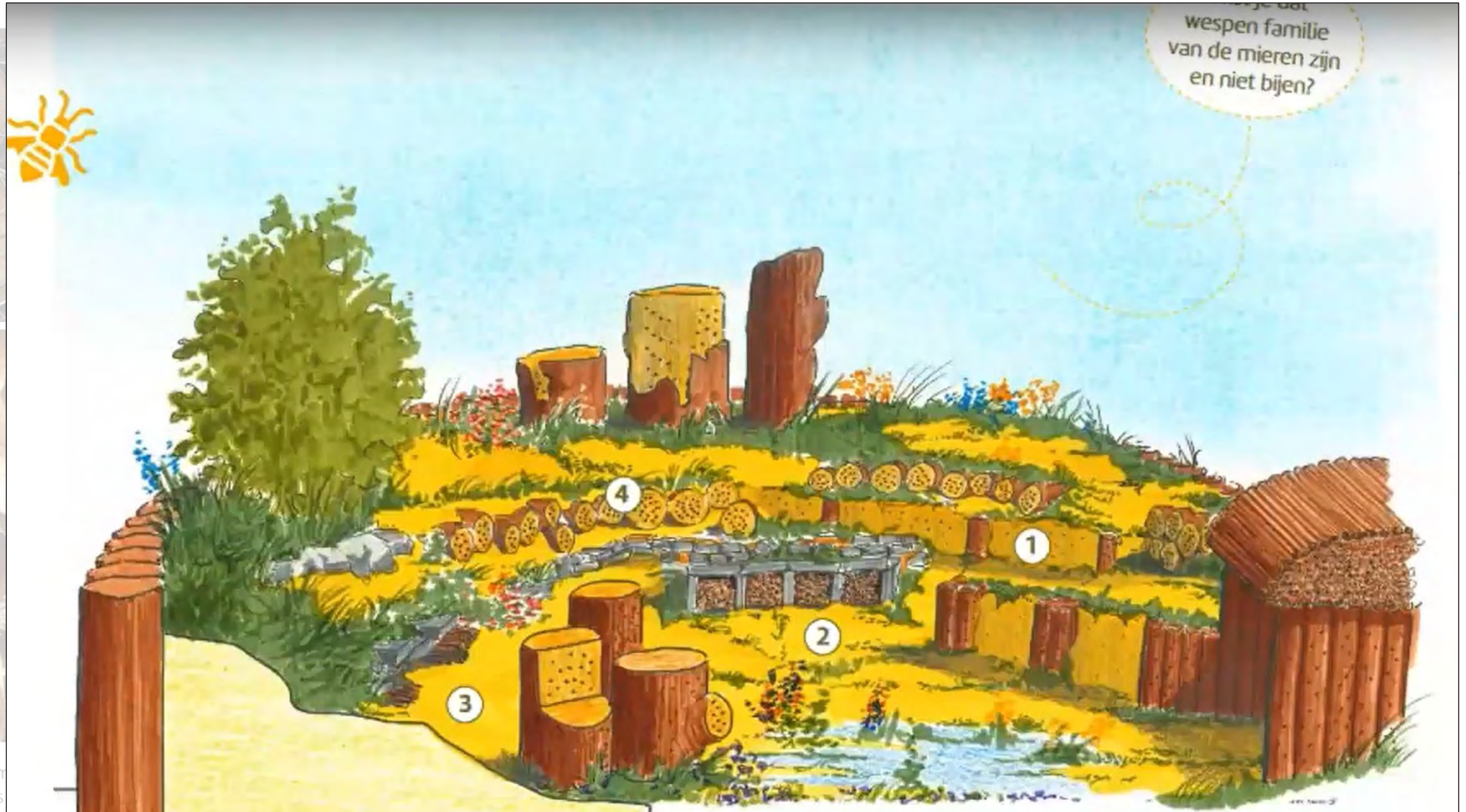
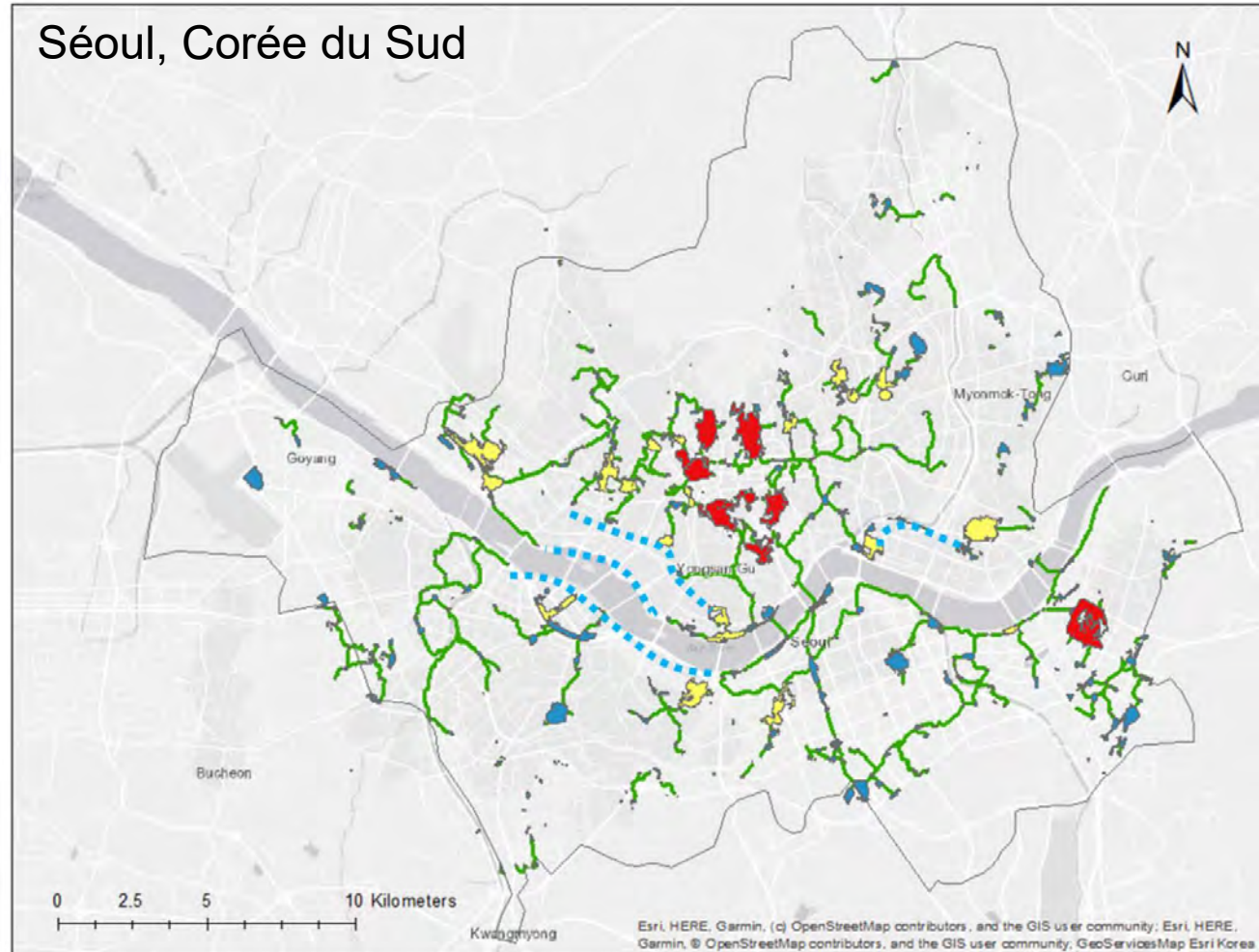


Figure 9. Fens emmagasinés *Anthidium*. Cliche P.-J. VANDOORNE (juillet 2018, Anglet, Pyrenees-Atlantiques, France).

Fournir de multiples gîtes très différents



- Pour que les villes soient des refuges :
 - Augmenter les chances de (re)colonisation

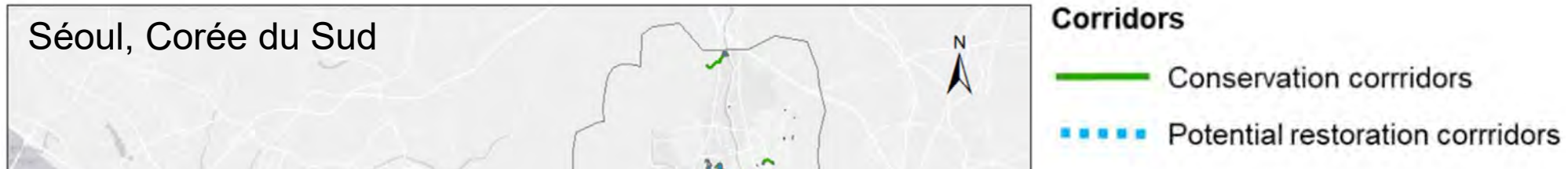


Corridors

— Conservation corridors

••• Potential restoration corridors

- Pour que les villes soient des refuges :
 - Augmenter les chances de (re)colonisation



Biological Conservation 291 (2024) 110480

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Biological Conservation

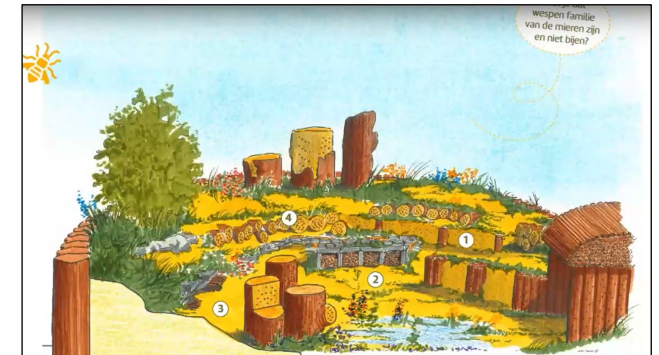
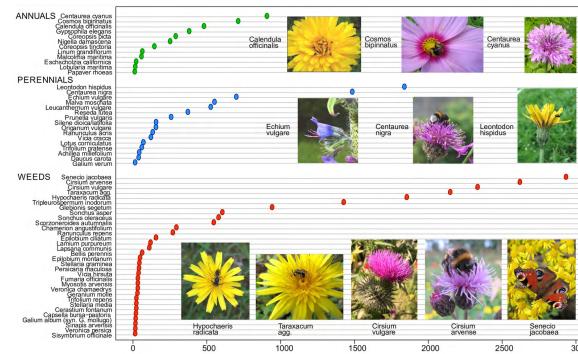
journal homepage: www.elsevier.com/locate/biocon



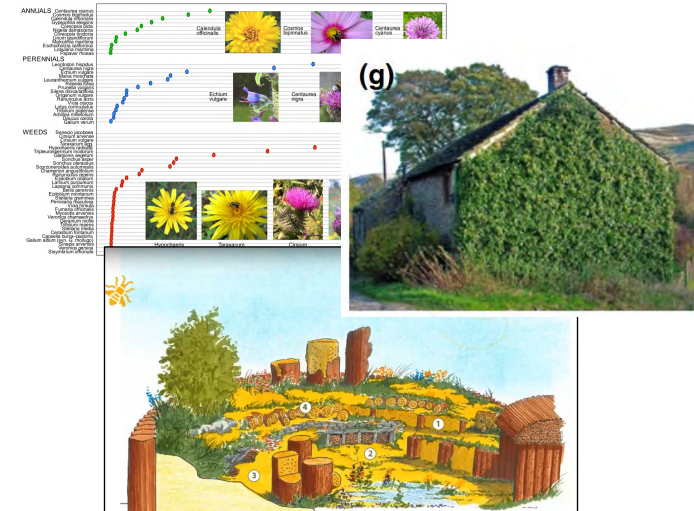
Winners and losers at **enhanced urban roadsides**: Trait-based structuring of wild bee communities at local and landscape scale

Simon Dietzel ^{a,*}, Sandra Rojas-Botero ^a, Anja Dichtl ^b, Johannes Kollmann ^a, Christina Fischer ^c

- Pour que les villes soient des refuges :
 - ❑ Augmenter les chances de (re)colonisation
 - ❑ Augmenter les chances de maintien des populations



- Pour que les villes soient des refuges :
 - ❑ Augmenter les chances de (re)colonisation
 - ❑ Augmenter les chances de maintien des populations
- Expansion vs. Densification ?

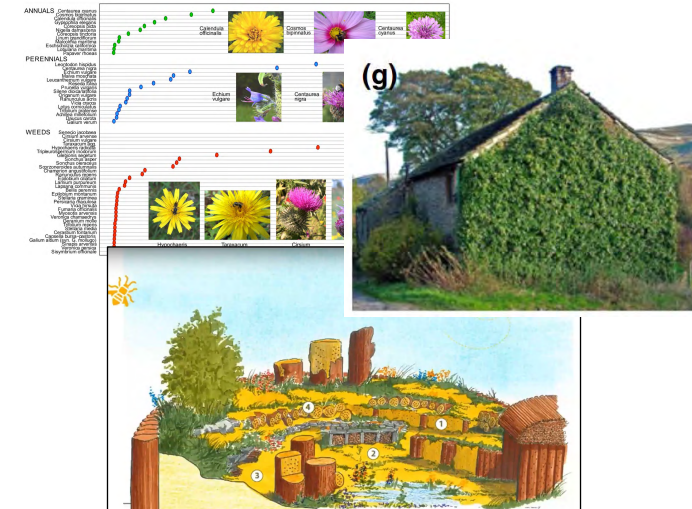


- Pour que les villes soient des refuges :
 - ❑ Augmenter les chances de (re)colonisation
 - ❑ Augmenter les chances de maintien des populations

- Expansion vs. Densification ?

↓
plus favorable à
la biodiversité...

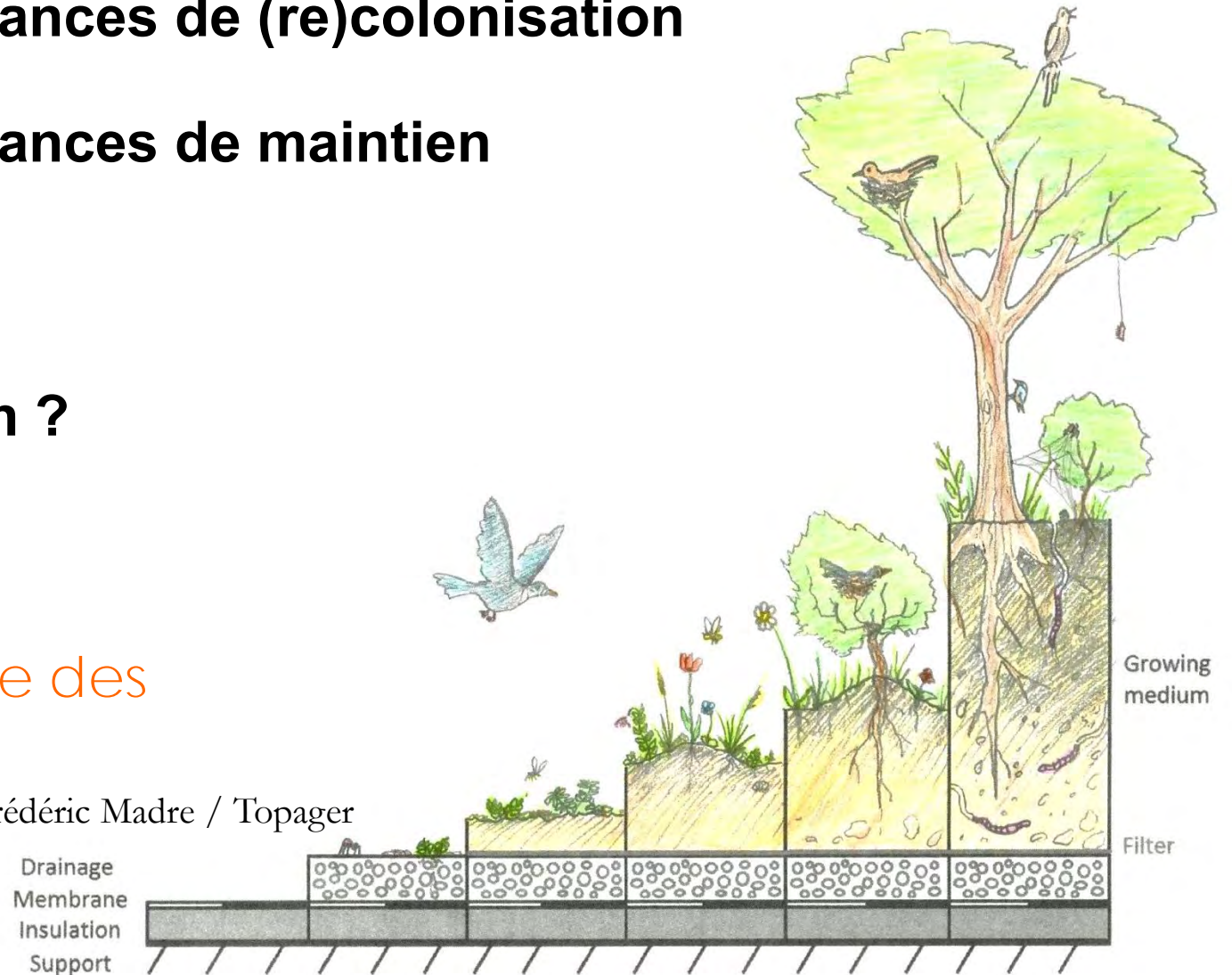
↘
... au détriment d'autres espaces
(y compris 21% des aires *protégées*
Natura 2000 entre 1990 et 2012)



- Pour que les villes soient des refuges :
 - ❑ Augmenter les chances de (re)colonisation
 - ❑ Augmenter les chances de maintien des populations
- Expansion vs. Densification ?

Typologie écologique des toitures végétalisées

© Frédéric Madre / Topager



Merci pour votre attention.



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