

Global impoverishment of natural vegetation revealed by dark diversity


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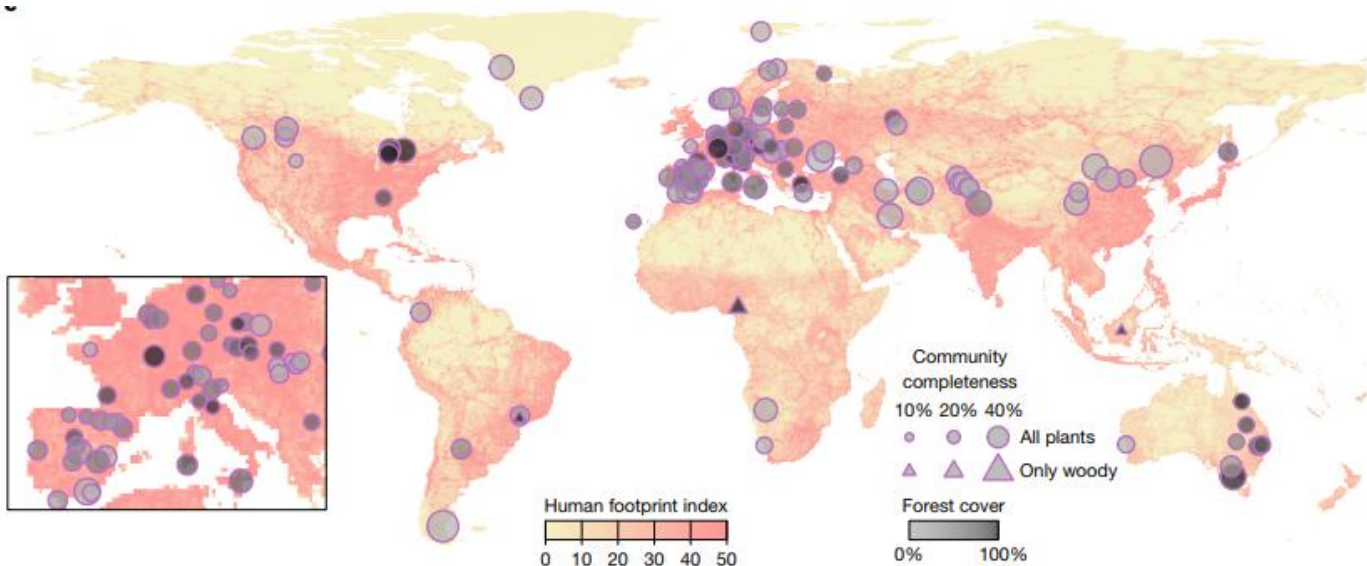
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Anthropogenic biodiversity decline threatens the functioning of ecosystems and the many benefits they provide to humanity¹. As well as causing species losses in directly affected locations, human influence might also reduce biodiversity in relatively unmodified vegetation if far-reaching anthropogenic effects trigger local extinctions and hinder recolonization. Here we show that local plant diversity is globally negatively related to the level of anthropogenic activity in the surrounding region. Impoverishment of natural vegetation was evident only when we considered community completeness: the proportion of all suitable species in the region that are present at a site. To estimate community completeness, we compared the number of recorded species with the dark diversity—ecologically suitable species that are absent from a site but present in the surrounding region². In the sampled regions with a minimal human footprint index, an average of 35% of suitable plant species were present locally, compared with less than 20% in highly affected regions. Besides having the potential to uncover overlooked threats to biodiversity, dark diversity also provides guidance for nature conservation. Species in the dark diversity remain regionally present, and their local populations might be restored through measures that improve connectivity between natural vegetation fragments and reduce threats to population persistence.



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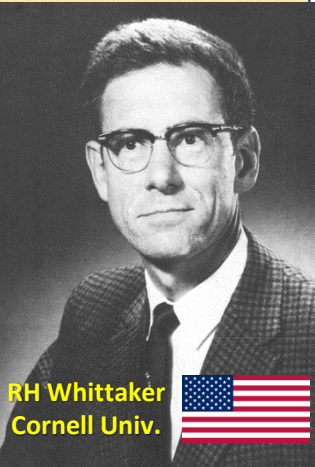
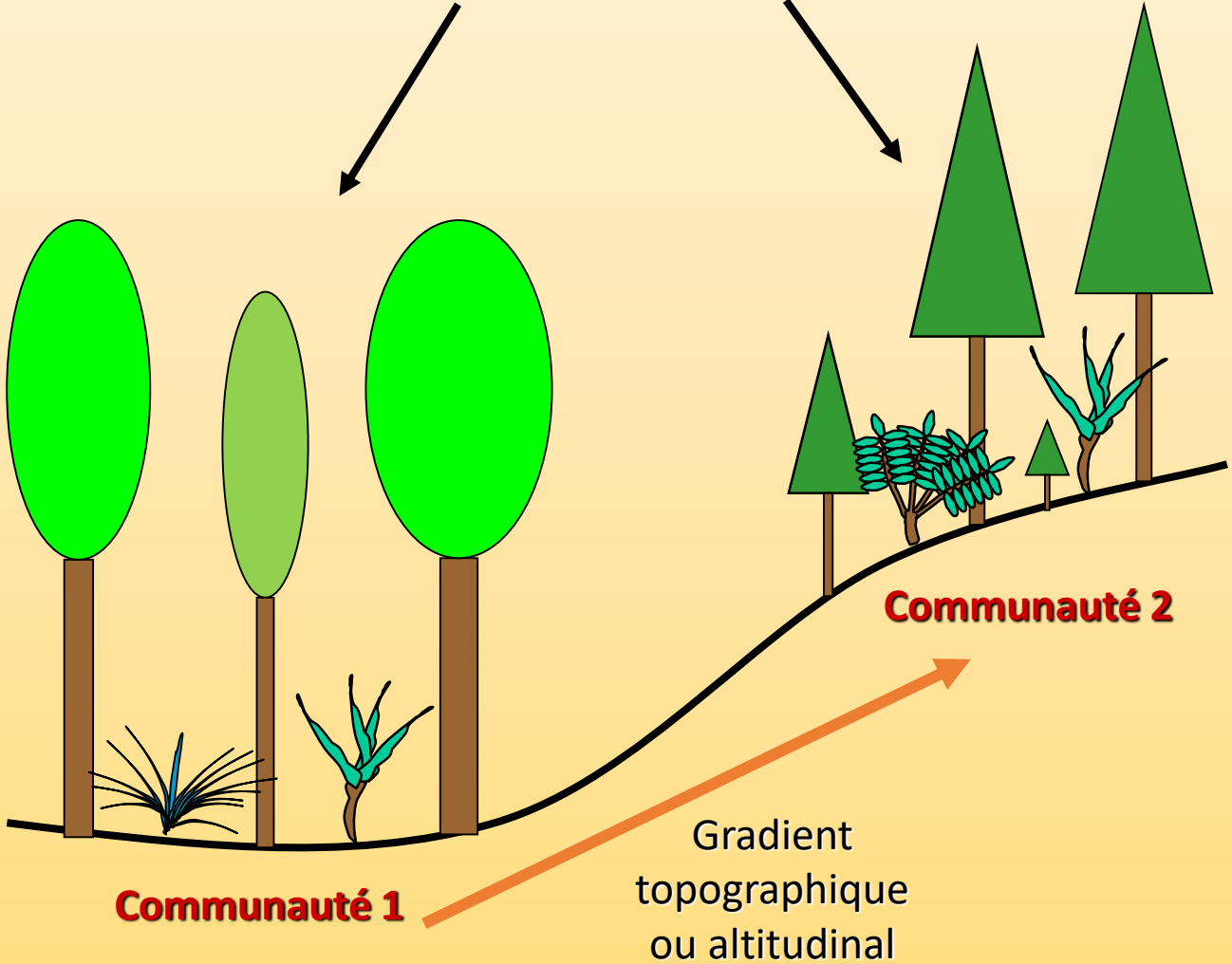
Les différents types de diversité

Diversité $\infty = 6$
(nombre d'espèces dans un paysage)

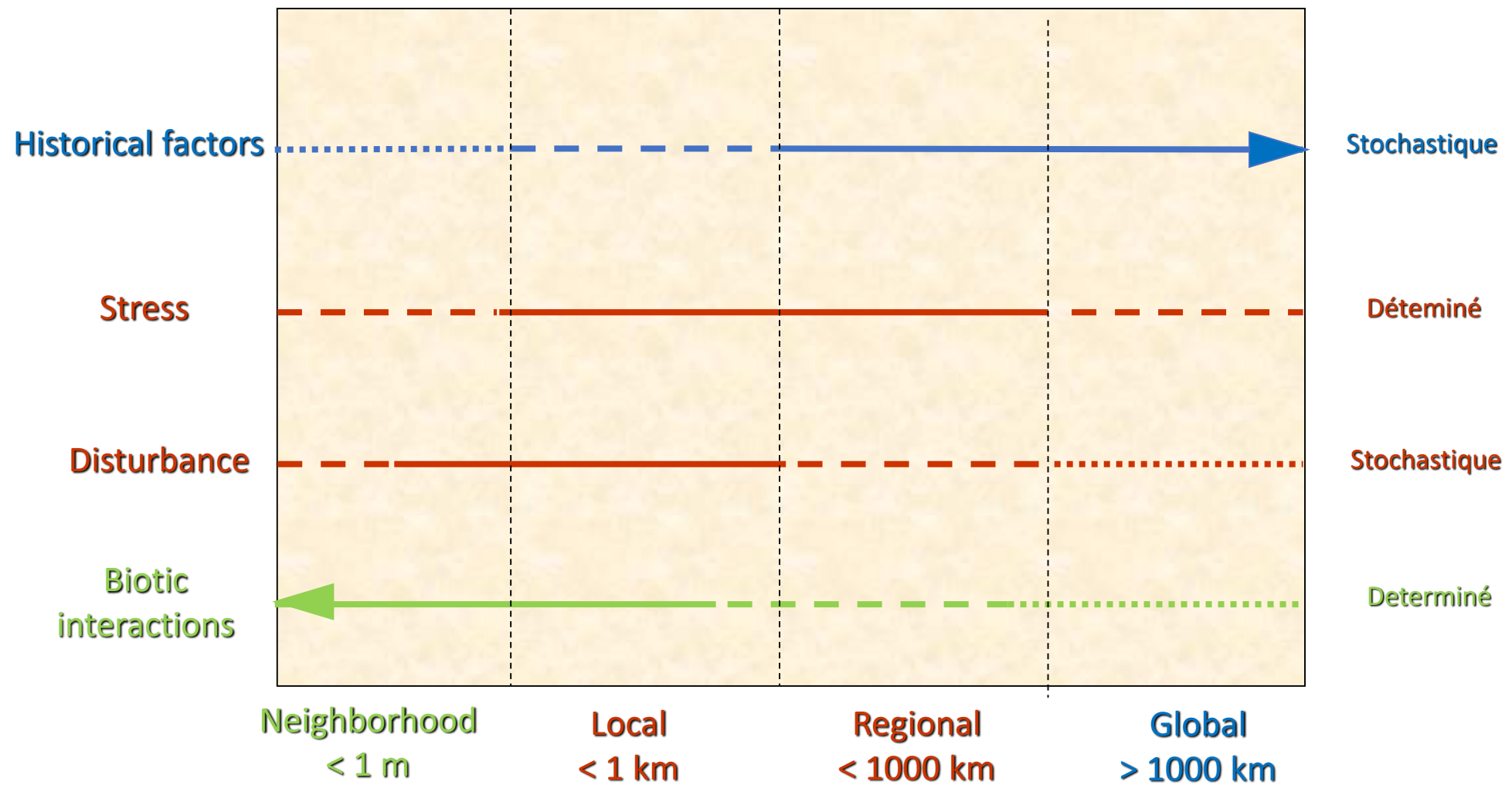
Diversité β
(nombre de communautés dans un paysage)

Diversité $\alpha = 4$
(nombre d'espèces dans une communauté)

Diversité $\alpha = 3$



Facteurs écologiques déterminant la diversité alpha et la composition des communautés en fonction de l'échelle spatiale

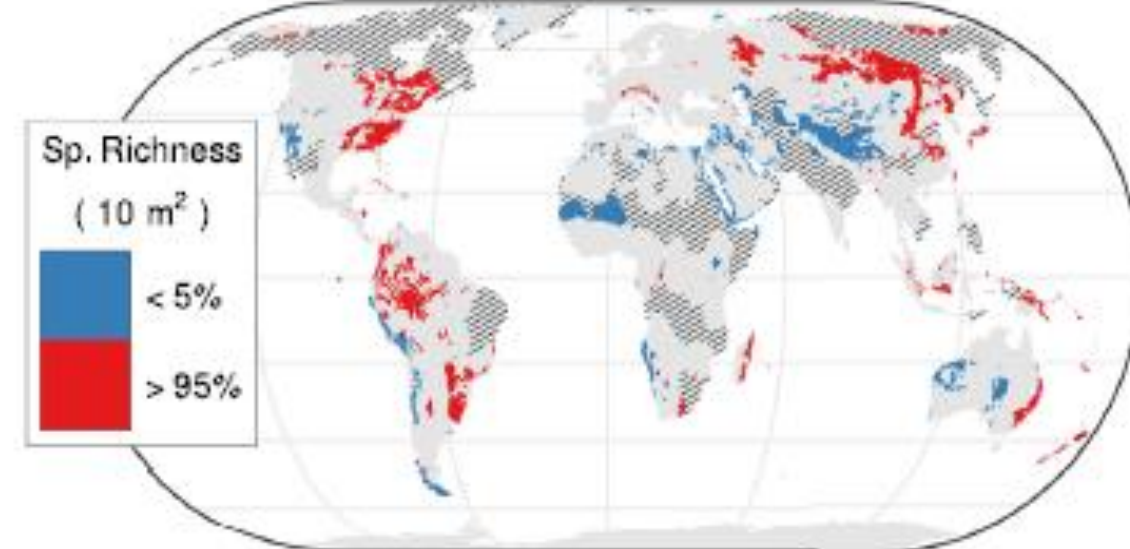
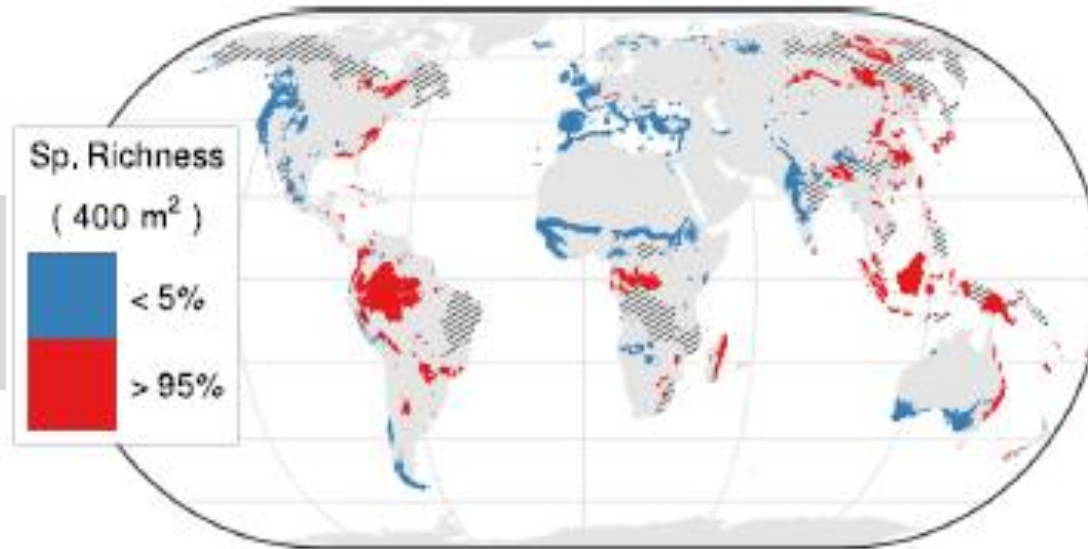


Variation de la richesse spécifique à l'échelle globale: cold & hotspots of alpha diversity

Forest ecosystems

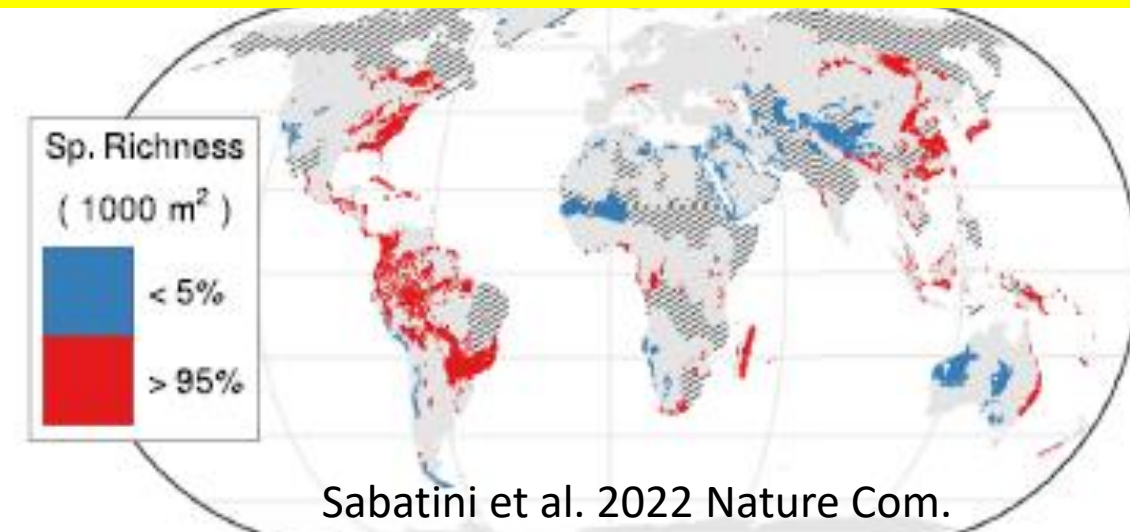
Non-forest ecosystems

Fine-grained plots

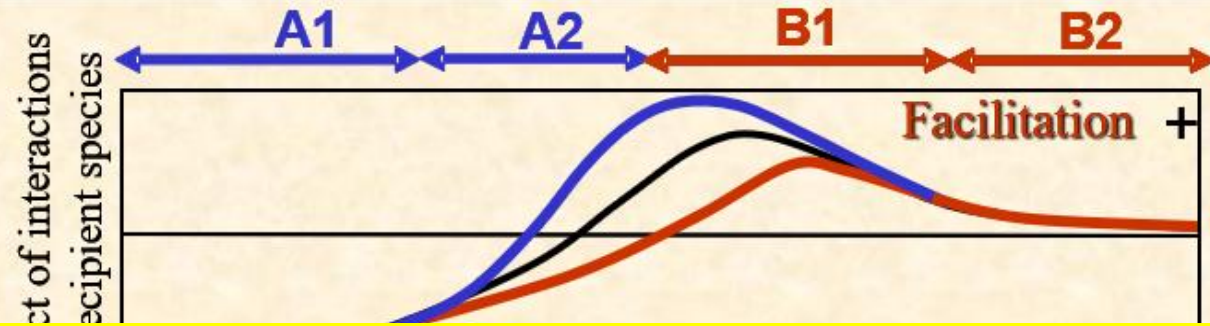


Influence prépondérante des pools régionaux d'espèces, du climat, du type d'écosystème et de la taille des plots

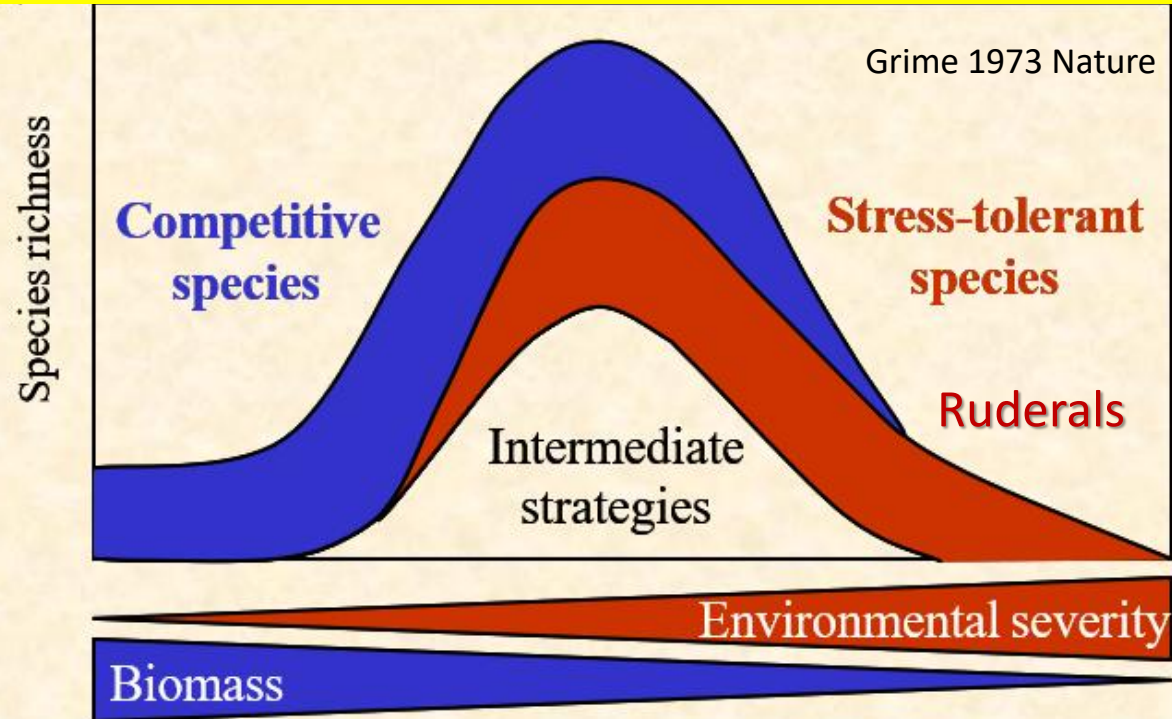
Coarse-grained plots



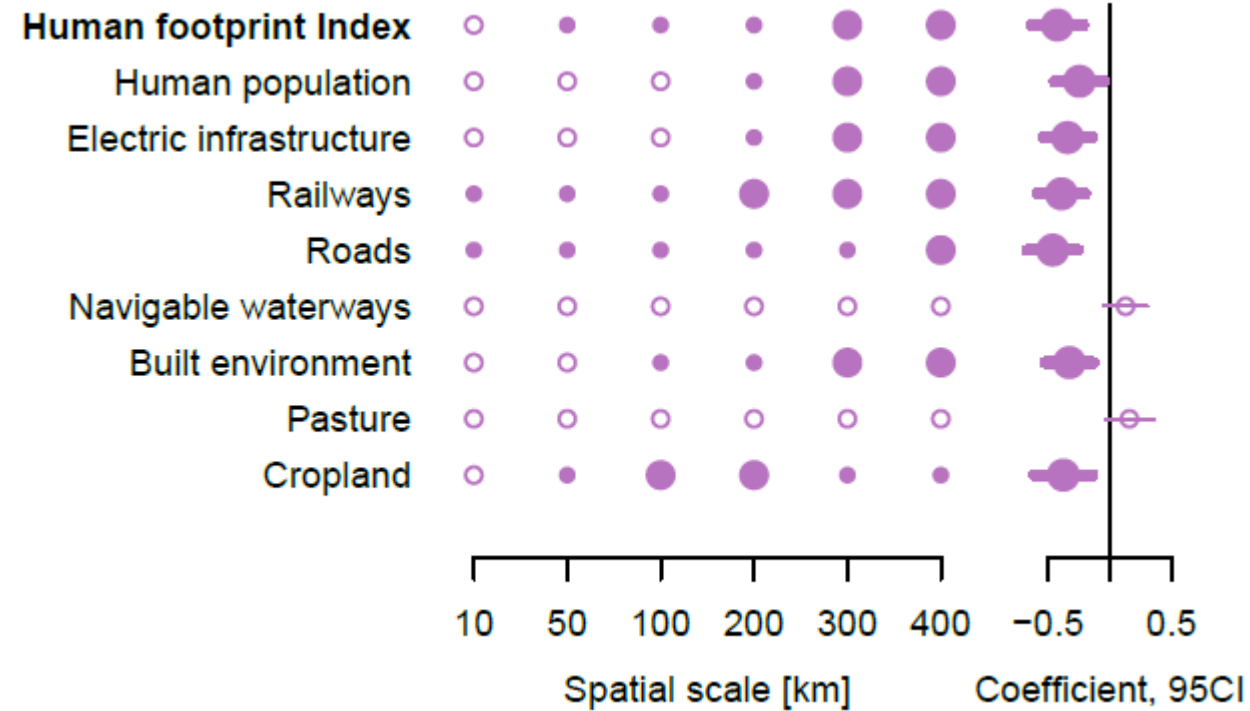
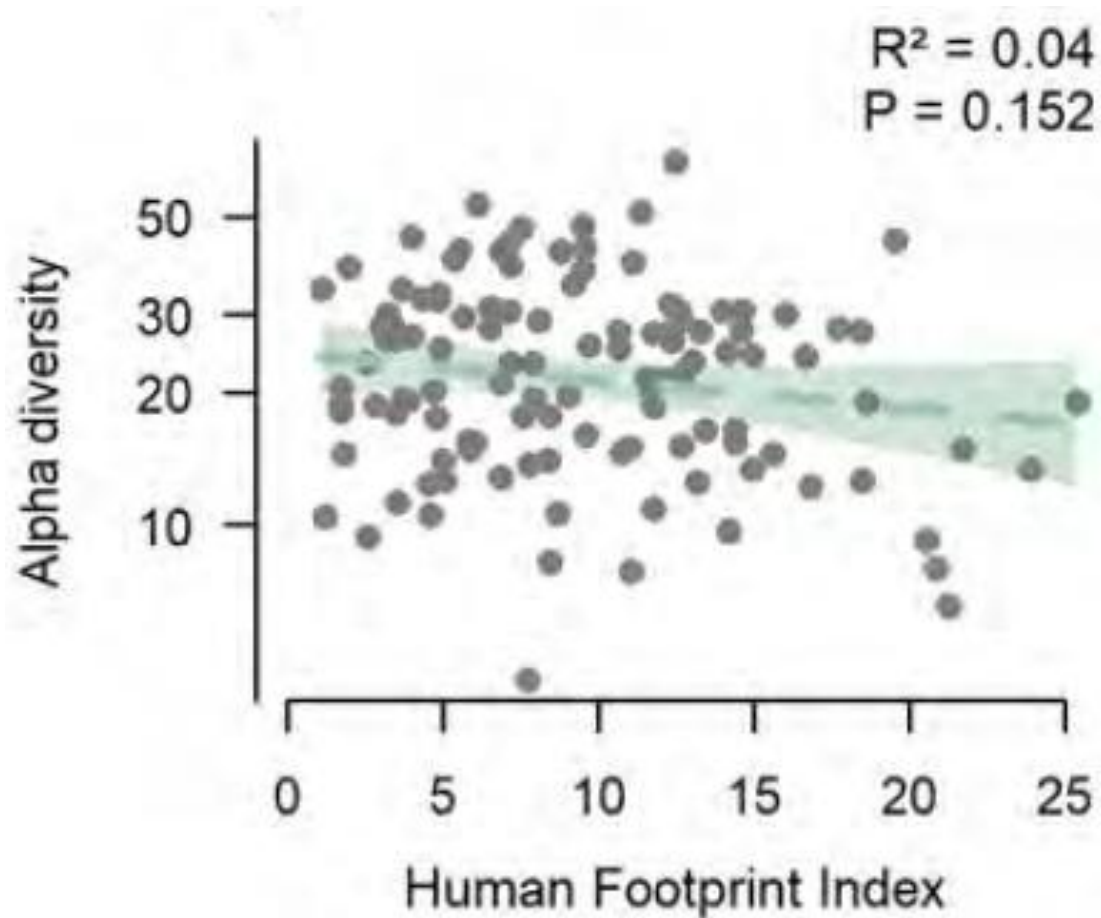
Variation de la richesse spécifique dans les communautés herbacées aux échelles locales et régionales



Influence prépondérante du stress, de la disturbance et des interactions biotiques

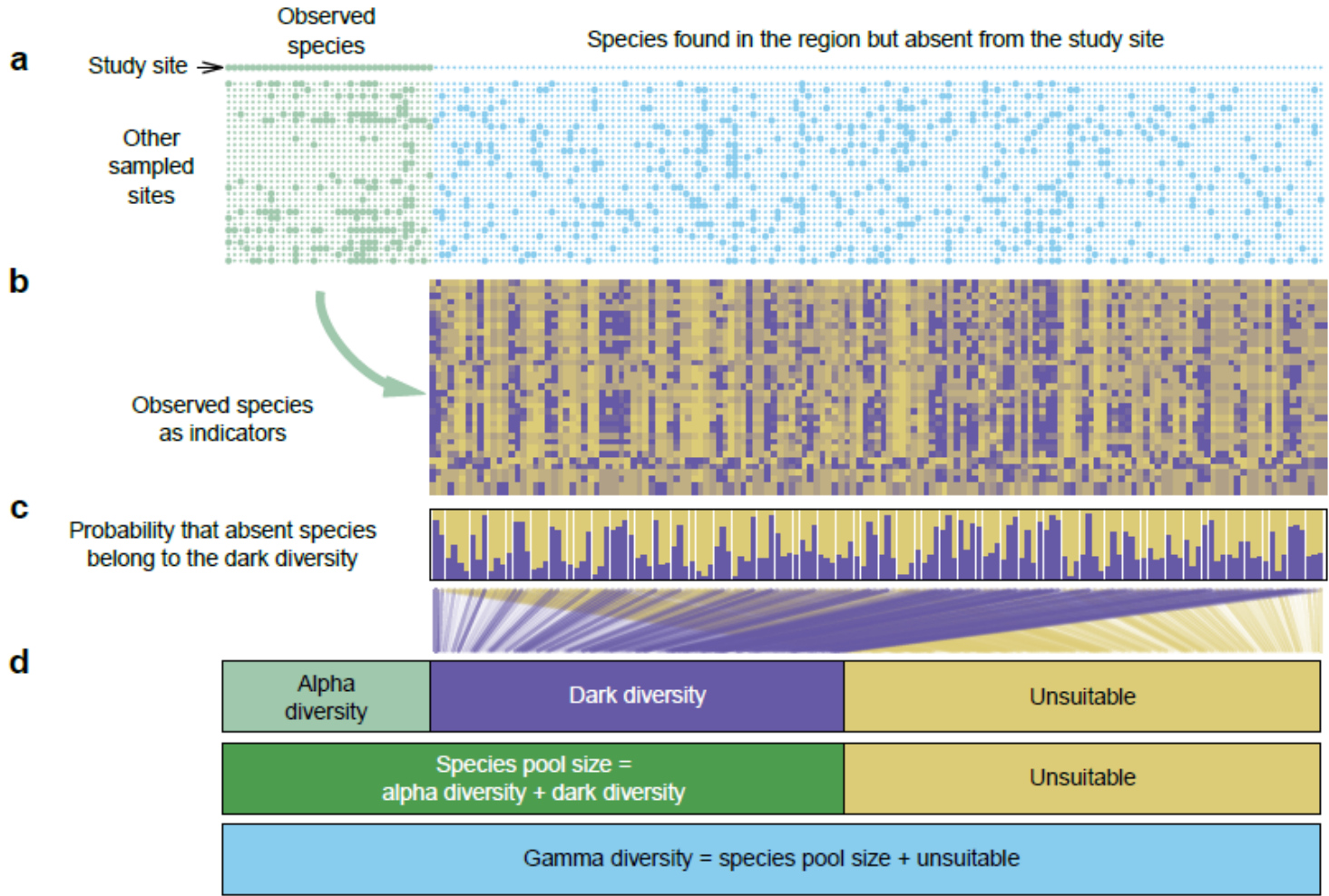


Variation de la richesse spécifique à l'échelle globale en fonction de l'empreinte anthropique



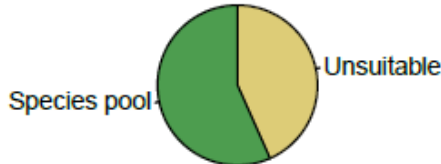
Pas de relation significative entre l'influence humaine et la diversité alpha au niveau global, de part l'influence des pools régionaux d'espèces et des facteurs écologiques locaux

Quantifying dark diversity and community completeness



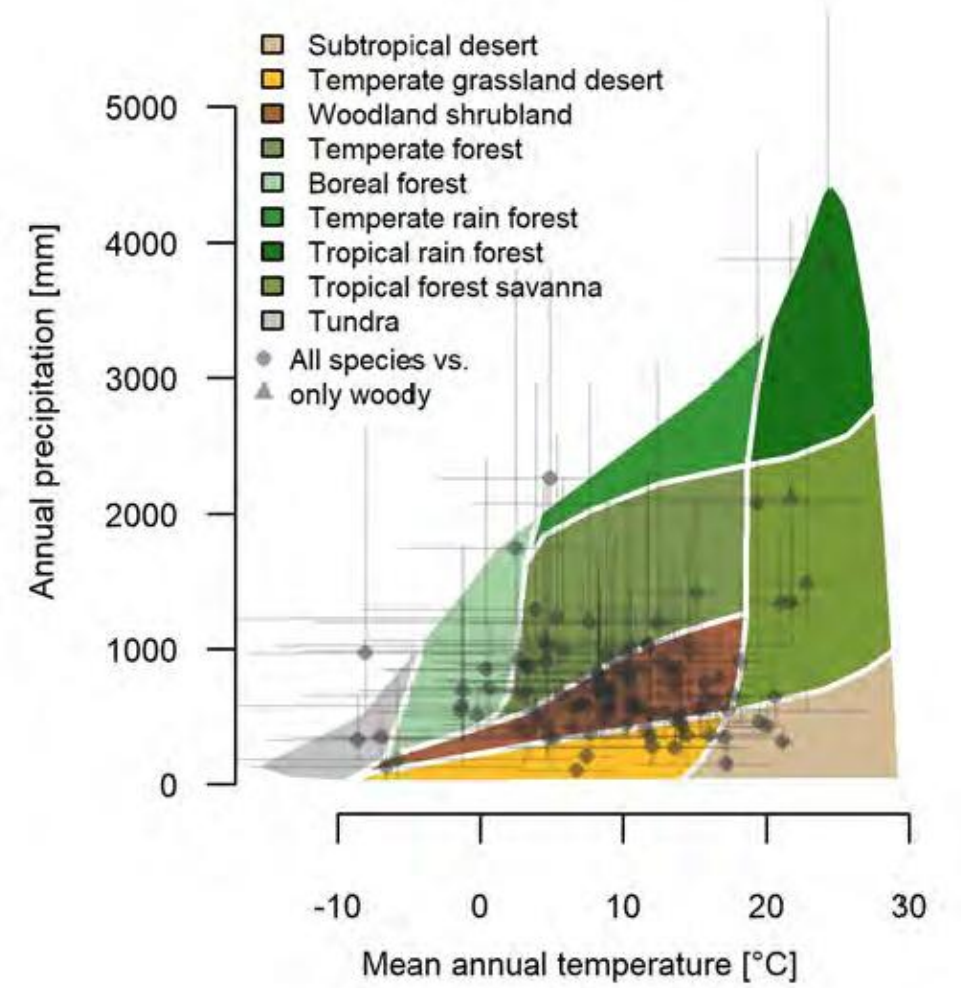
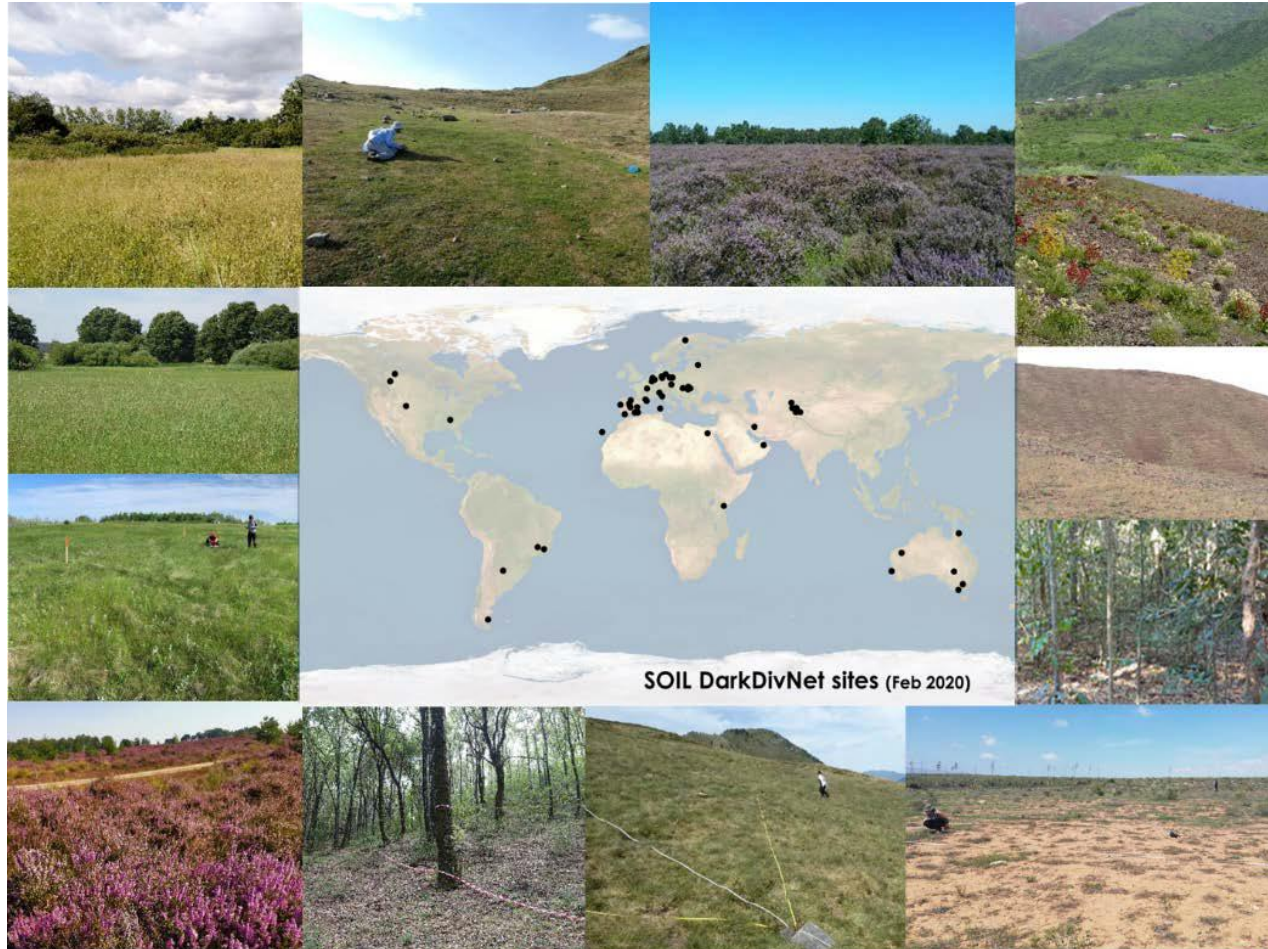
Community completeness:
alpha diversity as a percentage
of species pool size

Beta diversity:
unsuitable as a percentage
of gamma diversity



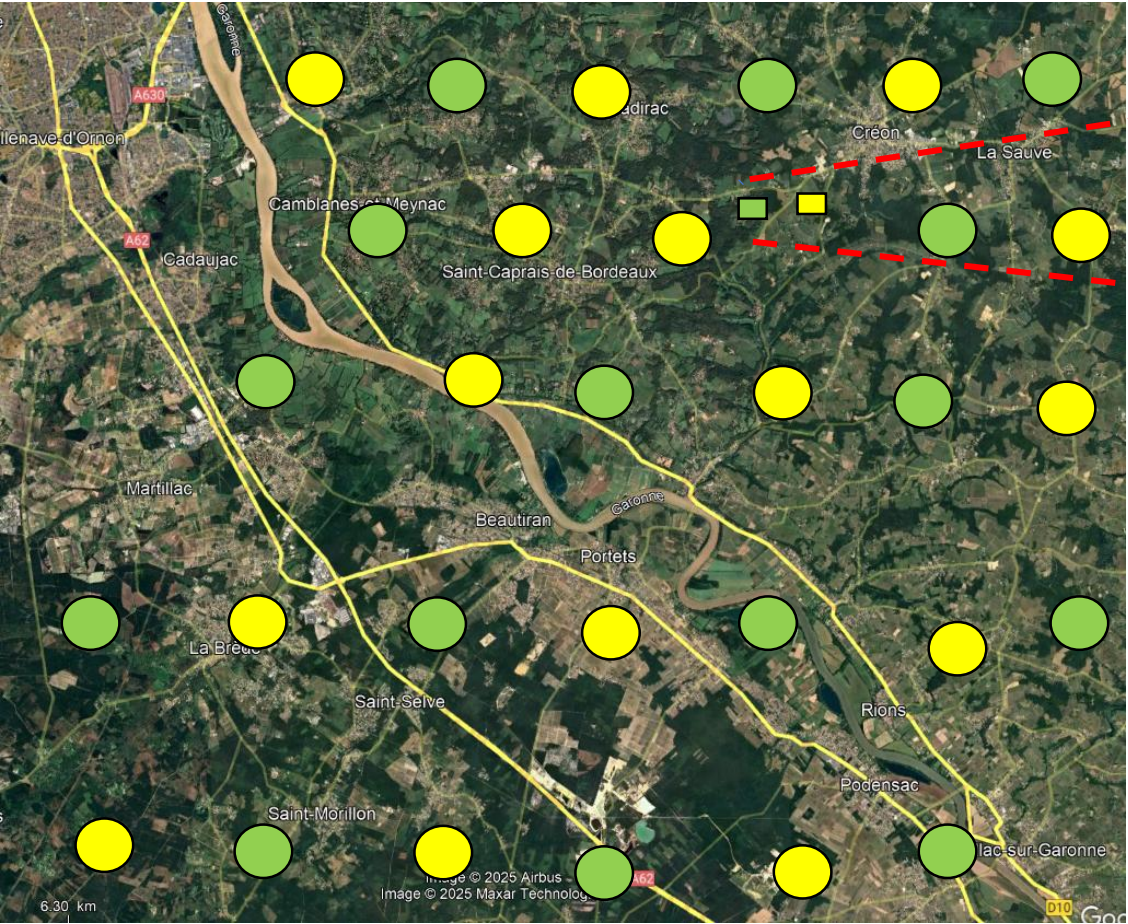
Complétude ou plénitude
de la communauté

Global design



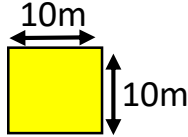
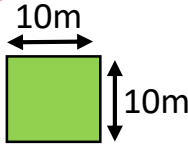
Sampling design in Gironde

30 sites in at least 300km²



1 sampled forest site of 100m²

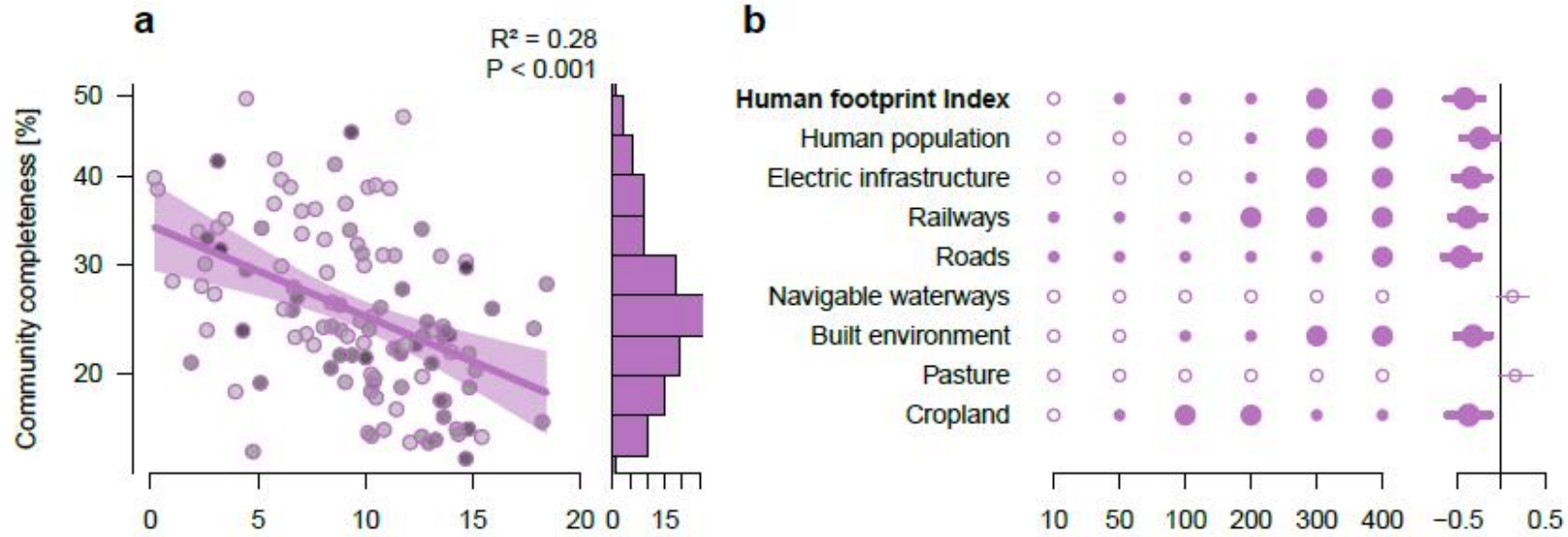
1 sampled grassland site of 100m²



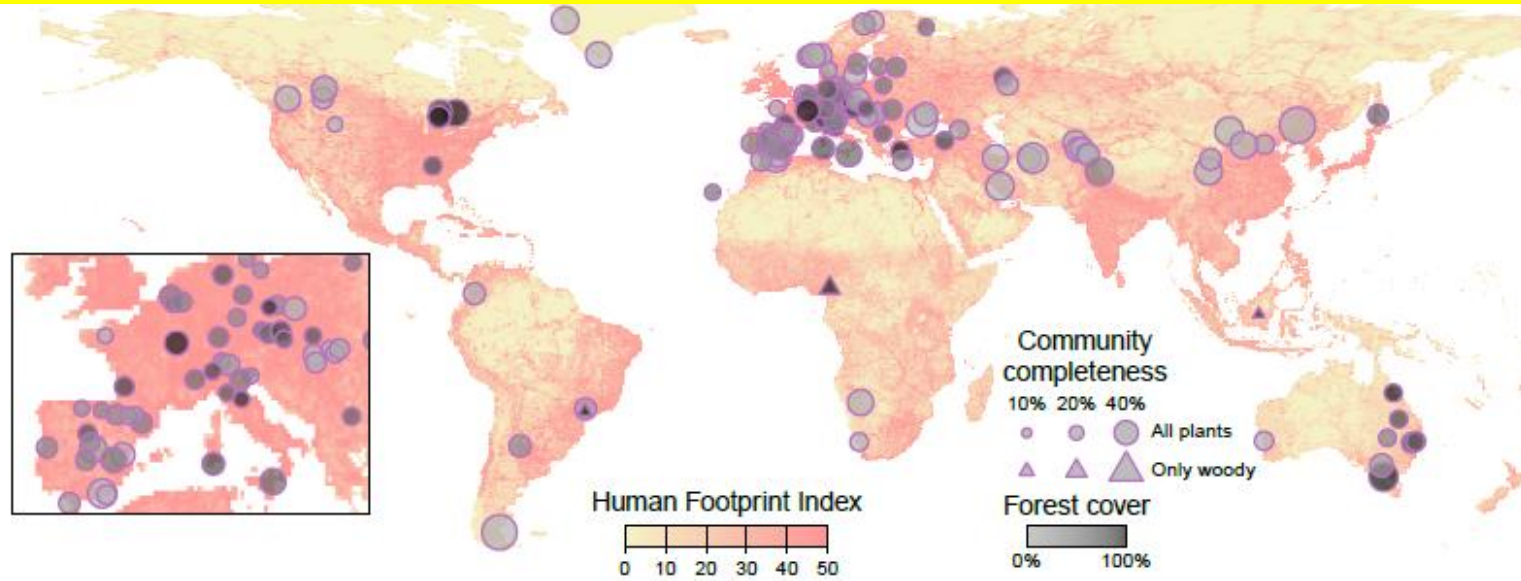
20 km

20 km

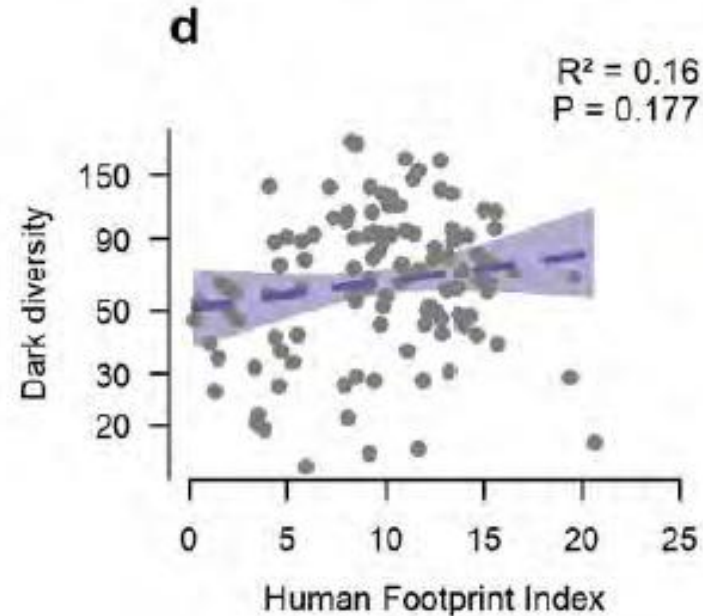
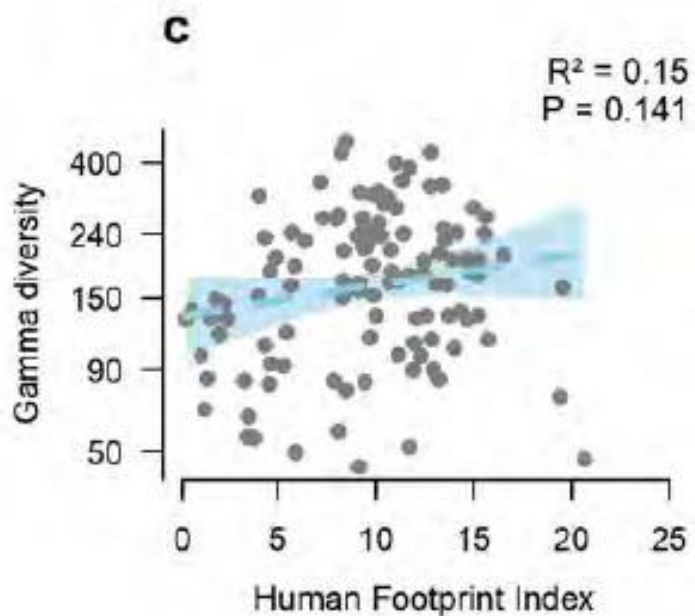
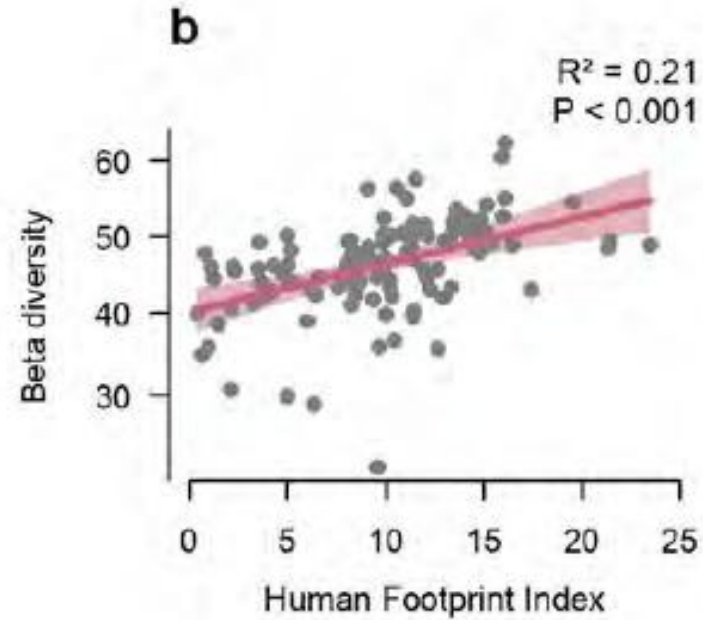
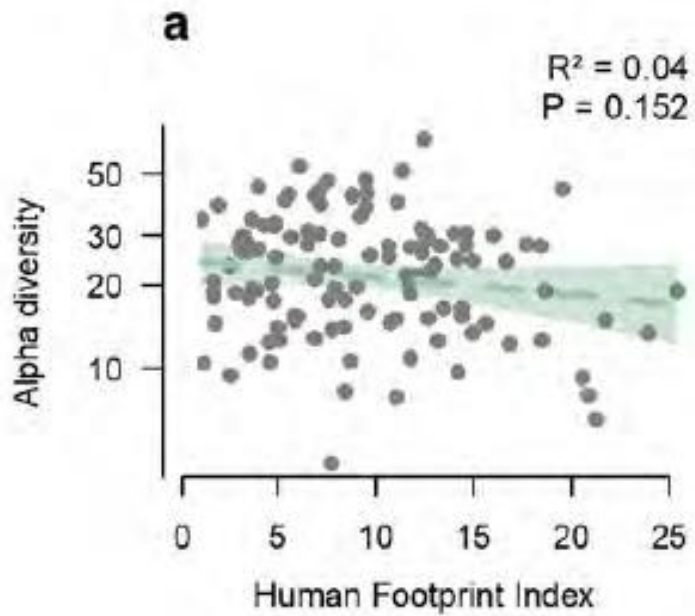
Results



In the sampled regions with minimal Human Footprint Index, an average of 35% of suitable plant species are present locally, compared with less than 20% in highly-impacted regions.



Results



Only beta-diversity among traditional diversity metrics is significantly correlated with human footprint

Conclusions

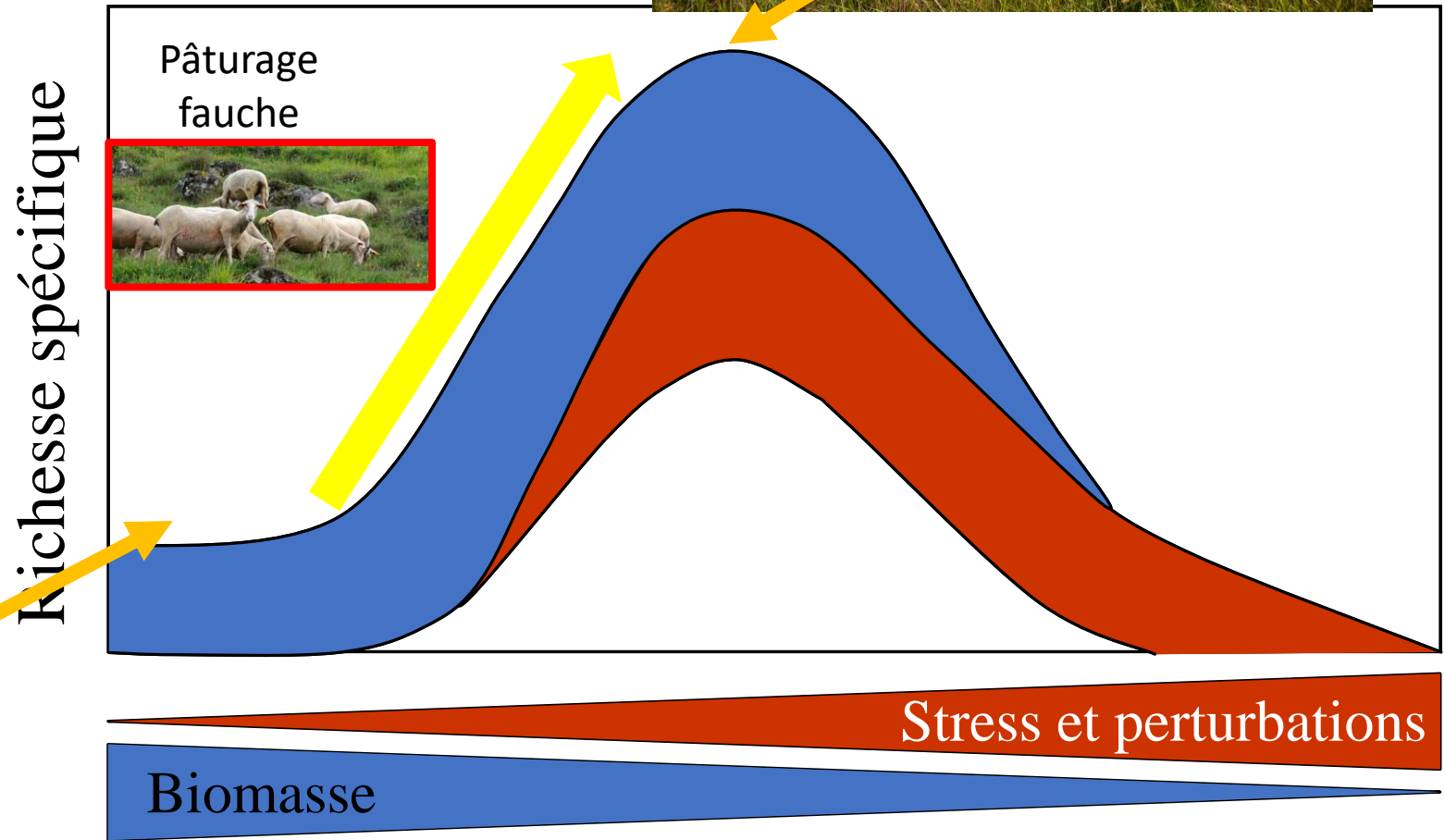
Community completeness (the proportion of all suitable species in the region that are present at a site) is a robust metric of man influence on biodiversity.

Besides causing species losses in directly affected locations, human influence might also reduce biodiversity in relatively unmodified vegetation if far-reaching anthropogenic effects trigger local extinctions and hinder recolonisation.

WARNING! Human influence can also increase diversity!

Pelouses calcaires:

La diversité alpha est favorisée par l'activité humaine de par une baisse de la compétition par la disturbance

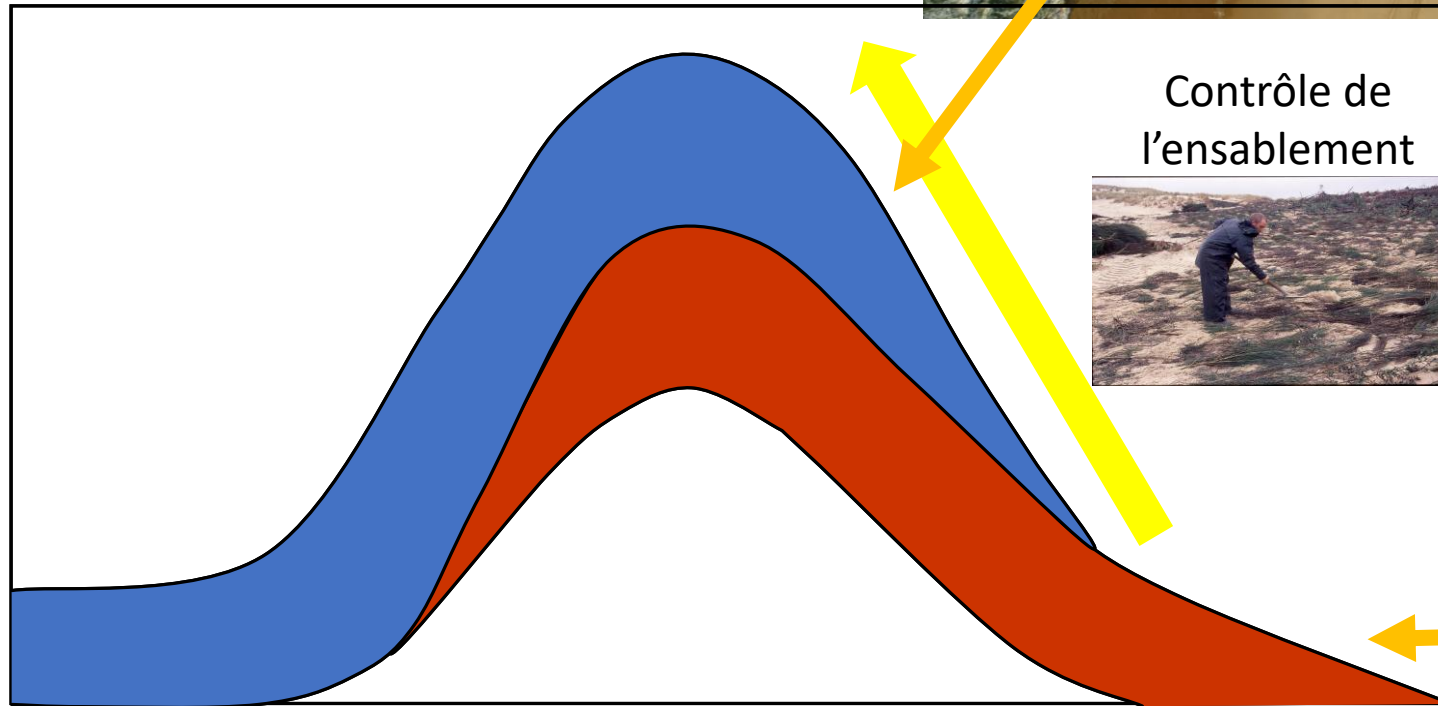


Dunes côtières:

La diversité est favorisée par l'activité humaine qui diminue la perturbation par ensablement dans un milieu très stressé



Richesse spécifique



Stress et perturbations

Biomasse

