

Towards a **forest bocage**: multifunctionality of a network of **broadleaved hedgerows** in a pine plantation landscape

Nattan Plat
& Hervé Jactel

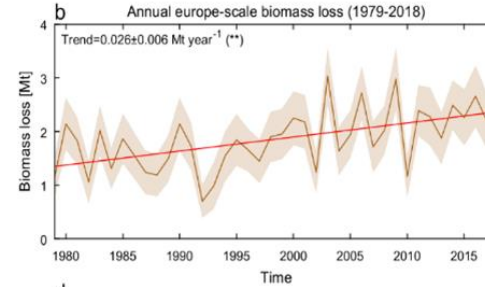
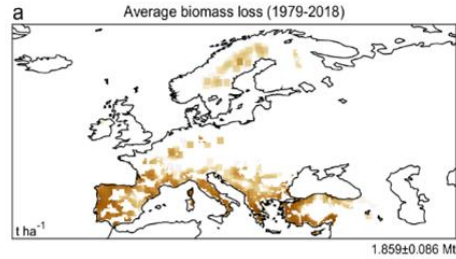
INRAE



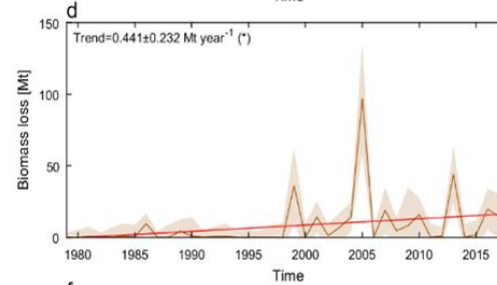
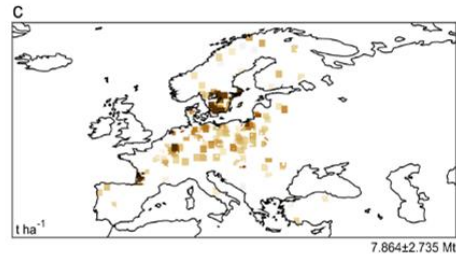
Context: an increase in disturbances

Biomass loss

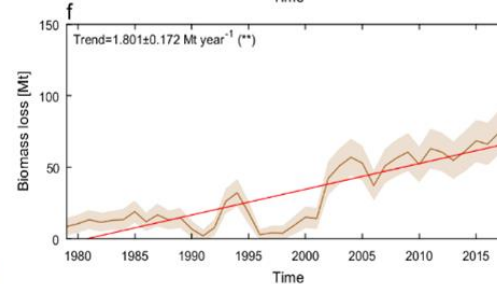
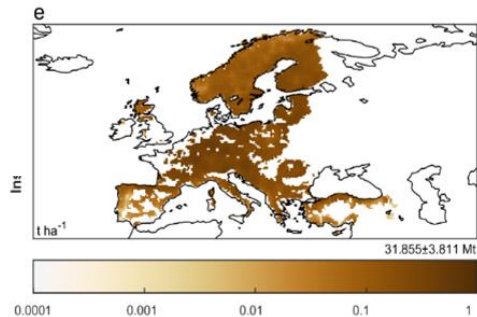
Fire



Windthrow

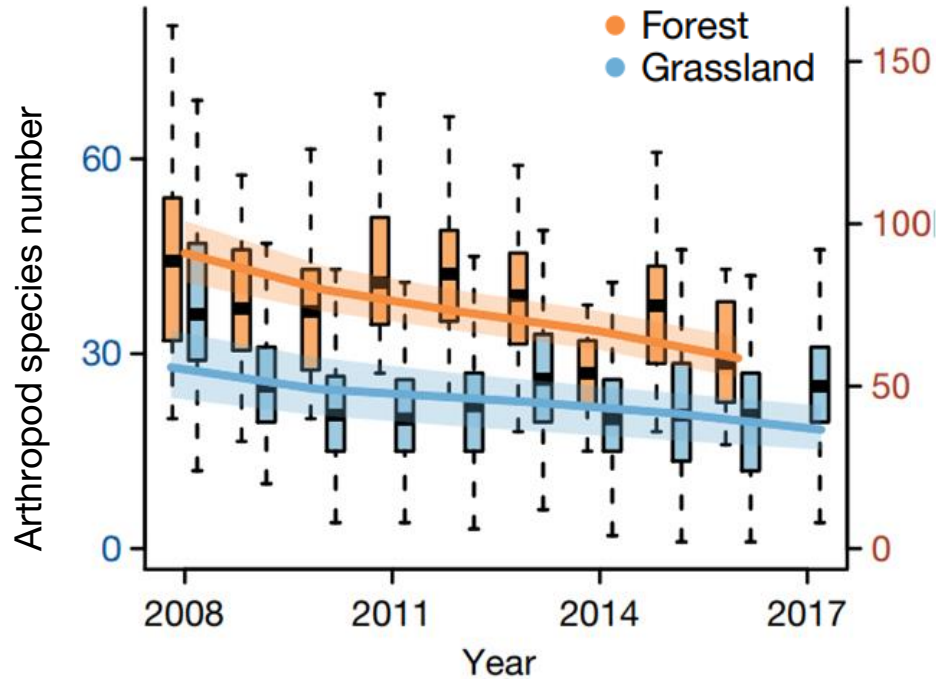


Insect outbreaks



Forzieri
et al. (2021)

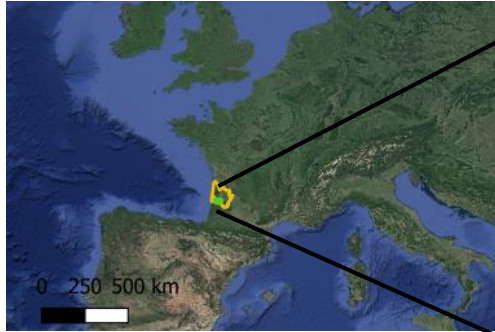
Context: biodiversity loss



- Forest resilience to disturbances
- Biodiversity conservation
- Forest contribution to people

Seibold *et al.* (2019)

Landes de Gascogne Forest



Maritime pine stands (*Pinus pinaster*)



1 million hectares of pure pine plantations

Tree diversity as a solution

Curr Forestry Rep
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FOREST ENTOMOLOGY (E BROCKERHOFF, SECTION EDITOR)

Tree Diversity Drives Forest Stand Resistance to Natural Disturbances

Hervé Jactel¹ · Jürgen Bausch² · Johanna Boberg³ · Damien Bonal⁴ ·
Bastien Castagneyrol¹ · Barry Gardiner⁵ · Jose Ramon Gonzalez-Olabarria⁶ ·
Julia Koricheva⁷ · Nicolas Meurisse⁸ · Eckehard G. Brockerhoff⁹

Tree diversity is key for promoting the diversity and abundance of forest-associated taxa in Europe



Evy Ampoorter, Luc Barbaro, Hervé Jactel, Lander Baeten, Johanna Boberg, Monique Carnol, Bastien Castagneyrol, Yohan Charbonnier, Seid Muhie Dawud, Marc Deconchat, Pallieter De Smedt, Hans De Wandeler, Virginie Guyot, Stephan Hättenschwiler, François-Xavier Joly, Julia Koricheva, Harriet Milligan, Bart Muys, Diem Nguyen, Sophia Ratcliffe, Karsten Raulund-Rasmussen, Michael Scherer-Lorenzen, Fons van der Plas, J. Van Keer, Kris Verheyen, Lars Vesterdal and Eric Allan

Bocage landscape as a Nature Based Solution



- Biodiversity conservation
- Protection against disturbances: insect pests, flood and wind damage

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Towards a Forest Bocage



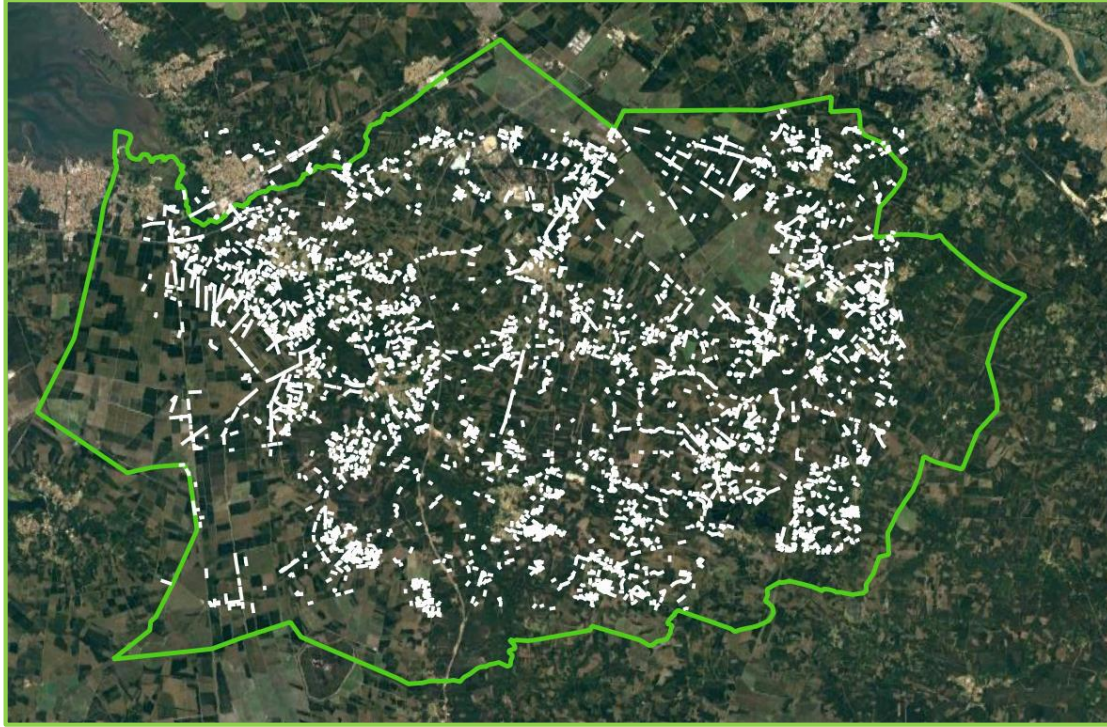
Maritime pine stands (*Pinus pinaster*)



Oak hedgerow (*Quercus robur*)

- Biodiversity conservation
- Protection against disturbances: insect pests, wildfire or windstorm

Living Lab: Forest Bocage (100 000 hectares)



Many broadleaved hedgerows



Syndicat des sylviculteurs du Sud-Ouest



Société Forestière
Faire de la nature une valeur sûre



Parc naturel régional
des Landes
de Gascogne



Hypotheses and experimental design



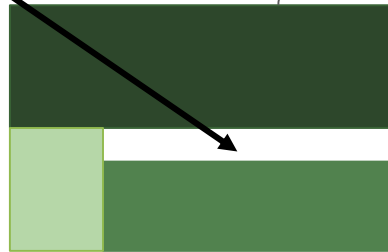
pine plantations
of different ages



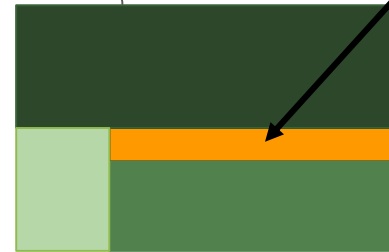
broadleaved



1. Habitat identity



Control pine
border

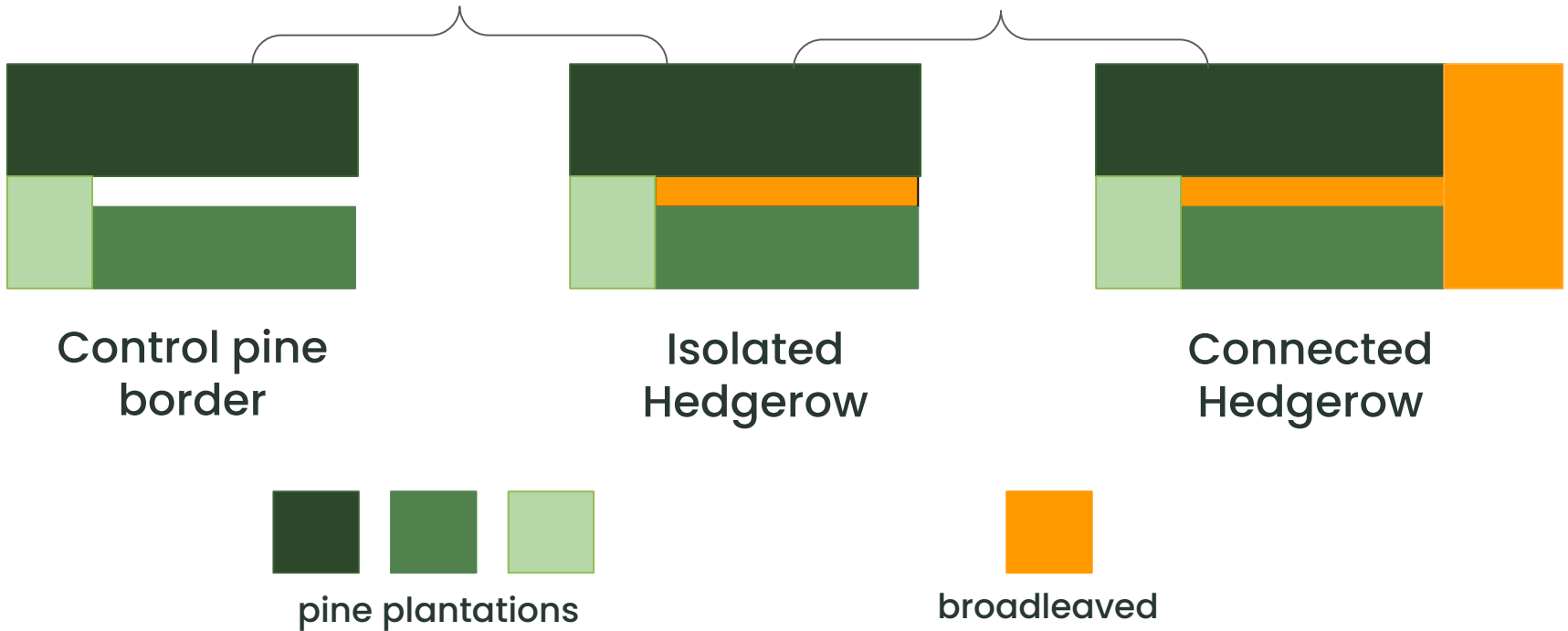


Broadleaved
Hedgerow

Hypotheses and experimental design

1. Habitat identity

2. Habitat connectivity



Hypotheses and experimental design

3.Habitat amount

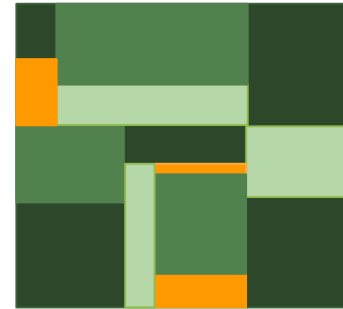


Hypotheses and experimental design

High broadleaved amount



Low broadleaved amount



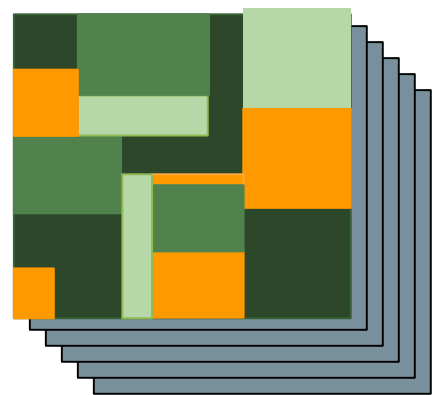
Control pine border

Isolated Hedgerow

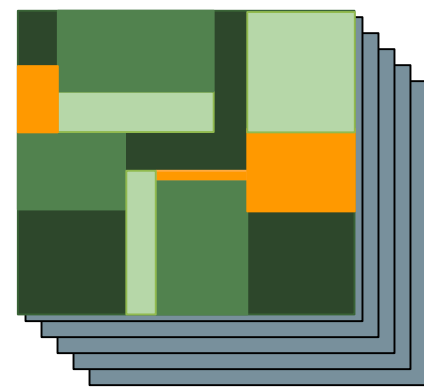
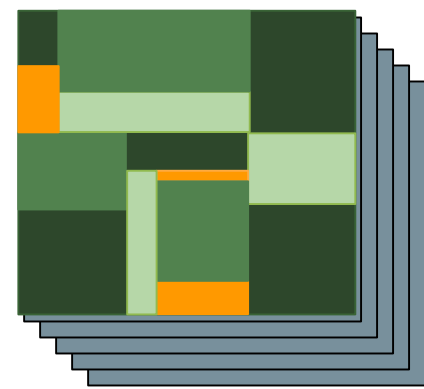
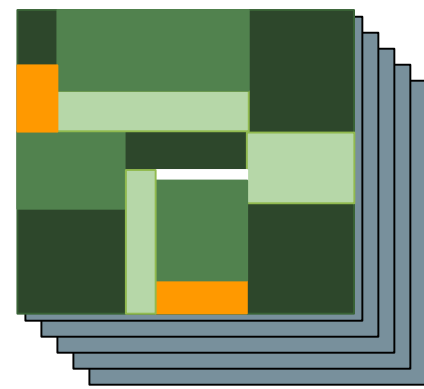
Connected Hedgerow

Hypotheses and experimental design

High broadleaved amount



Low broadleaved amount

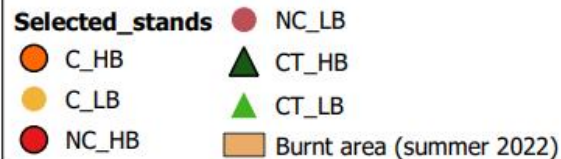
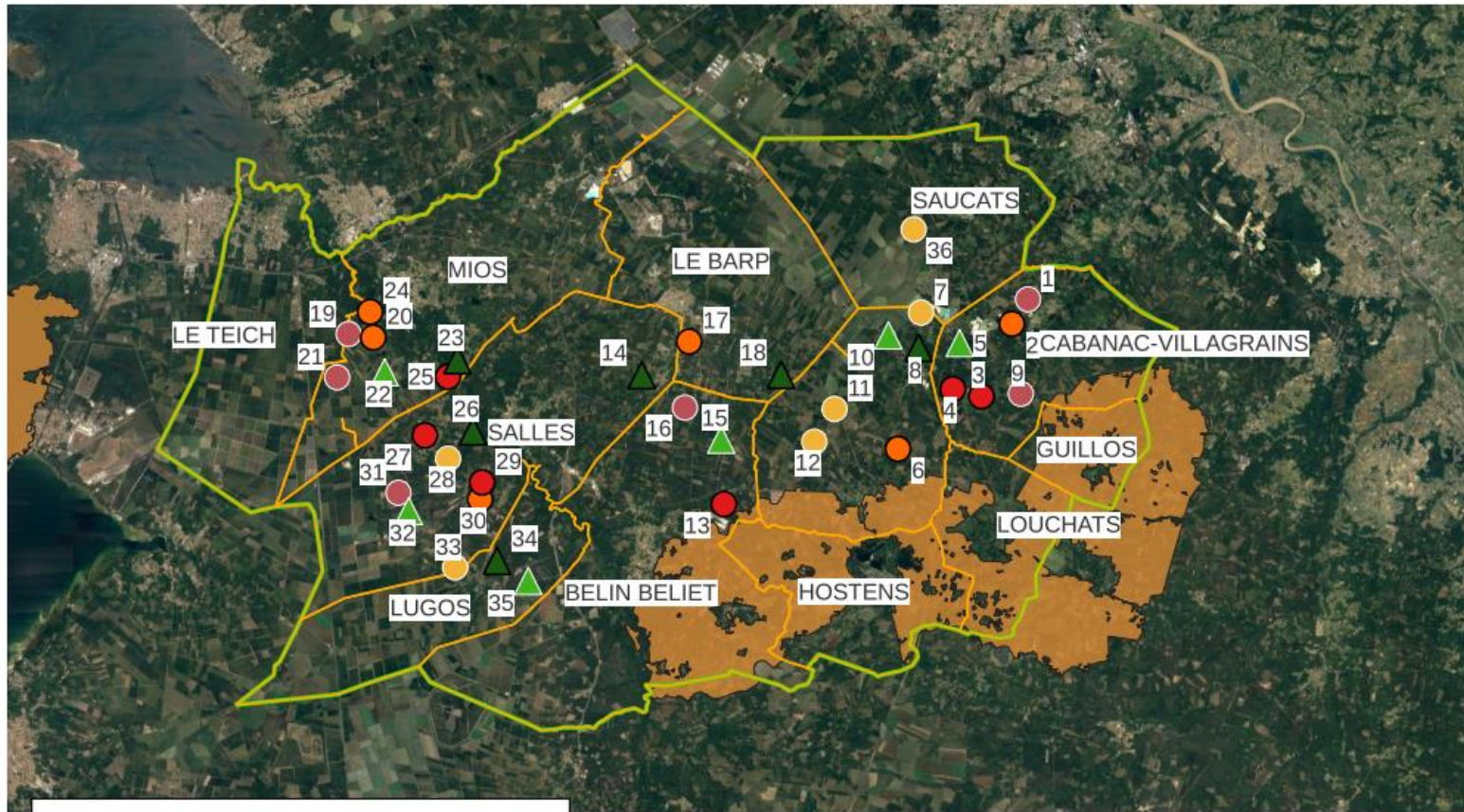


**6 modalities
x 6 replicates
= 36 sites**

Control pine border

Isolated Hedgerow

Connected Hedgerow



Glossary:
 C: Connected hedgerow / NC: Non-connected hedgerow
 CT: Control pine edge
 LB: Low Broadleaved density / HB: High Broadleaved

Biodiversity monitoring



Vascular Plants



Ground beetles



Ground spiders

And
more to
come ...



Butterflies

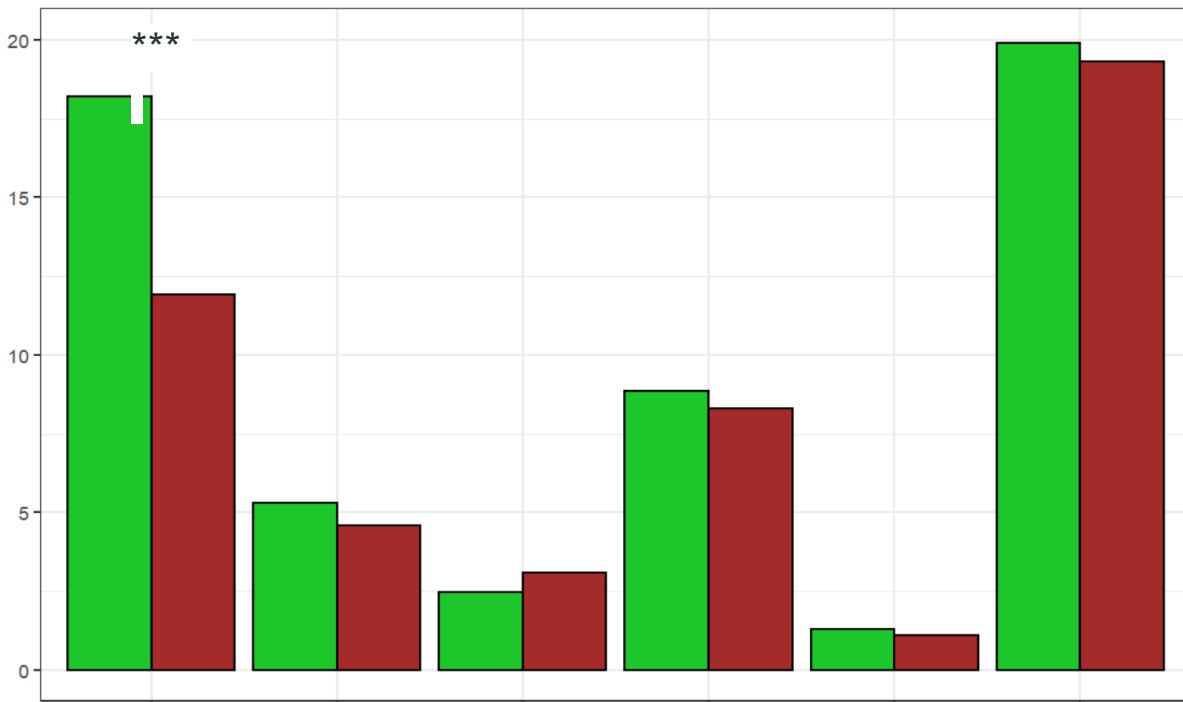


Reptiles

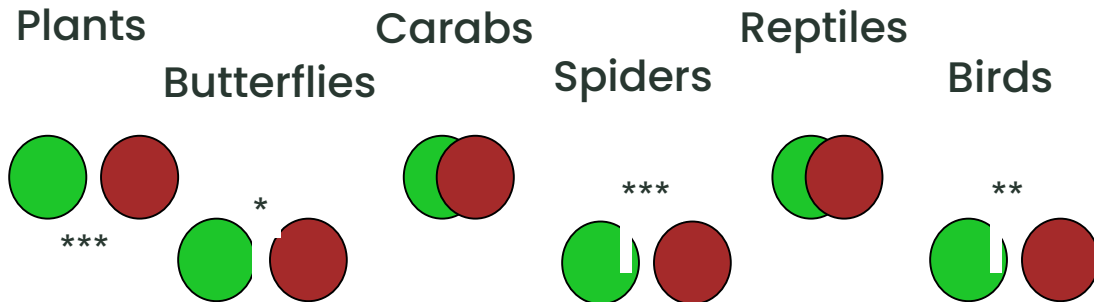


Birds

Species richness (Anova)



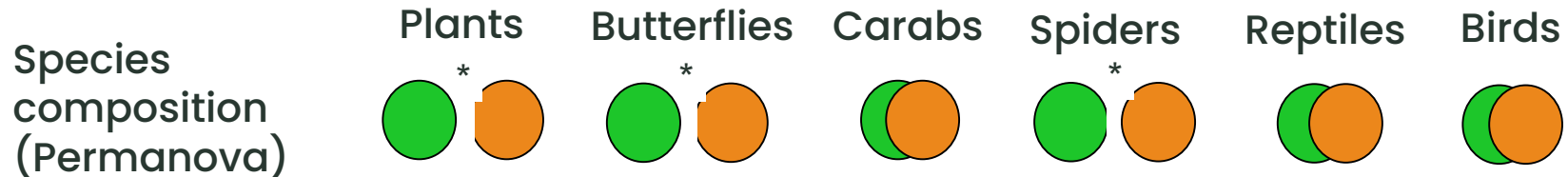
Species composition (Permanova)



Connectivity

No effect of hedgerow connectivity on biodiversity

Amount of broadleaved habitat



Effect of broadleaved hedgerows on damage by the pine processionary moth in adjacent pine plantations (*Thaumetopoea pityocampa*)



Defoliation

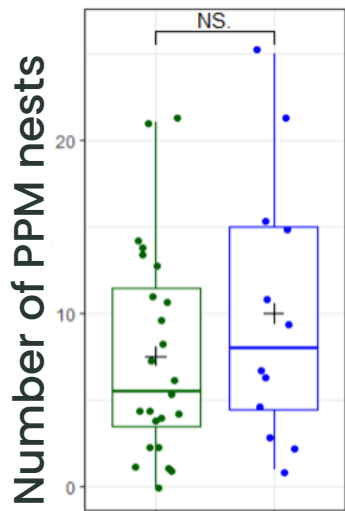


caterpillars



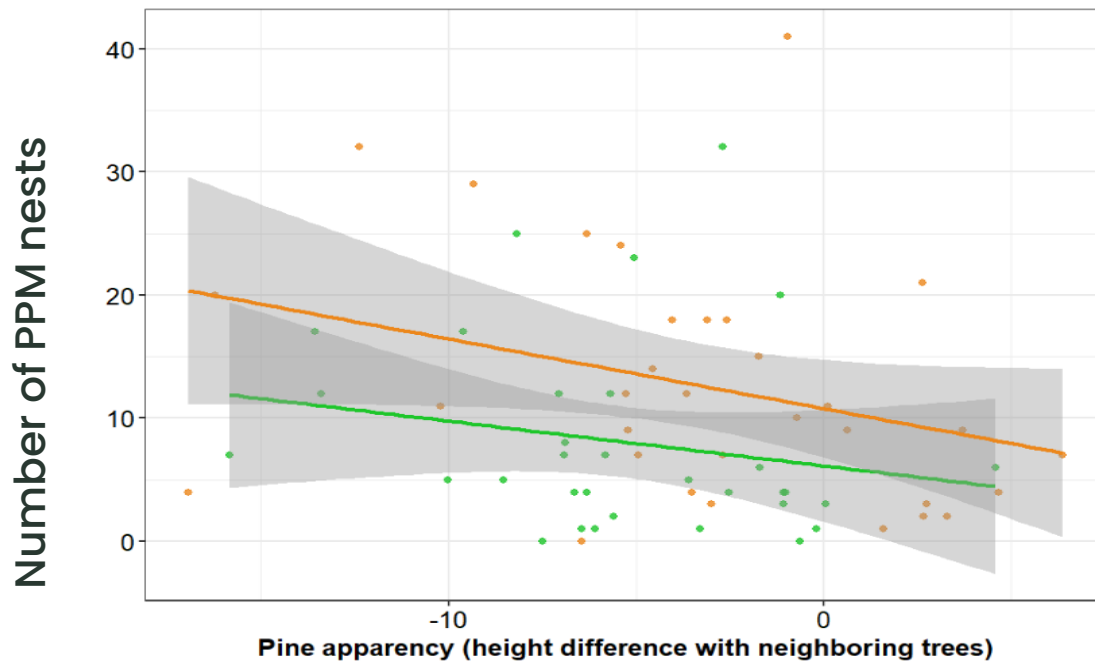
nest

Effect of broadleaved hedgerows on pine processionary moth nests



Broadleaved
hedgerows

No broadleaved
hedgerows



Low 
broadleaved
amount

High 
broadleaved
amount

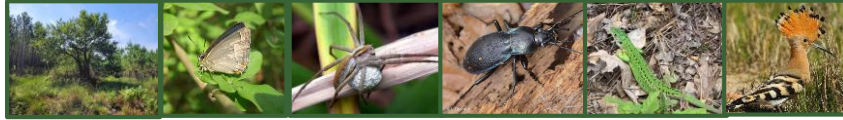


Oak height - Pine height



Take home message

Biodiversity:



- 1) Forest Bocage can improve biodiversity by complementing species communities
- 2) The amount of broadleaved habitat around hedgerows is more important for biodiversity than connectivity of hedgerows

Pest control:

- 1) Broadleaved hedgerows and patches can reduce pine processionary moth damage



Next Step

Role of broadleaved hedgerows as habitats for insect predators



Effect of broadleaved hedgerows on slowing the spread of fire and windstorms



Based on this knowledge, where to plant 10km of new hedgerows in our Living Lab



Acknowledgement



NEO TERRA
Transition écologique
et énergétique



SUPERB
Upscaling Forest Restoration



Thank you for your attention

