



HAL
open science

Spatial patterns of Tree-related Microhabitats: key factors and ecological significance for the conservation of the associated biodiversity

Laurent Larrieu, Christophe Bouget, Benoit Courbaud, Nicolas Goux, Goulard Michel, Daniel Kraus, Thibault Lachat, Sylvie Ladet, Yoan Paillet, Olivier Rose, et al.

► To cite this version:

Laurent Larrieu, Christophe Bouget, Benoit Courbaud, Nicolas Goux, Goulard Michel, et al.. Spatial patterns of Tree-related Microhabitats: key factors and ecological significance for the conservation of the associated biodiversity. 5. European Congress of Conservation Biology, Jun 2018, Jyvaskyla, Finland. 13 p. hal-02788682

HAL Id: hal-02788682

<https://hal.inrae.fr/hal-02788682>

Submitted on 5 Jun 2020

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

A Tree-related Microhabitat (TreM) is a specific above-ground tree morphological singularity (Larrieu, Paillet, Winter et al. 2017)

- distinct, **well delineated structure**
- borne by **standing living or dead trees**
- **essential substrate or life-site for taxa**
- encompassing decaying wood (=saproxylic TreM) or not (=epixylic TreM)



Cavities



Injuries



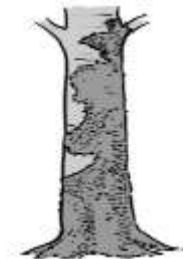
Crown deadwood



Excrescences



Fungi



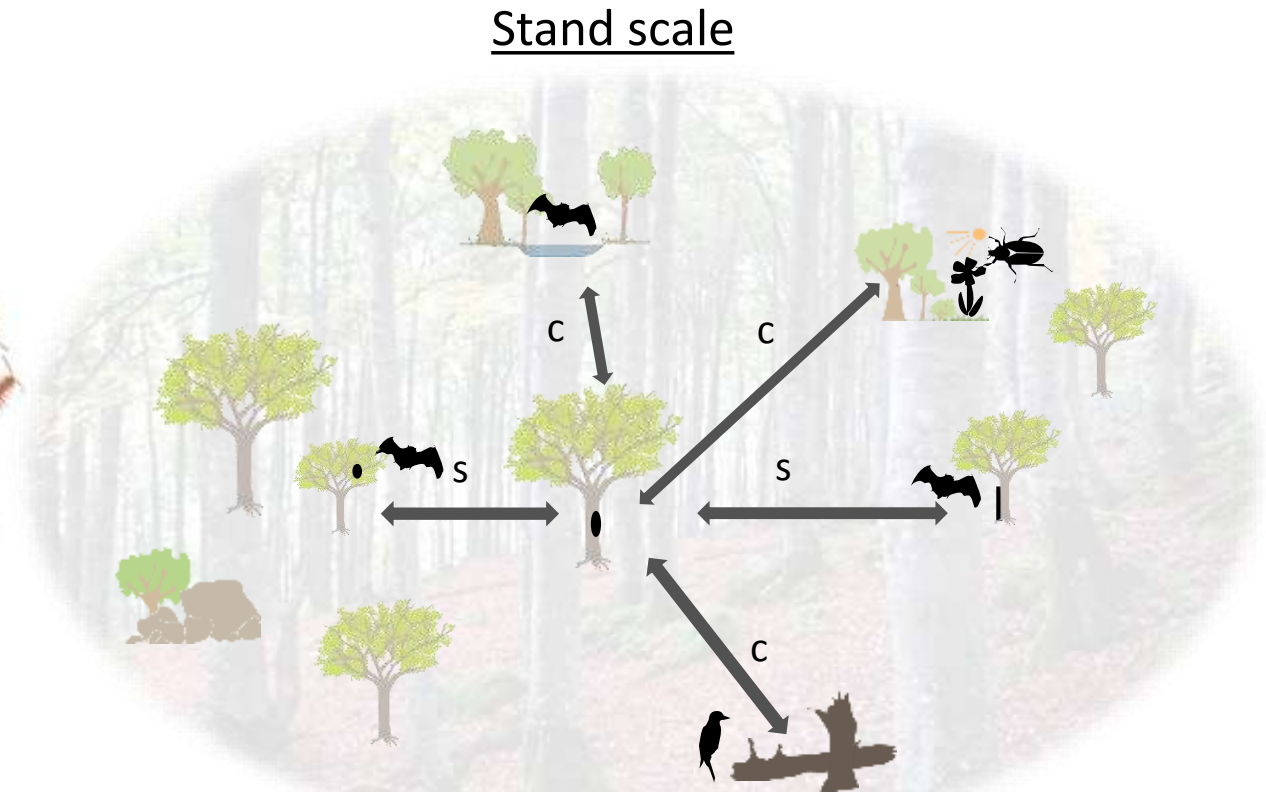
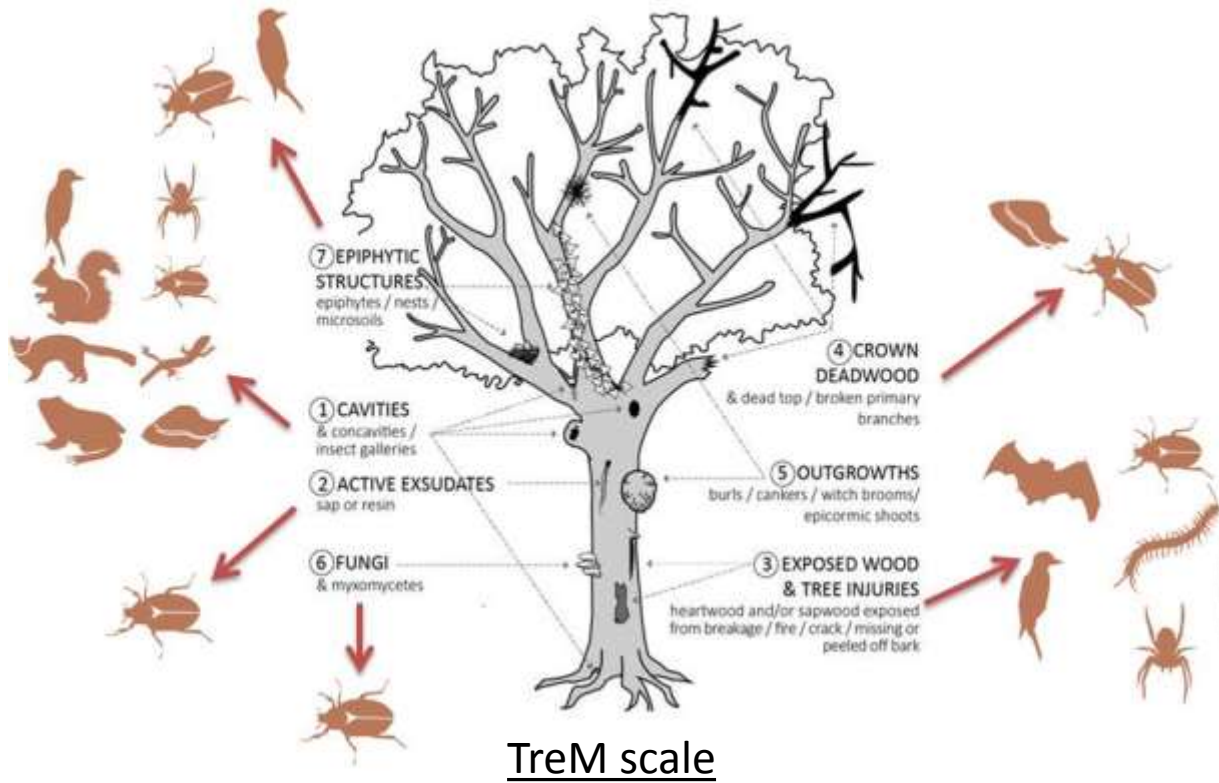
Epiphytes



Exudates

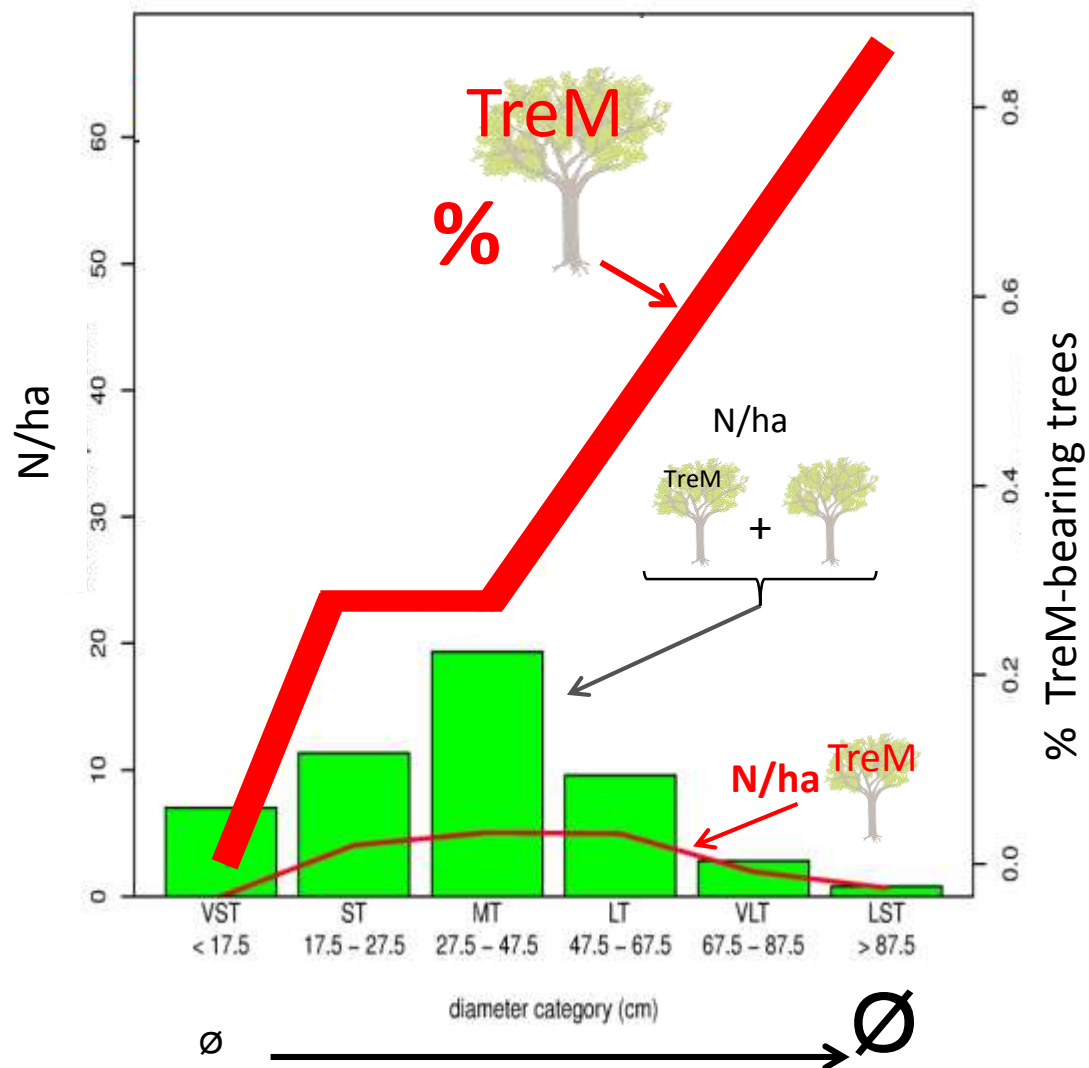
7 Forms

TReMs are key features for many taxa and participate in a complex functional habitat network in species life cycles



Examples of supplementation (s) and complementation (c) resources

Large trees bear most of the TreMs within a forest stand (e.g. Larrieu et al. EJFR 2012)



= TreM-bearing trees

(See also: Michel et al. CJFR 2011;
Vuidot et al. BC 2011; Regnery et al.
FEM 2013)

Does the spatial pattern of the largest trees drive the spatial pattern of the TreMs at the stand level?

Stochastic events

- Neighbour-tree falling
- Lightning
- Wind damages
- Rock fall

Old growth forests



Managed stands



Tree dbh ?

Biotic processes

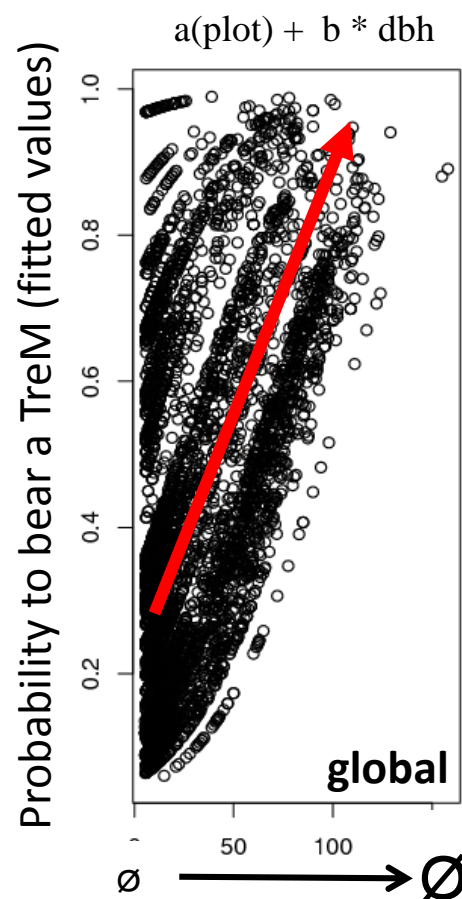
- Woodpecker drillings
- Between-tree light competition
- Cambium dysfunctioning
- Etc.

Forestry operations

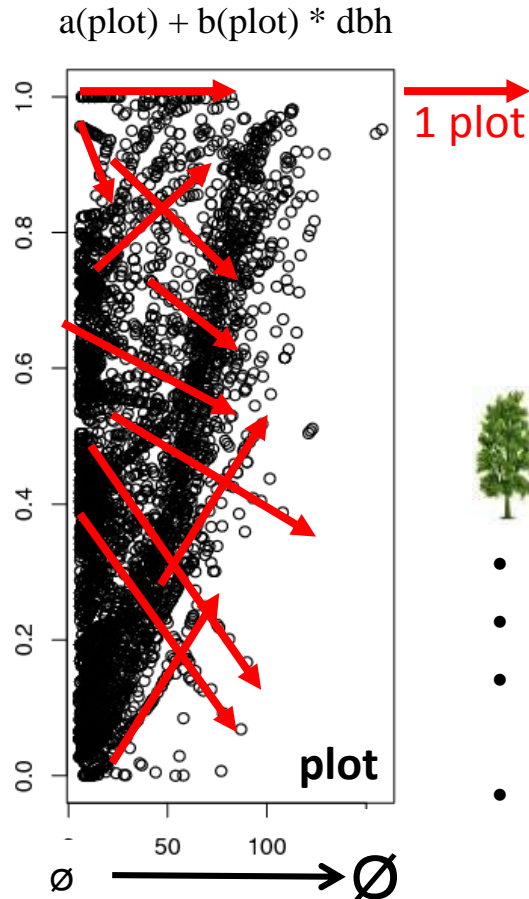
- Tree-marking
- Harvesting injuries

At a multi-site sample level, the probability of bearing a TreM increases with dbh but the direction of this relationship is variable at the plot level

Non-spatialized dbh model



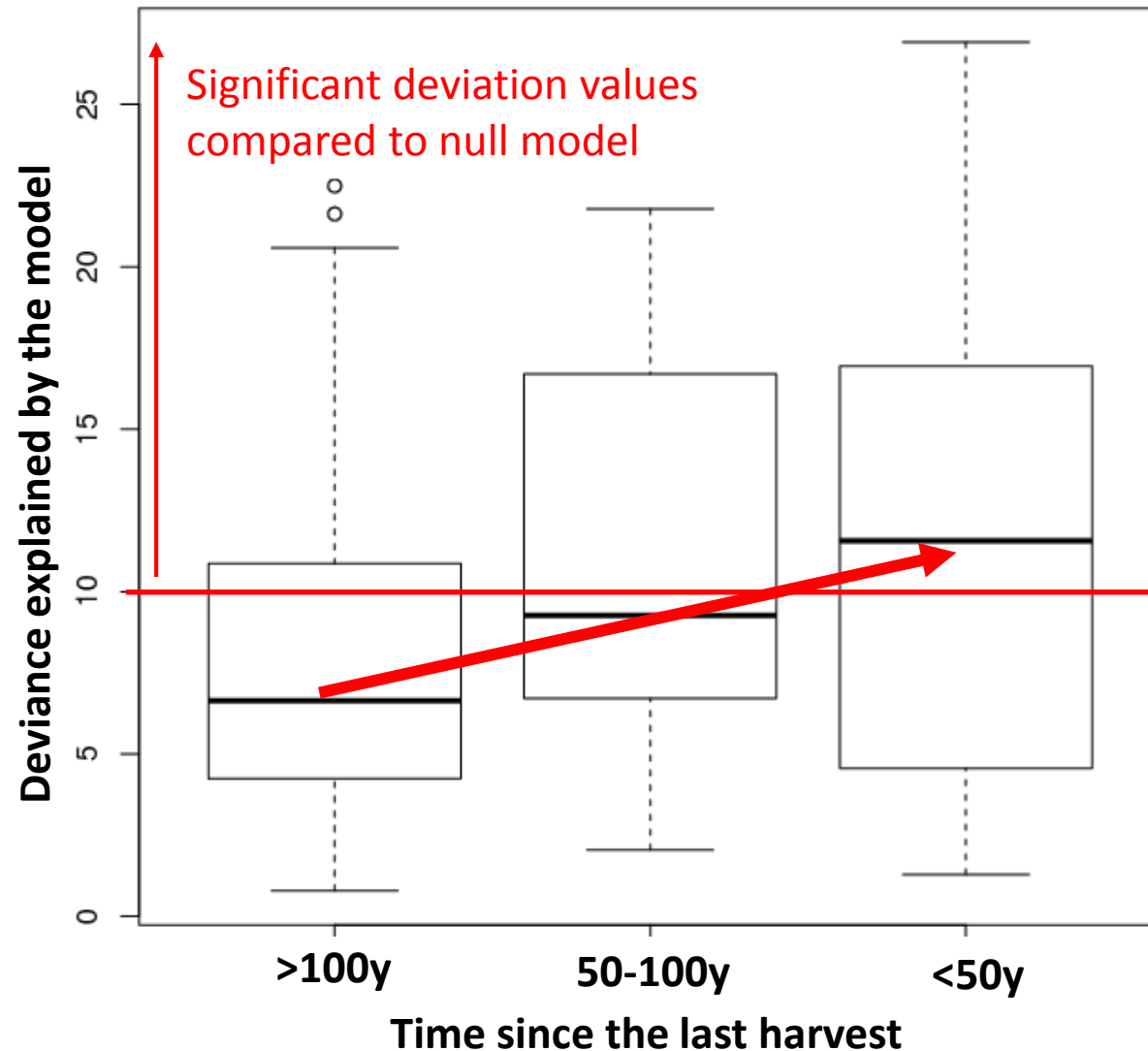
Spatialized dbh model ***



Fagus sylvatica > 50%

- Time since the last harvest > 100 y
- 5 sites/126 plots/5519 trees
- 11 TreM groups
- GLM binomial (Y=with a TreM or not)

Time since the last harvest influences the spatial pattern of the TreM-bearing trees



Fagus sylvatica > 50%

- 25 sites/165 plots/11425 trees
- 11 TreM groups
- **GLM binomial** (Y=with a TreM or not)
- **4 variables describing tree-neighborhood**
 - d to the closer TreM-bearing tree
 - d to the closer tree without TreM
 - nb TreM-bearing trees in a 40m-buffer
 - nb trees without TreM in a 40m-buffer

Studying spatial distribution pattern of TreM-bearing trees is more challenging than expected...

➤ Some preliminary results

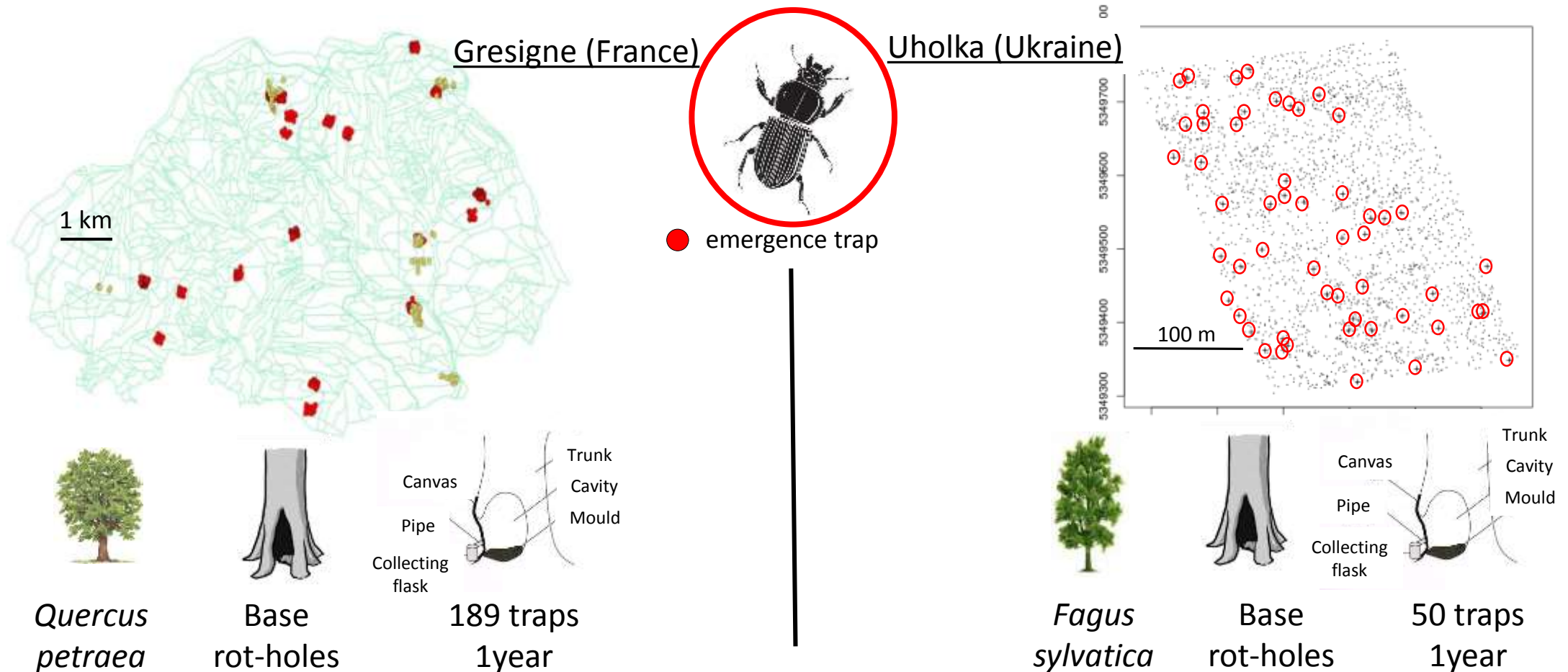
- **No clear and universal spatial pattern** by analyzing a set of 11 TreM groups
- In addition to a dbh effect, there is a **strong site_plot_managing effect**

➤ Some methodological challenges in spatial pattern study

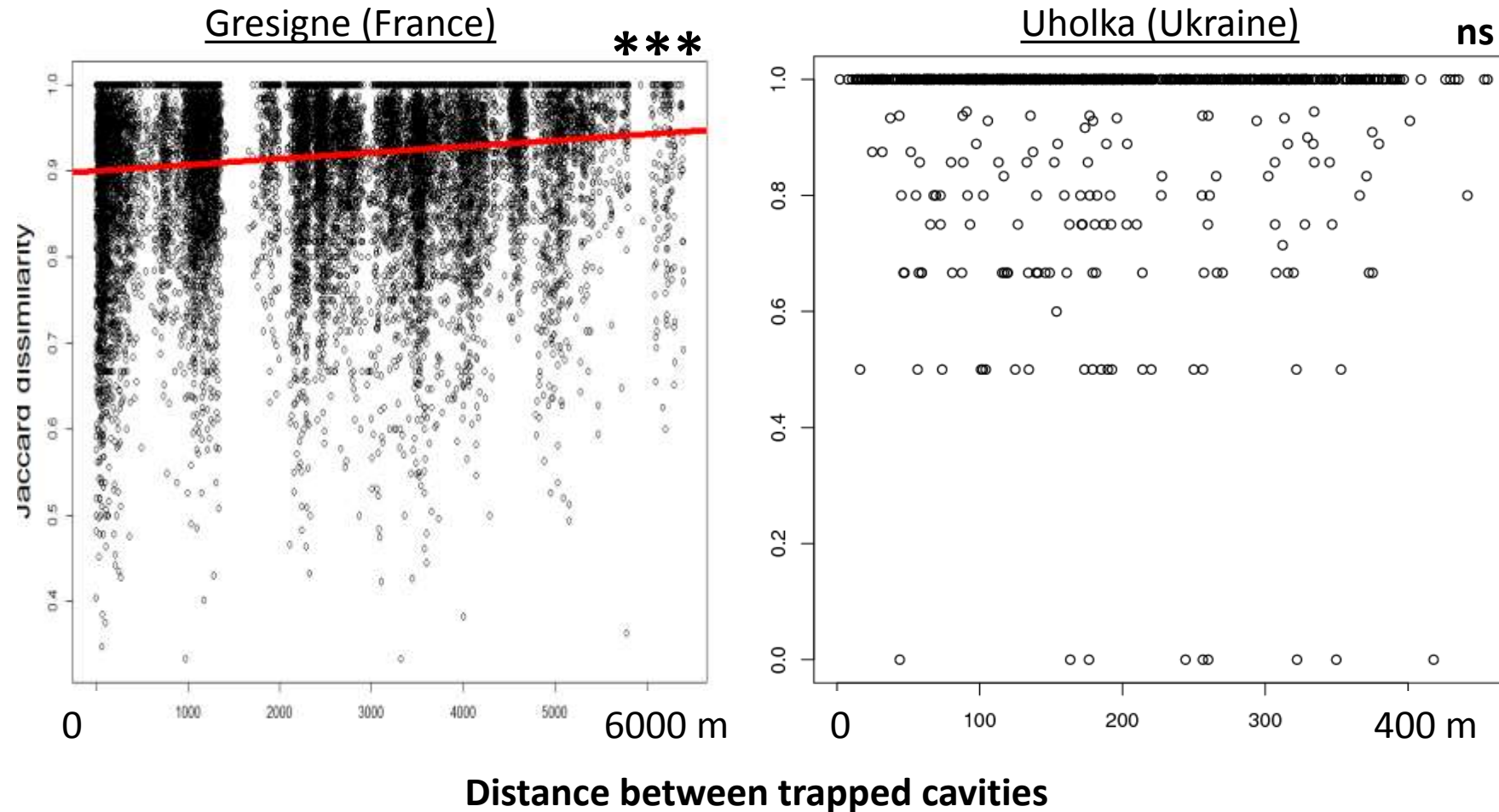
- **Scarcity of most of the TreM types** → need of large-area plots with georeferenced trees
- But **changing the spatial extent and the grain size may affects the results** (in agreement with the « Modifiable Areal Unit Problem”, Openshaw 1983)
- **Need of additional variables describing the local context:** slope, presence of cliffs, woodpecker assemblages, etc.
- **TreMs are “ephemeral resource patches”** (sensu Finn 2001) → dynamic spatial distribution patterns

Is the dissimilarity of assemblages hosted by tree-cavities related to the between-cavity geometric distance?

➔ « distance decay of similarity » (Nekola & White, 1999)

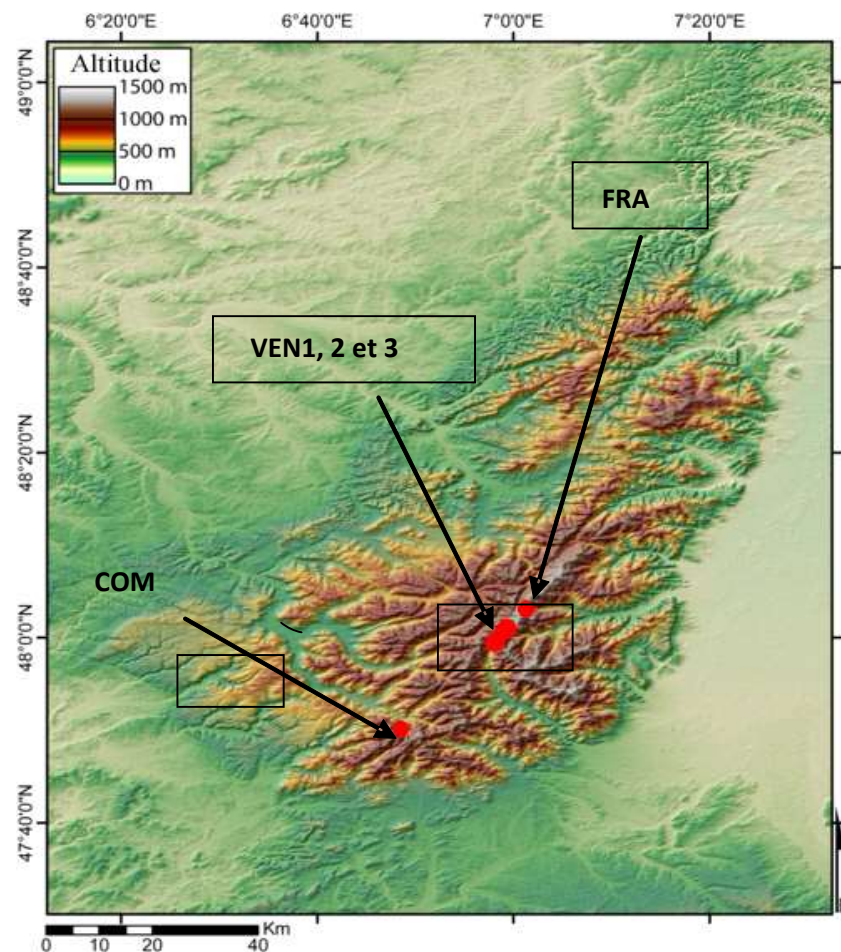


The closer, the more similar? The distance decay of similarity pattern for cavity-dwelling biodiversity is not consistent



Does an increasing density of sporocarps at tree or plot scales foster the mean species richness of fungus-dwelling beetles in sporocarps?

The Vosges mountains (France)



Fagus sylvatica



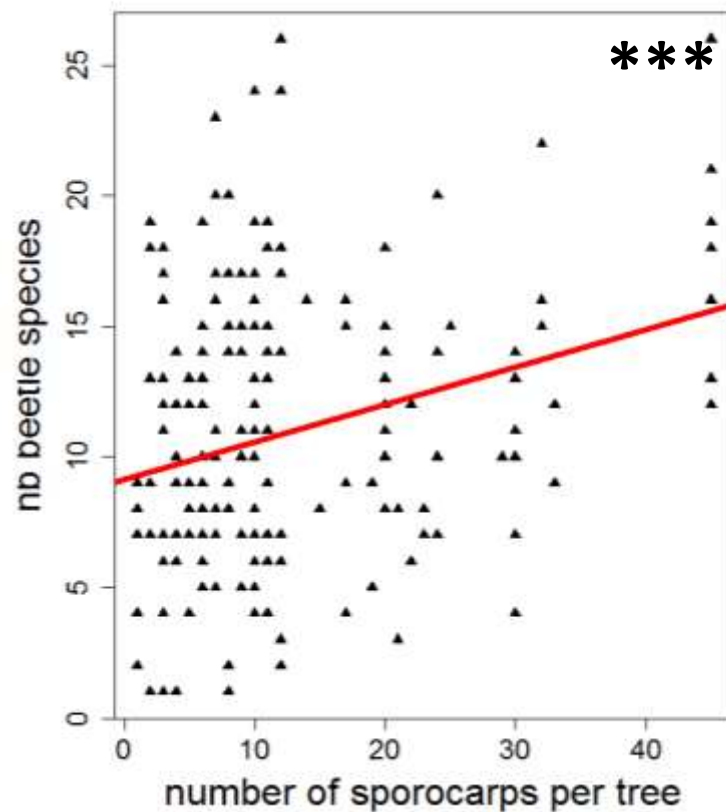
Fomes fomentarius

- 196 traps
- 1 year

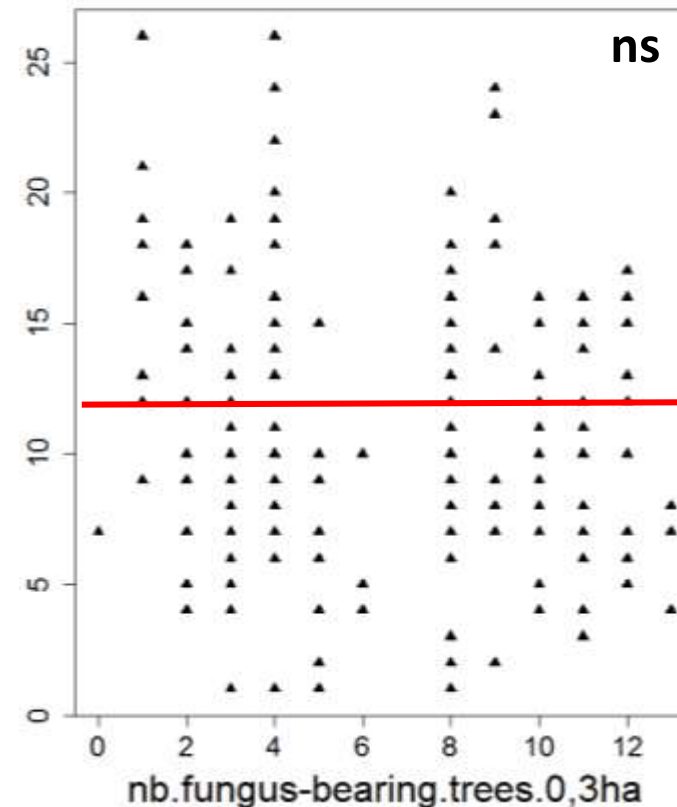


Fine-scale habitat aggregation has a positive effect on the local species richness of fungus-dwelling beetles...

...but neither mass effect nor dilution effect of mid-scale habitat aggregation



Tree-scale



0.3 ha scale

In a nutshell...

- **Other features than tree-dbh should be considered to explain spatial patterns of Trem-bearing trees**
- **Spatial scale of studies strongly influences :**
 - **The relationship between tree-dbh and the probability to bear a TreM**
 - **The relationship between spatial patterns of TreMs and associated biodiversity**
- **Both alpha and beta diversity of TreM-dwelling beetles may be influenced by the spatial distribution of TreMs**

Thank you for your attention