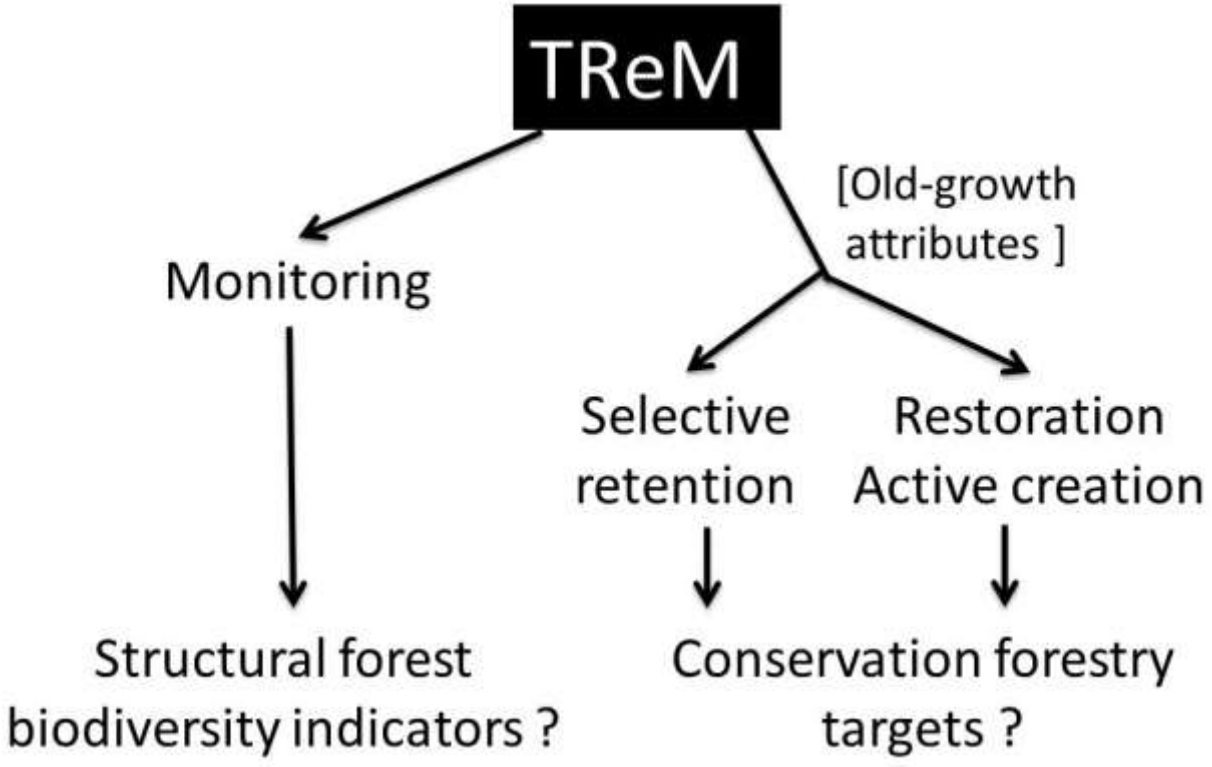
Could TReMs be relevant conservation forestry targets and/or biodiversity indicators ?

Christophe BOUGET & Laurent LARRIEU

Forest Conservation 2nd Conference
Bavarian National Park, Neuschönau, 26-29/04/2017

TReMs, biodiversity and forestry



Biodivers Conserv (2009) 18:3891–3908
DOI 10.1007/s10531-009-9687-2

ORIGINAL PAPER

Boxes mimicking tree hollows can help conservation of saproxylic beetles

Nicklas Jansson · Thomas Ranius · Anna Larsson · Per Milberg

Research Article - doi: 10.3832/ifor1281-007

The Habitat-Trees experiment: using exotic tree species as new microhabitats for the native fauna

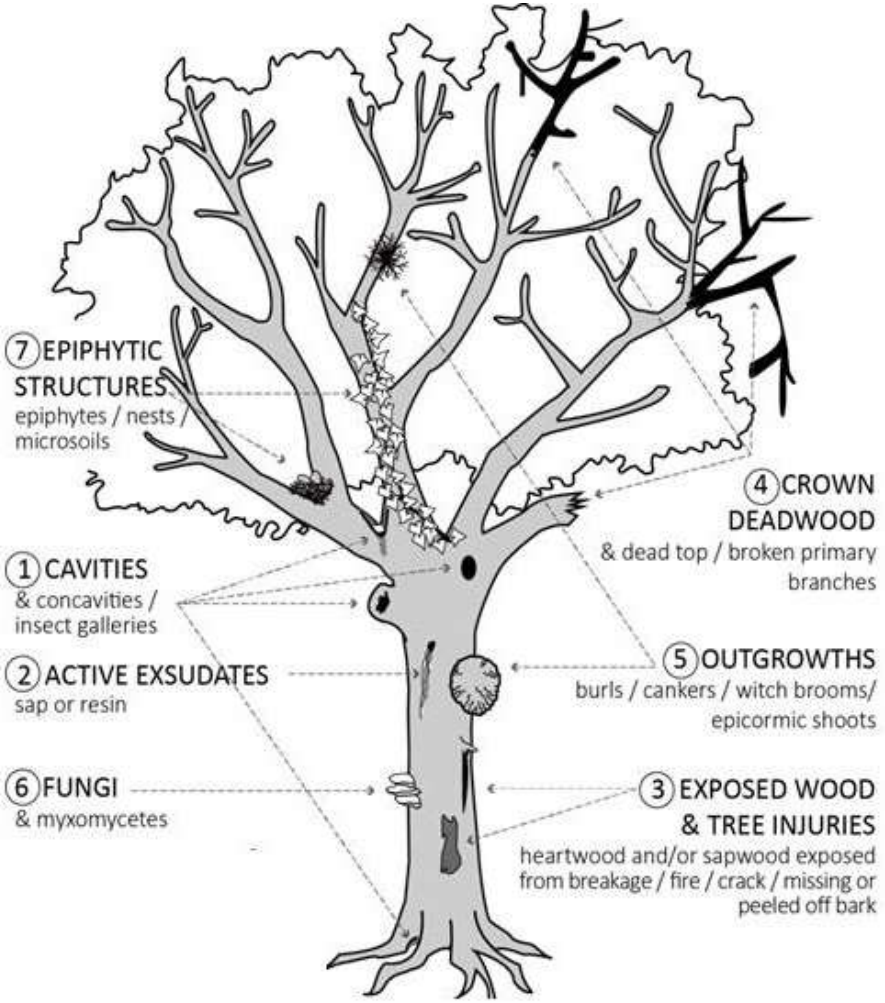
Livia Zapponi, Emma Minari, Luca Longo, Ilaria Toni, Franco Mason, Alessandro Campanaro

1

TReMs and biodiversity

What are Tree-Related Microhabitats (TReMs)?

What are Tree-Related Microhabitats (TReMs)?

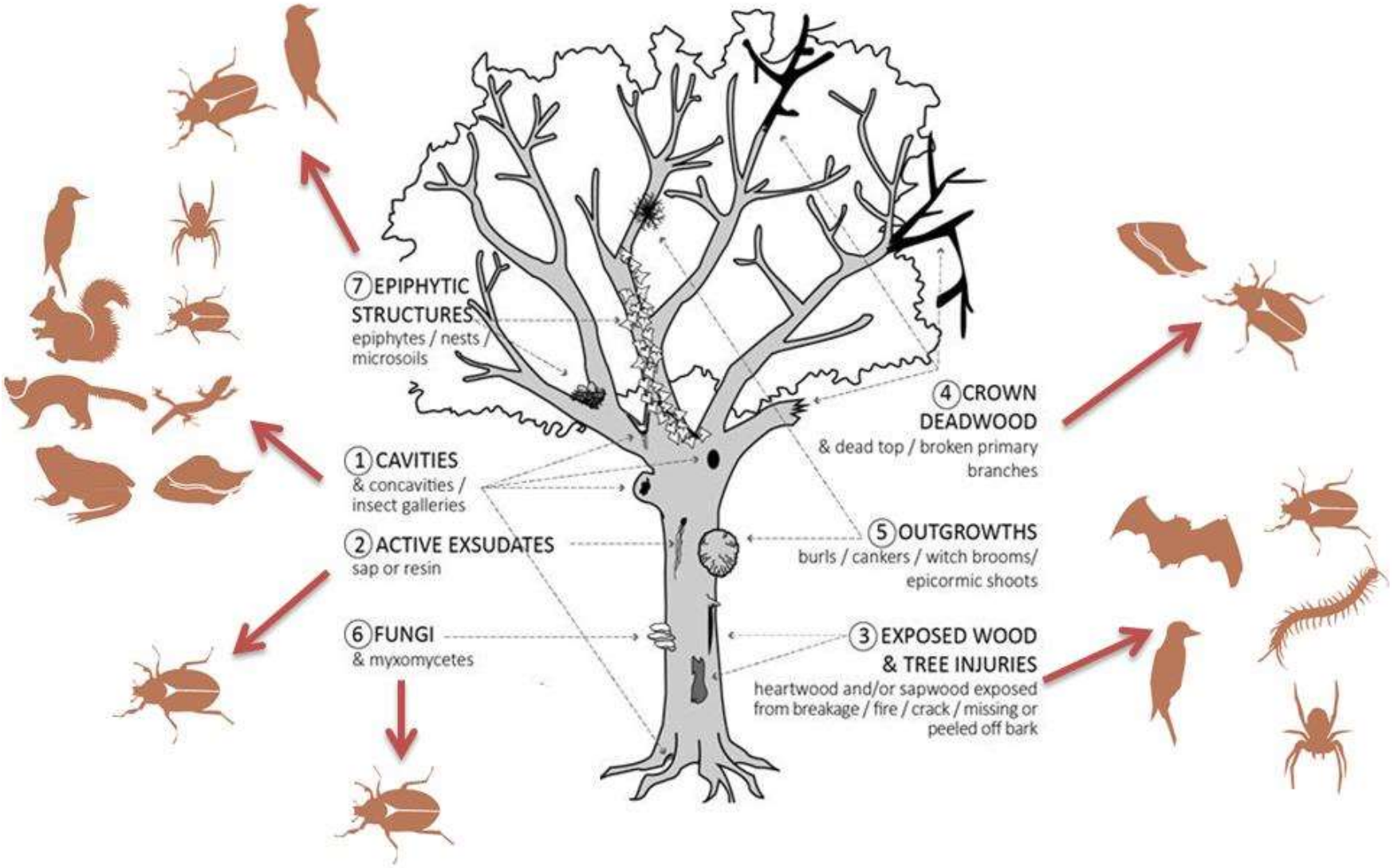


Italian Journal of Agronomy 2016; volume 11(s1)

Forest management for invertebrate conservation

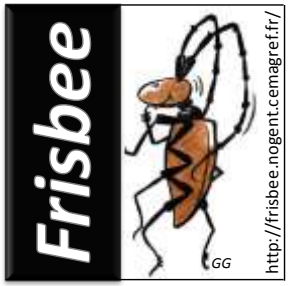
Maarten de Groot,[1] Livia Zapponi,[2,3] Davide Badano,[2,3] Serena Corezzola,[2,3] Franco Mason[2,3]

TReMs host a wide diversity of taxa



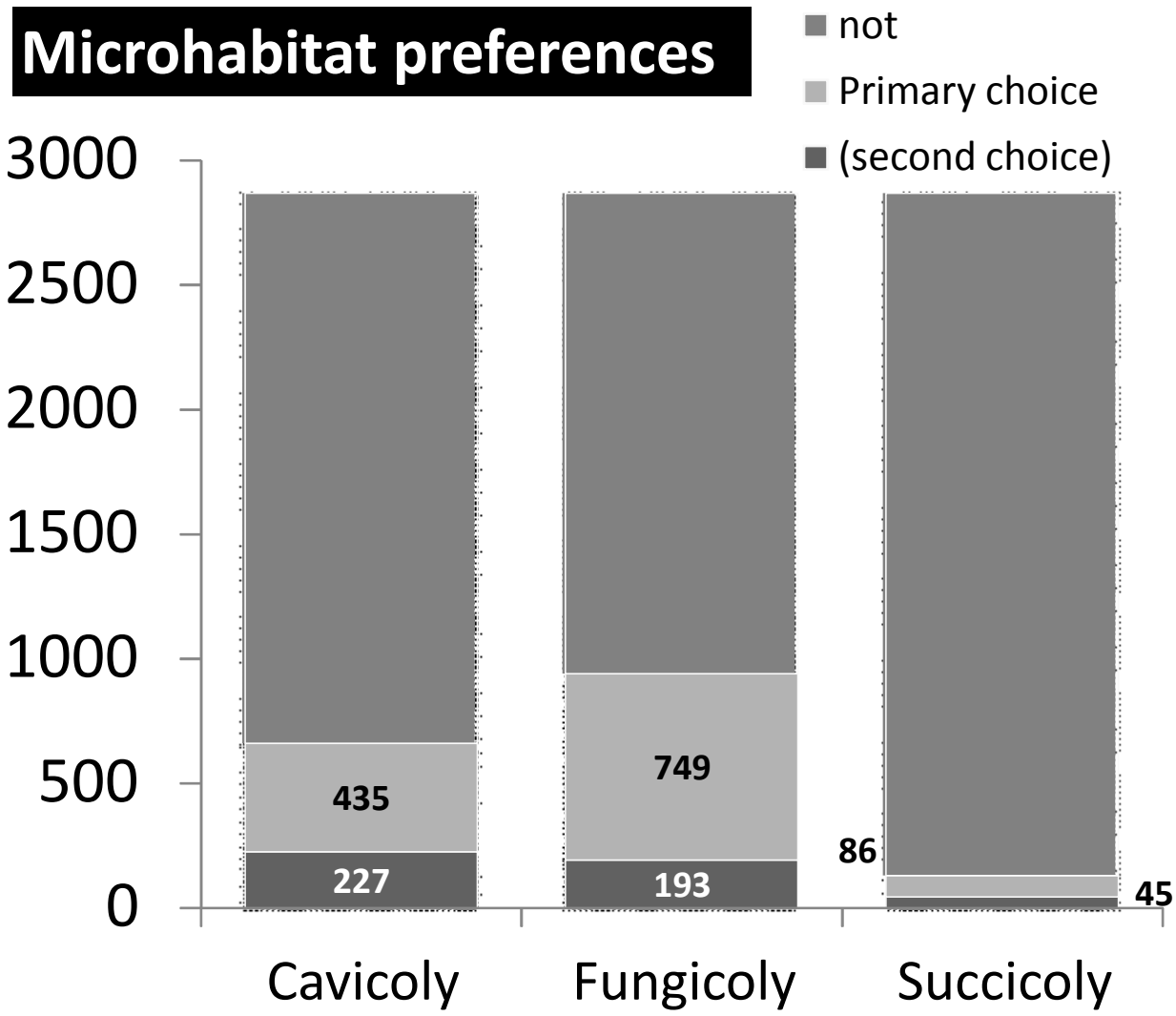
TReMs host species-rich assemblages

e.g. many beetle species depend on TReMs !



Bouget et al., in prep.

Microhabitat preferences



2

At stand scale,

the relationships between TReMs and saproxylic beetle diversity…

…

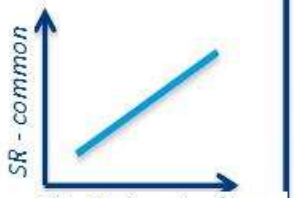
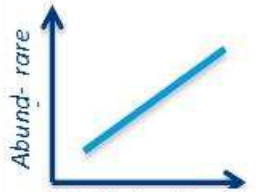
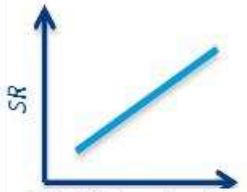
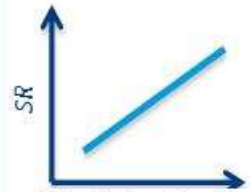
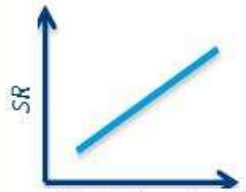
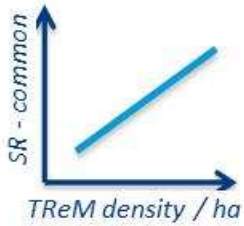
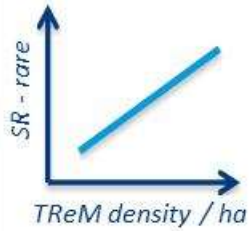
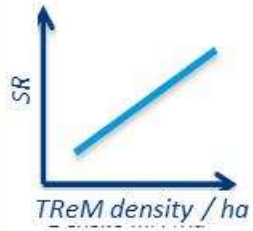
…are strongly context-dependent

Saproxylic beetle species richness increases with the local amount of certain TreM-bearing trees in various but not all forest contexts

Contents lists available at ScienceDirect
Ecological Indicators
journal homepage: www.elsevier.com/locate/ecolind

Key features for saproxylic beetle diversity derived from rapid habitat assessment in temperate forests

C. Bouget[a,*], L. Larrieu[b,c], A. Brin[d]

SR	Oak *Lowland*	Beech *Lowland*	Beech *Highland*	Pine *Lowland*	Spruce-Fir *Highland*
					
					

In lowland deciduous forests, TReMs are significantly associated to variations in species richness, but to a lesser extent than deadwood or openness

2

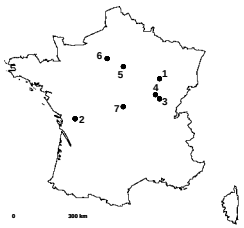
Biodivers Conserv (2013) 22:2111–2130
DOI 10.1007/s10531-013-0531-3

ORIGINAL PAPER

In search of the best local habitat drivers for saproxylic beetle diversity in temperate deciduous forests

C. Bouget · L. Larrieu · B. Nusillard · G. Parmain

Key factors of saproxylic beetle diversity



		rare sp	common sp
Oak	Abiotic	2=Openness	1=Openness
	Deadwood	1=Deadwood diversity	2= Lying deadwood volume
			3= Large lying deadwood volume
			4= Deadwood diversity
	TReMs	ns	5=density fungus-bearing trees
			6=density cavity-bearing trees
Beech	Abiotic	ns	1=Openness
	Deadwood	ns	2=Deadwood diversity
	TReMs	1=density fungus-bearing trees	3=density crown-deadwood-bearing trees

In highland forests some relationships between TReM density and saproxylic beetle diversity depend on stand openness

Contents lists available at ScienceDirect
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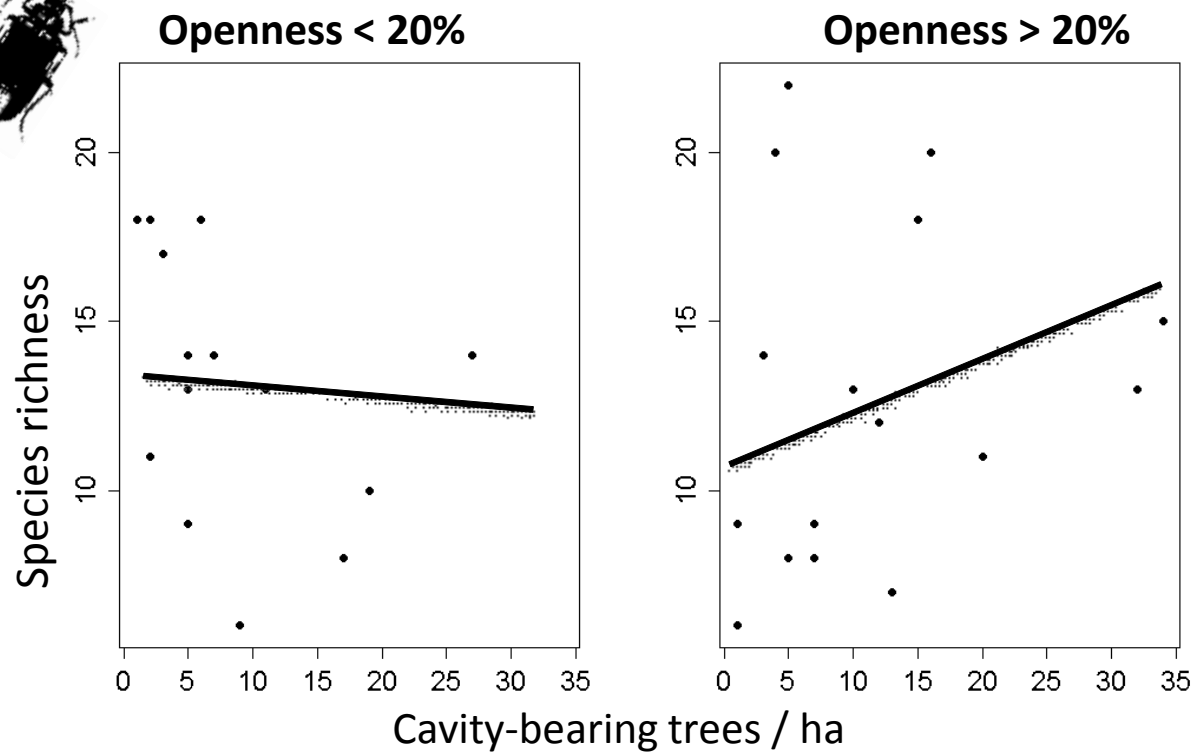
Key features for saproxylic beetle diversity derived from rapid habitat assessment in temperate forests

C. Bouget[a,*], L. Larrieu[b,c], A. Brin[d]



In highland forests TReM diversity only slightly correlates with saproxylic beetle assemblage structure

Contents lists available at ScienceDirect

Biological Conservation

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

Forest continuity acts congruently with stand maturity in structuring the functional composition of saproxylic beetles

Philippe Janssen [a,*], Marc Fuhr [a], Eugénie Cateau [c], Benoit Nusillard [b], Christophe Bouget [b]

	Mean trait CWM	Functional Dispersion FDis	Sp. richness	Abundance
Body Size	ns	ns		
Canopy prefer.	ns	ns		
Decay prefer.	↗	↗		
Diameter prefer.	↗	ns		
Low-dispersal			ns	ns
High-dispersal			ns	ns
Cavicolous			ns	ns
Fungicolous			ns	ns

3

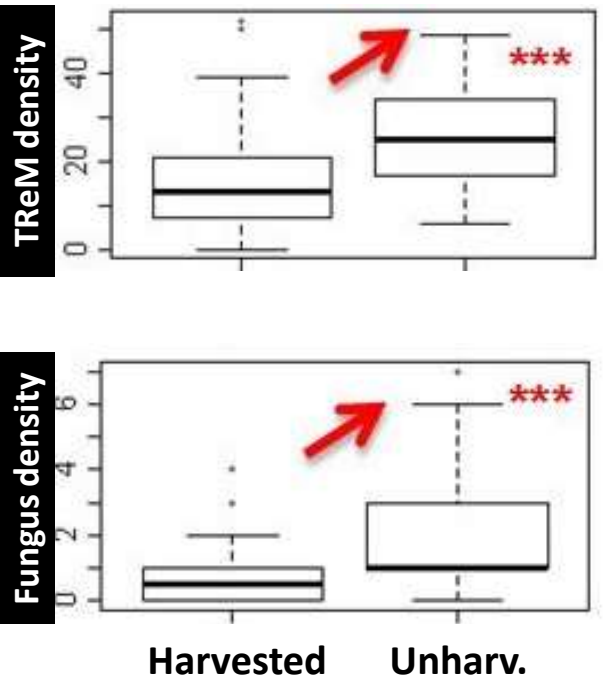
Why are TReM-biodiversity relationships so weak at stand scale in ecological studies?

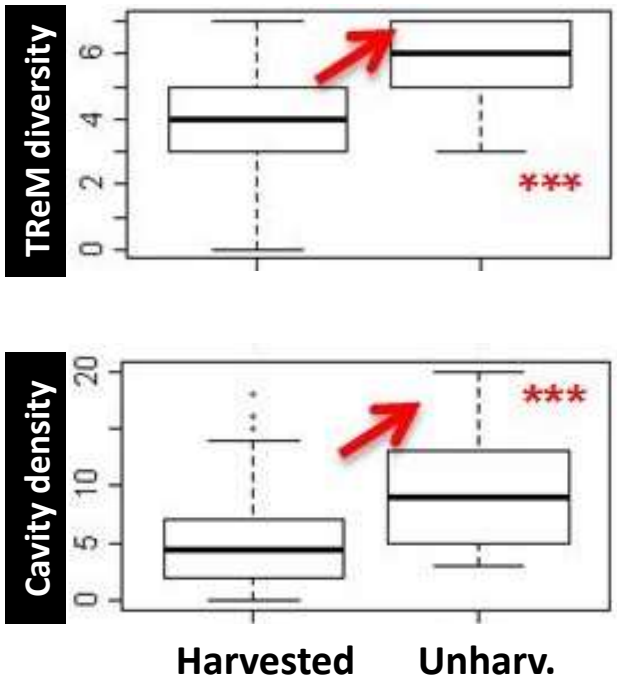
1. TReM metrics

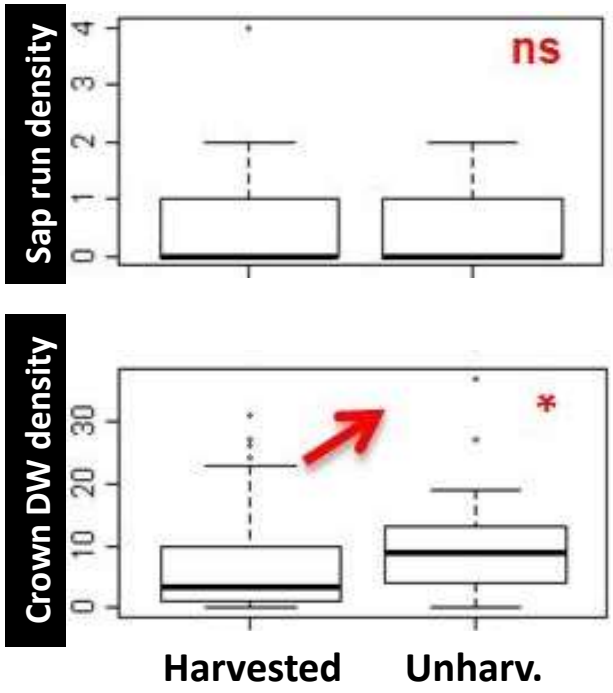
- TReM values are too low in managed forests?
  - Values below ecological thesholds ?

- Bad biodiversity sampling ?
  - Analysis of the response pf TReM-associated organisms only
  - sampling methods dedicated to TReM-associated organisms
- Bad TReM sampling ?

Trem density and diversity are affected by forestry







Unharv > 30 yrs

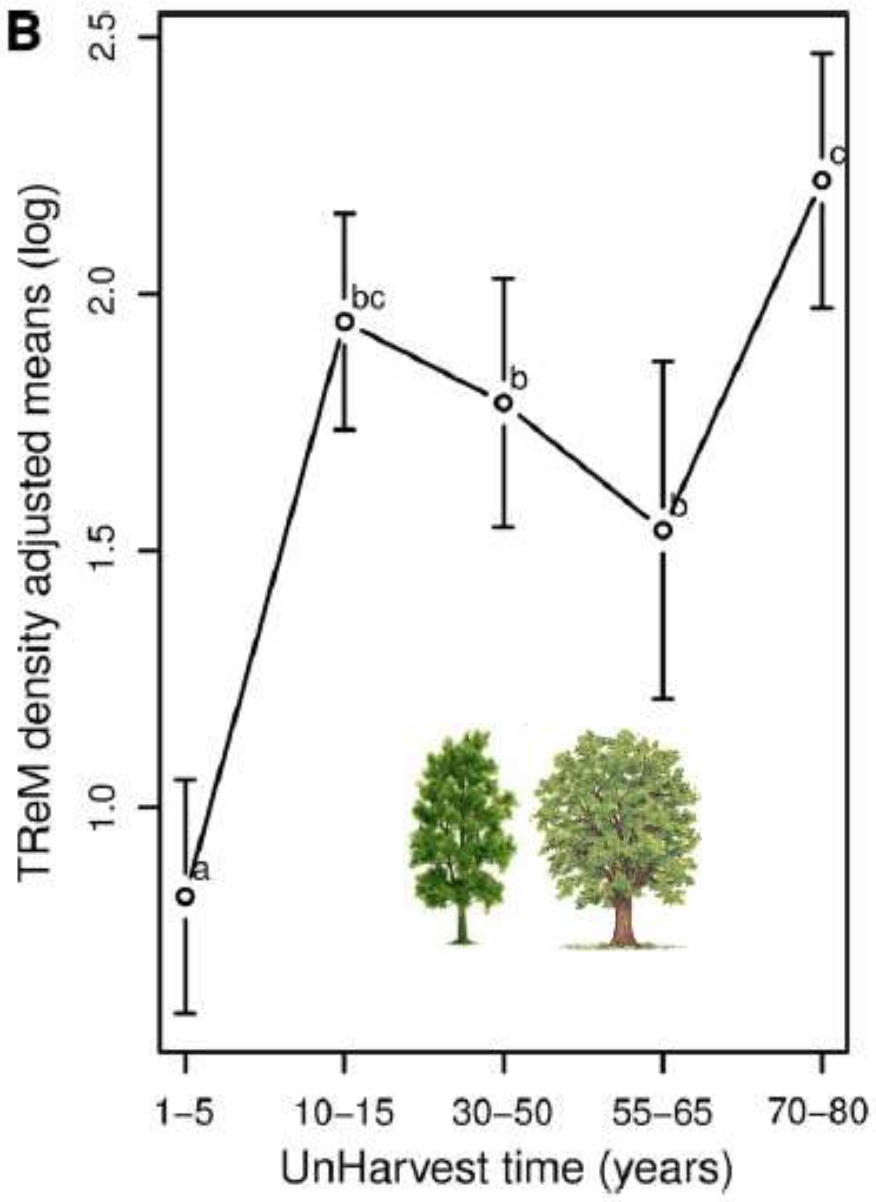
Animal Conservation ZSL

Animal Conservation. Print ISSN 1367-9430

Does a set-aside conservation strategy help the restoration of old-growth forest attributes and recolonization by saproxylic beetles?

C. Bouget[1], G. Parmain[1,2,3], O. Gilg[4], T. Noblecourt[2], B. Nusillard[1], Y. Paillet[1], C. Pernot[1], L. Larrieu[5,6] & F. Gosselin[1]

After forestry abandonment, TreM stock recovery needs decades



Eur J Forest Res
DOI 10.1007/s10342-016-1006-3

ORIGINAL PAPER

Development over time of the tree-related microhabitat profile: the case of lowland beech–oak coppice-with-standards set-aside stands in France

Laurent Larrieu[1,2] · Alain Cabanettes[3] · Nicolas Gouix[3] · Laurent Burnel[3] · Christophe Bouget[4] · Marc Deconchat[1]

Beech–oak coppice-with-standards stands
24 forests, France

TReM density/diversity sharply increase in overmature stands

Biodivers Conserv (2016) 25:1167–1185
DOI 10.1007/s10531-016-1116-8

ORIGINAL PAPER

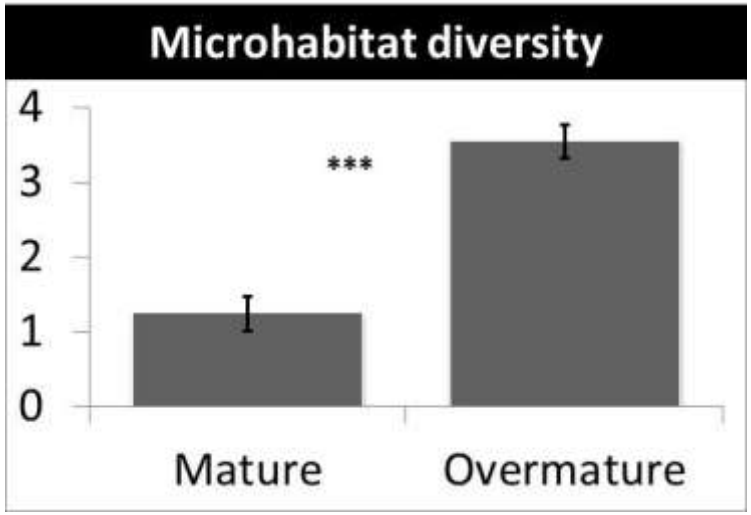
Are biodiversity patterns of saproxylic beetles shaped by habitat limitation or dispersal limitation? A case study in unfragmented montane forests

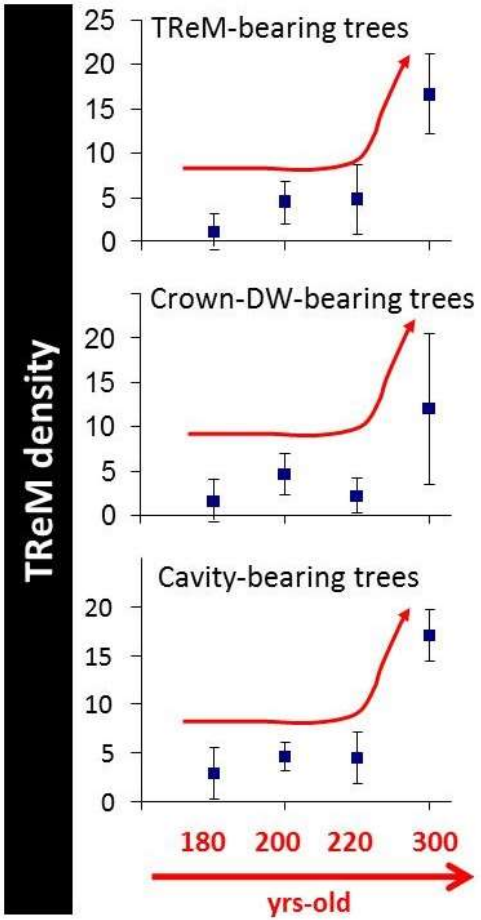
Philippe Janssen[1,2] · Eugénie Cateau[4] · Marc Fuhr[1,2] · Benoit Nusillard[3] · Hervé Brustel[4] · Christophe Bouget[3]

Insect Conservation and Diversity

The effects of forest age on saproxylic beetle biodiversity: implications of shortened and extended rotation lengths in a French oak high forest

AURORE LASSAUCE,[1,2] LAURENT LARRIEU,[3,4] YOAN PAILLET,[1] FRANCOIS LIEUTIER[5] and CHRISTOPHE BOUGET[1]

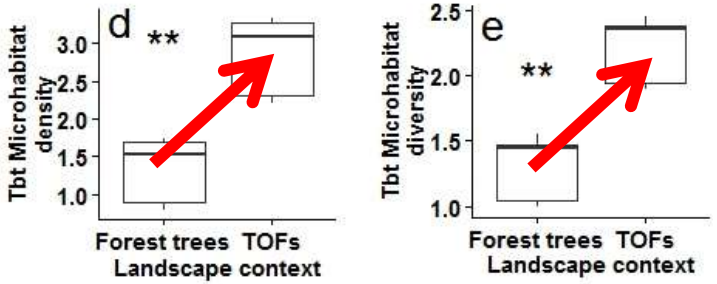




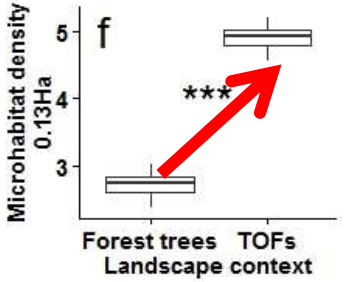
TReM effects increase withTReM values

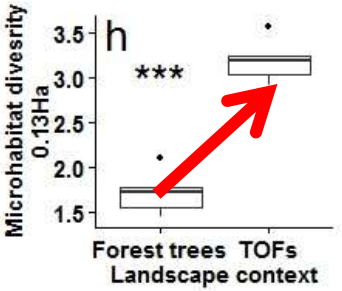
TReM density and diversity are higher in and around veteran trees outside than inside forests

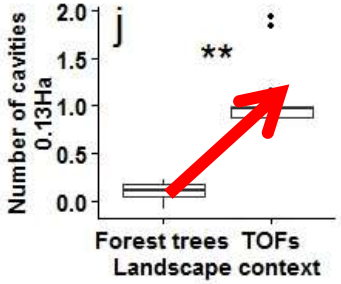
Veteran tree scale



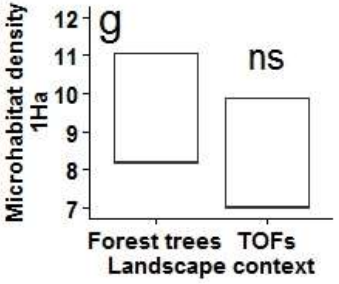
0.13ha-scale

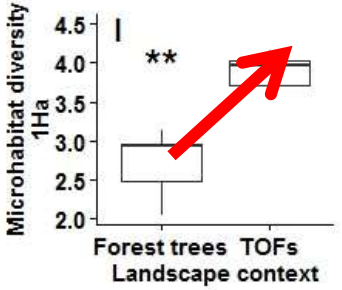


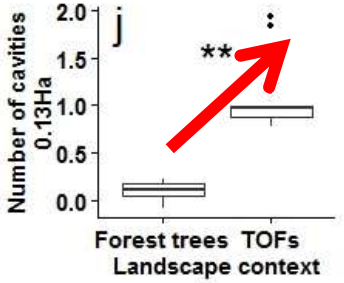




1ha-scale







Parmain & Bouget, 2017

Insect Conservation and Diversity

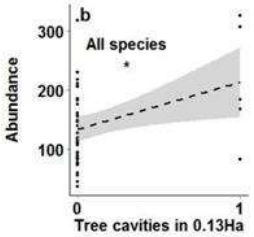
TReM effects increase withTReM values

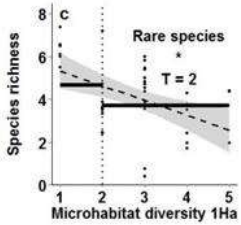
The effects of TReM metrics on sx beetle diversity are stronger outside than inside forests!

All sx beetle species

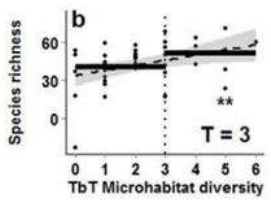
Rare sx beetle species

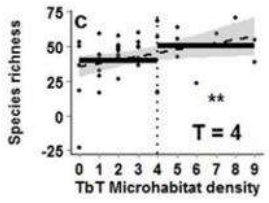
Veteran trees inside forest

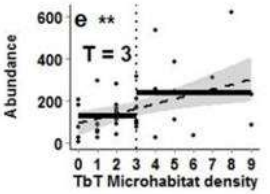


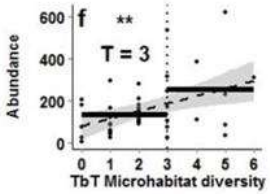


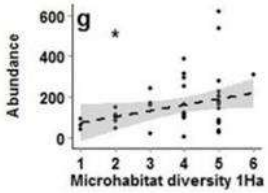
Veteran trees outside forests

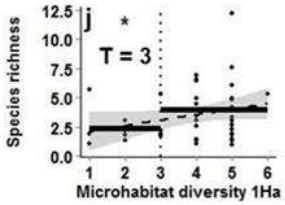


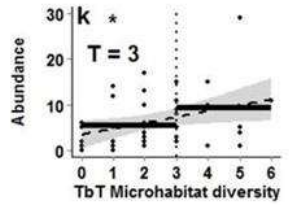


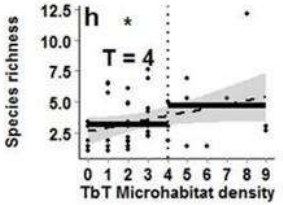


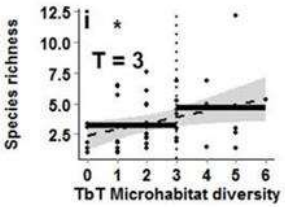












Insect Conservation and Diversity

Parmain & Bouget, 2017

2. TReM sampling

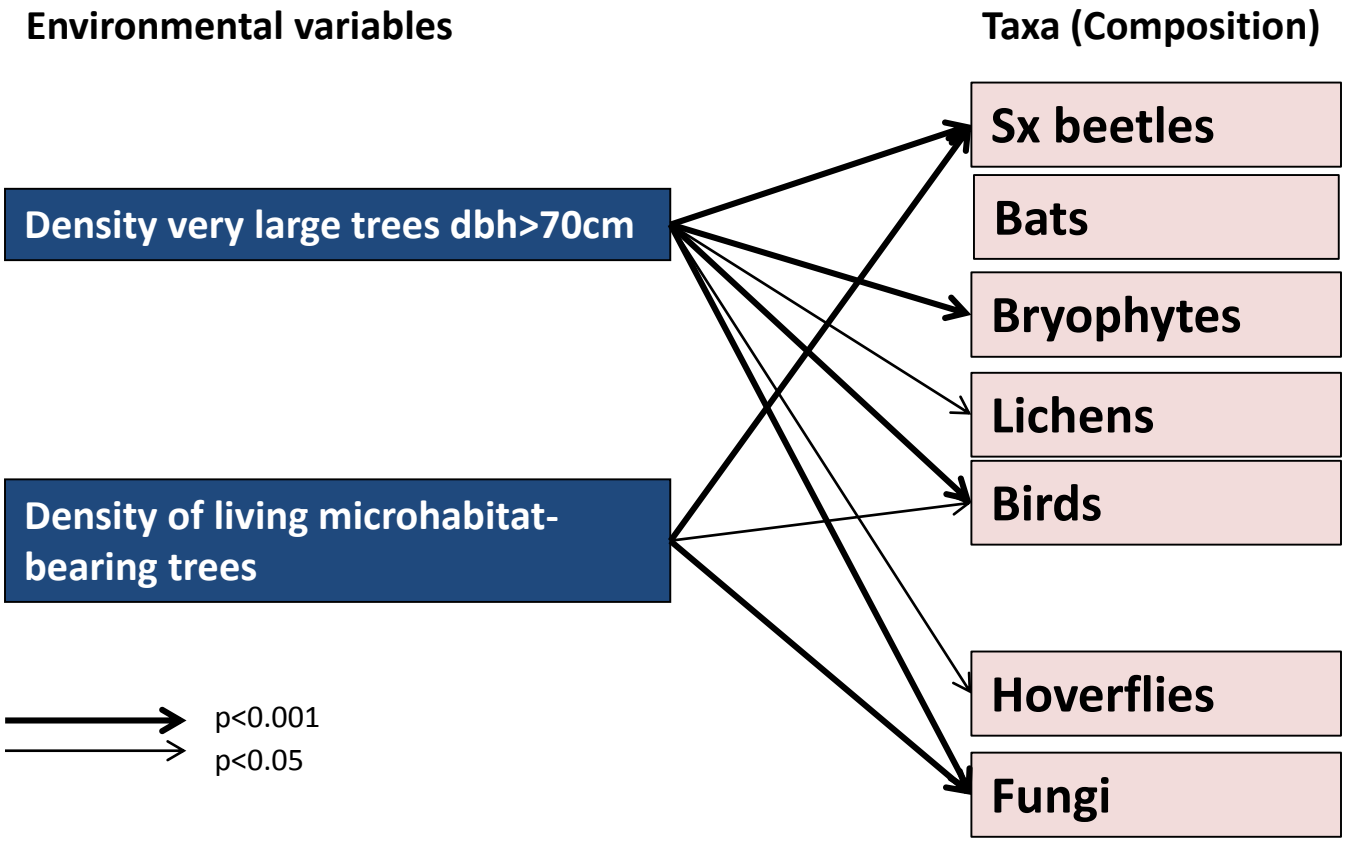
– Low TReM values in managed forests ?

– Irrelevant TReM sampling ?

– Bad biodiversity sampling ?

- Analysis of the response pf TReM-associated organisms only
- Sampling methods dedicated to TReM-associated organisms
- Multi-taxon approaches

Facing low TReM detectability…
…by the use of proxies?



487 plots in 19 areas

Larrieu et al., in prep.

3. Biodiversity metrics

– Low TReM values in managed forests ?

– Irrelevant biodiversity metrics ?

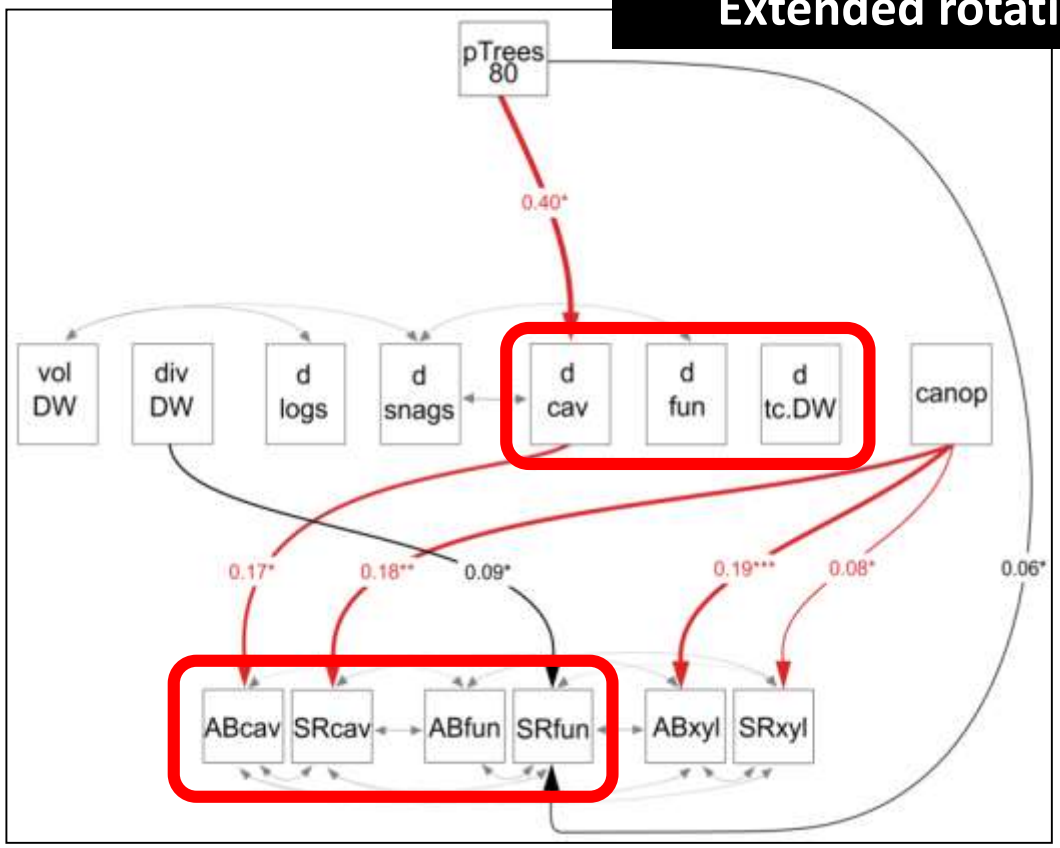
- Diversity of TReM-associated taxa only vs overall diversity
- sampling methods dedicated to TReM-associated organisms

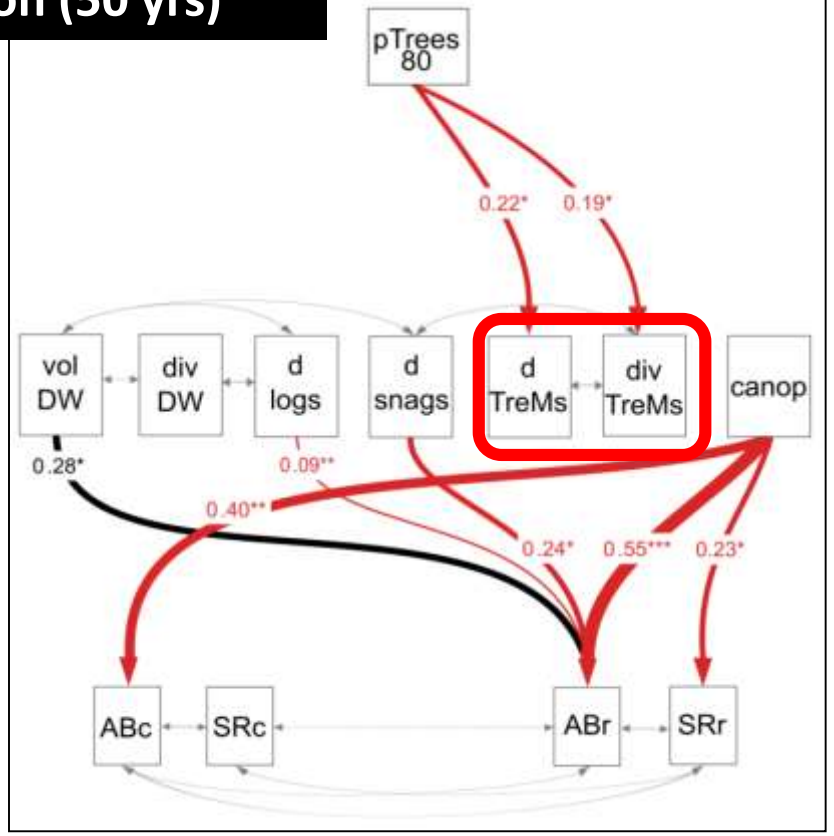
– Bad TReM sampling ?

TReM are fostered by extended rotation…

Only TReM-associated (and not all sx) taxa correlate to TReM rise

Extended rotation (50 yrs)





SEM path diagram (glmm) Percel et al. in prep.

3. Biodiversity metrics

– Low TReM values in managed forests ?

– Irrelevant biodiversity metrics ?

- Saproxylic beetles only

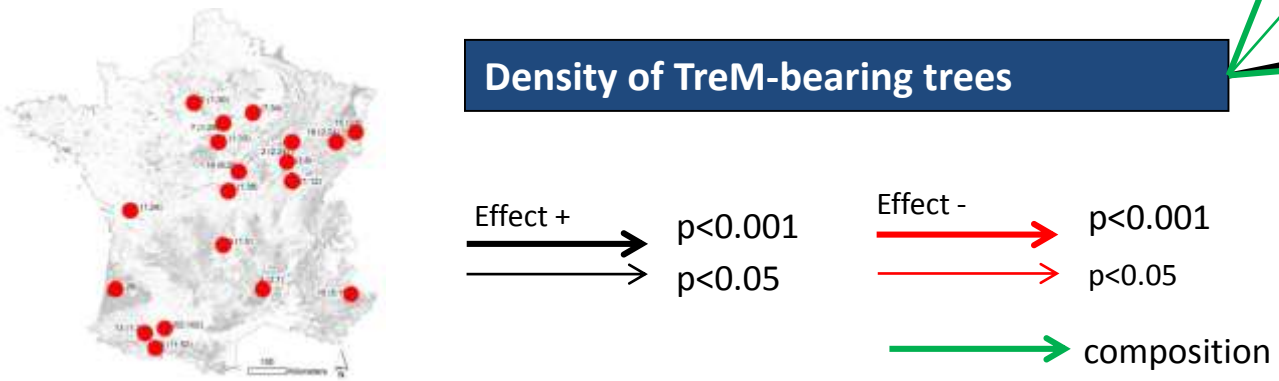
vs

Multi-taxon approaches

- sampling methods dedicated to TReM-associated organisms

– Bad TReM sampling ?

Monitoring more taxa --> more TReM-biodiversity relationships…sometimes difficult to interpret



487 plots in 19 French forest areas

Larrieu et al., in prep.

4. Biodiversity sampling

– Low TReM values in managed forests ?

– Irrelevant biodiversity sampling ?

- Analysis of the response pf TReM-associated organisms only
- Freely hanging flight interception traps

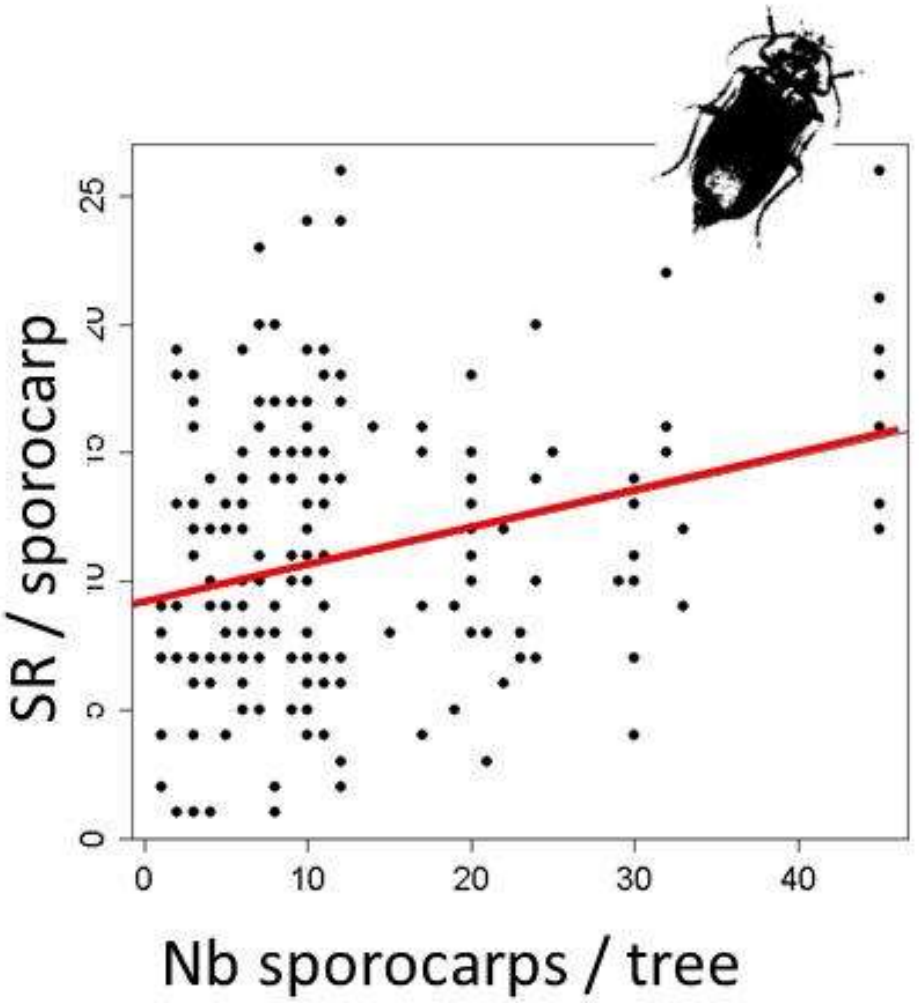
vs

Sampling methods explicitly dedicated to TReM-associated taxa

– Bad TReM sampling ?

Sporocarp-associated beetle sampling

Positive effects of aggregation of suitable microhabitats



Specific emergence traps

Nb sporocarps/tree >> Nb fungus-bearing trees/0.3ha

Best model ; Rose & Bouget in prep.

Conclusion

- At the stand scale : TReM effects on biodiversity
  - Low significance, magnitude and consistency
- Role of finer-scale connectivity effects (tree scale)
- Importance of :
  - taxon sampling method adequation
  - TReM sampling improvements
- …Further research required to inspire quantitative management guidelines…

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