

Do Tree-related Microhabitats and associated biodiversity respond to forest dieback?

A case study in French mountain Silver Fir forests

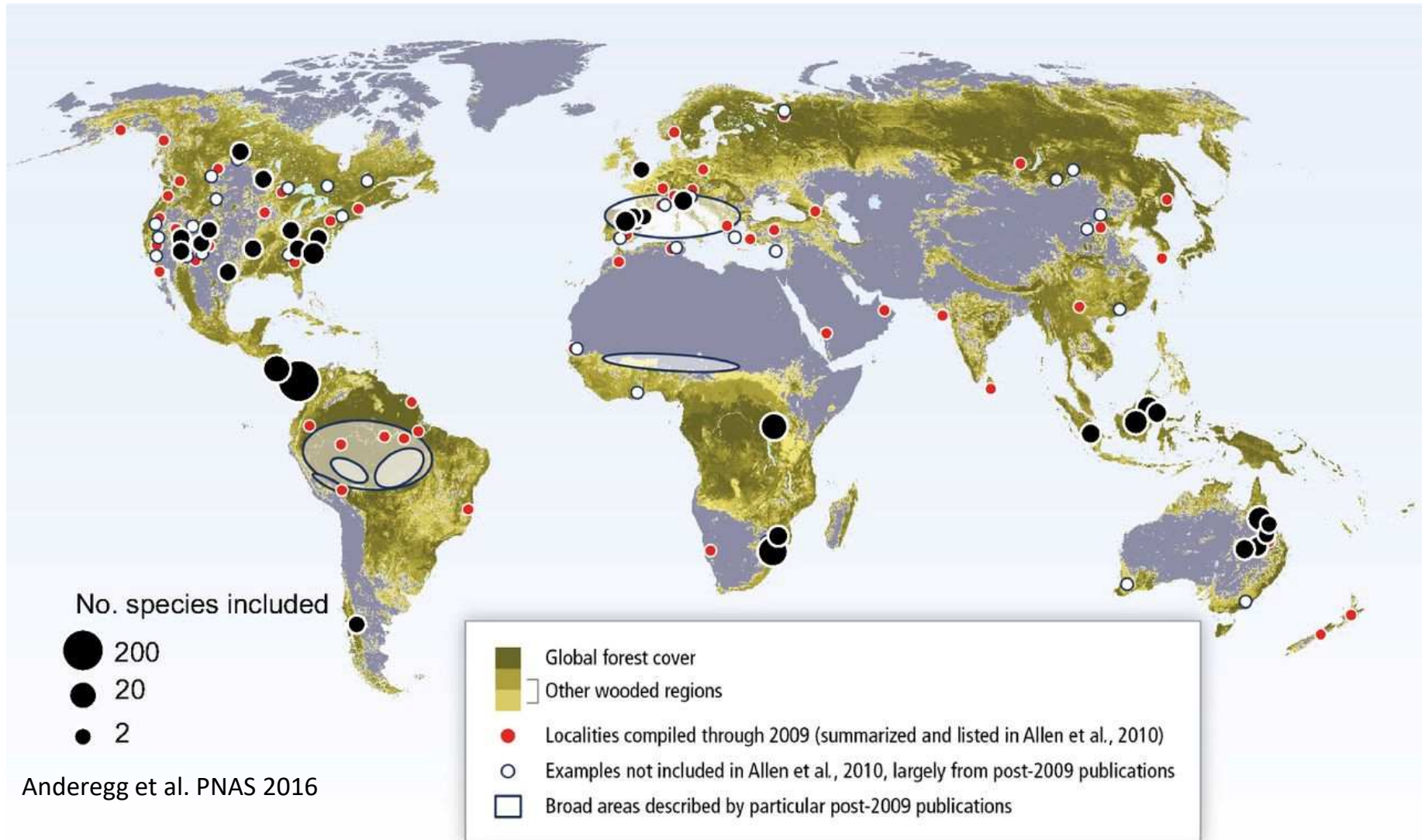
BOUGET, C., LARRIEU, L., BURNEL, L., CHERET, V., LADET, S., LOPEZ-VAAMONDE, C., MOLIARD, C., MOLINA, J., PARMAN, G., SAJDAK, G., SIRE, L., WILLM, J.



Belmont Forum Collaborative Research Action / Mountains as Sentinels of Change



Climate change, droughts and forest diebacks



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Dieback-induced changes in forest conditions

Weakened trees with crown decline

TreM (Tree-related **M**icrohabitats)

Crown deadwood

Polypores

Cavities...

Dead trees and **deadwood**

Openings and **microclimate**



↗ Saproxylic habitats ?

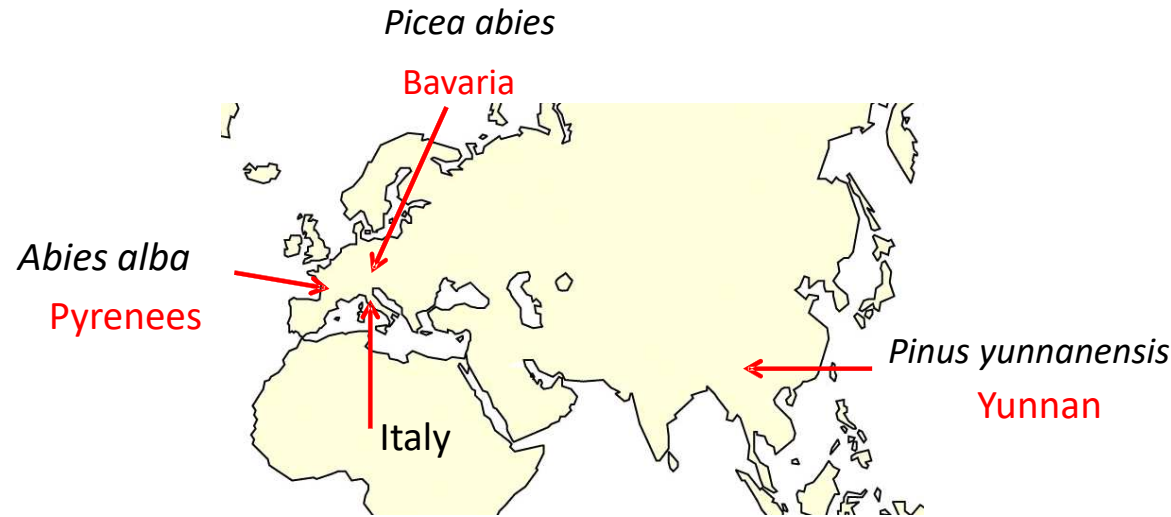


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Mountain forests as sentinels of climate change



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International **CLIMTREE** project

Ecological and Socioeconomic Impacts of Climate-Induced Tree Diebacks in Highland Forests



MUSÉUM
NATIONAL D'HISTOIRE NATURELLE



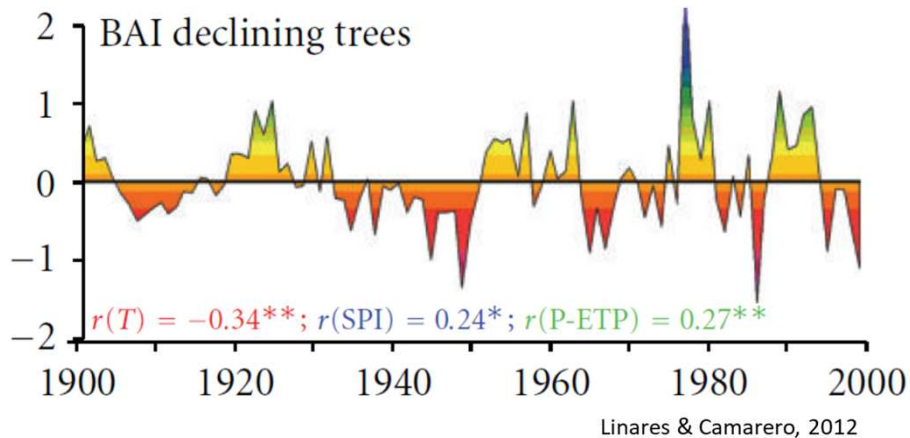
UNIVERSITÄT GREIFSWALD
Wissen lockt. Seit 1456



Silver fir, a model tree species for dieback studies in southwestern Europe



Silver fir defoliation at its Southernmost distribution limit
= drought sensitivity



Long-term climatic warming is a major driver of growth decline in silver fir

Severe periodical dieback crises since 1973

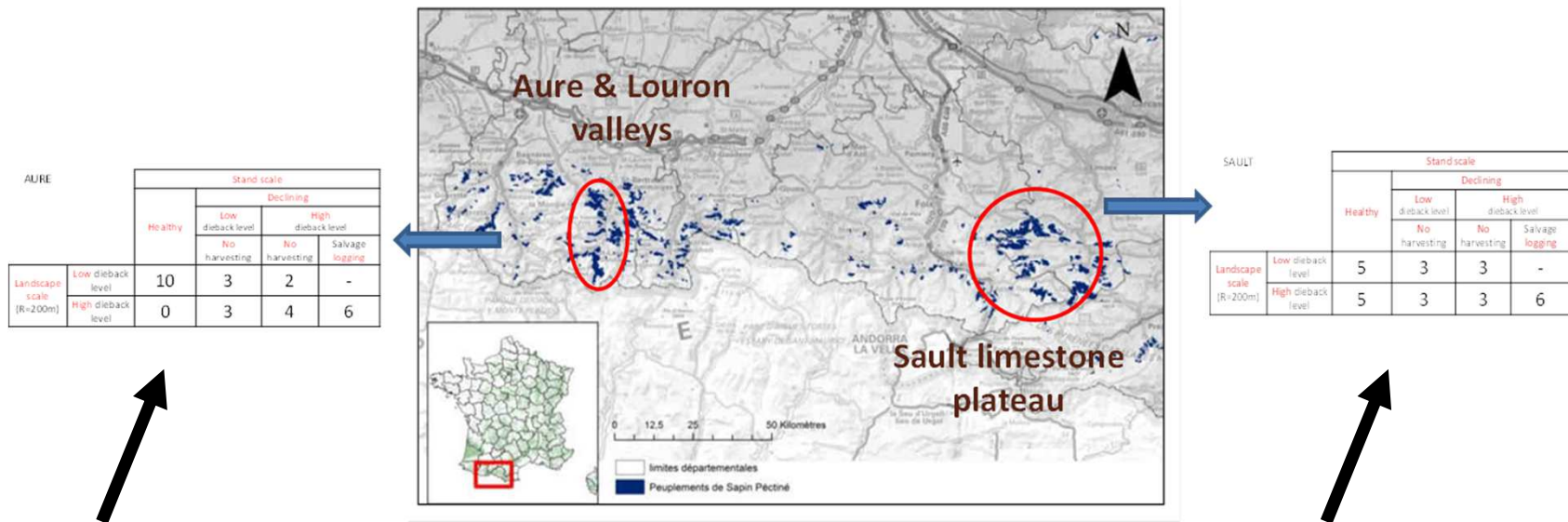


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Sampling design



A **stratified** and almost **balanced** sampling design **replicated** in 2 French regions

56 plots

112 window-flight traps (beetles)

Landscape scale		Stand scale - 0.3 and 1ha			
		Healthy	Declining		
			Low dieback No harvesting	High dieback No harvesting	High dieback Salvage logging
Low dieback	15	6	5	-	
High dieback	5	6	7	12	

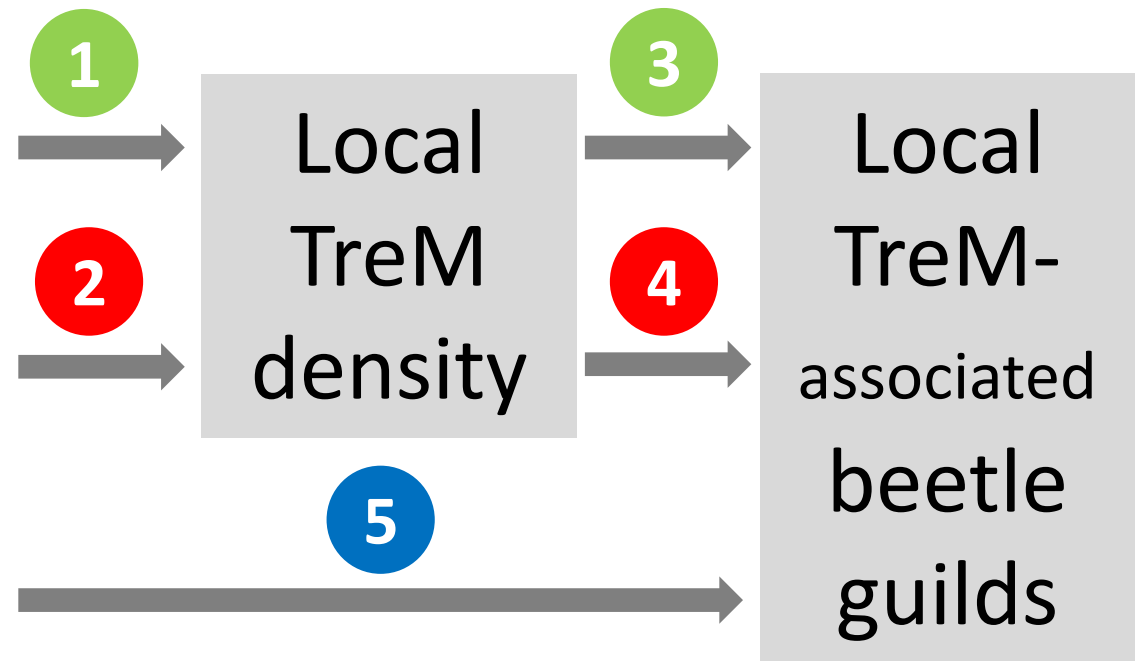


Issues

Dieback (stand)

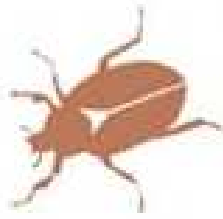
Salvage logging (stand)

Dieback (landscape)

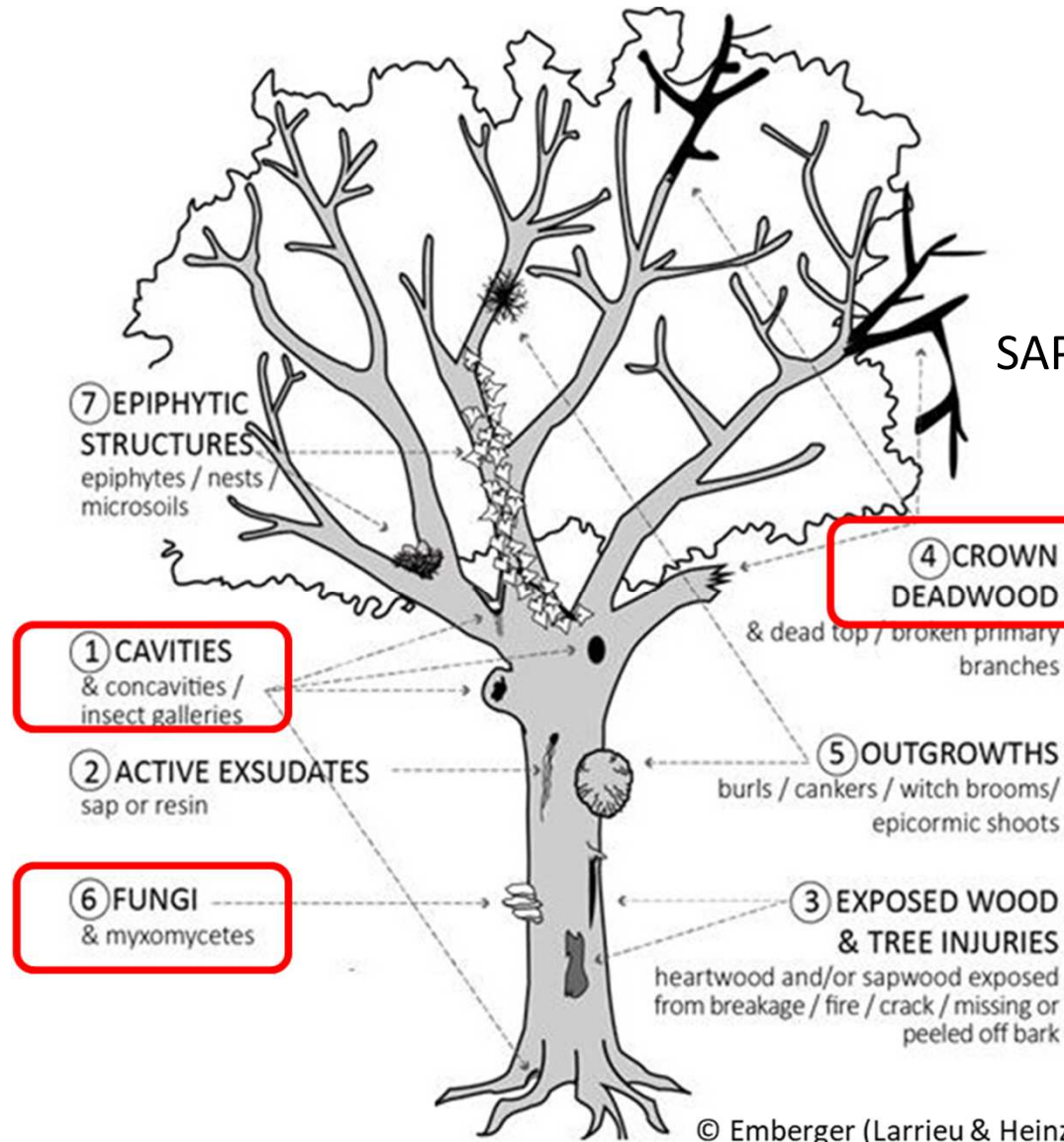
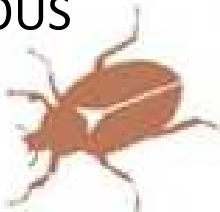


Focus on key TreMs / associated beetle guilds

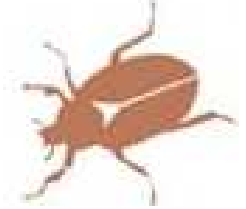
CAVICOLOUS



FUNGICOLOUS

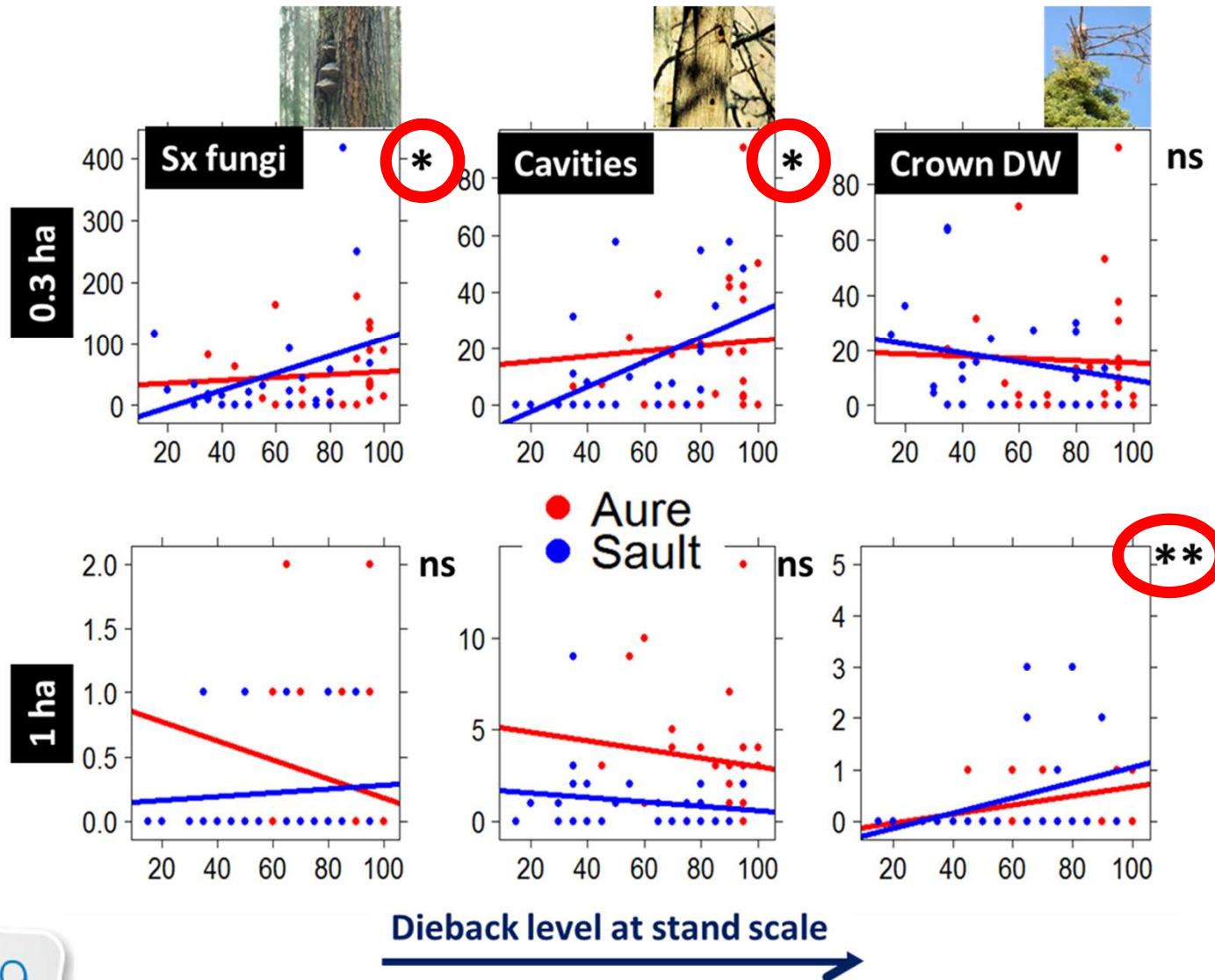


XYLOPHAGOUS
SAPROXYLOPHAGOUS



Key microhabitats rose in density in declining stands

1



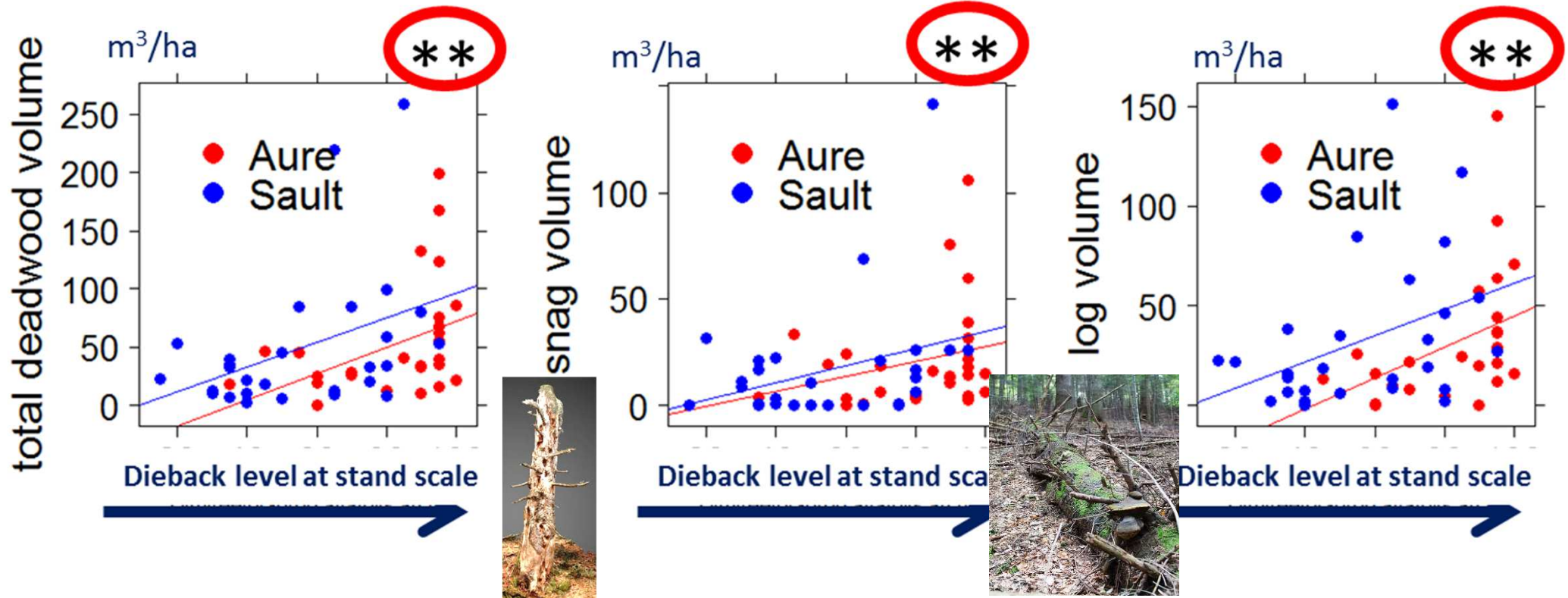
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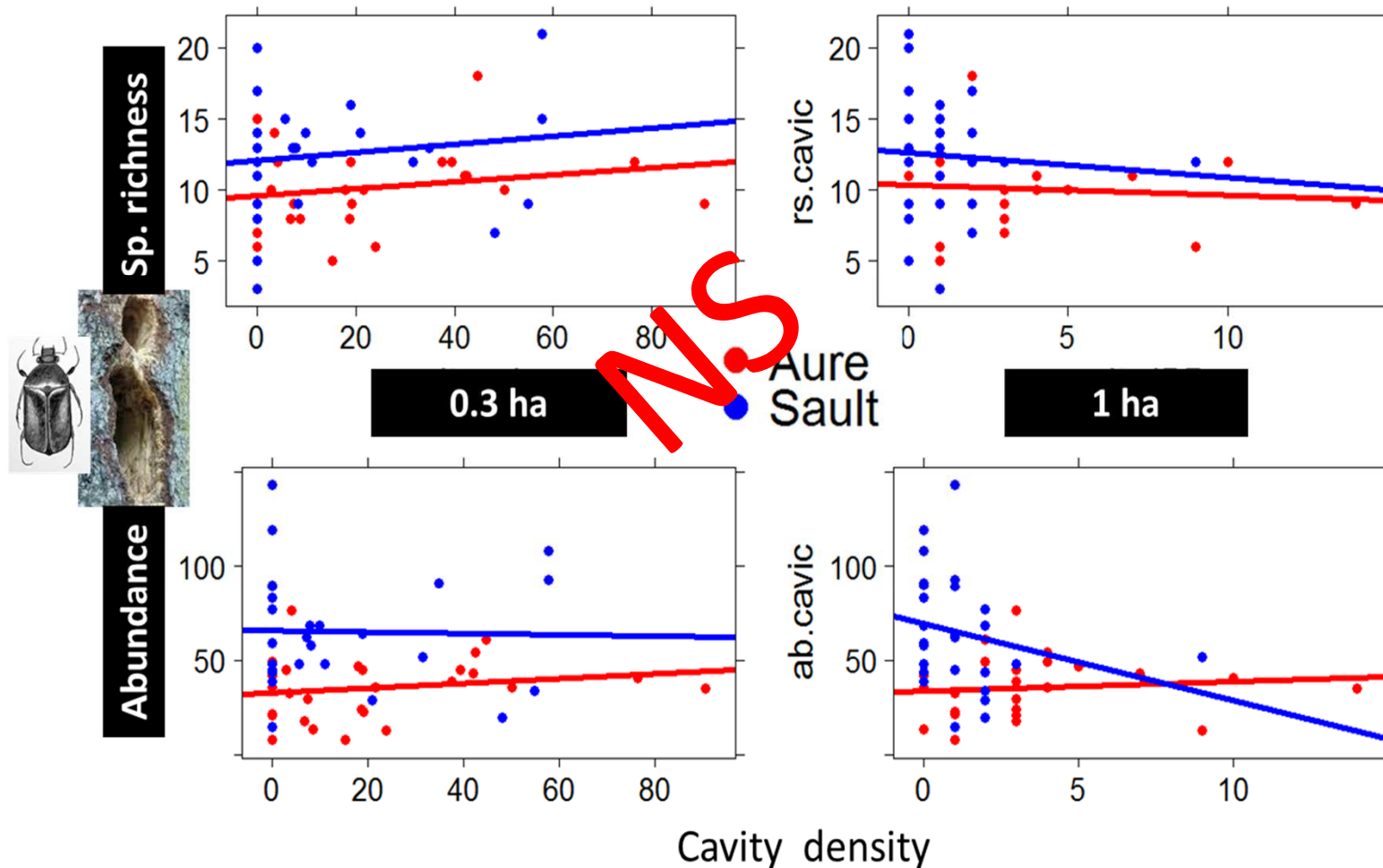
...the rise in dead wood density in declining stands was nonetheless stronger !

1



Dieback-induced increase in local cavity density does not foster abundance/diversity of cavicolous beetles

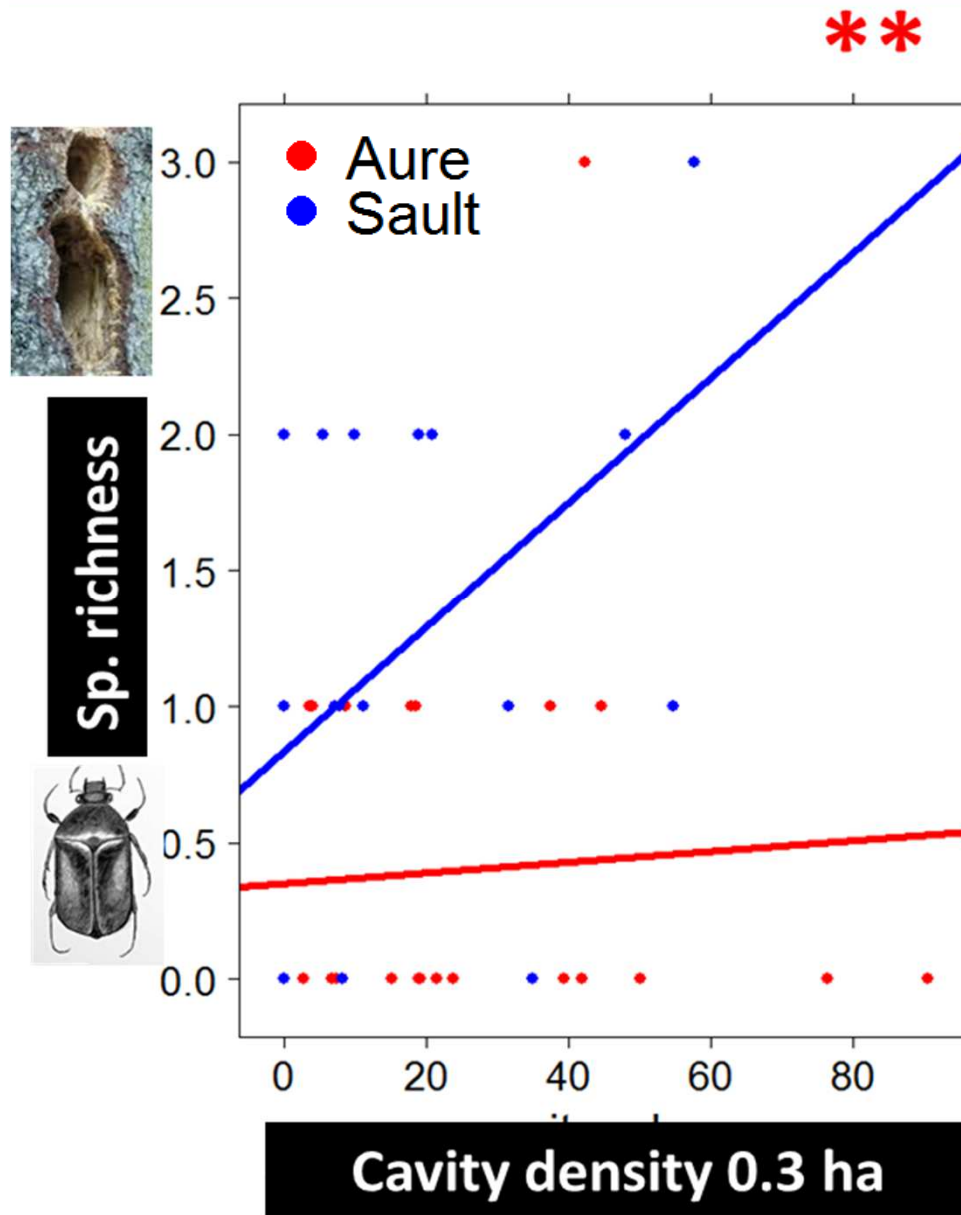
3



...the same for fungicolous beetles associated to polypores

...but dieback-induced increase in local cavity density does strengthen rare cavicolous species richness

3



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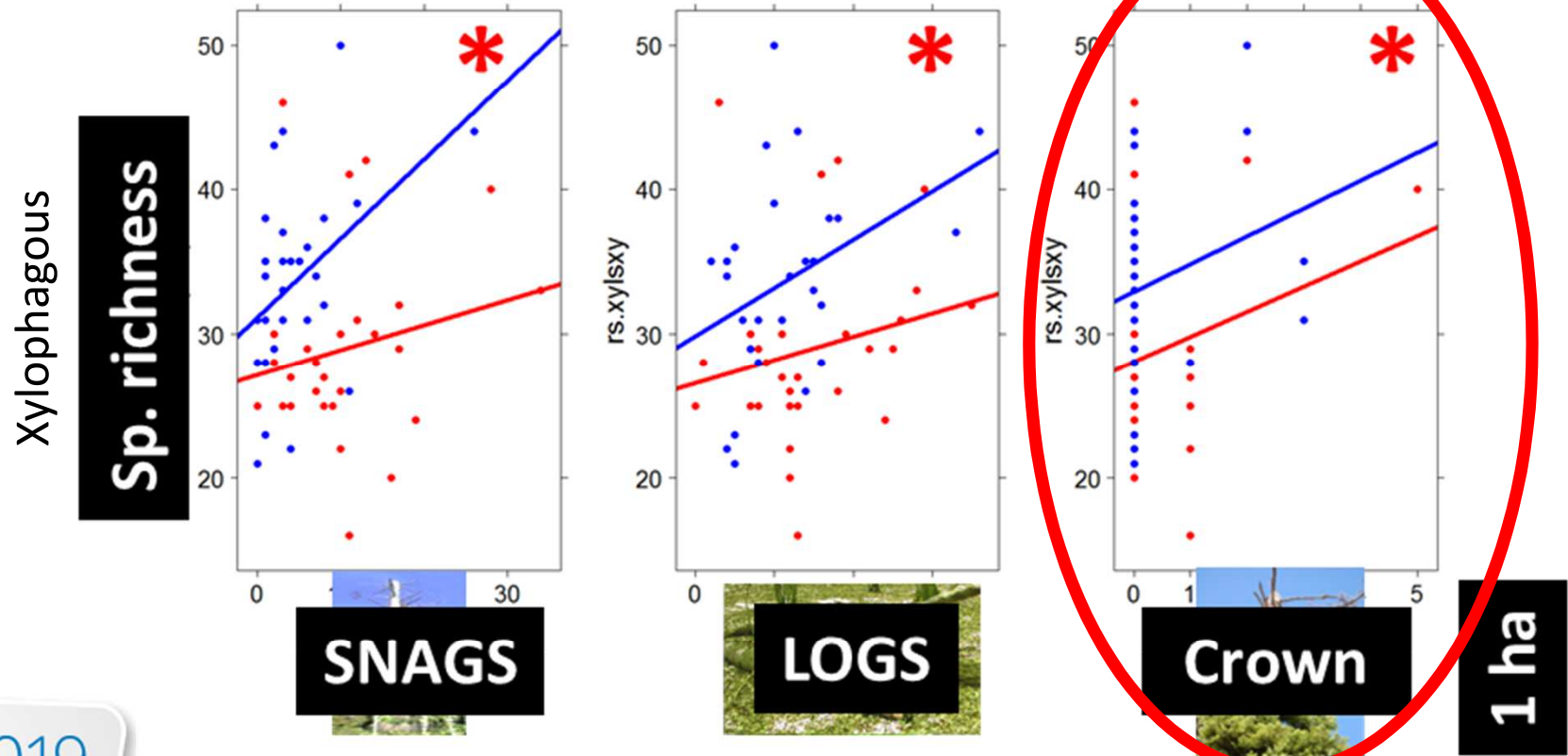
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Xylophagous beetles are affected by logs and snags, but also by crown deadwood density

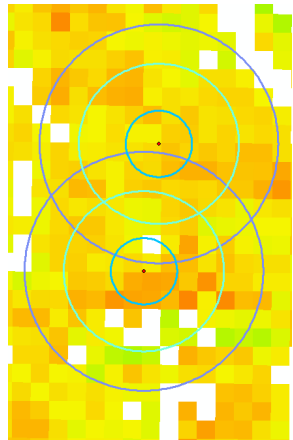


● Aure
● Sault



TreM-associated beetles increase in abundance and richness with dieback intensity at the landscape scale

5



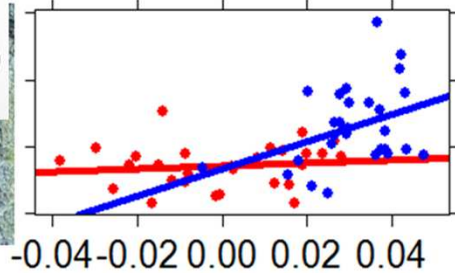
Vitality trend index
High : 0,540766
Low : -0,446544

Cavicolous



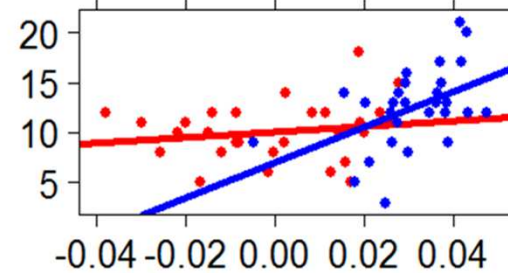
Abundance

**



Sp. richness

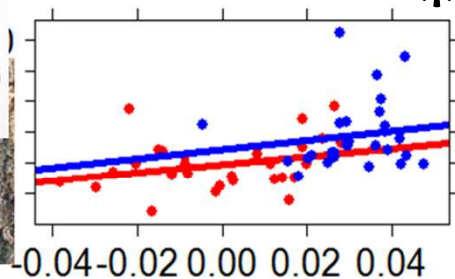
**



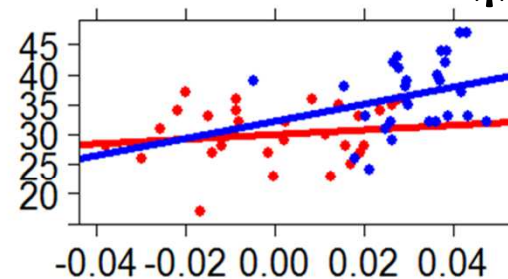
Fungicolous



*



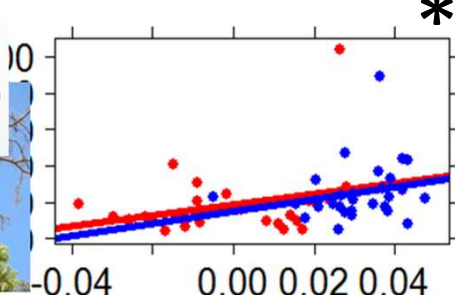
*



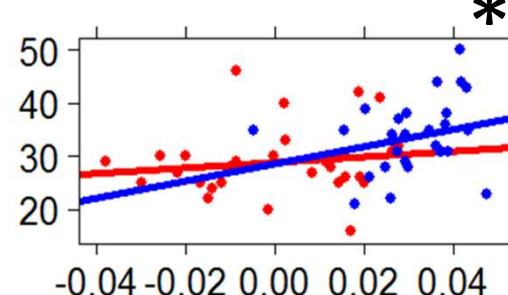
Xylophagous



*



*



Dieback level at 54ha landscape scale



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Salvage logging does slightly depress microhabitat density



2



Sx fungi

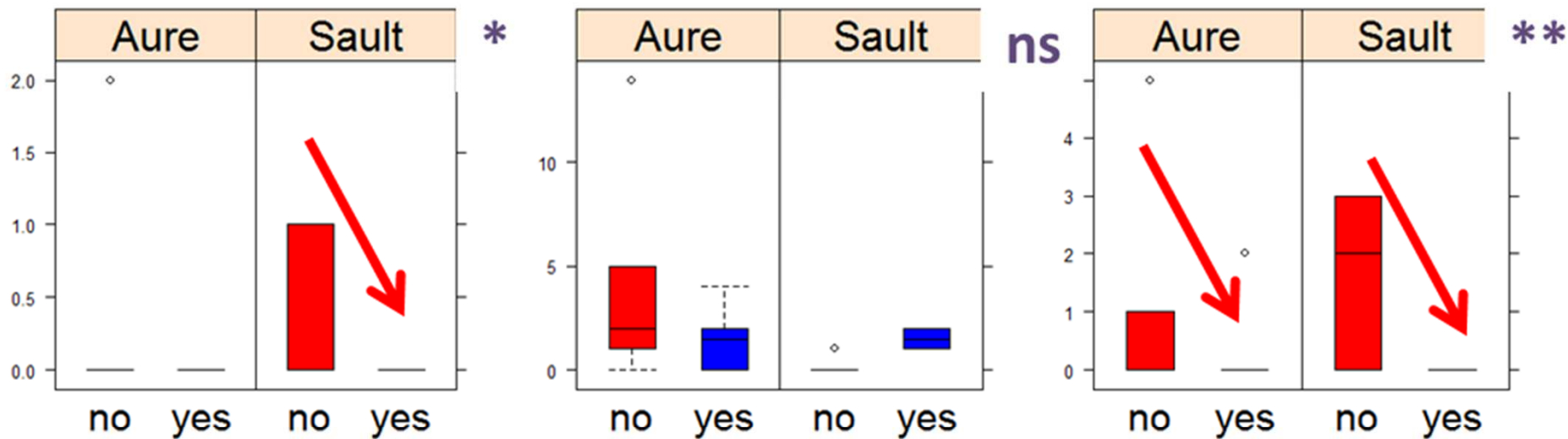


Cavities



Crown DW

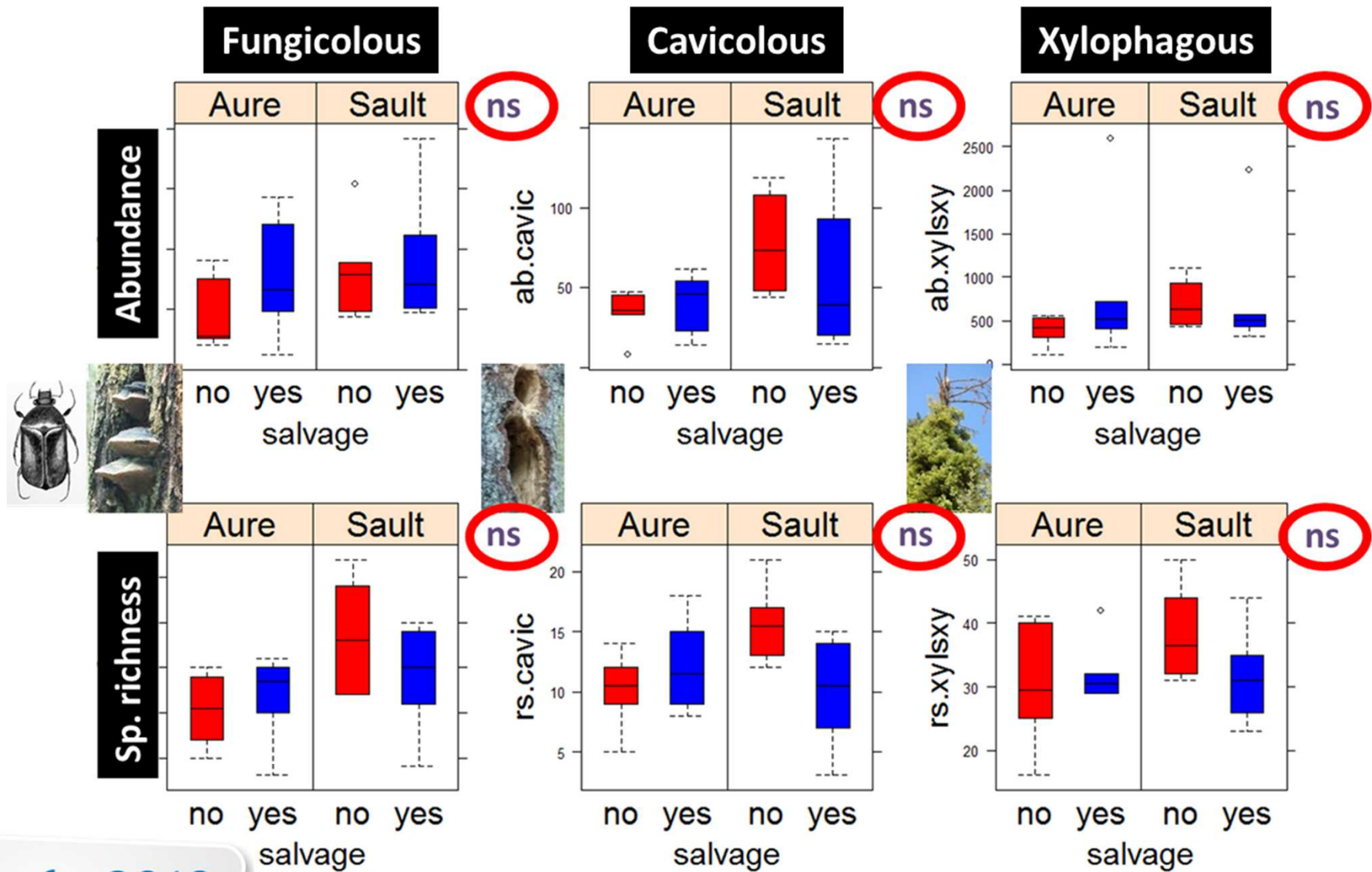
1 ha








Salvage logging (no / yes) in highly declining stands

Salvage logging does not impact TreM-associated beetle guilds

4



Take-home messages

	TreM density	TreM-associated beetle guilds
Dieback (stand)	1 	3 
Salvage logging (stand)	2 	4 
Dieback (landscape)		5 

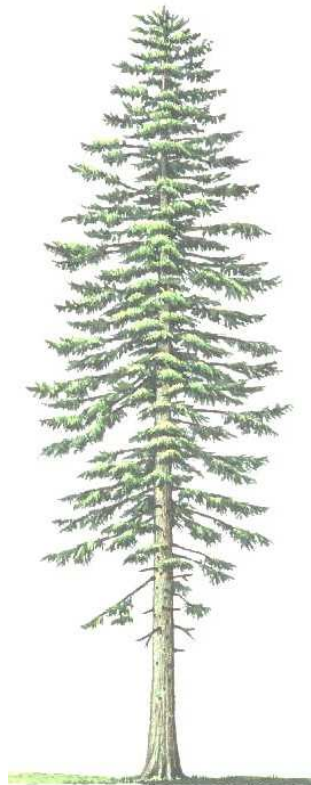


Ongoing dieback (studies): data analyses in progress

Opportunistic **meta-analysis**:

TreM & Biodiversity response to dieback in various contexts

- ✓ French Silver Fir
- ✓ French oak
- ✓ German spruce
- ✓ ...



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Ongoing dieback (studies): data analyses in progress

Time series of dieback level at the landscape scale

Longitudinal approaches about the effects of past regional pulses of resources on present biodiversity



Journal of Ecology 2013, 101, 58–67

doi: 10.1111/1365-2745.12025

FORUM

Identification of 100 fundamental ecological questions

William J. Sutherland¹, Robert P. Freckleton², H. Charles J. Godfray³, Steven R. Beissinger⁴, Tim Benton⁵, Duncan D. Cameron², Yohay Carmel⁶, David A. Coomes⁷, Tim Coulson⁸, Mark C. Emmerson⁹, Rosemary S. Hails¹⁰, Graeme C. Hays¹¹, Dave J. Hodgson¹², Michael J. Hutchings¹³, David Johnson¹⁴, Julia P. G. Jones¹⁵, Matt J. Keeling¹⁶, Hanna Kokko¹⁷, William E. Kunin¹⁸, Xavier Lambin¹⁴, Owen T. Lewis³, Yadvinder Malhi¹⁹, Nova Mieszkowska²⁰, E. J. Milner-Gulland²¹, Ken Norris²², Albert B. Phillimore²³, Drew W. Purves²⁴, Jane M. Reid¹⁴, Daniel C. Reuman^{21,25}, Ken Thompson², Justin M. J. Travis¹⁴, Lindsay A. Turnbull²⁶, David A. Wardle²⁷ and Thorsten Wiegand²⁸

Ecology, 89(3), 2008, pp. 621–634
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WHAT CAN WE LEARN FROM RESOURCE PULSES?

LOUIE H. YANG,^{1,3} JUSTIN L. BASTOW,¹ KENNETH O. SPENCE,² AND AMBER N. WRIGHT¹

54 How do resource pulses affect resource use and interactions between organisms?



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Special thanks to:

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....for **field** and **lab** work

and forest owners and managers...for allowing access to their properties

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