Management of bark beetles in unison with biodiversity of mountain forests

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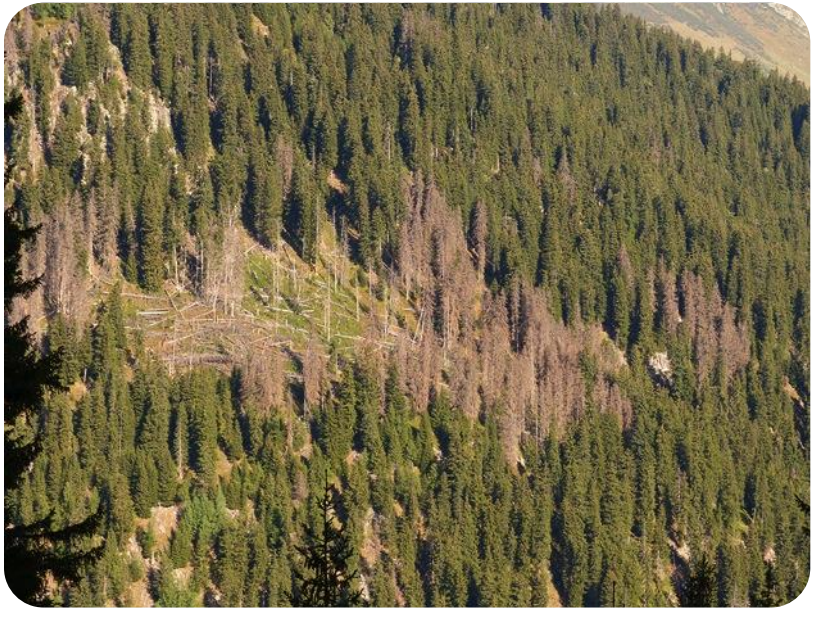
Technical University of Munich

Institute of Zoology - Entomology

NATIONALPARK
Bayerischer Wald

Natural disturbance events promoting bark beetles

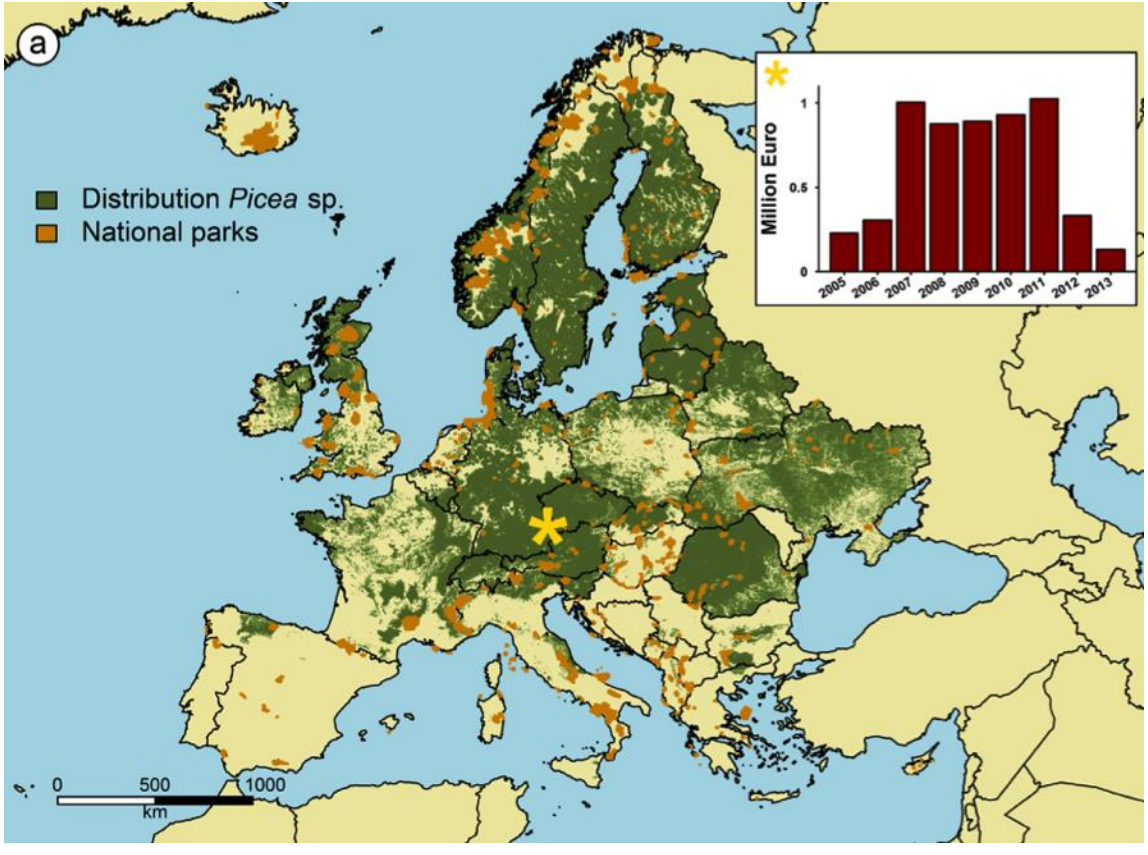
Picture: Christoph



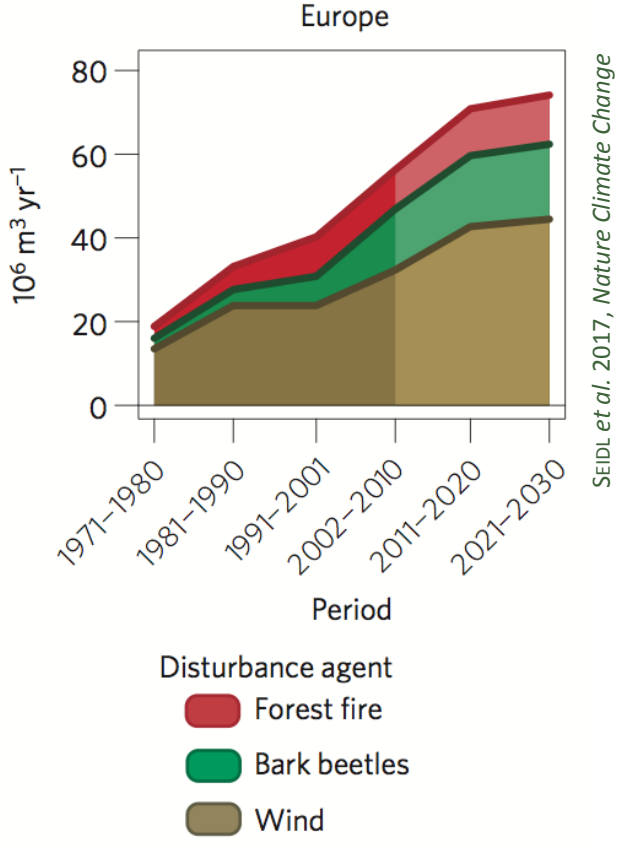
Picture: Michael Opiasa

How to manage bark beetles and account for biodiversity simultaneously?

Frequency of disturbance



THORN *et al.* 2016, *Forest Ecology and Management*



SEIDL *et al.* 2017, *Nature Climate Change*

Picture: J.-C. Grégoire


Non intervention
Salvage logging

Salvage logging for disturbance management

Logging to salvage timber value and/or to decrease populations of bark beetles

Maximize economic return

Naturally disturbed forests in most conventionally managed forests are completely salvage logged to extract as much wood value as possible. Nevertheless, characteristic legacies of disturbance-affected stands, such as uprooted root plates, clusters of regenerated and surviving spruces, sun-exposed, dry branches of storm-felled trees, and solitary snags of beetle-killed spruces can be retained in salvage logging.

Maximize pest reduction

In some cases, such as in the management zones of national parks or remote mountain areas, the reduction of bark beetle population is the primary justification for salvage logging of disturbed spruce stands. Here, wind-felled spruces may be bark scratched instead of debarked in order to decrease densities of *Ips typographus*, while maintaining most biodiversity. Additionally, legacies can be retained.

No salvage logging

Naturally disturbed forests in the core zones of national parks are typically excluded from salvage logging operations. However, also disturbed forest stands in conventionally managed forests may be partially retained if pest hazards are low. Such a retention would allow natural succession and provides habitat to post-disturbance specialists.

THORN *et al.* 2017, *Forest Ecology and Management*

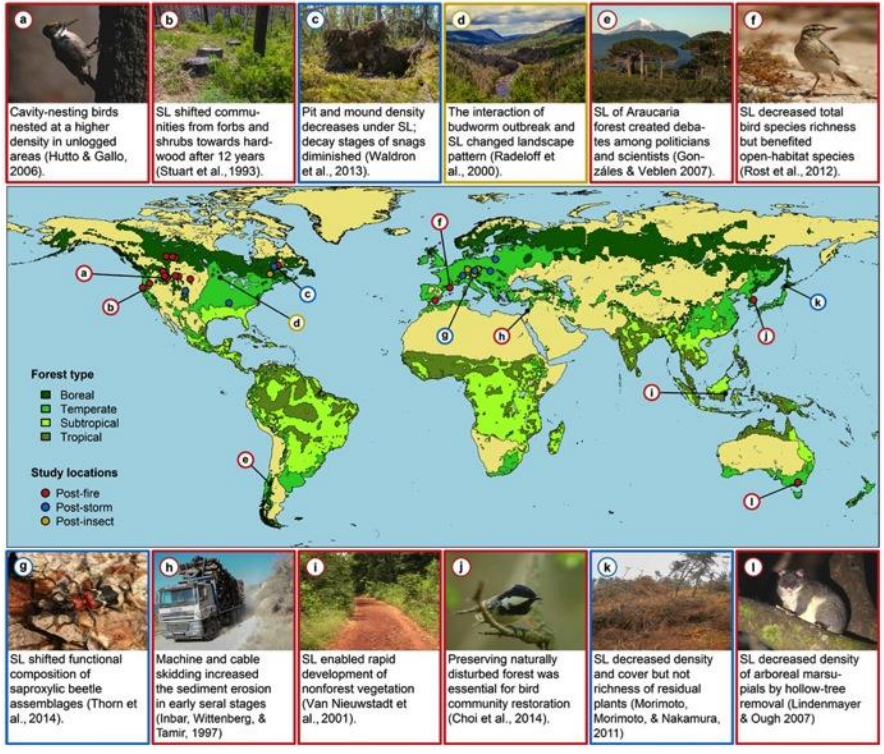
- Logging to salvage timer and/or to decrease populations of bark beetles
- Difference between economical and ecological perspective
- ? How to manage bark beetles and account for biodiversity simultaneously?

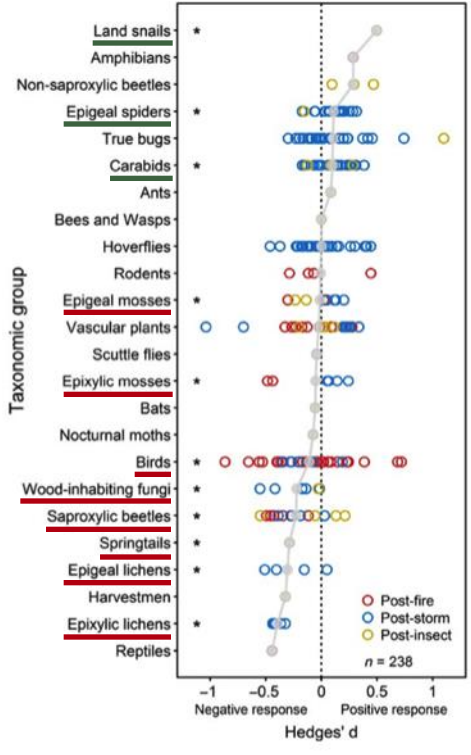
Savage logging and biodiversity

REVIEW

Journal of Applied Ecology

Impacts of salvage logging on biodiversity: a meta-analysis





Positive effects on taxa associated with open habitats

Negative effects were particularly strong for taxa that depend on dead wood

THORN *et al.* 2017, *Journal of Applied Ecology*

Debarking of disturbance affected trees

Debarking by device mounted on chainsaw

Picture: Bavarian Forest National Park

Debarking by harvester

Picture: Kuratorium für Waldarbeit und Forsttechnik e.V.

On-site method of pest control

Accounts for conservation targets because woody biomass is retained ?

Function of bark

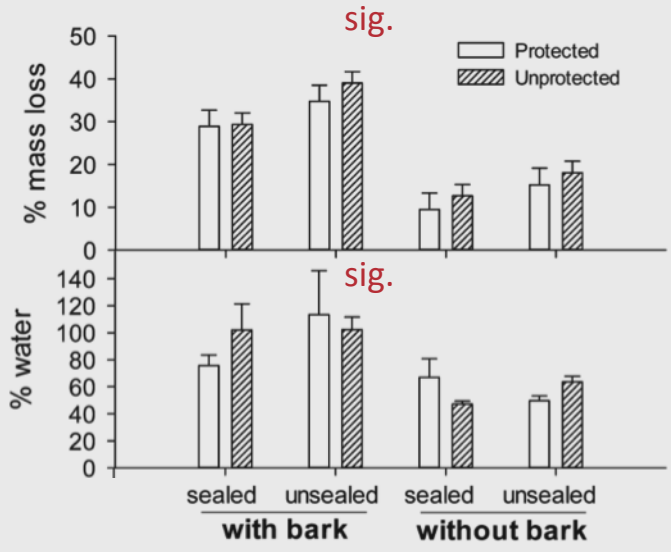
Function of bark for dead wood?

"… no experimental studies have been conducted to explore the importance of bark for wood decomposition …"

MICHAEL D. ULYSHEN (2014) *Biological Reviews*

Do tree bark affects wood decomposition, diversity of wood decomposer and community composition?

Quantitative contribution of bark to wood decomposition



ULYSHEN *et al.* 2016, *Applied Soil Ecology*

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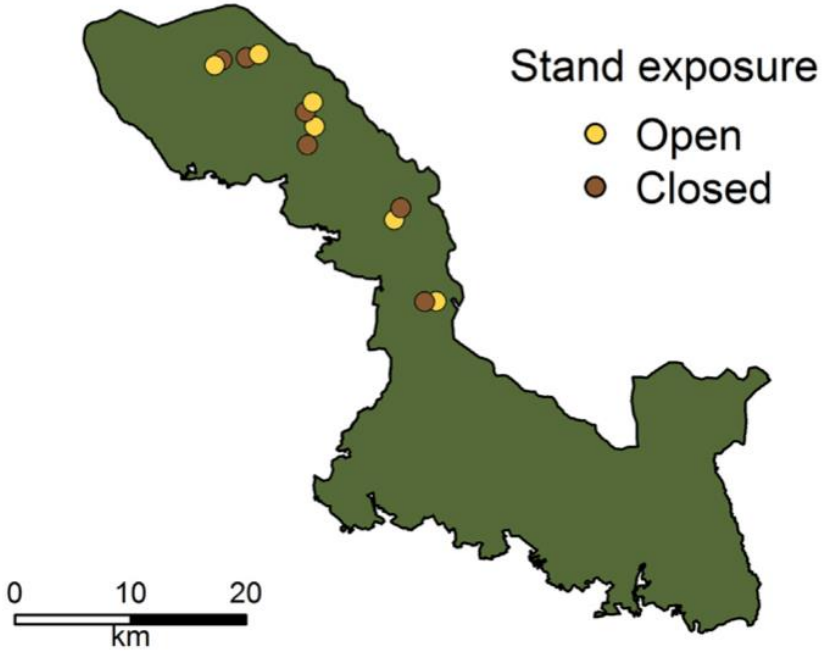
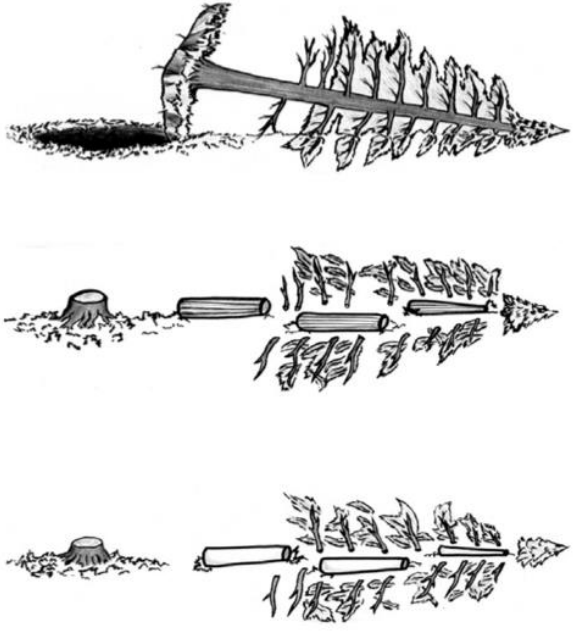
Experimental approach





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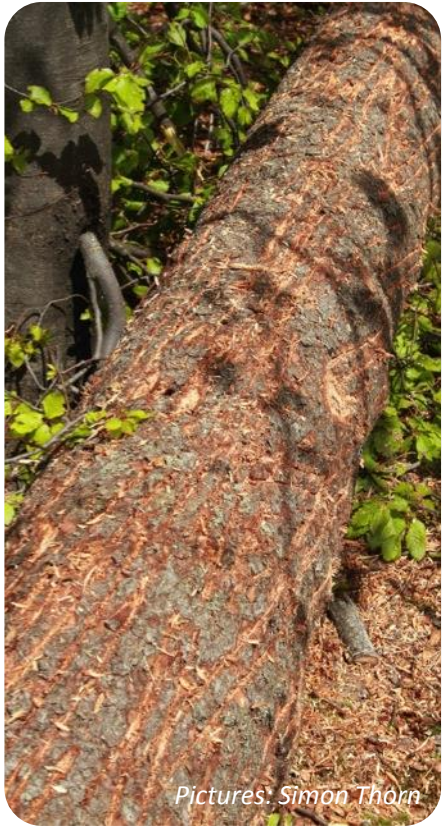
Establishment of experiments



Pictures: Simon Thorn

Sampling of the main decomposers

Pictures: Jonas Hagge

- Stem emergence traps for saproxylic insects
- Next generation sequencing of core samples for wood inhabiting fungi and bacteria

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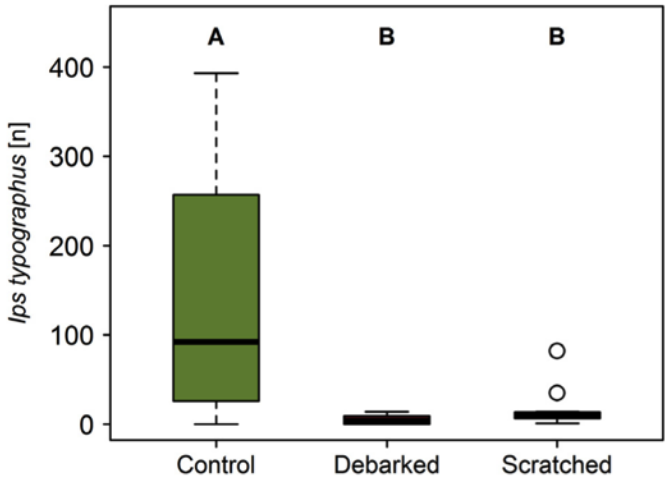
Managing of *Ips typographus*



THORN *et al.* 2016, *Forest Ecology and Management*

Bark-scratching reduces *Ips typographus* as well as debarking

Drawing: Robert Dzwonkowski

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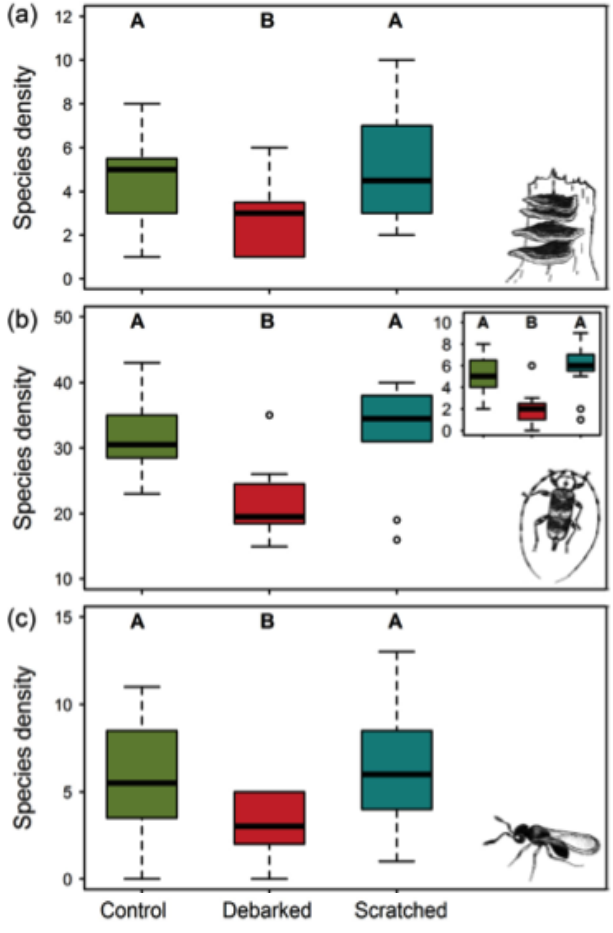
Biodiversity of different bark treatments



THORN *et al.* 2016, *Forest Ecology and Management*

Biodiversity of saproxylic organisms is the same between control and bark-scratched logs

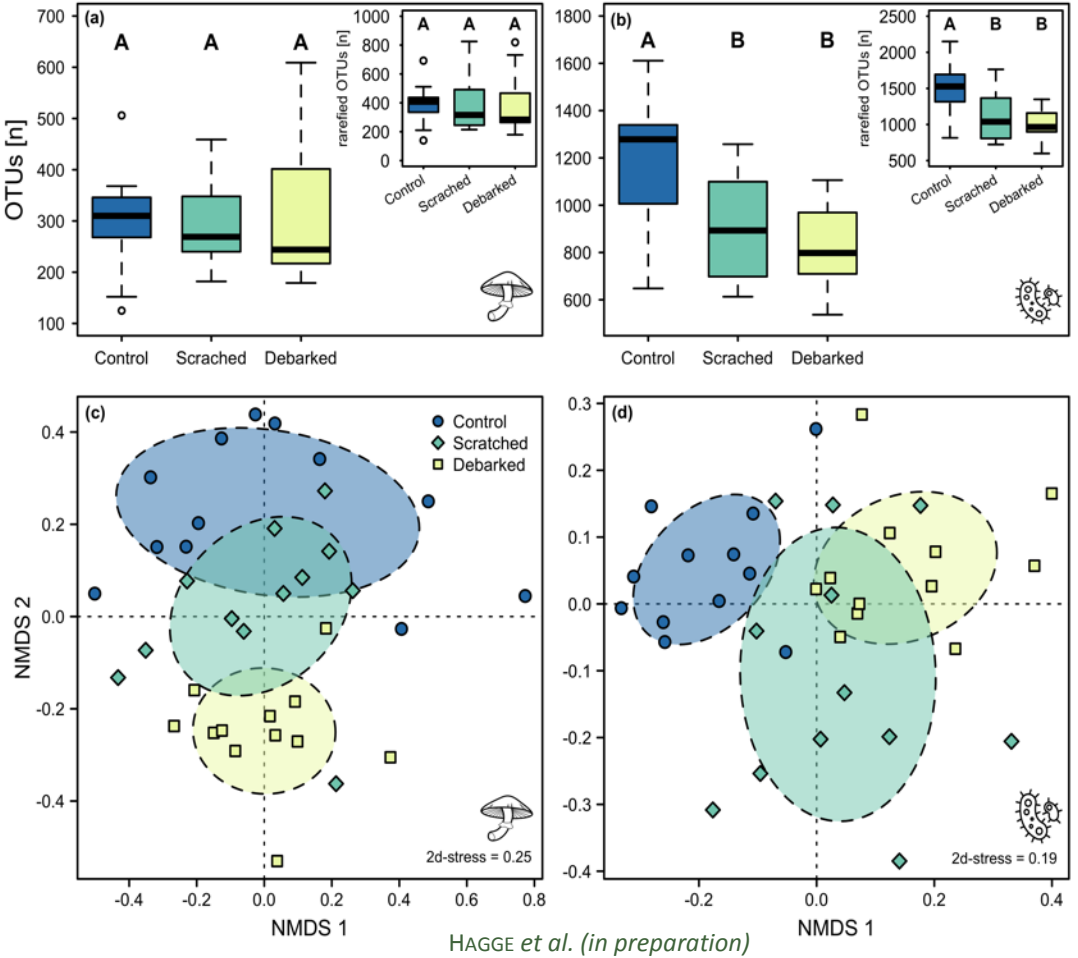
Full debarking reduces biodiversity

Perspective of microbial decomposers

Control

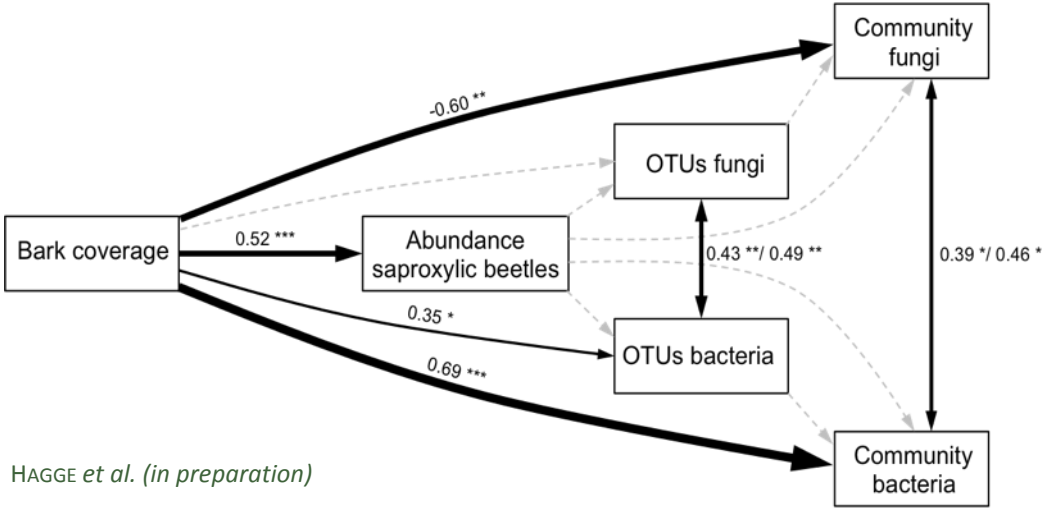
Scrached

Debarked



HAGGE *et al. (in preparation)*

Perspective of microbial decomposers



HAGGE *et al. (in preparation)*

Picture: Jonas Hagge

Conclusions for microbes

- Bark cover promotes diversity of some decomposer groups
- The community of decomposers is shapes by the bark
- For dead wood the bark is the initial colonisation surface of decomposers
- Bark determines moisture conditions of dead wood

Bringing bark-scratching to practice

- Is bark-scratching also feasible for invested trees?
- How long can bark-scratching successfully applied for invested trees?
- Differences between bark-scratching with normal chainsaw and special device?
- Economic costs of different bark treatments
- Same results by sampling with stem-emergence traps and with rearing boxes?

Bark-scratching by chainsaw

Bark-scratching by device

Bringing bark-scratching to practice




April

May



2 weeks

3 weeks

Timeline
one year

Artificial wind throw four bark treatments

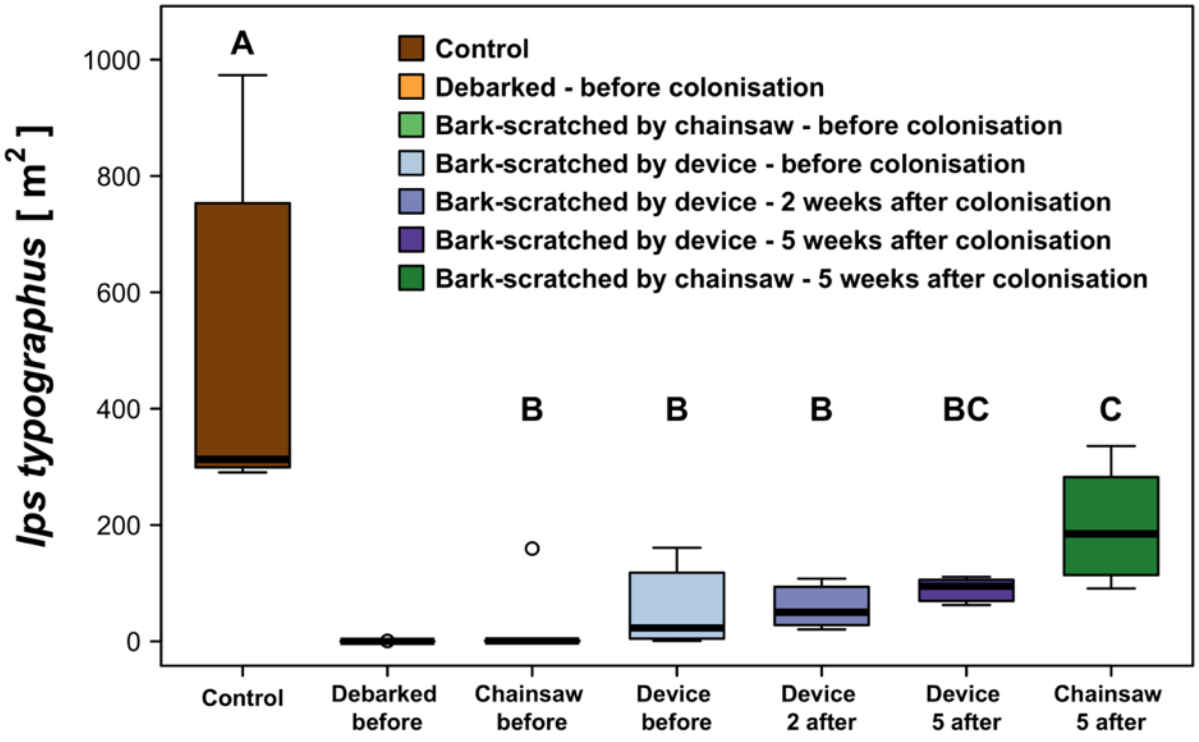
Colonisation by *Ips typographus*

Bark-scratching 2 weeks after colonisation

Bark-scratching 5 weeks after colonisation

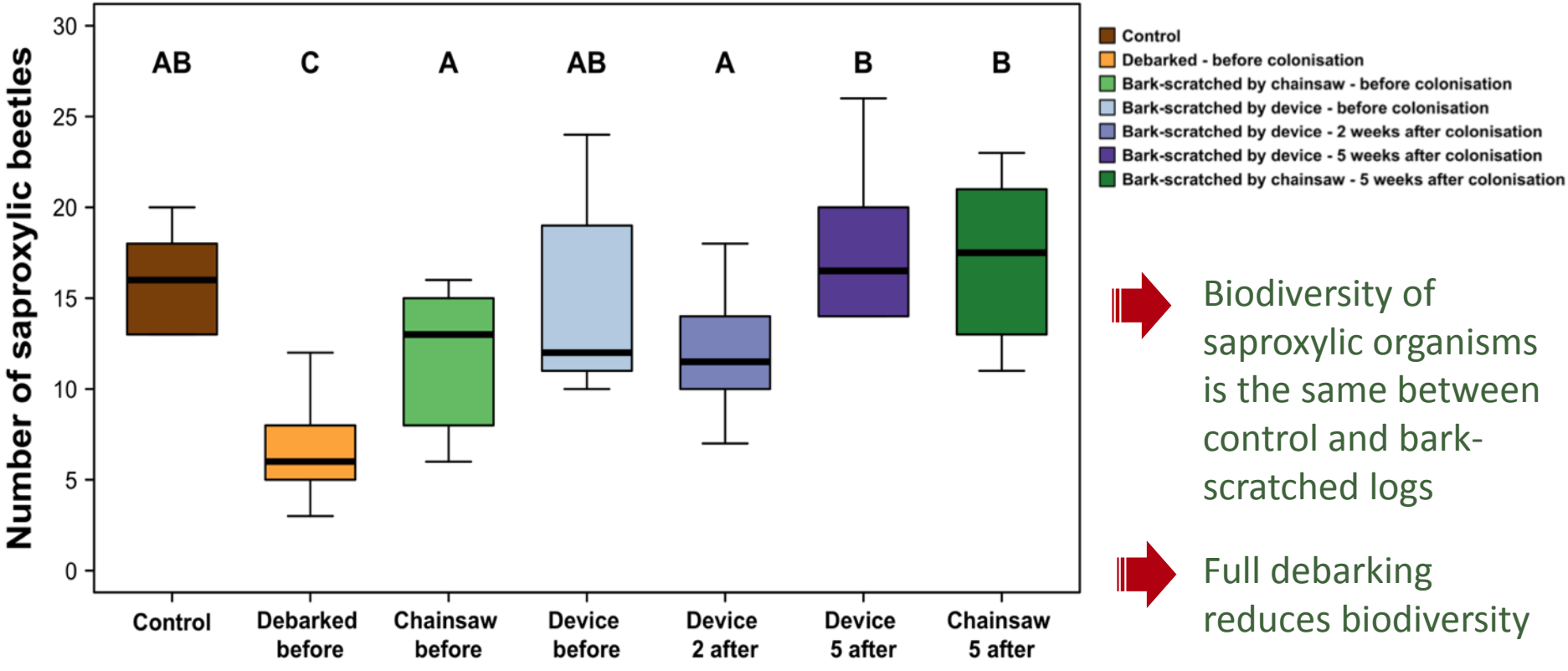
Sampling of beetle community over the year

Impact of insect pest species



- Bark-scratching before colonisation show less than 10 % *Ips* than for control
- Bark-scratching 2 weeks after colonisation show less than 10 % *Ips* than for control
- Bark-scratching 5 weeks after colonisation had more *Ips* but still less than control

Impact of insect pest species

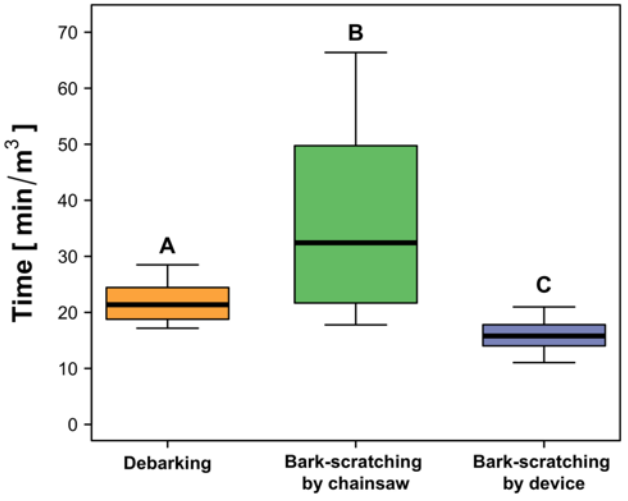


- Biodiversity of saproxylic organisms is the same between control and bark-scratched logs
- Full debarking reduces biodiversity

Conclusions

- Both debarking and bark-scratching significantly decreased numbers of the emerging target pest *Ips typographus*
- Bark-scratching is effective before and after colonisation of *Ips typographus*
- Bark-scratching preserve biodiversity, whereas debarking reduces biodiversity
- Bark-scratching can be conducted by normal chainsaw or special device
- Bark-scratching by device had lowest economic cost
- Public perceptions of bark-scratching?

Economic costs of bark treatments



Public perception

BIOLOGICAL CONSERVATION 142 (2009) 375–383

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Managing natural disturbance in protected areas: Tourists' attitude towards the bark beetle in a German national park

Martin Müller[a,*], *Hubert Job*[b]

- Overall neutral attitude towards bark beetles and slightly against controlling the insect in the park
- Higher affinity for the national park, better knowledge about the bark beetle and who expect a recovery of the affected areas have a significantly more positive attitude

MÜLLER & JOB 2009, *Biological Conservation*

Public perception of different bark treatments?

Method: Standardized questionnaire survey, incorporating 1000 participants

Results: *Coming soon …*

Thanks for your attention!

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