Does forest biodiversity respond to pulses of saproxylic microhabitats induced by tree dieback: a case study in mountain French silver fir forests

Christophe Bouget, Laurent Larrieu, Laurent Burnel, Veronique V. Cheret, Sylvie Ladet, Carlos Lopez-Vaamonde, Carl Moliard, Jerome Molina, Guilhem Parmain, Grégory Sajdak, et al.

To cite this version:

Christophe Bouget, Laurent Larrieu, Laurent Burnel, Veronique V. Cheret, Sylvie Ladet, et al.. Does forest biodiversity respond to pulses of saproxylic microhabitats induced by tree dieback: a case study in mountain French silver fir forests. 25. IUFRO world congress 2019, Sep 2019, Curitiba, Brazil. 770 p. hal-02734096

HAL Id: hal-02734096
https://hal.inrae.fr/hal-02734096
Submitted on 2 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.
Do Tree-related Microhabitats and associated biodiversity respond to forest dieback?

A case study in French mountain Silver Fir forests

Climate change, droughts and forest diebacks

Anderegg et al. PNAS 2016

No. species included

- 200
- 20
- 2

Anderegg et al. PNAS 2016

Global forest cover
- Other wooded regions
- Localities compiled through 2009 (summarized and listed in Allen et al., 2010)
- Examples not included in Allen et al., 2010, largely from post-2009 publications
- Broad areas described by particular post-2009 publications

Bouget et al.
Dieback-induced changes in forest conditions

Weakened trees with crown decline

**TreM (Tree-related Microhabitats)**
- Crown deadwood
- Polypores
- Cavities...

Dead trees and **deadwood**

Openings and **microclimate**

↑ **Saproxylic habitats ?**
Mountain forests as sentinels of climate change

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

Bouget et al.
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

Bouget et al.
A stratified and almost balanced sampling design replicated in 2 French regions

56 plots
112 window-flight traps (beetles)
Issues

Dieback (stand)

Salvage logging (stand)

Dieback (landscape)

Local TreM density

Local TreM-associated beetle guilds

1 2 3 4 5
Focus on key TreMs / associated beetle guilds

- XYLOPHAGOUS
- SAPROXYLOPHAGOUS
- CAVICOLOUS
- FUNGICOLOUS

RESULTS-1

© Emberger (Larrieu & Heinz)
Key microhabitats rose in density in declining stands.
...the rise in dead wood density in declining stands was nonetheless stronger!
Dieback-induced increase in local cavity density does not foster abundance/diversity of cavicolous beetles.

...the same for fungicolous beetles associated to polypores.

Bouget et al.
...but dieback-induced increase in local cavity density does strengthen rare cavicolous species richness.
Xylophagous beetles are affected by logs and snags, but also by crown deadwood density.
TreM-associated beetles increase in abundance and richness with dieback intensity at the landscape scale.
Salvage logging does slightly depress microhabitat density.
Salvage logging does not impact TreM-associated beetle guilds

**RESULTS**

- **Fungiculous**
  - Abundance: ns
  - Sp. richness: ns

- **Caviculous**
  - Abundance: ns
  - Sp. richness: ns

- **Xylophagous**
  - Abundance: ns
  - Sp. richness: ns

*Images and data points show comparative analyses between Aure and Sault with and without salvage logging. Each comparison is marked with 'ns' for non-significant results.*
### Take-home messages

<table>
<thead>
<tr>
<th></th>
<th>TreM density</th>
<th>TreM-associated beetle guilds</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dieback (stand)</strong></td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td><strong>Salvage logging (stand)</strong></td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td><strong>Dieback (landscape)</strong></td>
<td></td>
<td>5</td>
</tr>
</tbody>
</table>

**SUMMARY-1**

Bouget et al.
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
✓ ...

Bouget et al.

PROSPECTS-1
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
Special thanks to:

Benoit Nusillard, Wilfried Heintz, Olivier Rose, Gianfranco Liberti, Fabien Soldati, Thomas Barnouin, Thierry Noblecourt, Yves Gomy, Olivier Courtin, Benedikt Feldmann, Pierre Zagatti

....for field and lab work

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

Contact: christophe.bouget@irstea.fr