Comparing saproxylic beetle assemblages on three different substrates on clear-cuts, and studies of long-term effects of stump harvesting

Jon Andersson
Dept. of wildlife Fish and Environmental studies
Swedish University of agricultural sciences
Background

- A large part of the Swedish forest land have over the last century been transformed into even-aged stands with few characteristics resembling the original old growth forest

- Natural disturbance regimes as fire have effectively been halted with the use of fire suppression. Clear-cutting is now the dominating disturbance in the Swedish forest landscape

- Since the early 50’s this trend have been accentuated by the use of mechanical forestry with clear-cutting as the major practice in forestry

- The amount of dead and decaying wood in the forest landscape is a small fraction of the volumes found in pristine forests

- Forest fuel harvesting and intensified management might further increase the negative pressured on vulnerable species
Coarse dead wood on clear-cuts

- Short stumps left after harvesting are by far the most common coarse dead wood substrate on clear-cuts!

- Stumps constitutes about 80% of the dead wood on clear-cuts

Andersson et al. (unpublished)
16 environmental objectives

• Reduced Climate Impact
• Clean Air
• Natural Acidification Only
• A Non-Toxic Environment
• A Protective Ozone Layer
• A Safe Radiation Environment
• Zero Eutrophication
• Flourishing Lakes and Streams
• Good-Quality Groundwater
• A Balanced Marine Environment, Flourishing Coastal Areas and Archipelagos
• Thriving Wetlands
• Sustainable Forests
• A Varied Agricultural Landscape
• A Magnificent Mountain Landscape
• A Good Built Environment
• A Rich Diversity of Plant and Animal Life
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Two goals in conflict with a third goal

1. A Rich Diversity of Plant and Animal Life
2. Sustainable Forests
   - Halt loss of biodiversity!
   - Increase the volume of dead wood!
3. Reduced Climate Impact
   - By 2020 half of Sweden’s energy should originate from renewable energy sources
Aim of the studies

I. Determine, quantitatively, the extent to which low stumps are utilized by saproxylic beetles

II. Are beetle assemblages in low stumps similar to those of other dead wood substrates found on clear-cuts?

III. Are there long-term effects from stump harvesting on any functional-and/or taxonomic group of beetles?

IV. If there are effects from stump harvesting, are these effects comparable in importance to effects from variation in characters of the surrounding forest landscape?
• 10 clear-cuts in the boreal forest of Sweden
• All clear-cuts did have similar age (5-7 years)
Experimental Design 1

- Experimentally placed logs, high stumps and low stumps left after clear-cutting
- Emergence traps for catching beetles hatching from the substrates
Emergence traps were active between May and September 2006.
Study area 2

- 28 localities in the hemiboreal forest of Sweden
- At each locality we placed 3 window traps for catching flying beetles
- Half of the traps placed in stands which were stump harvested app. 20 years ago
- Around each stand forest age, area of clear-cuts and volume of deciduous forest was estimated using detailed satellite data
Window traps

- Three traps on each locality
- The data from each locality was pooled
- Traps were active between June – Oktober 2007
• Two buffer zone sizes
• Four age classes
  (0-40, 41-80, 81-120, >121)
• Volume of deciduous forest
• Area of clear-cuts
  (Up to 8 years old clear-cuts)
Results, study 1

- We collected 929 saproxylic beetle individuals belonging to 120 species.
- Sixty-eight species were collected on low stumps, 58 species on high stumps and 56 species on logs.
- Nine red-listed species were collected, of which three were found on low stumps.
Results, study 1

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</table>

* p = 0.0024, 0.008 and 0.0032 respectively

ANOVA and PERMANOVA analyses testing the effect of substrate type and locality on the abundance, species richness and assemblage composition of saproxylic beetles.
Results, study 1

nMDS plot visualizing the differences in species assemblage composition between substrate types.
Results, study 2

- The species richness of the functional group Fungivores and the beetle family Latrididae were significantly lower in the harvested areas.
- Saproxylic beetles did not show response to stump harvesting after such a long time.
- The most important factor for explaining beetle occurrence was forest age.
- There were no difference in species assemblage composition between the previously harvested areas and the control areas.
Conclusions

• Low stumps left after harvesting produces the same number of beetle individuals and beetle species as other substrates on clear-cuts

• Low stumps harbor a specific set of beetle species in comparison to other substrates on clear-cuts

• Since low stumps are the most common substrate on clear-cuts they might be of high value for species able to utilize this specific substrate

• Long-term effects doesn’t necessarily show on species associated with dead wood like saprophytics

• Fungivores might be affected because fungi growing on decaying stumps are missing or because ground fungi are missing due to the lack of substrate in the soil after the stump harvesting
Thanks for listening!

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