EMEND





ECOSYSTEM-BASED MANAGEMENT EMULATING NATURAL DISTURBANCE

EMEND Insights #5

Ecological Messages:

- A total of 286 species of beetles were collected from deadwood, with at least seven being new to science.
- Many beetles were associated with deadwood greater than 25 cm in diameter.
- Assemblages of beetles varied between standing and fallen deadwood, different decay stages, and different diameters of deadwood.
- The presence of bark cover on logs was important for many beetle species.

Management Implications:

- Both *quantity* and *quality* of deadwood should be considered when planning retention harvesting that includes conservation goals.
- Logs and snags from a diversity of decay states, diameters, and other qualities (e.g., presence of moss cover and amount of bark cover) should be retained to conserve beetle species.
- Forest management should emulate natural processes that create a diverse deadwood pool and ensure the presence of logs larger than 25 cm in diameter.

Life After Death: The Importance of Deadwood for Beetles in the Boreal Forest

By Charlene Wood, John Spence and David Langor

Deadwood is often overlooked in forest management and is frequently perceived as waste wood. Yet, it should be a critical part of discussions around sustainable forest management. Not only does deadwood support a huge diversity of species, it provides other ecological services like returning nutrients to soils and creating microsites for the growth of plants and trees.

Saproxylic beetles are a group of organisms that depend on deadwood for their survival and research has shown they are particularly sensitive to large-scale forest harvesting. Harvesting leaves much less deadwood than is found in mature forests, and even less than would be found naturally after a wildfire. More specifically, large diameter trees, snags and logs are particularly rare after harvesting, but yet are important habitats for a number of saproxylic species.

We studied saproxylic beetles living in dead trembling aspen within the mixedwood boreal forest of Alberta. Our field surveys revealed that some species were exclusively found living in snags, while others were only found in logs on the forest floor. We also found that some beetle species preferred highly decayed deadwood while others preferred recently fallen deadwood. Similarly, a range of log sizes were important, particularly those larger than 25 cm in diameter.

Snags are critical habitat for many species in the boreal forest.

In Alberta, forest management directives covering deadwood, such as the Alberta Forest Management Planning Standard, focus on the *quantity* of deadwood retained after harvesting. A key implication of our work is that in addition to the amount of deadwood retained, forest managers must also consider the *quality* of deadwood in terms of characteristics like position, diameter, and degree of decay. **Read on to find out more. . .**

The Context

Forest Harvesting and Deadwood

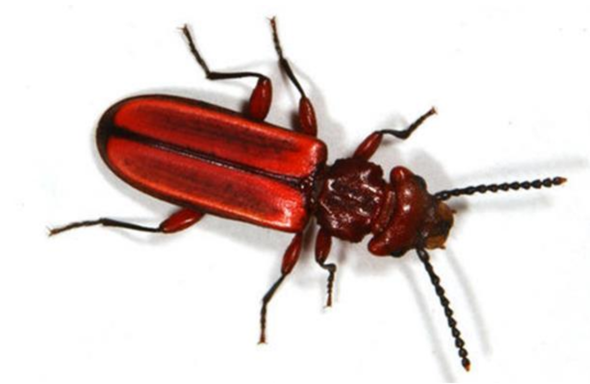
The value of deadwood as a source of organic matter and nutrients, and as habitat for plant, fungal, and animal species, is widely recognized. Yet, we have a limited understanding of which specific deadwood attributes are important for particular species. Given the important role that deadwood plays in the ecology and productivity of forests, filling this knowledge gap is critical to conserving biodiversity on harvested landscapes and thereby achieving sustainable forest management.

Saproxylic insects comprise one of the most diverse groups of organisms in the boreal forest. These insects exploit standing snags and deadwood on the forest floor as habitat and food resources. The diversity of deadwood is a key driver of the diversity in saproxylic species found in the boreal forest.

However, research has shown that saproxylic species are particularly sensitive to large-scale forest harvesting. **Harvesting tends to create an even-aged structure to forests, meaning that forests are often lacking the natural range of variation in deadwood amounts and size classes.** These changes can result in declines in abundance and even the disappearance (i.e., extirpation) of some species. It is therefore critical to understand what characteristics of deadwood are important for saproxylic species so that management strategies can be developed to conserve these species, and the deadwood they depend on.

About EMEND:

The Ecosystem-based Management Emulating Natural Disturbance (EMEND) Project is a multi-partner, collaborative forest research program. The EMEND project documents the response of ecological processes to experimentally-delivered variable retention and fire treatments. The research site is located in the western boreal forest near Peace River, Alberta, Canada, with monitoring and research scheduled for an entire forest rotation (i.e. 80 years).



Cucujus clavipes a deadwood inhabiting beetle from EMEND. Credit Phil Myers.

Research Findings

Managing for Deadwood Diversity Can Maintain Beetle Diversity

In our field research we sampled beetles in trembling aspen (*Populus tremuloides*) logs and snags from aspen dominated stands. Our samples included deadwood ranging in diameter from 7 cm to 43 cm that was also classified into categories reflecting different states of decay. In addition, we sampled saproxylic beetle species at different depths in the xylem and looked for associations between beetle species and surface attributes such as the presence of bark, mosses, and fungi.

Among the 5519 beetles captured, 286 species were identified. Of these, 94 beetle species were considered obligate saproxylic, i.e., species that require deadwood for their survival. Furthermore, 71 species were found only on logs while 119 species were exclusive to snags. **For forest managers the message of these findings is clear: post-harvest retention of both snags and logs is essential to ensure habitat for a large number of species.**

It is also necessary that deadwood retention programs feature a variety of diameters, decay stages, and other qualities if all saproxylic beetle species are to be conserved on harvested landscapes. Over 75% of the deadwood-dependent species that we recorded were

Found in only one or two deadwood diameter classes. Moreover, **logs in the largest size class were used by the greatest proportion of species even though that class made up only a small proportion of deadwood on the forest floor.** We also found that bark surface area and moss cover were associated with many indicator species and explained much of the variation we recorded in saproxylic beetle assemblages. **Maintaining a range of log diameters and ensuring the presence of large logs and logs with a large amount of bark present are therefore critical if the goal is to provide habitat for beetle species of boreal mixedwood forests.**

A combination of individual tree and patch retention can provide a continual supply of deadwood over time. Photo courtesy of DMI.

Management Implications

Our results support earlier studies which have shown that beetles perceive fallen logs differently from snags. What's more, **some species appear to have specific preferences for different qualities (i.e., decay stage, diameter) of deadwood within these two coarse categories (snags and logs).**

Our findings suggest that management practices that focus only on the *quantity* of deadwood retained might offer limited protection for these species. We suggest that deadwood management practices must be more ecologically rigorous. In particular, **managers must aim to retain deadwood with a wide range of attributes**, such as:

- position (i.e., both snags and logs);
- diameter;
- stages of decay; and
- surface area covered by bark.

Emulating natural processes, like wildfire, via retention practices that maintain both individual trees and clusters of trees of different age classes and species could be a way to create this diversity. **Individual trees retained at harvest will undoubtedly fall over a few years after harvesting, providing a short-term staggered input into the deadwood pool. Longer term inputs could be achieved by using retention patches to preserve clusters of live and dead trees of different species and ages after harvesting.**

As the surrounding forest regenerates, these retained trees will provide inputs to the local pool of snags and logs. Planning could focus on managing species of deadwood (such as aspen, white spruce, and/or balsam fir), while also aiming to provide various decay classes of deadwood throughout time. **Retention of large diameter trees (>34cm) is especially important given their ecological value and increasing rarity on managed landscapes.**

Adopting this approach of retaining patches of trees after harvesting may also be important for providing habitat for species that are negatively associated with sun-exposed sites. Retention patches, if large enough, may emulate the more shaded and moist conditions of intact forest that are important to the maintenance of bryophyte and fungal communities.

These techniques should help to maintain deadwood within managed forests in a way that is closer to the natural range of variation within the mixedwood boreal forest.

Further Reading

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