Green-tree retention benefits recovery of ground beetles

In their new research, Linhao Wu and colleagues set out to answer the question 'how do retention harvest and forest type together affect the conservation and recovery of ground beetles assemblages'?

Ground beetles (members of the family Carabidae) are common and important components of forest biodiversity. Because they are easy to collect, highly diverse and sensitive to habitat changes, they have been widely used as indicator species to assess the success of sustainable forest management prescriptions. When ground beetle communities change, changes in forest function are reflected as well.

The Ecosystem Management Emulating Natural Disturbance (EMEND) project is a large scale experiment to evaluate effects of retention forestry in NW Alberta, Canada. Ground beetles were collected at EMEND in the pre-harvest year (1998) and 1, 2, 5, 10, and 15 years following harvest. We collected samples in the unharvested controls, clear-cuts, and stands harvested leaving 10%, 20%, 50%, and 75% dispersed retention in four different types of forest.

We used the resulting data to track changes in ground beetle composition over time in different retention treatments and used these unusual 16-year results to answer the following question: how do retention harvest and forest type together affect the conservation and recovery of ground beetles assemblages (i.e., species and their abundance)?

We first noticed that retention harvest accelerated the return of ground beetle assemblages toward pre-harvest states by 15 years post-harvest. Even the lowest retention treatment at EMEND (10%) was more effective at conserving and promoting recovery of forest beetle assemblages. Higher retention levels appear to 'lifeboat' sensitive forest ground beetle species through time after harvesting.

We also found that patterns of ground beetle recovery are complex and depend on forest type. In contrast to the situation in deciduous stands, ground beetles in coniferous and mixedwood stands did not recover to pre-harvest states, but instead became strikingly more similar to pre-harvest assemblages found in deciduous stands.

We suspect these differences can be partly attributed to the fast natural regeneration of aspen within the harvested matrix. In other words, ground beetle assemblages follow trajectories of forest succession in their own recovery after harvest. Thus, beetle species characteristic of old forests with high levels of coniferous trees will require more time to achieve recovery.

What are the implications? First, we submit that variable retention harvests will promote and maintain biodiversity better than clear-cutting. This understanding is essential to accurate calculation of trade-offs between amount of in-block retention and the total area that must be harvested within a region to meet economically sustainable requirements for fiber volume.

Second, older conifer dominated stands present the most significant challenge for maintaining biodiversity on boreal mixedwood landsacpes. We suggest that leaving significant unharvested reserves and applying higher retention prescriptions in at least some late successional conifer dominated stands will preserve local faunal and likely promote full faunal recovery in the wake of forest harvesting. In addition, silvicultural approaches that promote more rapid post-harvest regeneration of conifers, such as understory protection and under planting will foster development of stands suitable for faunal elements of mature forest.

Originally posted on The Applied Ecologist

Article: Wu, L, He, F, Spence, JR. Recovery of a boreal ground-beetle (Coleoptera: Carabidae) fauna 15 years after variable retention harvest. *J Appl Ecol*. 2020; 00: 1– 13. https://doi.org/10.1111/1365-2664.13687