

Branching out

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Using insects as biodiversity indicators for the boreal forest

Over the years, forest stakeholders have become aware of the importance of preserving biodiversity, but how can we measure it? Is it enough to simply count the number of species (trees, shrubs, insects, fungi, birds, mammals, etc.) that are present in a given environment? It appears that insects may help to get a clearer picture of the situation.



Irregular boreal forest in the North Shore region.
Photo: Philippe Janssen (Université Laval)

In general, the more varied the habitat, the greater the biodiversity. Changes in forest composition and structure in time and space, such as those associated with forest fires and harvesting, contribute to the heterogeneity of forest habitats.

Habitat diversity and ground-dwelling insects

Forest composition has a direct influence on the diversity of ground-dwelling insects because the trees that make up the forest provide the raw materials for the soil litter.

For example, in old-growth boreal forests of the North Shore region, Canadian Forest Service (CFS) researchers, working in collaboration with researchers at the NSERC-Université Laval Industrial Research Chair in Silviculture and Wildlife, observed that a forest with a more heterogeneous composition may have a larger quantity of soil resources, which could have a beneficial effect on ground-dwelling insect diversity.

Forest composition and structure

In old-growth boreal forests, forest composition and structure have a positive influence on the diversity of flying insects. A forest with a heterogeneous composition provides a greater variety of food for insects. In addition, forests with a heterogeneous structure have a larger number of microhabitats. As forest basal area and the amount of coarse woody debris on the ground increase, so does the number of flying insect species.



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Cutovers adjacent to residual forest areas may attract certain flying insects because the temperature is warmer there than under the canopy. However, harvesting generally has an adverse effect on ground-dwelling insects since it breaks up their habitat.

Assessing biodiversity in the field

How can inferences be made about biodiversity when 400 insect species are present? To address this problem, researchers have developed a model for assessing co-occurring species, that is, species that are simultaneously present in a given environment. They hypothesized that insects that naturally live together show a similar response to changes in their environment. By identifying patterns of co-occurrence, scientists can structure diversity into groups of species that respond in a similar manner to a set of environment variables that characterize the forest.

In addition, indicator species in each group can be used to assess overall species diversity. For example, fifteen indicator species in four groups of flying beetles were found to predict 81% of the species diversity at a given site, whereas thirteen other species in two groups of ground-dwelling beetles predicted 85% of the species diversity. These indicators make it possible to accurately quantify a given site's beetle diversity using only a subset of all the insects captured.



Leiodes assimilis, a ground-dwelling beetle that feeds on fungi and is associated with open forests.
Photo: Yves Dubuc (NRCan)



Triplax thoracica, a flying beetle that depends on dead wood and is associated with the presence of birch and snags.
Photo: Yves Dubuc (NRCan)



Pseudanostirus triundulatus, a flying beetle species that lives in decomposing wood and is associated with open forests.
Photo: Carole Germain (NRCan)



Pterostichus punctatissimus, a ground-dwelling predatory beetle species associated with closed-canopy fir forests.
Photo: Yves Dubuc (NRCan)

Ongoing research

In most countries, biodiversity conservation is one of the sustainable forest management criteria included in forest certification. The studies conducted in old-growth boreal forests of the North Shore region may be used to assess the impact of forest harvesting on biodiversity. This research is therefore very timely in view of the current emphasis on forest certification.

USEFUL LINKS:

NSERC–Université Laval Industrial Research Chair in Silviculture and Wildlife:

<http://www.sylvifaune.ulaval.ca/default.htm>

Canadian Council of Forest Ministers: Criteria and Indicators of Sustainable Forest Management in Canada:
http://www.ccfm.org/english/coreproducts-criteria_in.asp

Biodiversity in general (in French only):
<http://www.mrn.gouv.qc.ca/faune/habitats-fauniques/biodiversite/index.jsp>

FOR MORE INFORMATION, PLEASE CONTACT:

Christian Hébert

Natural Resources Canada
Canadian Forest Service
Laurentian Forestry Centre
1055 du P.E.P.S.

P.O. Box 10380, Stn. Sainte-Foy
Quebec City, Quebec G1V 4C7
Phone: 418-648-5896

Fax: 418-648-5849

E-mail: Christian.Hebert@nrcan.gc.ca

Website: cfs.nrcan.gc.ca