WINDTHROW EVENTS ENHANCE BIODIVERSITY IN A *QUERCUS* MESIC DECIDUOUS FOREST IN THE CENTRAL RUSSIAN UPLAND

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INTRODUCTION

Deciduous broadleaf forests in Europe have long been subjected to intense anthropogenic pressure: the land in the region is mostly plowed and the remaining forests have been used for centuries for logging, firewood, and grazing.

All this has led to **the decline of temperate deciduous forests** with long-term spontaneous development **with coarse woody debris (CWD) and treefalls with uprooting.**

AIM

To test the hypothesis that the presence of CWD contributes significantly to the diversity and composition **of vascular plants and xylotrophic fungi** in old-growth mesic broad-leaved forests.

To define: (1) the differences in vascular plant species richness and composition between the forest floor and tree-fall microsites: fallen logs, pits and mounds formed by tree uprooting and (2) xylotrophic fungi on fallen logs of 8 tree species 14 years after the mass windthrow.

RESULTS

Fallen logs (with uprooting) significantly affect vascular plant species richness and composition in terms of both woody seedlings and herbaceous species.

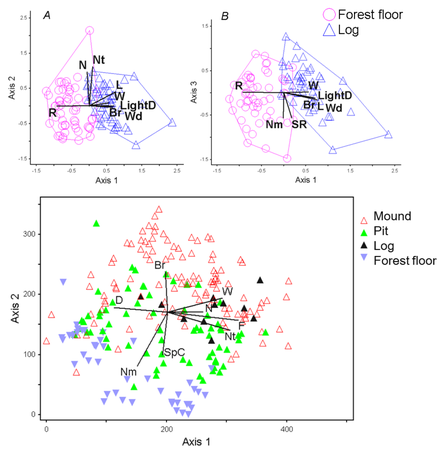
There were more vascular plant species on fallen logs and pit-and-mound than on a forest floor without deadwood.

Species diversity was higher because atypical boreal and light-demanding species were present on the microsites.

The organic matter supplied by decaying wood is an important substrate for nitrophilous plants and this further enhanced species diversity.

Large logs (more than 40 cm in diameter) with cracked bark were a critical substrate for regenerating trees.

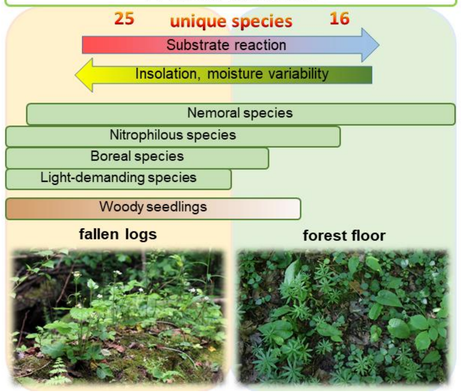
Competition among woody plants, herbs and bryophytes on fallen logs is important in structuring vegetation on fallen logs: with herbs apparently outcompeting bryophytes and tree seedlings on well illuminated sites.



Ordinations of Log- and Forest-floor plots (above) and Mound-, Pit-, Log-, and Forest floor plots (below). Landolt indicator values: L = insolation, R = substrate reaction, N = nutrient content, W = moisture variability, F = moisture, and D = aeration. Richness of species groups: Nt = nitrophilous, LightD = light-demanding, Br = boreal, Wd = woody, and Nm = nemoral species; SR (SpC) = total species richness.

108 paired vegetation plots of 1 m²: on 44 fallen *Quercus robur* logs with mean DBH 75.4 (SD 25.6) cm and on the forest floor. 82% of logs from 1 to 3 stages of decay

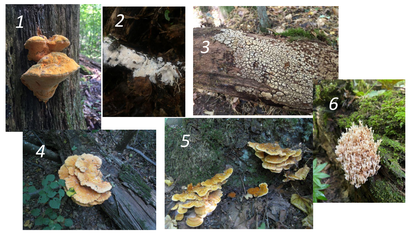
71 vascular plant species



251 vegetation plots: 206 plots on pit-and-mound microsites formed by fall of 45 trees of 8 species (ash, aspen, linden, elm, birch, oak, maple, and spruce) and 45 reference plots of 1 m² on the forest floor.
78 vascular plant species, 26 unique species in the tree-fall microsites

On 35 fallen logs, a total of 73 basidial fungi species were revealed including 36 species new to Kaluga Region.

There are rare in European Russia species, such as *Aurantiporus croceus (1), Hydnocristella himantia (2), Xylobolus frustulatus (3),* etc. A new locality of the rare species *Subulicystidium perlongisporum* strictly inhabited in old-growth broadleaf forests was registered.



4 Laetiporus sulphureus, 5 Pycnoporellus fulgens 6 Artomyces pyxidatus

The highest diversity was noted on the dead trunks of *Picea abies* (fruit bodies of 24 species); 14 species on birch and aspen wood, 12 species on oak and maple, 11 species on ash, 8 species on linden and 4 species on elm.

METHOD

Study area is Kaluzhskie Zaseki State Nature Reserve located in the north-west of the Central Russian Upland. Vascular plant species were surveyed in plots on fallen logs, pit-and-mound microsites and on the forest floor as the reference.

Data analysis

- Differences in species composition: NMDS and PERMANOVA (adonis2). Landolt' IV as environmental characteristics
- Relationships between environmental variables and species richness: Generalized Linear Models with the Poisson error distribution
- Differences in species richness: additive diversity partitioning (adipart)

CONCLUSIONS

The vascular plant species pool in temperate deciduous forests is larger than earlier assumed. Fallen logs, pits and mounds after treefalls with uprooting are natural forest microsites which have been eliminated by humans in the past. The biodiversity of forests is increasing due to windthrow events. What species have been lost from modern forests and how can we make them return?

Through the cross-scaling mechanisms, our results can be used to link landscape ecology and macroecology in terms of biodiversity dynamics, aiming to manage future and to assess past biodiversity changes.

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