05.06.2023.
“Modelēšanas instrumenti oglekļa aprites un siltumnīcefekta gāzu emisiju novērtēšanai serdes trupes bojātās lapu koku audzēs” (Nr. 1.1.1.1/21/A/063)

Rezultāti prezentēti starptautiskā zinātniskā konferencē

Latvijas Kokkopju – Arboristu biedrība, Latvijas mežzinātnes institūts “Silava” un a/s “Latvijas Valsts Meži” kopā organizēja starptautisku zinātnisku konferenci “Tree Conference Riga 2023”, kurā piedalījās pētnieki no Lielbritānijas, Francijas, Norvēģijas, Nīderlandes, Čehijas un Latvijas. Konferencē notika ar koku un mežaudžu izpēti saistītu rezultātu prezentēšana un ideju apmaiņa starp arboristiem, mežzinātniekiem, urbānistiem, pilsētu plānotājiem un mežu apsaimniekotājiem.

Projekta rezultāti, raksturojot trupes sastopamību lapu koku stumbros, to ietekmējošos faktorus un rezultājoš ietekmi uz oglekļa uzkrājumu, prezentēti divu atsevišķu stenda ziņojuma formātā:

1) The occurrence and effect of the stem rot on wood basic density in European aspen (Populus tremula)
2) Forests and water: effect on carbon storage

The occurrence and effect of the stem rot on wood basic density in European aspen (Populus tremula)

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When estimating the biomass and carbon stocks of aspen stands, it is assumed that all trees are healthy, without signs of damage. However, in reality, this is not the case, which means that the trunk biomass and, therefore, especially the carbon stock of trees is overestimated. The occurrence and distribution of stem rot in stands of different ages affect wood quality and value, however, this effect on stem biomass and thus also obtainable wood products had not been quantified before. Wood density is an important indicator that characterizes both wood strength and several deformation indicators, such as bending strength. Similarly, wood density data are also needed to determine significant changes in stem biomass and to characterize biomass under the influence of rot. Additionally, higher wood density always indicates higher carbon accumulation.

Material and Methods

The occurrence of decayed trees in aspen stands was determined by increment cores, sampling 4140 trees altogether across Latvia. For detailed inspection, the sample trees were selected with the resistograph Rinntech RESISTOGRAPH® R650. Each tree in a sample area of 500 m2 was drilled in three directions from the bark to the center, forming an imaginary equilateral triangle. If the presence of a rot was found, the tree was selected. Altogether 60 sample aspen trees from 8 stands were analyzed to characterize the distribution of the rot. Decayed tree trunks were divided into 1m long segments and trunk cross-section discs were obtained for characterizing the area occupied by the rot and its density. The wood density analysis was performed following the previously developed methodology (J. Liepiņš et al., 2017). Decayed wood is divided into two groups: 1) discolored wood - spots of a darker color begin to appear in the wood or it has already completely changed its original color; 2) spongy rot – there are obvious changes in the wood structure. When the decay of the wood is over, a cavity is formed.

Results

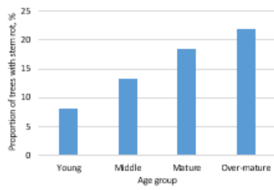
The proportion of aspen with stem rot was very variable between stands, significantly affected by tree age, and increased from 8.2% in young stands to 22.0 % in over-mature.

While searching for sample trees, the presence of spongy rot was detected in an average of 50.6% of growing trees, in individual plots the number of rotten trees ranged from 0% to 91%. About 32% of the affected trees had already formed a smaller or larger cavity. No significantly lower density was observed for discolored wood compared to undamaged wood, while the density of spongy rot has decreased almost twice. The length of the rot column in the affected aspen reached an average height of 19.4 m, while the diameter of it at stump height was 21.5 cm. Aspen has the lowest density in the middle part of the trunk. It is in this part of the trunk the rot most often develops primarily. Decayed aspens like this often develop aphids on the surface of the trunk, which produce spores and continue to infect other trees.

Conclusions

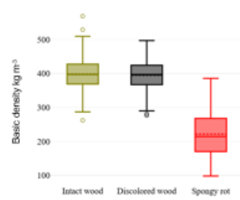
Our study quantified the significant variation of stem wood basic density for different types of decay within European aspen stems. The preliminary results of this study suggest that the decrease in wood density due to internal decay must be taken into account in the stem biomass calculations, especially in mature and over-mature stands, which is an important step in reducing the uncertainty in the estimation of forest biomass and carbon stocks.

As for the management – our study clearly demonstrates the need to shorten the rotation period to increase the outcome of valuable assortments and thereby maximize the carbon sequestration in wood products. Biodiversity maintenance needs to be ensured while leaving ecological trees and set-aside areas, not with longer rotation periods.



Occurrence of aspen trees with stem rot

Determining the prevalence of internal stem decay by the cross-section discs.



Mean basic density (kg m^{-3}) values for intact wood and two types of rot (decay).

IEGULDĪJUMS TAVĀ NĀKOTNĒ

Funding
This research was funded by ERDF project "Tool for assessment of carbon turnover and greenhouse gas fluxes in broadleaved tree stands with consideration of internal stem decay" (ERDF No. 1.1.1.1/21/A/063).

Forests and water: effect on carbon storage

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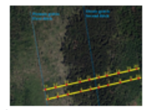
The increase of groundwater level (rewetting) is gaining popularity as a biodiversity enhancement measure across Europe. In Latvia large areas of wet forests on mineral and peat forests exists (10% and 11% of the total forest area, respectively), thus the additional benefit to biodiversity of such measure can be justified only in very specific cases. Aim of our study was to characterize the effect of rewetting on forest carbon stock and its potential in relation to the occurrence of stem rot.

Material and Methods

Transects of sample plots (500m²) were established perpendicular to a clogged ditch, where water flow was stopped by a beaver dam and not renewed due to nature protection goals and a functioning ditch. The site was characterized by deep organic soil.



The occurrence of decayed trees in birch stands with and without drainage systems (i.e. wet and drained) was determined by increment cores, sampling altogether 10542 trees across Latvia.

Results

The results show a significant ($p<0.05$) negative relationship between the distance from the functioning ditch and the accumulated carbon in living trees up to ~160 meters, and a positive relationship with the distance from the stopped ditch. Similar relationships were found in soil analysis – carbon storage in this component of the forest ecosystem was higher closer to the functioning ditch. In contrast, a higher amount of carbon in deadwood was present closer to the stopped ditch; however, it was insufficient to compensate for lost carbon in tree biomass and lower soil carbon storage.

The proportion of birches with stem rot increased significantly with age. The effect of growing conditions was significant, but notable only in older stands, where the proportion of affected trees was notably higher in wet forests than in drained or forests with normal moisture regime.

Conclusions

1. Discontinuation of the drainage system results in the collapse of the stand.

2. Decay of formed deadwood releases carbon in the atmosphere.

3. Stand decay coincides with carbon losses from soil and ground cover.

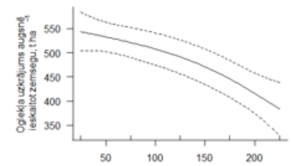
4. Maintenance of drainage systems is essential to ensure the positive effect of forests on climate change mitigation. Targeted biodiversity protection shall consider this aspect.

5. Elevated groundwater level leads to the increased share of birch with stem rot, especially in older stands, having a negative effect on carbon storage in biomass (in managed forests – also on storage in harvested wood products).

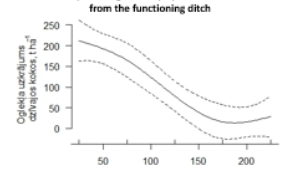
Nature Conservation Agency Republic of Latvia

Acknowledgement to Nature Conservation Agency Republic of Latvia for provision of research object in territory of Ķemeri National Park

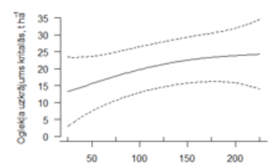
Cross-section discs of birch with stem rot



Carbon soil (including litter layer) in relation to distance from the functioning ditch



Carbon in tree biomass in relation to distance from the functioning ditch



Carbon deadwood in relation to distance from the functioning ditch

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