

► Project *brief*

Thünen Institute of Forest Ecosystems

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Advanced estimation of carbon storage in deadwood for the German greenhouse gas reporting

Katja Oehmichen¹, Steffen Herrmann¹, Steffi Dunger¹, Wolfgang Stümer¹

- A procedure for belowground sampling of dead coarse roots (≥ 2 cm) was developed and applied.
- For the first time, data on the belowground biomass of dead coarse roots could be collected for spruce, pine and beech.
- According to an exemplary extrapolation, belowground carbon storage in dead coarse roots is of similar magnitude as in aboveground deadwood.
- Regional values on deadwood density and carbon content for aboveground deadwood were collected.

Background and aims

The storage of carbon in deadwood and its change is an important part of the national climate reporting of forests. The inventory of greenhouse gas emissions also includes the deadwood pool, which covers standing and lying deadwood, dead roots and dead tree stumps. Currently, there are some shortcomings in the reporting of deadwood regarding the completeness and the level of detail. So far, it is not possible to report about dead coarse roots, since there is no existing data. When deriving the biomass from the deadwood volumes assessed in the forest inventories, data for different deadwood densities are used. There is potential for improvement in order to use country-specific data in the future. The aim of this project was the completion and the improvement of the greenhouse gas reporting of deadwood. The main focus was placed on the assessment and estimation of dead coarse roots.

Methods

In the first phase of the project, which included a comprehensive literature review, a methodological concept was developed. This was followed by the conception and planning of the deadwood inventory. For this purpose, a procedure for belowground sampling was developed within the framework of a field study. This included digging up the roots, measuring them, taking samples (Fig. 1) and conducting the laboratory analysis. The data collection and field work were carried out in the north-east of Brandenburg at various locations, while the laboratory preparation was carried out in Eberswalde. The C/N analysis was conducted in the central laboratory of the Thünen Institute in Braunschweig. Furthermore, country-specific, statistically validated wood densities and carbon contents were determined for above-

ground deadwood of selected tree species. Based on these new data, approaches for modelling estimators and functions for the biomass calculation of aboveground and belowground deadwood were developed. With these functions and the forest inventory data, an exemplary calculation and compilation of a deadwood inventory according to IPCC specifications was carried out for Germany.

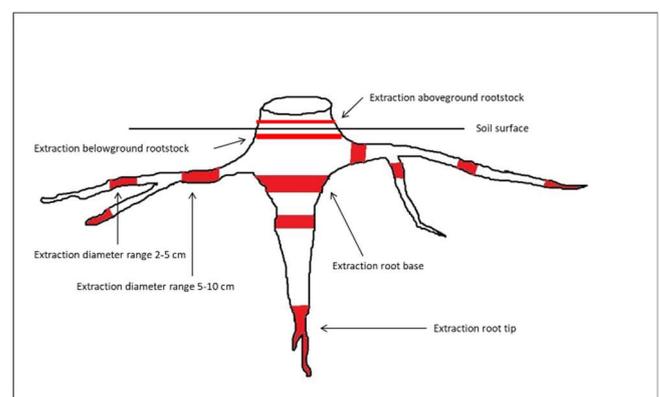


Figure 1: Measuring, weighing and sampling the rootstocks.

Results

After carrying out tests in the field for the indirect detection of dead coarse roots, a methodology for the direct survey of stumps and dead coarse roots was developed in the main part of this project, using beech as an example. This was followed by the practical implementation in the field, in which a total of fifteen rootstocks in north-eastern Brandenburg were excavated (see Fig. 2), sampled and analysed in the laboratory. With this, important practical experience was gained both with regard to the field phase of the root survey and with regard to the laboratory processing of the deadwood samples, and initial data on deadwood density and carbon content of dead coarse roots were collected (Table 1). Based on these data, a first estimate of the belowground carbon store in dead coarse roots was calculated. With this, an exemplary calculation and compilation of the deadwood inventory according to the specifications of the Intergovernmental Panel on Climate Change (IPCC) was carried out for Germany (Table 2).

The results from the literature analysis on deadwood density and carbon content in relation to decay class could be confirmed at a regional level. This was done by sampling aboveground deadwood at selected sites in Brandenburg and Thuringia using a methodology that was developed for this purpose. With this, important experience was gained related to the methodology and challenges of assessing the aboveground deadwood density of beech, oak and pine.

Table 1: Mean basic density and remaining mass of rootstocks of European beech and Norway spruce in relation to decay class (DC).

DC	Basic density (g cm ⁻³)		Remaining mass (%)	
	Beech	Spruce	Beech	Spruce
1	0.54	0.407	100	100
2	0.344	0.364	70	50
3	0.228	0.244	25	27
4	0.181	0.208	11	9

Table 2: Deadwood stock above- and belowground in 2012 and 2017 and its change.

Deadwood	Stock 2012 [tC/ha]	Stock 2017 [tC/ha]	Change 2012- 2017[C/ha*a]
Aboveground	2.701	3.086	0.077
Belowground	2.300	2.709	0.082

Outlook

So far, no comparable study is known in Central Europe in which an attempt was made to directly inventory the biomass and estimate the carbon storage of dead coarse roots. The data collected here are currently the only data of this kind available. However, this study should be extended to a larger sample size and more sites in the future. Only then can the representativeness and the range of variation of the results obtained here be assessed. This is a prerequisite for incorporating the carbon balance of dead coarse roots into the national climate reporting.



Figure 2: Excavated rootstocks of beech (left) and spruce (right) in decay classes 1 to 4 (from top to bottom, assessed aboveground).

Further information

Contact

¹ Thünen-Institute of Forest Ecosystems
katja.oehmichen@thuenen.de
www.thuenen.de/en

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Publications

Herrmann S, Dunger S, Stümer W, Oehmichen K. (2022): Verbesserung der Schätzung der Totholz-Kohlenstoffvorräte für die deutsche Treibhausgasberichterstattung: Schlussbericht zum Vorhaben 22WC413601, 2022,

Eberswalde. 86 Seiten, 10,2 MB,
<https://doi.org/10.2314/KXP:1812854994>

Oehmichen K, Herrmann S, Röhling S, Stümer W 2020: Totholz-Kohlenstoffvorräte im Wald besser erfassen. AFZ-Der Wald 10, 10-12

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