Impact of Improvement Felling on Soil Carbon Content in Commercial Forest Stands (Norway Spruce Monoculture)

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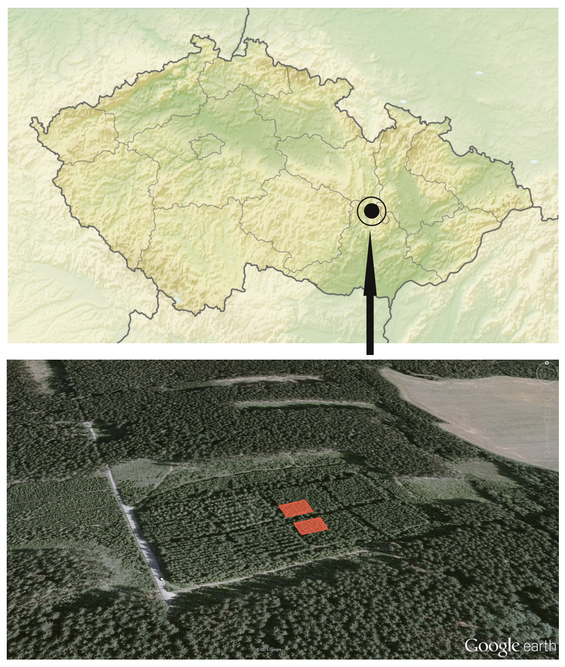
The objective of this study was to analyze and compare soil respiration during the 2010 and 2011 vegetation seasons in a Norway spruce plantation. The research plots are located in the Drahanská vrchovina highlands. In the Czech Republic, optimum conditions for cultivation of Norway spruce stands are found here. Measured soil respiration data and other soil characteristics were evaluated in young monoculture stands subjected to different kinds of forestry management. In spring 2010, we carried out two kinds of thinning of: 1/ subdominant trees in one stand; 2/ dominant trees in the other stand.

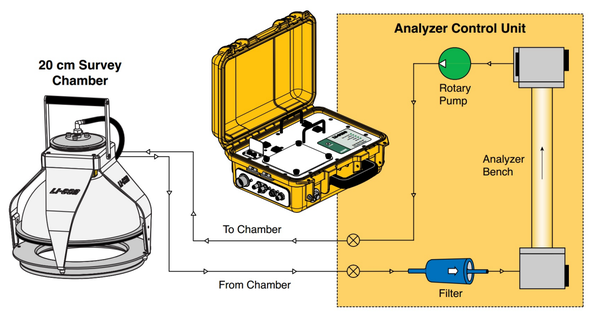
Plots	Stands structure [%]	Age [years]	Plots area [m]	planting/present density of tree[†] [number.ha^{-1}]	Forest Typology[†††]	Soil type[††]	A.S.L. [m]	Rainfall [mm]	Temp. [°C]
(1)	*Picea abies (L.) Karst.* 100	32	25 x 25	2000 / 1568	5S1–*Abieto-Fagetum mesotrophicum* with *Oxalis acetosella*	Cambisols (CM)	632	717	6.5
(2)	*Picea abies (L.) Karst.* 100	32		2000 / 1888					

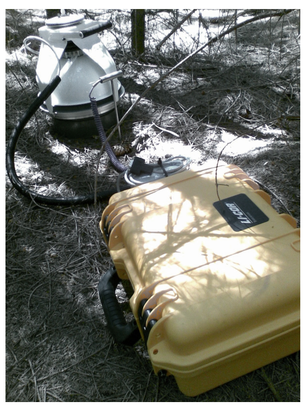
[†]Knott, R., *ÚEL, LDF, Mendelu Brno, unpublished;* [††]*World Reference Base for Soil Resources 2006;* [†††]*VIEWEGH ET AL. 2003*

Description of the research plots with subdominant thinning (1) and dominant thinning (2) plots.



The soil CO2 flux was measured using the portable infrared gasometric analyzer (IRGA) Li8100 (Li-Cor, U.S.) and chambers with diameter 20 cm. Measurements were carried out in 17 permanently installed rings evenly placed in both stands over a 14-day cycle during the vegetation season of 2010 and 2011.





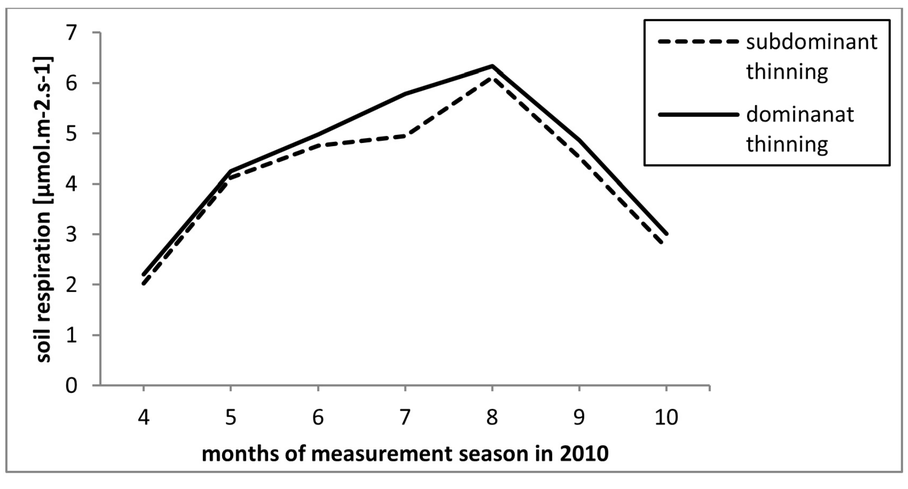
Infrared Gas Analyzer
Measurement Principle: Non-Dispersive Infrared
Traceability: Traceable to WMO standardsforCO2.
NIST traceable LI-610 Portable Dew PointGenerator for H2O

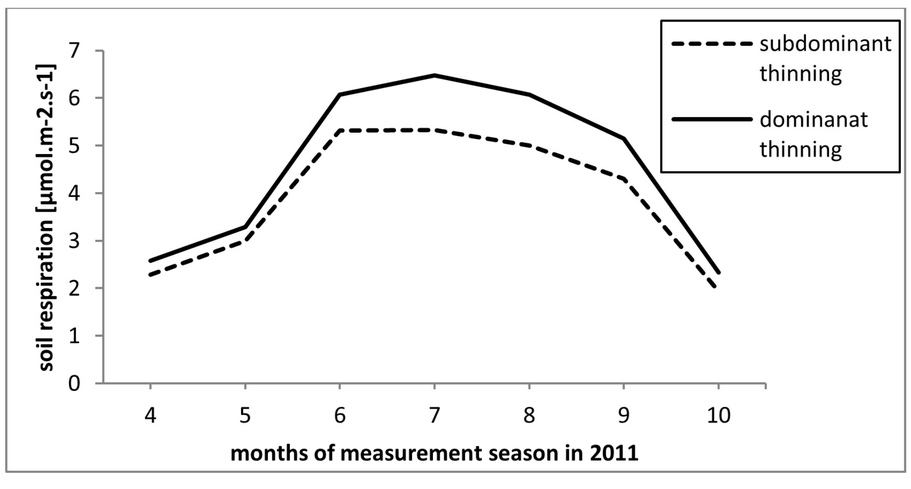
CO2
Measurement Range: 0-3000 ppm
Accuracy: 1.5% of reading
Calibration Drift
Drift at ppm: <0.15 ppm/°C
Span Drift: < 0.03 %/°C
Total Driftat370 ppm: <0.4 ppm/°C
RMS Noise at 370 ppm with 1 sec signal averaging: <1 ppm
Sensitivity to water vapor: < 0.1 ppm CO2/mmol/mol H2O

year	plots/months	4.	5.	6.	7.	8.	9.	10.	avr.	sum
2010	subdominant thinning	0.6	1.3	1.5	1.5	1.9	1.4	0.8	1.3	9.1
	dominant thinning	0.7	1.3	1.5	2.0	2.0	1.6	0.9	1.4	10.0
2011	subdominant thinning	0.7	0.9	1.7	1.7	1.8	1.3	0.6	1.2	8.7
	dominant thinning	0.8	1.0	1.9	2.0	2.2	1.7	0.7	1.5	10.3

Amount of C (carbon) [t.ha^{-1}.month^{-1}] released from forest floor and soil in monitored stands in individual months during vegetation season 2010 and 2011. In column 'avr.' is shown month average [t.ha^{-1}.month^{-1}] and under 'sum' is count from all months [t.ha^{-1}.year^{-1}].

Forest management has a long tradition (since the beginning of 20th century) in Bohemian. At the time of industrial development, forest management has become imperative to maintain forests as a source of wood. Quality of planting and cultivation system of forests (mainly allochtonous stands of Norway spruce) were necessary. In context of global climate change and regional environmental disturbances is needed verification and modification of forest management, at present. We tried to evaluate the influence of two kinds of thinning on important part of carbon cycle in young spruce forest stand – CO2 flux from the soil.





The results showed that in forest stand after thinning in dominant trees was released significantly higher amount of carbon from the soil profile. After the determination of R_{10} (respiration at soil temperatures 10 °C), was found the opposite result – more CO_2 was released in stand after thinning of subdominant trees. It is obvious that relevant influence has changed the temperature regime in the forest stand with thinning in dominant trees.

Acknowledgements

COST OC 09006 Carbon cycle of spruce stands - effects of silviculture as a tool for global change impact mitigation and adaptation

IGA LDF 26/2010 Influence of density in the young, allochtonous Norway spruce stands on the selected soil properties (form and stock of forest floor, pH, temperature, humidity, CO2 flux)

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