



## Willows strongly emit methane (CH<sub>4</sub>) during dormant season

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Wetlands are considered to be a substantial natural source of methane (CH<sub>4</sub>), due to CH<sub>4</sub> production by methanogens in flooded soil. Trees, especially wetland tree species possessing an aerenchyma system in roots, are known to emit CH<sub>4</sub> into the atmosphere. However, information about the seasonal dynamics of tree CH<sub>4</sub> emissions is rare.

We determined CH<sub>4</sub> emissions from stems of mature willow trees (*Salix pentandra*, *S. fragilis*) in wetlands from March 2014 to September 2015. We aimed to investigate the seasonal changes of CH<sub>4</sub> emissions within the soil-tree-atmosphere continuum and the impact of environmental parameters on these emissions. An intensive campaign investigating vertical profile of CH<sub>4</sub> emissions in stems was performed in May 2016.

The measurements were performed in sedge-grass marsh surrounding the ecosystem station Wet Meadows in South Bohemia, Czech Republic (49°01'30"N, 14°46'20"E), with scattered willow trees. Emissions of CH<sub>4</sub> were determined from stems and adjacent soil each month using static chamber systems and laser analyses.

Our study revealed that all trees studied consistently emitted CH<sub>4</sub> from their stems over the whole year. The CH<sub>4</sub> emissions were significantly higher in *S. fragilis* (up to 14.2 mg CH<sub>4</sub> m<sup>-2</sup> stem area h<sup>-1</sup>) than in *S. pentandra* (up to 1.03 mg CH<sub>4</sub> m<sup>-2</sup> h<sup>-1</sup>), and dramatically decreased within first 1.5 m of stem height with highest emissions detected close to the soil surface. Even though the CO<sub>2</sub> exchange of willow stems, as an indicator of their physiological activity, showed strong seasonality typical for tree species of temperate zone (high CO<sub>2</sub> emissions during vegetation season followed by low, but still detectable emissions in dormant season), the stems emitted CH<sub>4</sub> in an opposite pattern. The CH<sub>4</sub> emissions were the lowest in summer months (from June until August/September) and dramatically increased from September onwards and remained very high and almost constant until May. The soil even deposited CH<sub>4</sub> from the atmosphere from June until August/September, and emitted CH<sub>4</sub> during the rest of the year with highest emissions at the beginning and end of vegetation seasons. We assume that CH<sub>4</sub> is "passively" taken up by tree roots in the deep soil layers, transported via aerenchyma system to the bottom part of stems and released into the atmosphere independently on the physiological activity of the trees. Ongoing regression analyses with environmental/micrometeorological parameters will clarify the aspects of the unique and very strong emissions of CH<sub>4</sub> from the willow trees in winter time.

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