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Xylem anatomical responses of Vaccinium myrtillus exposed to air CO_2 enrichment and soil warming at treeline

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Plant life at treeline is limited by harsh growth conditions. In this study we used nine years of free air CO_2 enrichment (+200 ppm from 2001 to 2009) and six years of soil warming (+4 °C from 2007 to 2012) at a treeline experimental site in the Swiss Alps to investigate xylem anatomical responses of Vaccinium myrtillus, a co-dominant dwarf shrub in many treeline communities. Our aim was to identify whether the release from limiting growth conditions induced adjustments of the water conductive and storage tissues.

High-resolution images of wood anatomical microsections from the stem base of 40 individuals were captured with a digital camera mounted on a microscope. We used the specialized image analysis tool ROXAS to quantify size, density, grouping patterns, and potential hydraulic conductivity of vessels. In addition, we measured the abundance and distribution of ray parenchyma.

Our preliminary results show that CO_2 enrichment and soil warming induced contrasting anatomical responses. In the last years of the CO_2 enhancement vessels were larger, whereas soil warming induced an immediate reduction of vessel size. Moreover, larger vessels were found when V. myrtillus was in cohabitation with pine as opposed to larch. Results for ray parenchyma measurements did not show clear trends, although warming seemed to have a slightly positive effect on the fraction of uniseriate vs. multiseriate rays. These results suggest that release from the growth limiting factors can result in contrasting and partially lagged responses in the hydraulic system with little impact on the storage tissues. In addition, the overstory species seem to play a key role on the anatomy of V. myrtillus at treeline.