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Comparison of two plant water extraction methods for isotopic analysis: Scholander-type pressure chamber vs cryogenic extraction

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Stable water isotopes have been widely applied to quantify the movement of water through the environment. Of particular interest are the sources of water used by plants. Multiple approaches have been employed to extract plant water yet there are few direct comparisons of these methods. Particularly, differences may arise between methods that sample different portions of water within the plant tissue. Here we compare two water extraction methods: cryogenic distillation, which extracts all water from plant tissues, and a Scholander-type pressure chamber, which extracts water from xylem tissue.

Scholander-type pressure chambers are typically used to determine leaf and stem pressure. Here, we used the pressure chamber to force water out of xylem tissue for collection and subsequent isotopic analysis. We sampled the xylem water of five individuals from four tree species (apple, alder, beech, and chestnut) using the pressure chamber and simultaneously procured, from the same trees, leaf and stem samples (bark removed and bark intact) for cryogenic distillation. The trees were located within three field sites reflecting a range of land use, moisture state and landscape position in northern Italy: an irrigated apple orchard, a restored riparian floodplain in an Alpine valley, and a forested, pre-alpine, headwater catchment. Extracted water from both cryogenic distillation and pressure chamber methods were analyzed using mass spectrometry to determine the composition of δD and δ^{18}O. Results from ongoing isotopic analysis will be used to quantify the magnitude of difference, and statistical significance, between the two methods as well as across tree species, moisture state and landscape position.