# Where does the water come from?

# Variations in soil water uptake depth in a beech forest during the 2018 drought

**Arthur Gessler**[1,2], Lukas Bächli[1], Kerstin Treydte[1], Matthias Saurer[1], Matthias Häni[1], Roman Zweifel[1], Andreas Rigling[1,2], Marcus Schaub[1], Stefan Seeger[3], Barbara Herbstritt[3], Markus Weiler[3], Katrin Meusburger[1]

[1]Swiss Federal Research Institute WSL, Birmensdorf, Switzerland

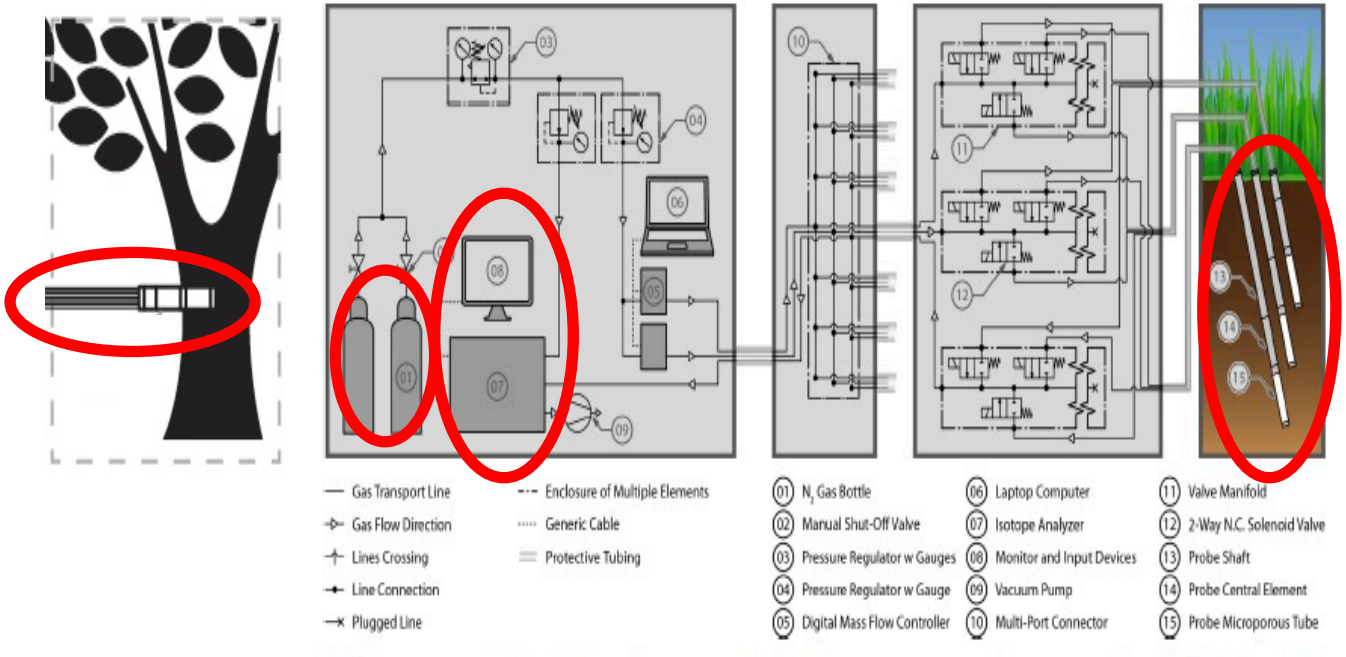
[2]ETH Zurich, Zurich, Switzerland

[3]University of Freiburg, Freiburg, Germany

# Background

- Current climate projections predict an **increasing variability of precipitation** and thus a higher frequency of **droughts** alternating with **extreme precipitation** events.
- **Reduced water** availability is the most critical driver for **tree mortality** and impairment of trees' functions.
- Under **variable water supply**, both the ability of a plant species to **utilize remaining water** under drought and to **immediately capitalize on soil rewetting** from subsequent rainfall events will be crucial for its survival and competitiveness.

# Methodology



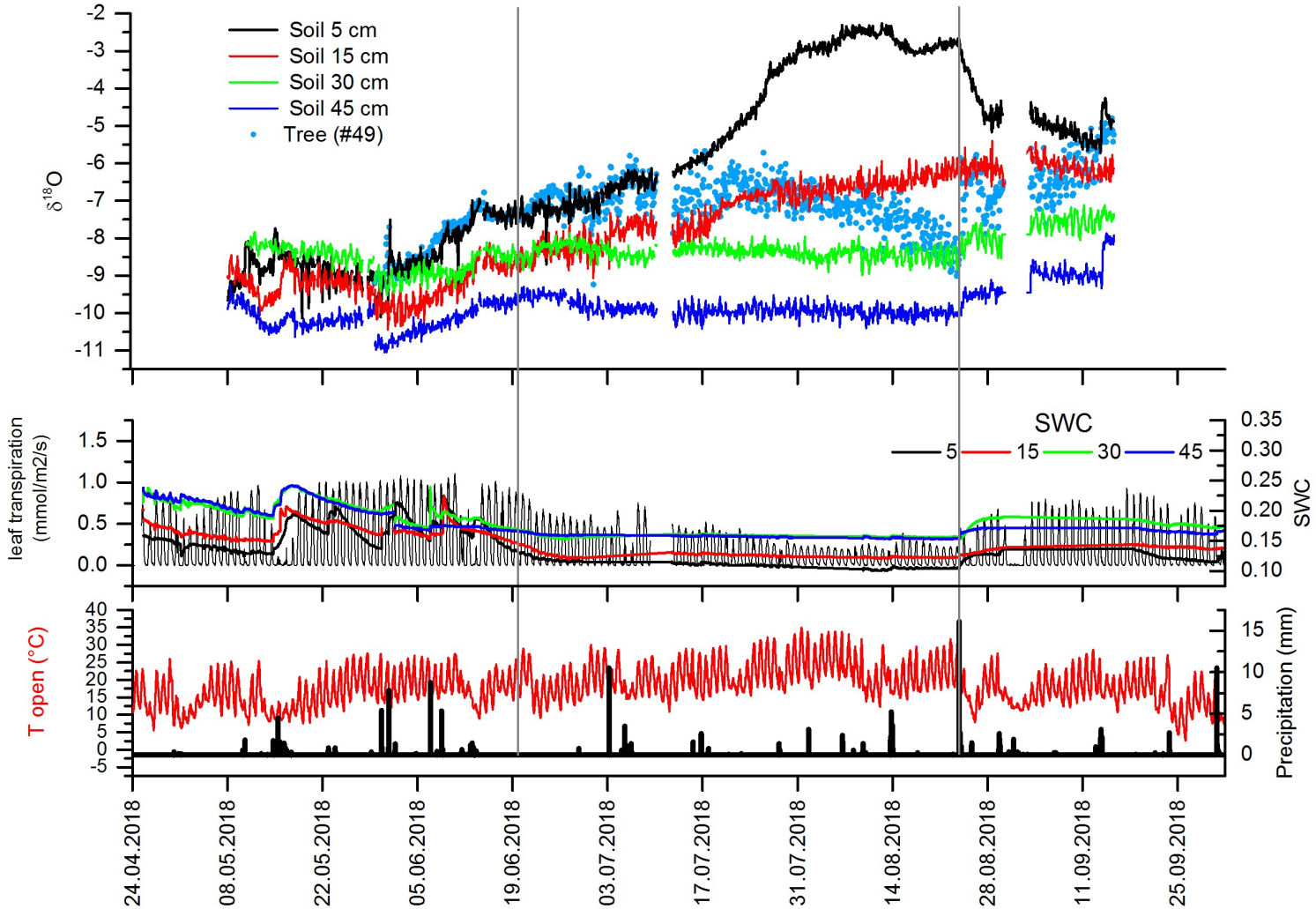

**Volkmann THM, Haberer K, Gessler A, Weiler M. 2016a.** High-resolution isotope measurements resolve rapid ecohydrological dynamics at the soil–plant interface. *The New phytologist* **210**: 839-849.

**Volkmann THM, Kühnhammer K, Herbstritt B, Gessler A, Weiler M. 2016b.** A method for in situ monitoring of the isotope composition of tree xylem water using laser

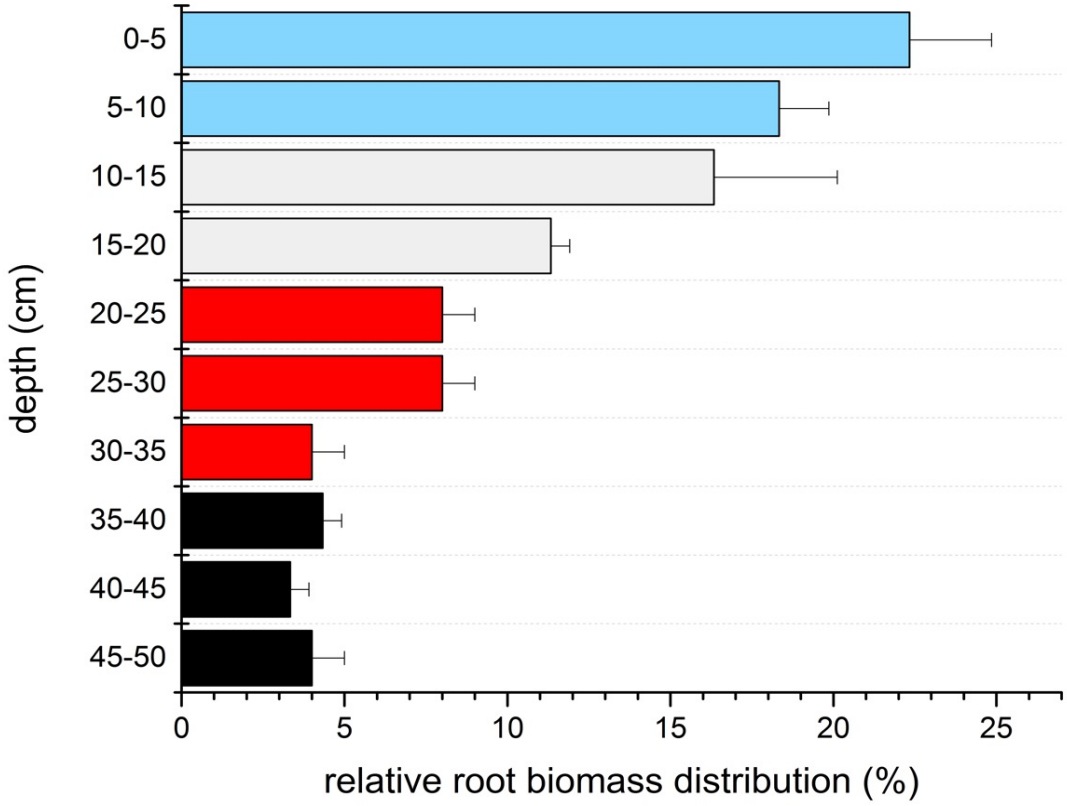
$^{18}O$ in soil water and tree xylem

Transpiration and soil water content

Meteorological parameters



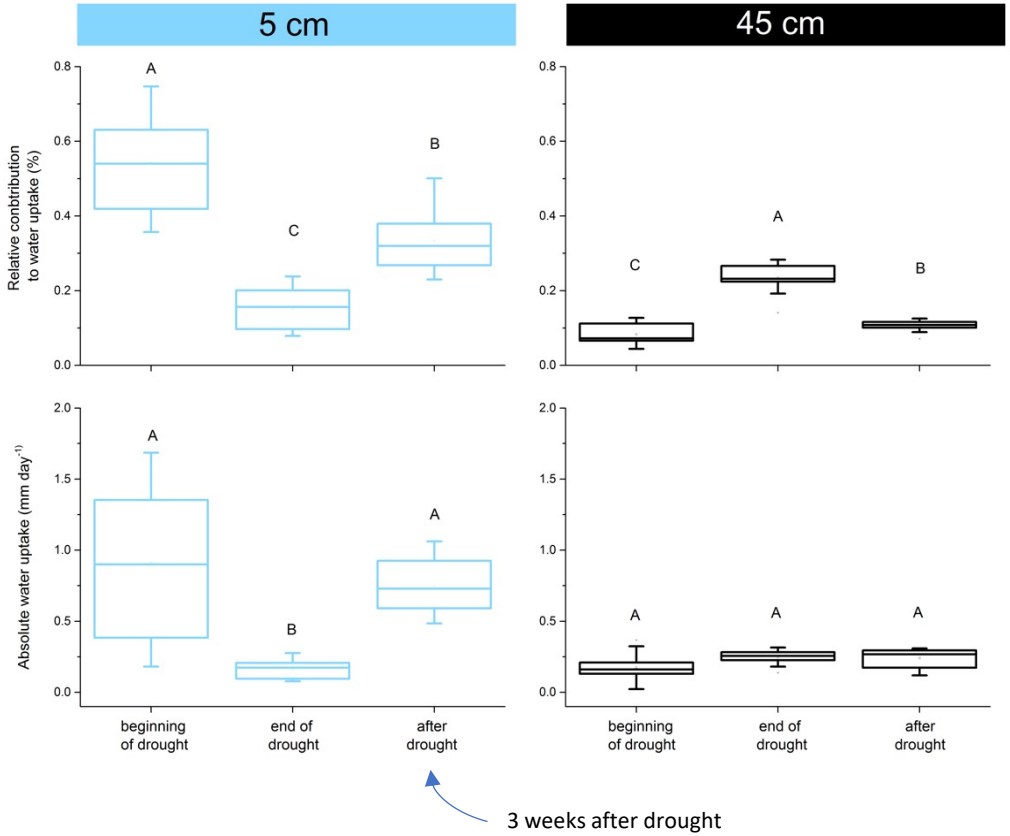
Root biomass distribution over the soil horizon



***Weekly values***

Relative uptake

Absolute uptake




3 weeks after drought

# Conclusions

- Beech trees (at our site) **are not able** to shift water uptake to **deeper layers** quantitatively
- Deep water sources seem to be a more or less **constant reserve** and their exploitation might be limited by root distribution
- **Fast recovery** of water use from shallower layers after drought