Università degli Studi di Padova | TESAF

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5th Xylem International Meeting

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THE LESSON LEARNT FROM TWO LONG-TERM PRECIPITATION EXCLUSION EXPERIMENTS: HOW INTENSITY AND DURATION OF DROUGHT MAY INFLUENCE XYLEM AND PHLOEM PLASTICITY

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MATERIALS AND METHODS

- 2m long apical branches.
- Segments of apical branches taken at different distances from the branch apex.
- Wood cores extracted from the stem at breast height.
- Samples are cut with a rotary microtome at ~10 µm.
- Wood sections are stained with a mixture of saphranine and Astrablue.
- Image analysis of wood sections is performed with ROXAS software.

- **Wood cores -> ~6M cells analyzed**
- **Branches -> ~1.5M cells analyzed**

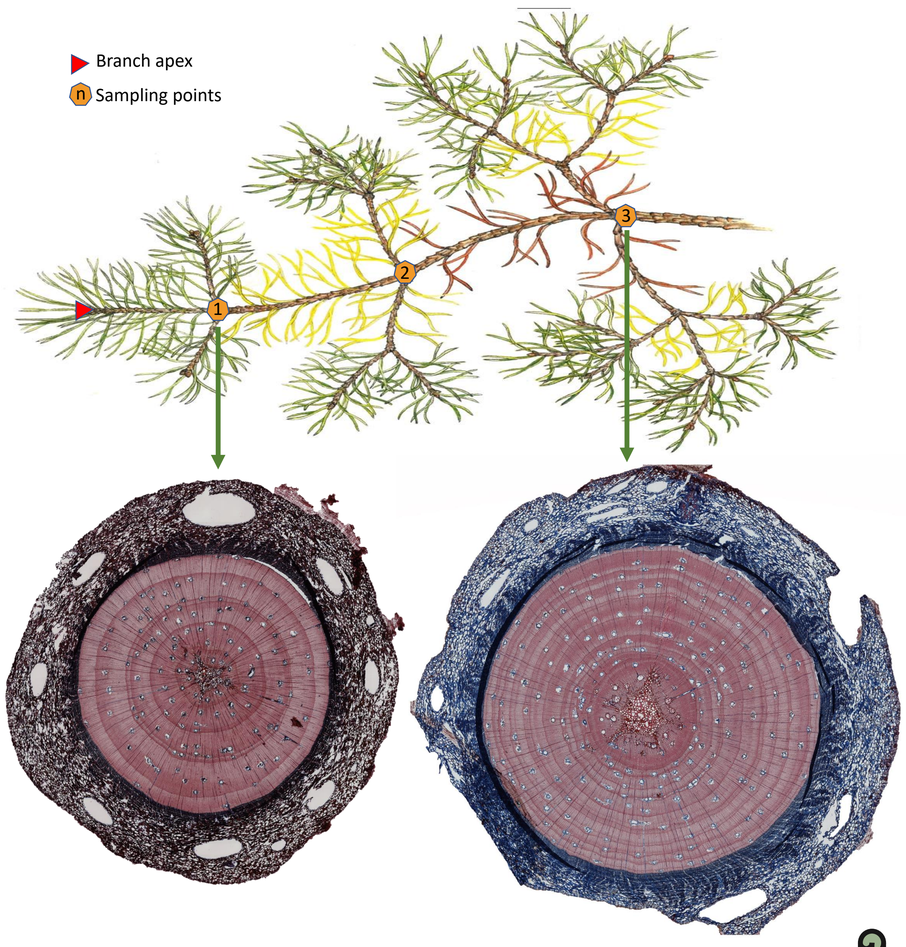


Fig.1 Anatomical sampling carried out at different distances from the branch apex

EXPERIMENTAL SITES

1) KROOF

- "Kranzberg Roof Project" (KROOF) in Bavaria
- **2 species** -> Norway spruce (*Picea abies* Karst.) and beech (*Fagus sylvatica* L.)
- **2 treatments**:

CO -> Control

TE -> Throughfall Excluded 5 years -70%

2) SEV-LTER

- Sevilleta Long Term Ecological Research (SEV-LTER) in New Mexico (USA)
- **1 species** -> Piñon Pine (*Pinus edulis* Engelm.)
- **4 treatments**:

CO -> Control

Legacy -> -50%rain 12 years

New50 -> -50%rain 1 year

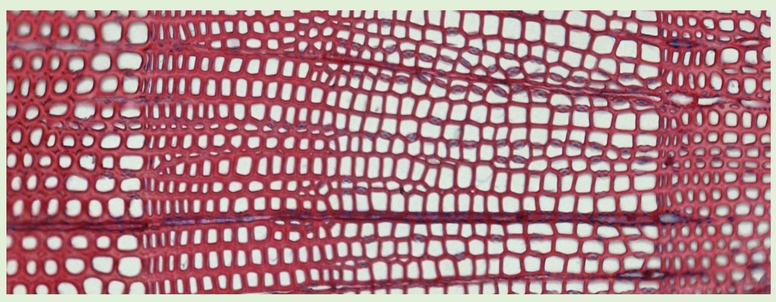
New90 -> -90%rain 1 year

RESULTS AND DISCUSSION

XYLEM & PHLOEM

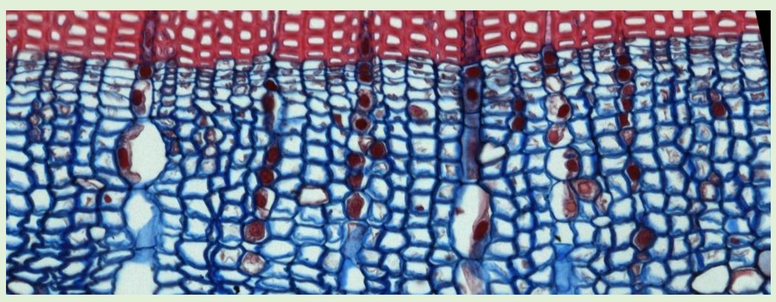
EXP. SITES

XYLEM



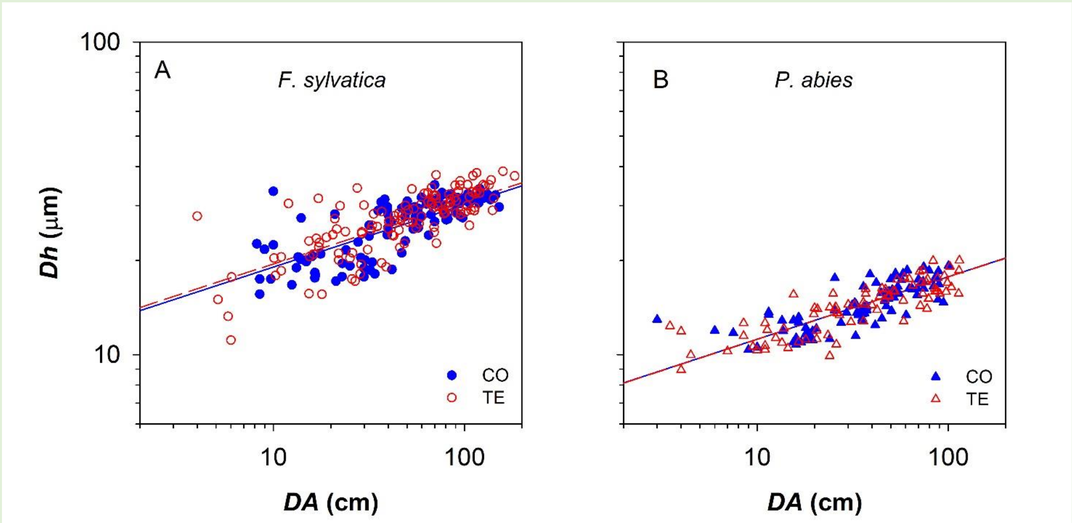
- The overall trend for xylem diameter in the last decade shows no difference between legacy and control in KROOF and SEV-LTER.
- In 2020 there is a slight significant increase in tracheid lumen area in Sevilleta for Legacy and New90 treatments.
- Clear axial pattern (lumen area) for different species and treatments

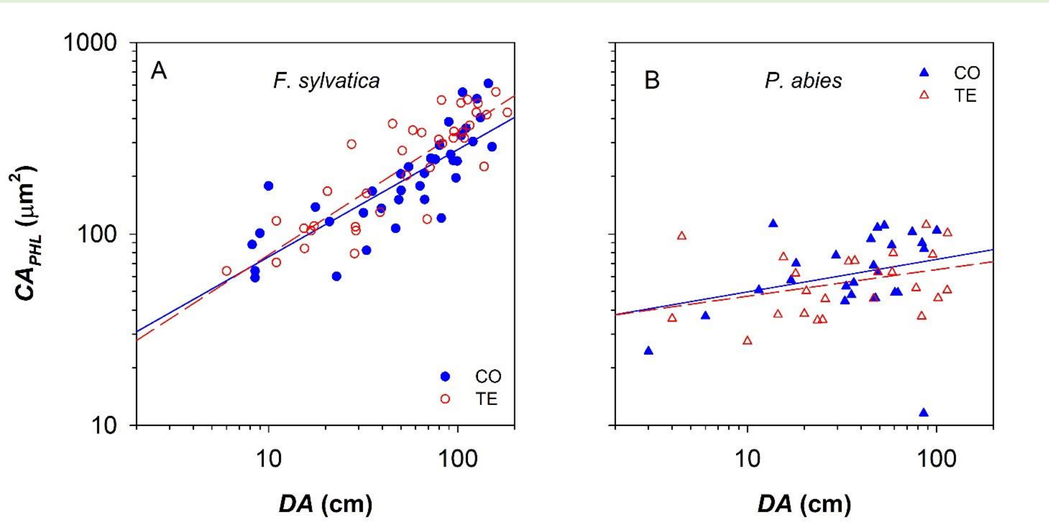
PHLOEM



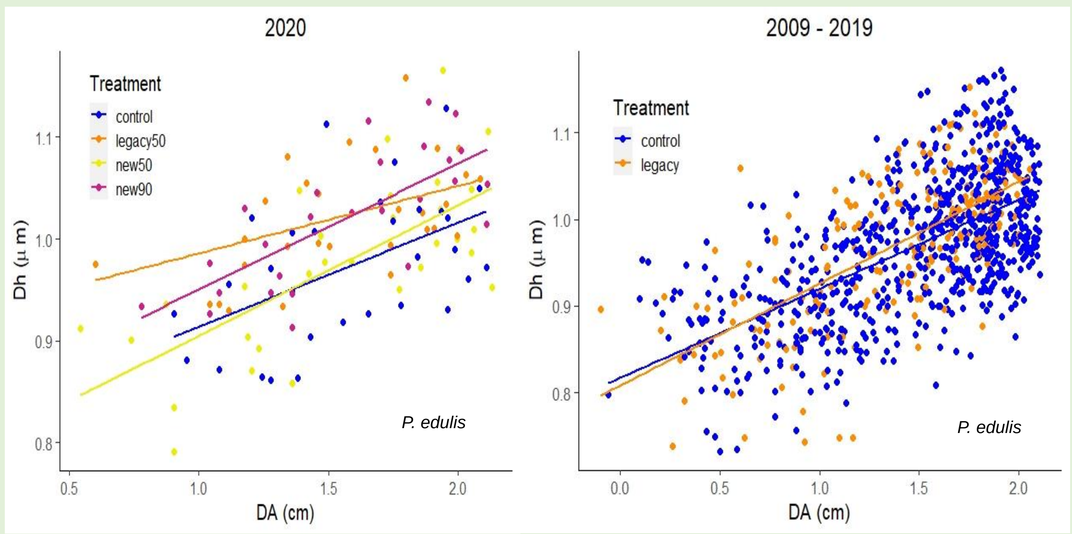
- Phloem sieve elements increased in lumen area (CA_{PHL}) and perimeter (PHL) axially with increasing DA.
- Beech and Spruce (KROOF) show no significant changes.
- In Sevilleta there is a clear and significant treatment effect: extreme stress (new90) has larger phloem elements while mild stress (new50) produced smaller sieve elements.

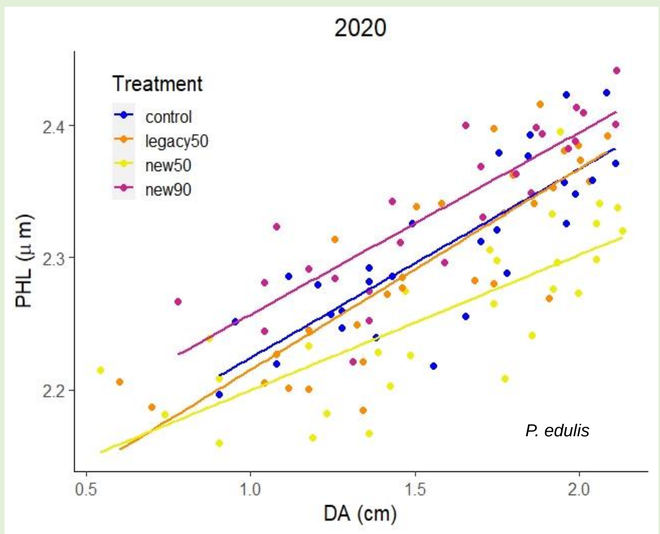
KROOF





SEV LTER





These results confirm the clear axial scaling of conductive elements. Therefore, it is necessary to sample at different distances from the apex when carrying out anatomical studies. Our data show that intensity and duration of drought may influence anatomical responses in standing vegetation towards an increased efficiency in extreme-drought scenarios.