P.halepensis primary growth response to drought in a long-term rainfall exclusion experiment

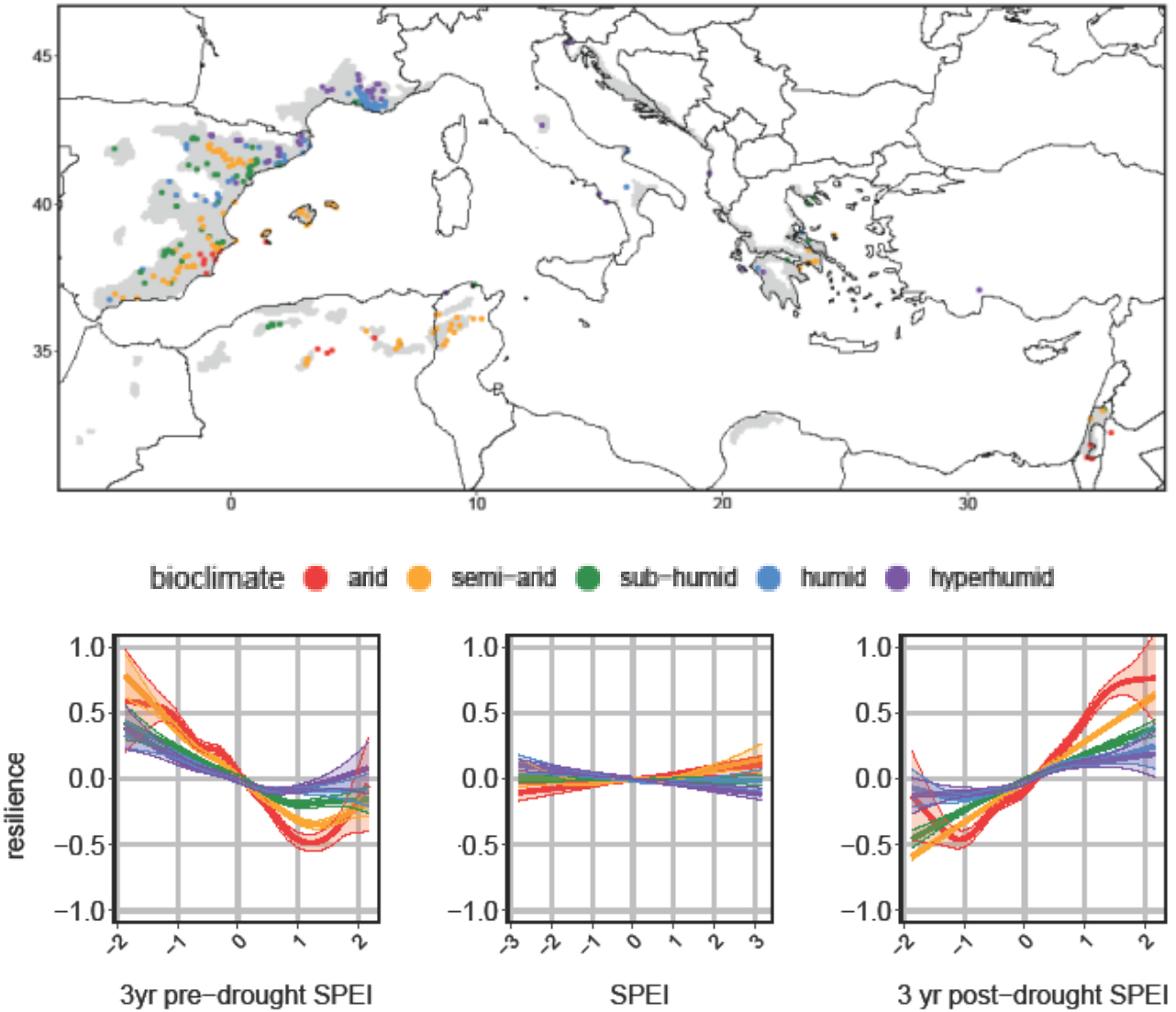
Veuillen Léa, Prévosto Bernard, Cailleret Maxime, Lopez Jean-Michel, Audouard Mathieu, Vennetier Michel

INRAE, Aix-Marseille Univ, RECOVER, Aix-en-Provence, France

lea.veuillen@inrae.fr

Context

- ✓ *P. halepensis* radial growth response to drought well studied



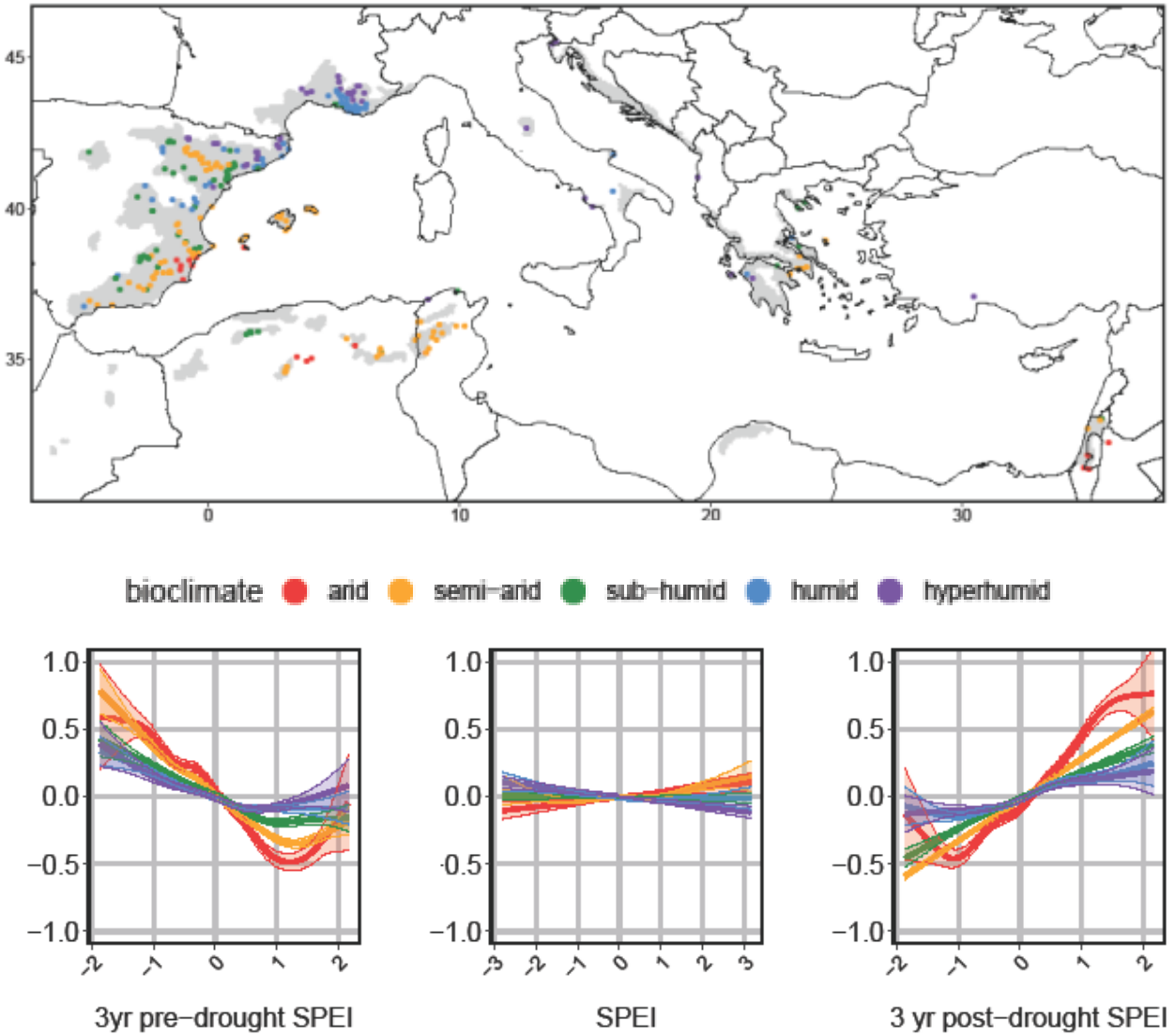
(Veuillen et al, in prep.)

Context

- ✓ *P. halepensis* radial growth response to drought well studied

- ✓ Primary growth and phenology response still unclear

➔ **Objectives** : Assess the sensitivity to drought of different traits of the species primary growth and its phenology



(Veuillen et al, in prep.)

Material and methods

Study site : **Font-blanche, south of France**

14,2°C

701mm
[371-1088mm]

(means 2008-2021, Fontblanche weather station)

Material and methods

Study site : **Font-blanche, south of France**

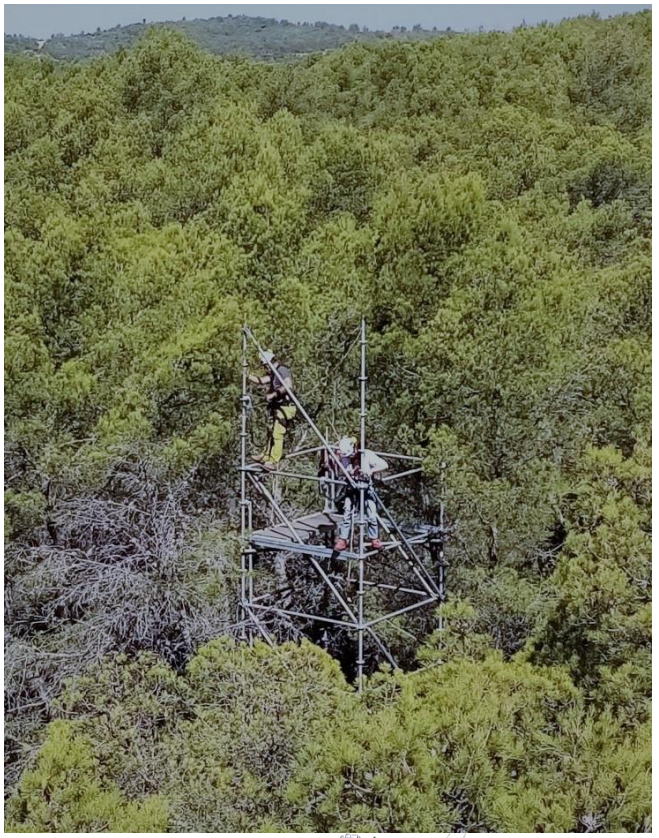
Aridity gradient

Irrigation	Control	Rainfall exclusion -30% precipitations
		
2009-2010 ; 2021-…		2009-2022

Material and methods

Monthly primary growth monitoring

- ✓ 2008-now
- ✓ **245 twigs** (671 since 2008)
- ✓ Today 3 trees in exclusion and irrigation, 6 in control



Monitoring of

- ✓ Shoot & leaf development stages and elongation
- ✓ Number of yearly growth units
- ✓ Ramification
- ✓ Flowering and Fruiting

Material and methods

Analysed leaf and shoot traits

4 leaf traits

- Out
- Senescence
- Longevity

DOY

- Length

mm

4 shoot traits

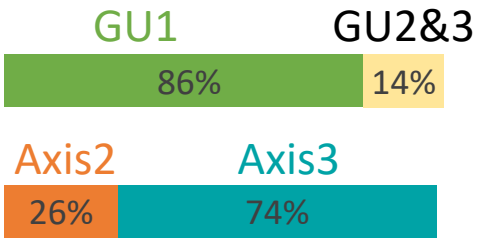
- Beginning of elongation — DOY
- Final growth unit length — mm
- Polycyclism
- Ramification

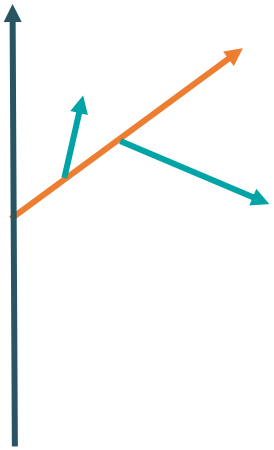
%

Sampling

✓ First growth unit (except for polycyclism)

✓ Third axis





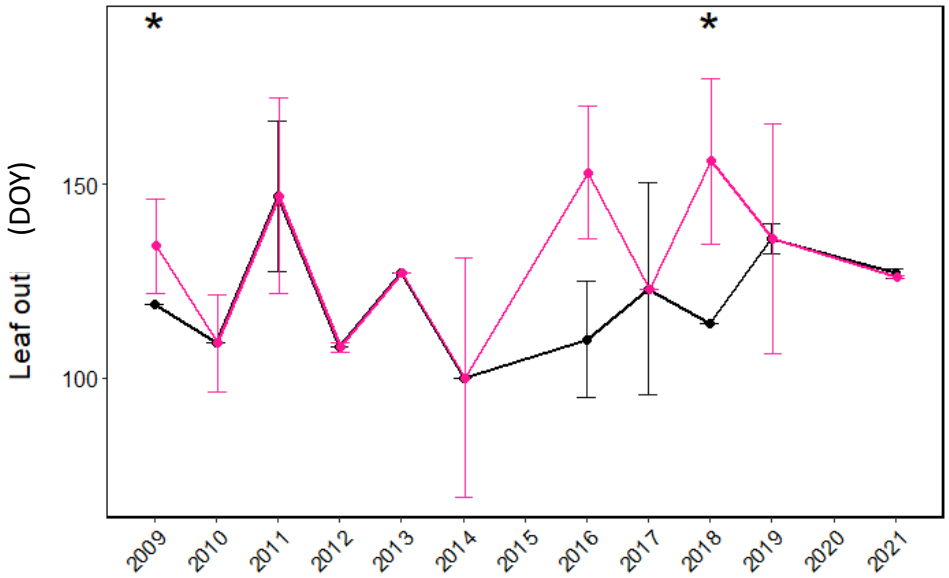
Analysis

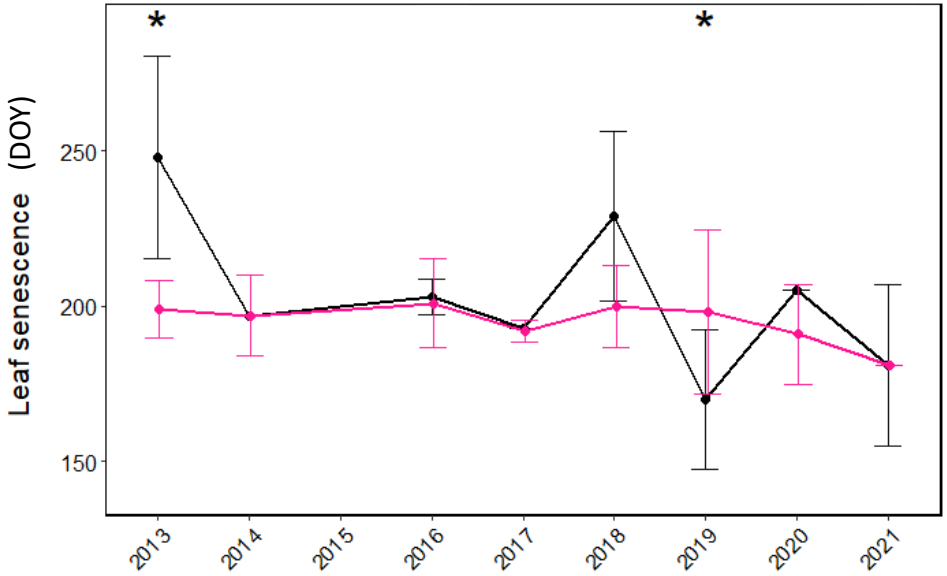
✓ Year by year comparison between treatments

Results

Leaf traits (1) : leaf out & senescence

Control
Exclusion



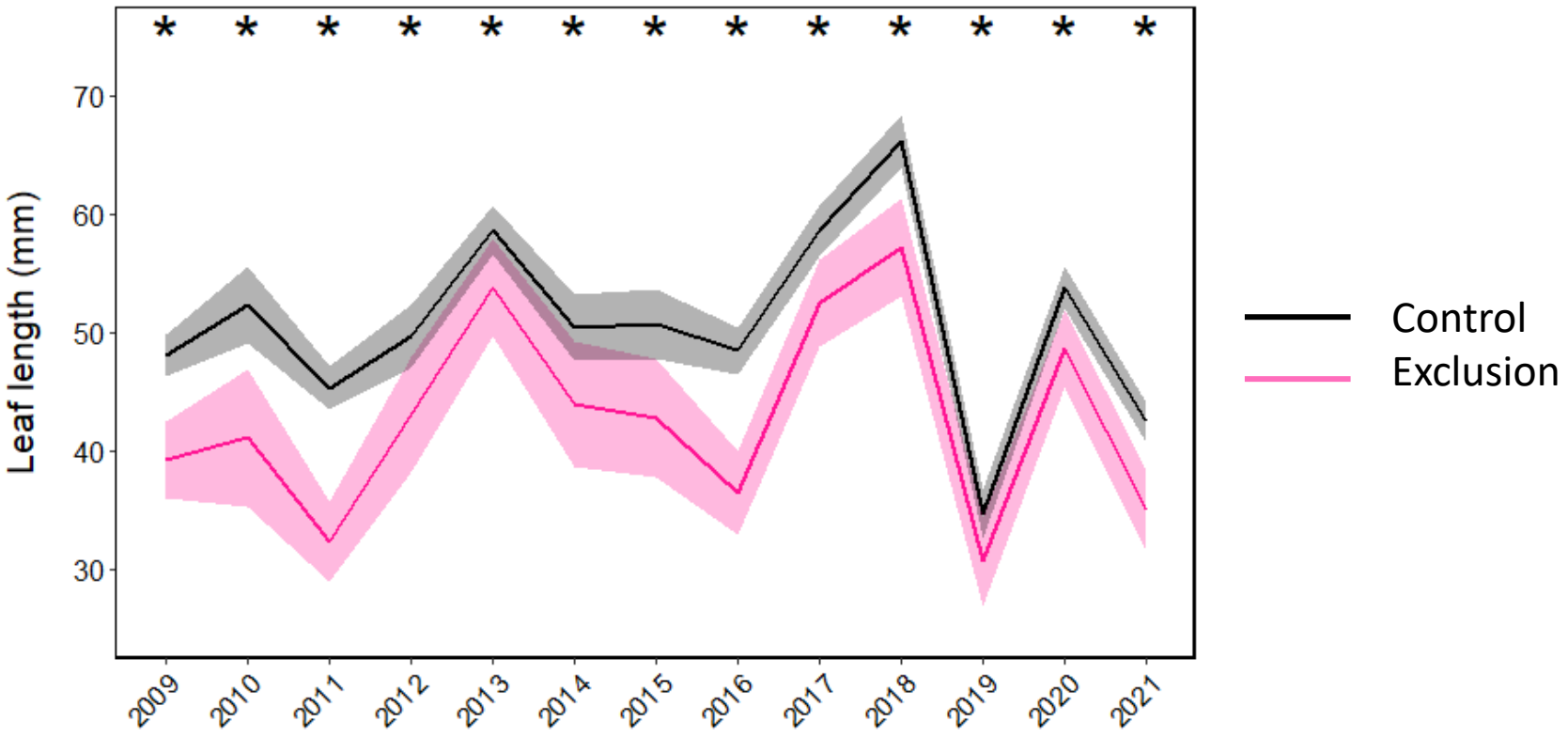


- No consistent difference between treatments
- No temporal trend

- Leaf out & senescence more related to temperature than water avaibility (Morin, 2010)
- 1 measure / month not enough to detect properly phenological shifts ?

Results

Leaf traits (2) : leaf length

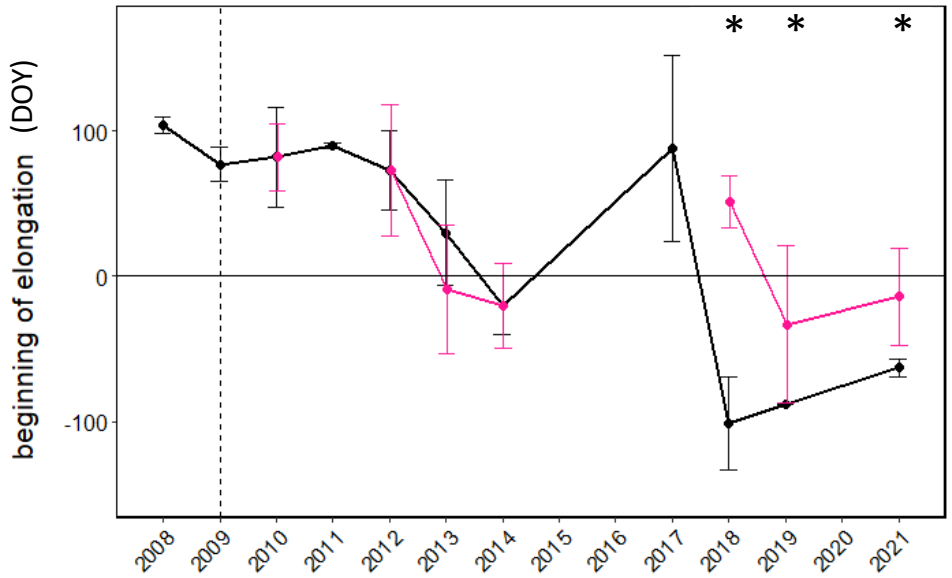


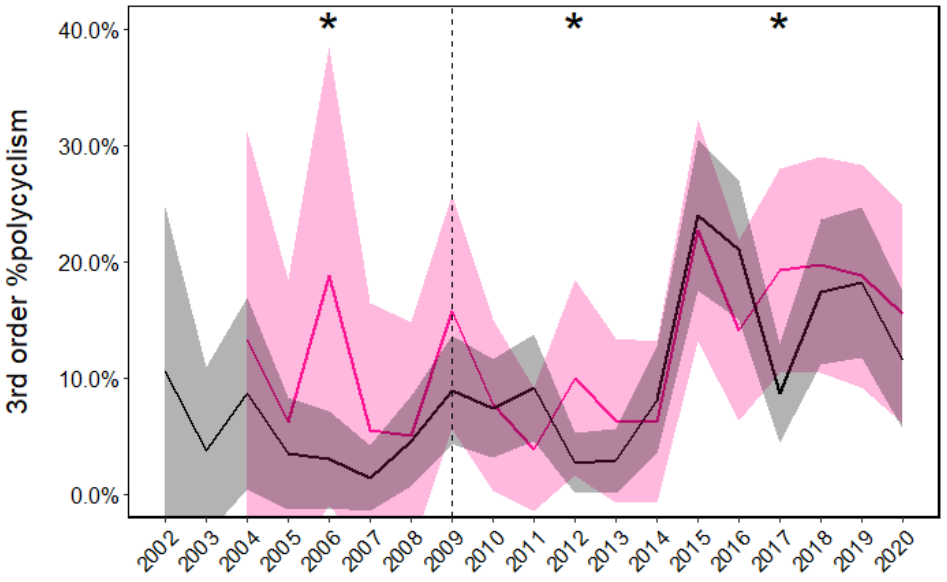
- Consistent and clear difference between treatments (mean -15,4%)
- No long-term trend but strong inter-annual variability
- Diminution of leaf area ➔ less transpiration & photosynthesis

Results

Shoot traits (1) : beginning of elongation & polycyclism

Control
Exclusion

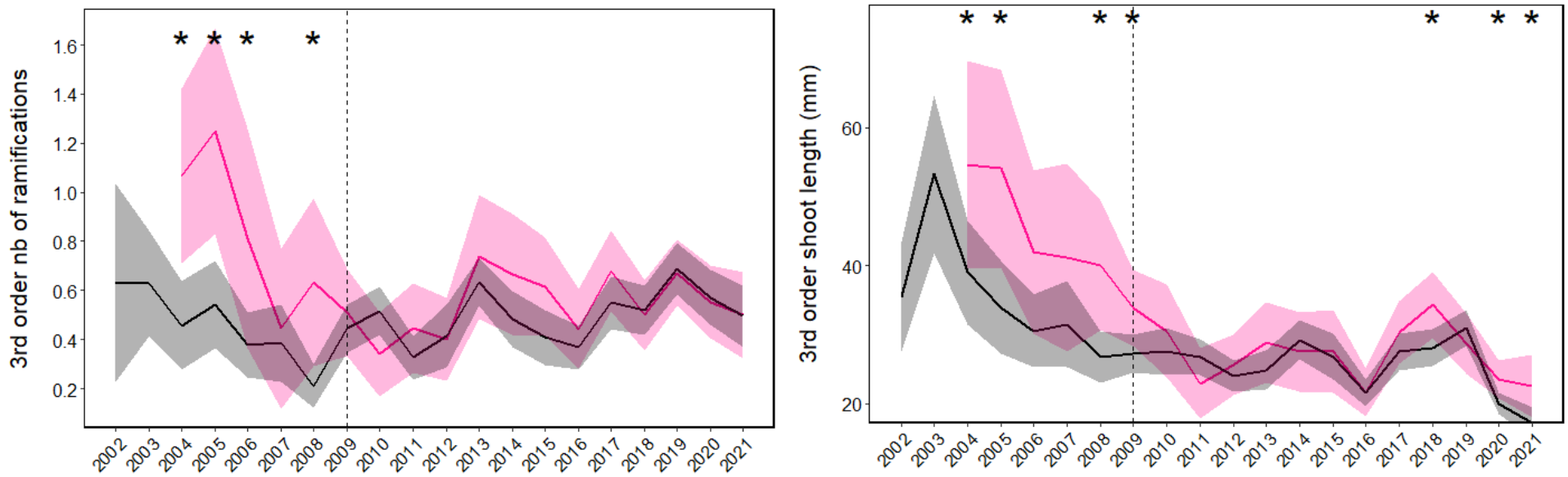




- No consistent difference between treatments
- Elongation starts earlier and earlier, now in year (n-1)

Results

Shoot traits (2) : ramification & shoot length



- No absolute difference between exclusion and control but clear reduction in the 2 shoot traits compared to before the treatment (Twigs were more vigorous in exclusion at the beginning)
- Delay of 1 year (shoot preformed in the bud the year before)

Results

First results of irrigation

2009-10
+173mm
(+12% march-june)

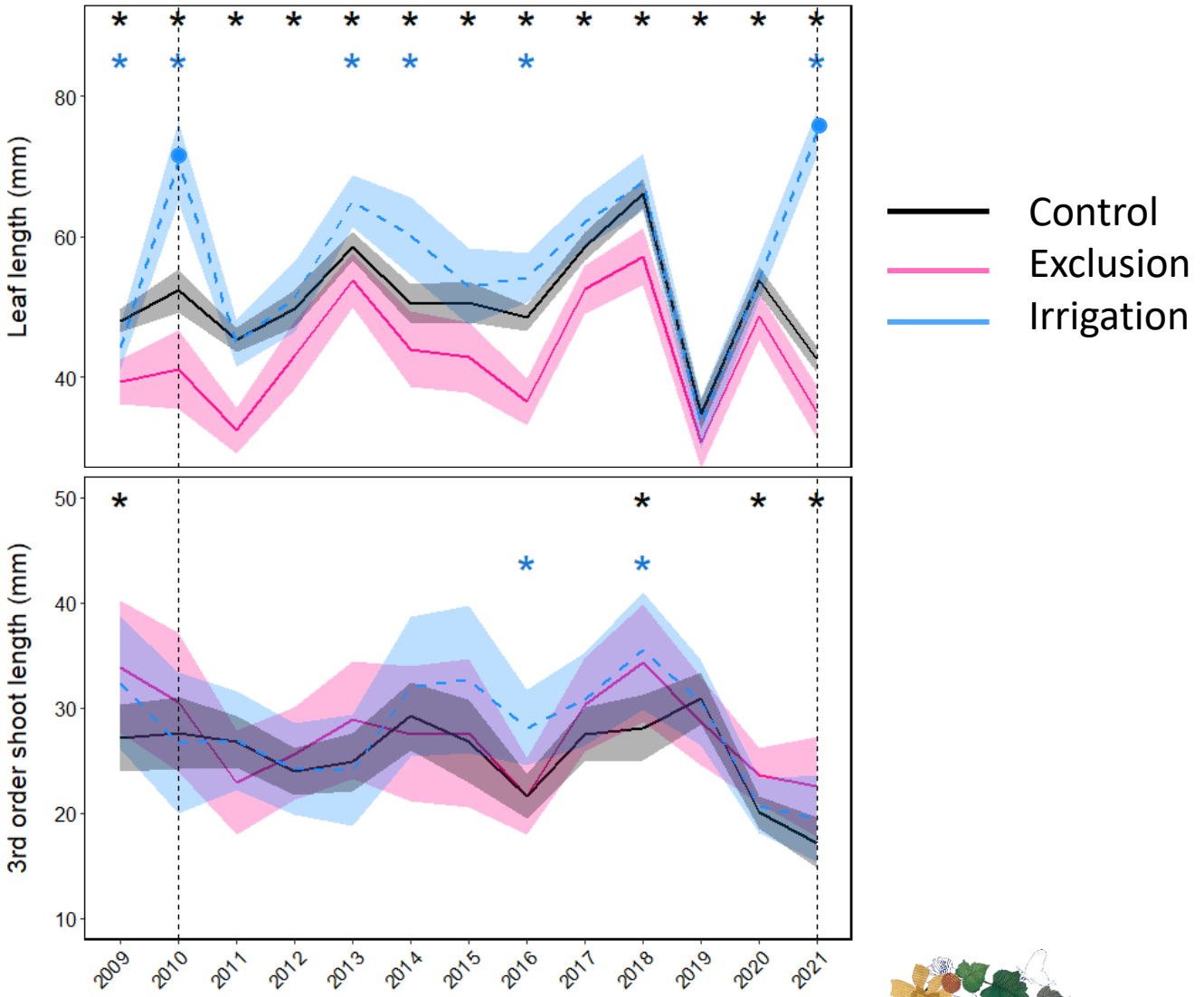
2021
+508mm
(+72% march-june)

✓ **Needle length**

Strong & proportional response

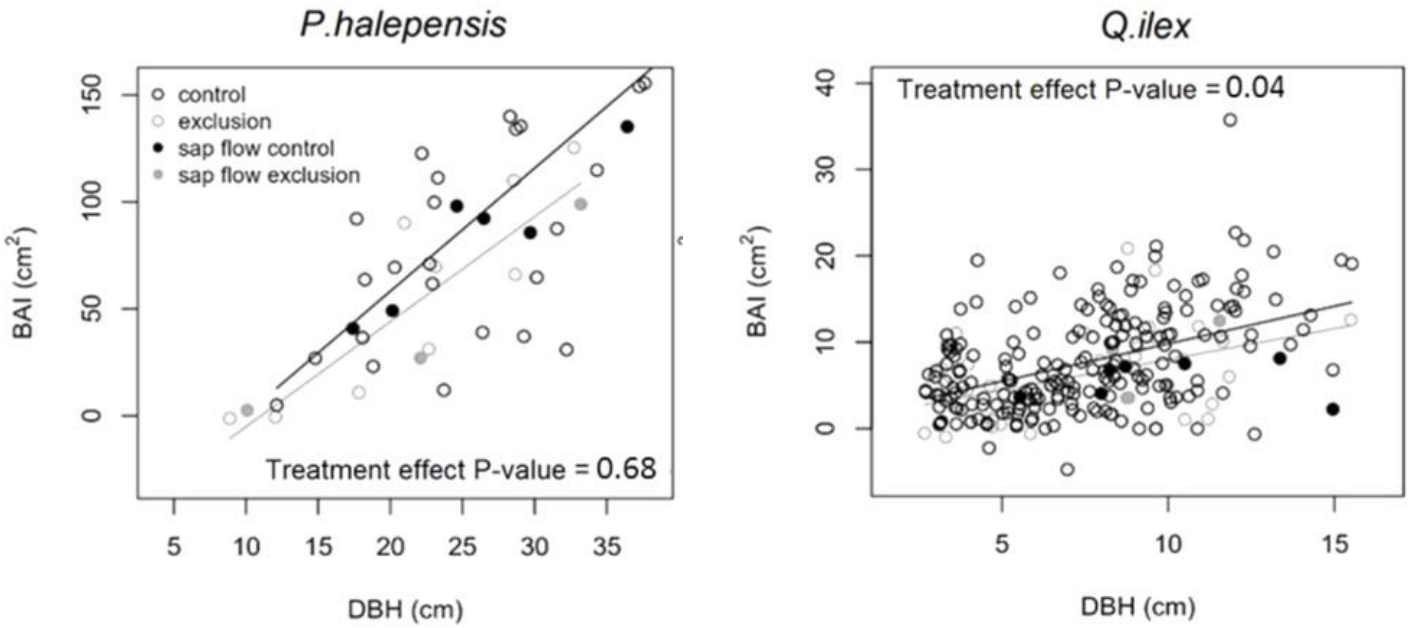
✓ **Shoot length**

No effect, maybe in 2022 ?



Conclusion & Perspectives

✓ **Needle length** is the most sensible trait to drought for *P.halepensis*



(Moreno, 2021, AFM)

✓ No difference between treatments found in terms of **radial growth** for this species

Conclusion & Perspectives

✓ **Needle length** is the most sensible trait to drought for *P.halepensis*

✓ *P.halepensis* **adapts its leaf area**

(1) long term consistent response to accentuated drought conditions,

(2) fast short-term response to interannual variations of water availability, reversibity

✓ No difference detected in **the timing of phenological events** (Loustaud 1992, 1996 ; Morin 2010)

✓ **Perspectives**

Climate sensitivity of the species: is there an acclimatation to prolonged accentuated drought conditions ?

Merci !

Veuillen Léa, Prévosto Bernard, Cailleret Maxime, Lopez Jean-Michel, Audouard Mathieu, Vennetier Michel