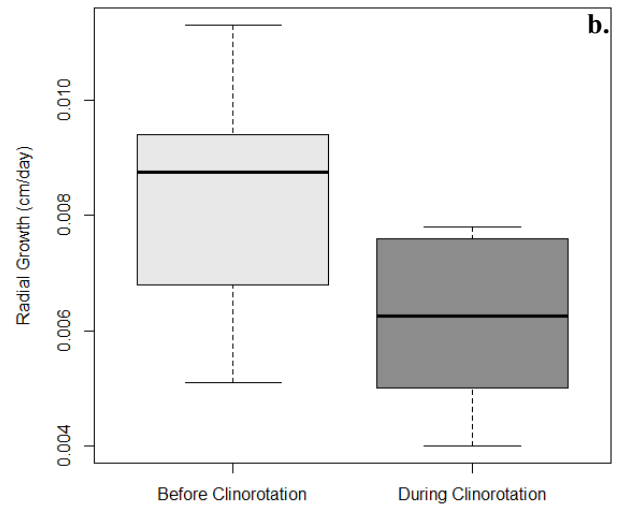
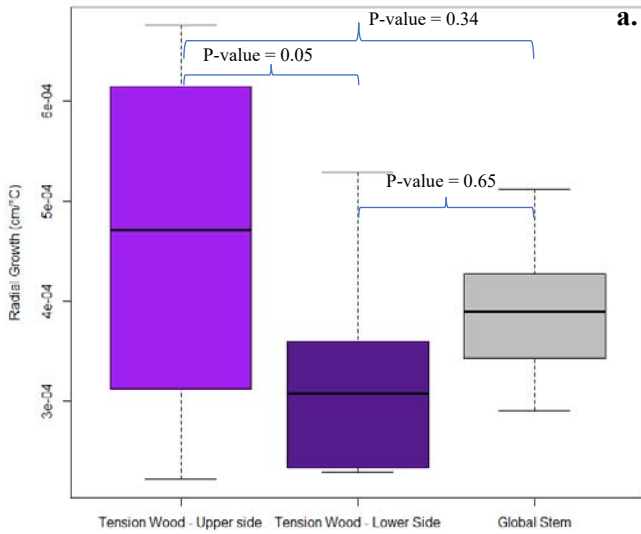


# Supplemental Data



S1 : Radial growth of tension wood and global stem (a.) and radial growth before clinorotation and during clinorotation (b.)

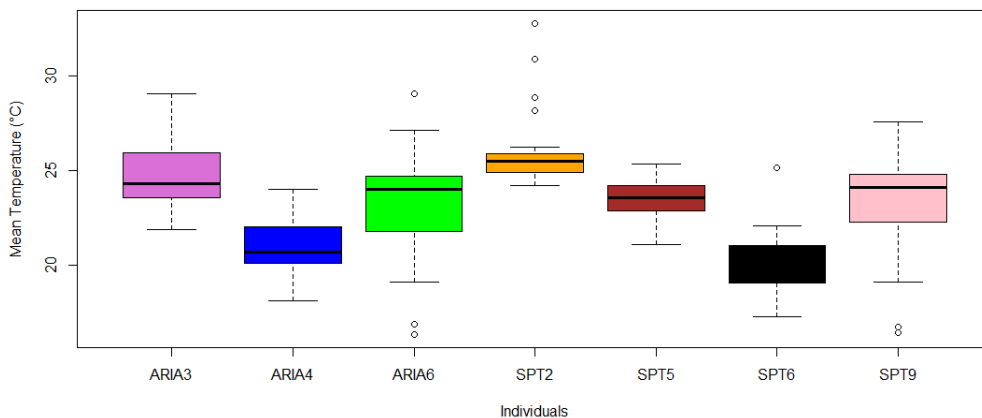


Tilted trees



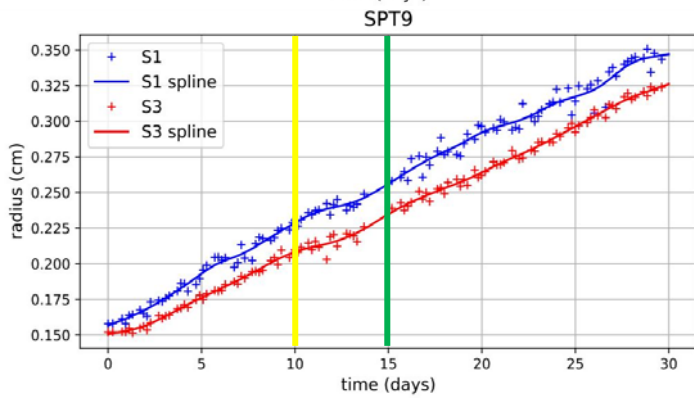
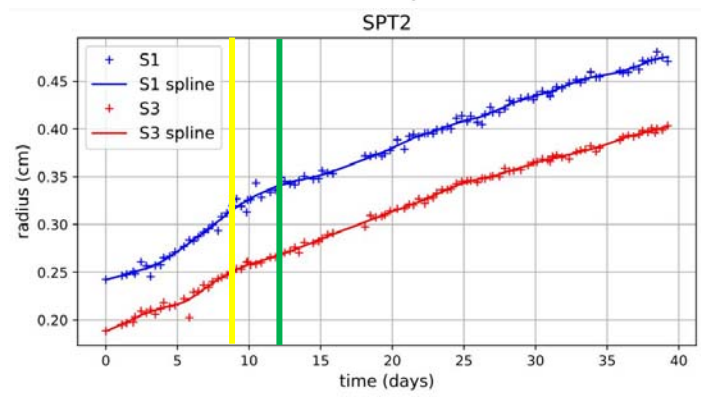
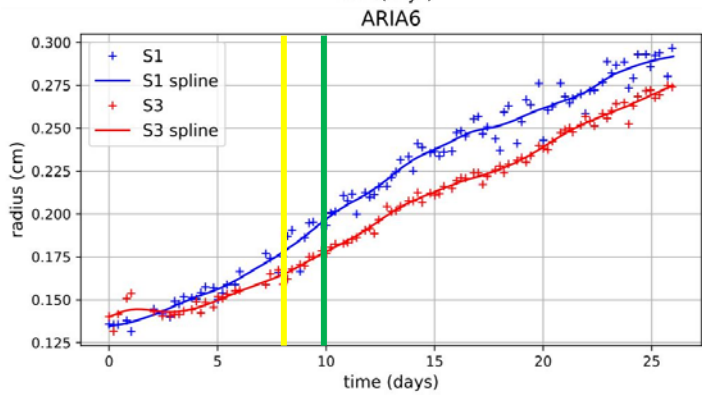
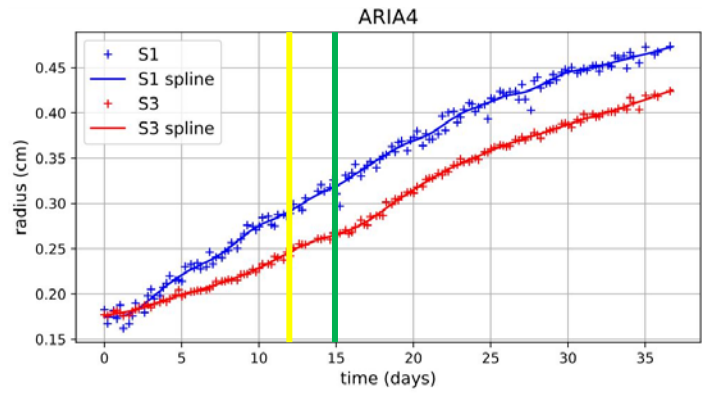
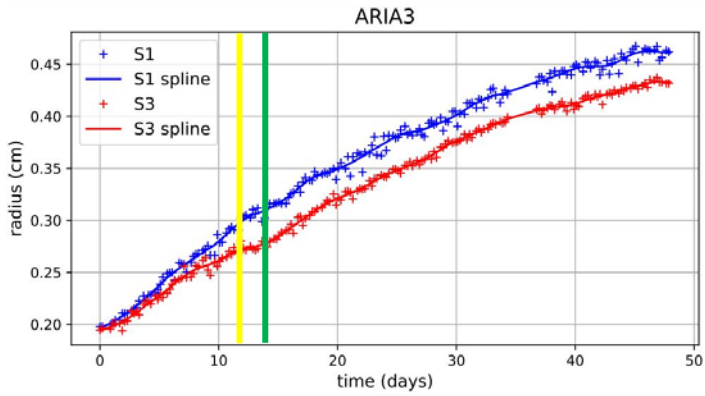
Tilted then clinostated tress

S2 : Time-lapse video of a "tilted trees" experiment (a.) and a "Tilted then clinostated trees" experiment (b.)



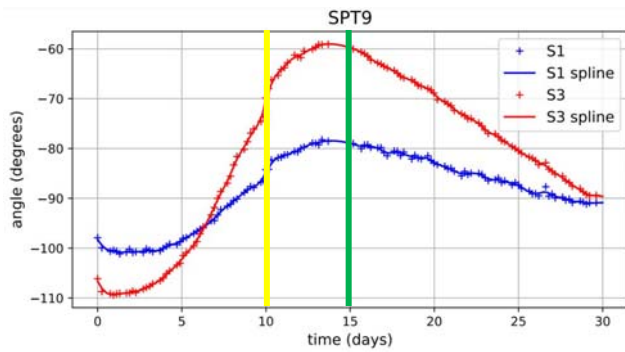
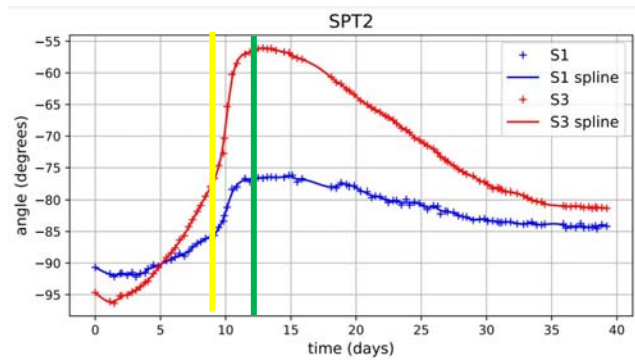
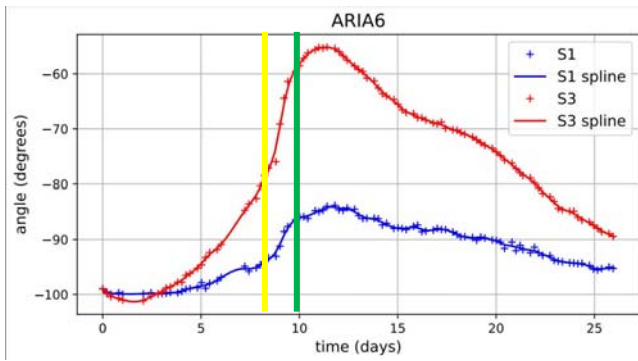
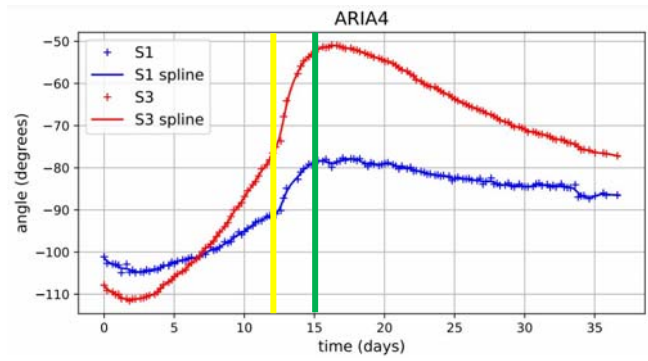
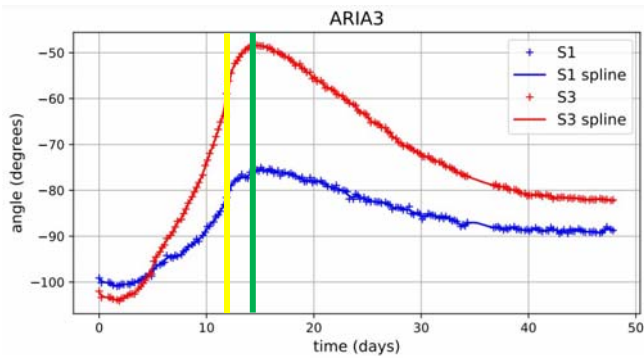
S3 : Average temperature (C°) for each individual in the experiment

# Supplemental Data



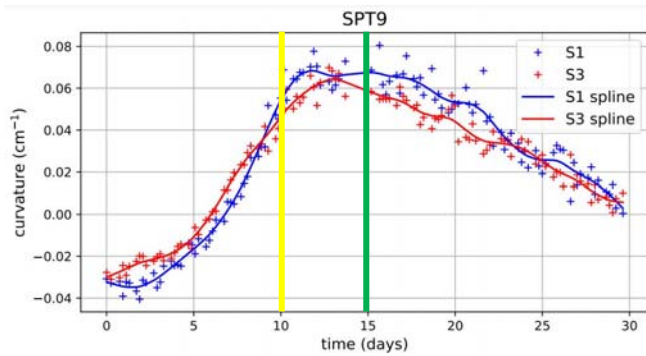
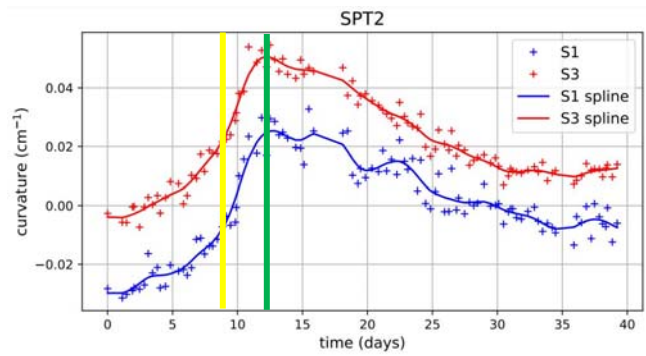
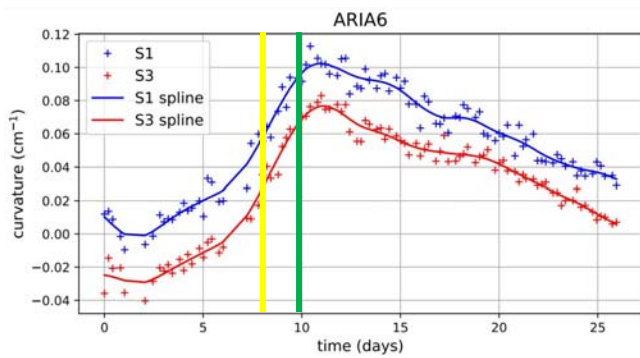
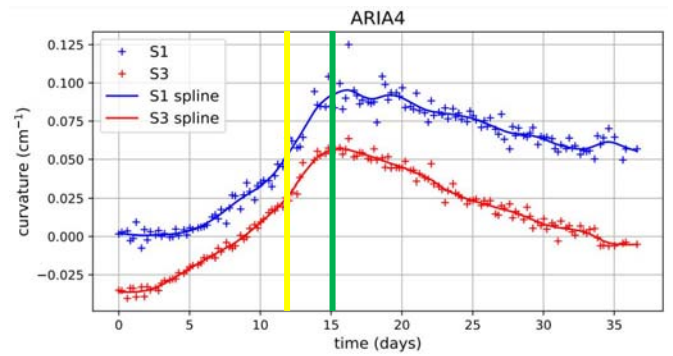
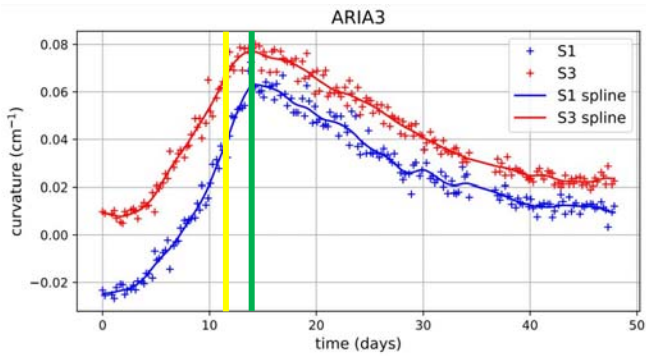
S4 : Radius (cm) versus time (days) for the individuals in our experiment. The yellow segment represents the moment of clinostat activation. The green segment represents peak curvature.

# Supplemental Data



S5 : Angle (degrees) as a function of time (days) in the individuals in our experiment. The yellow segment represents the moment of clinostat activation. The green segment represents peak curvature.

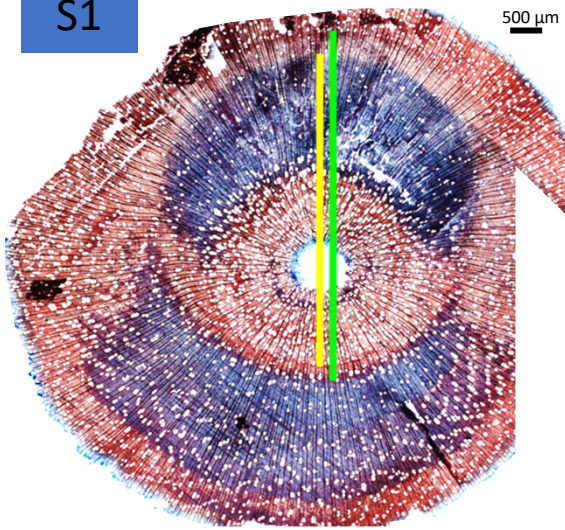
# Supplemental Data



S6 : Curvature (cm<sup>-1</sup>) as a function of time (days) in the individuals in our experiment. The yellow segment represents the moment of clinostat activation. The green segment represents peak curvature.

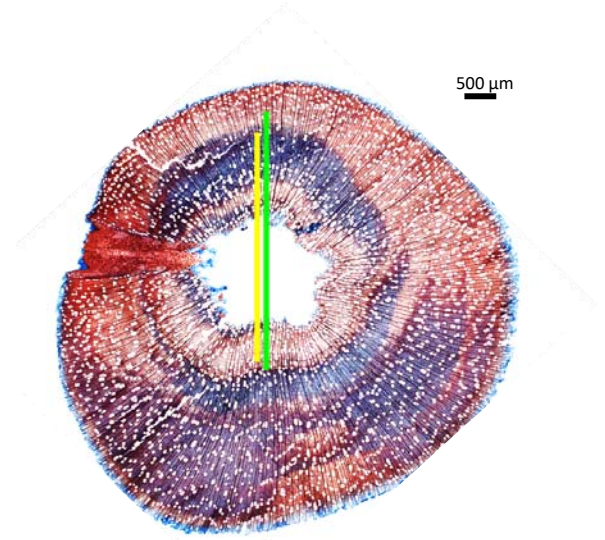
# Supplemental Data

S1



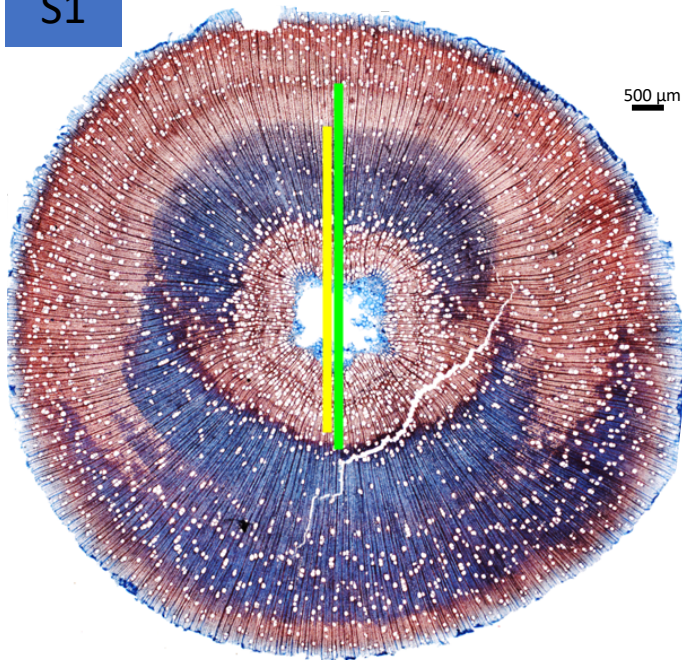
Ariane 3

500 μm



Ariane 3

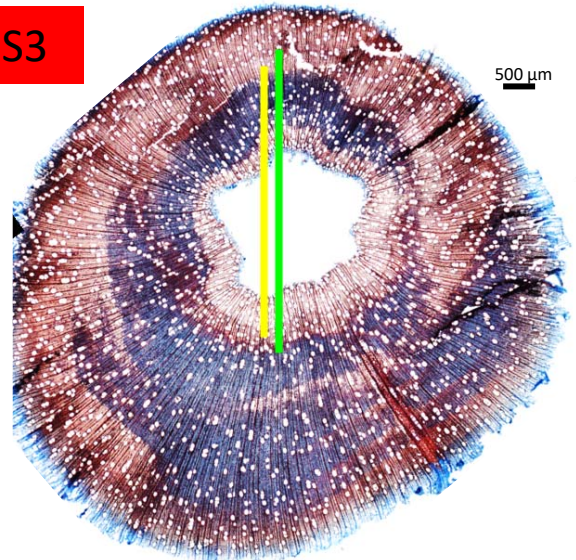
S1



Ariane 4

500 μm

S3

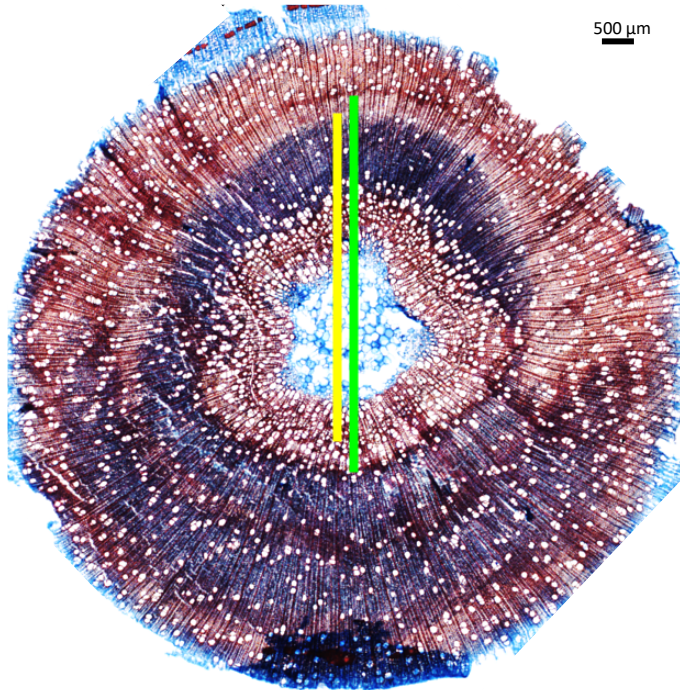


Ariane 4

500 μm

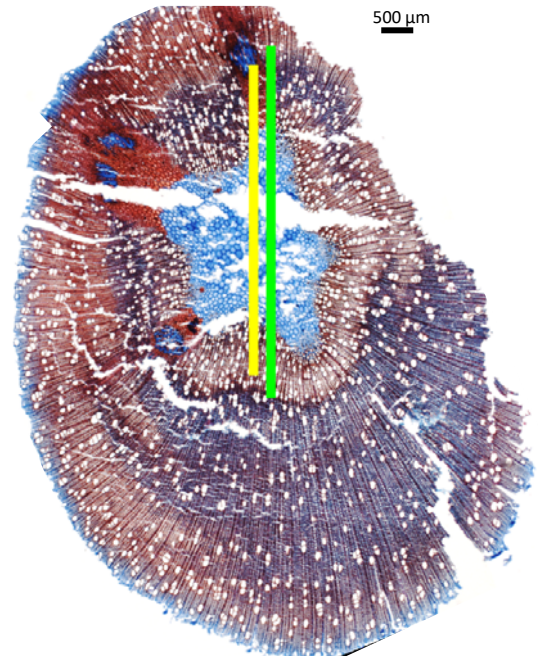
# Supplemental Data

S1



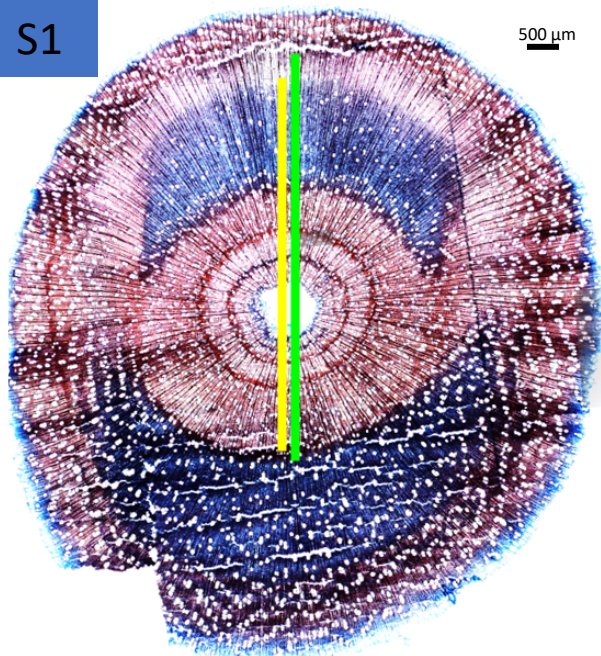
Ariane 6

S3



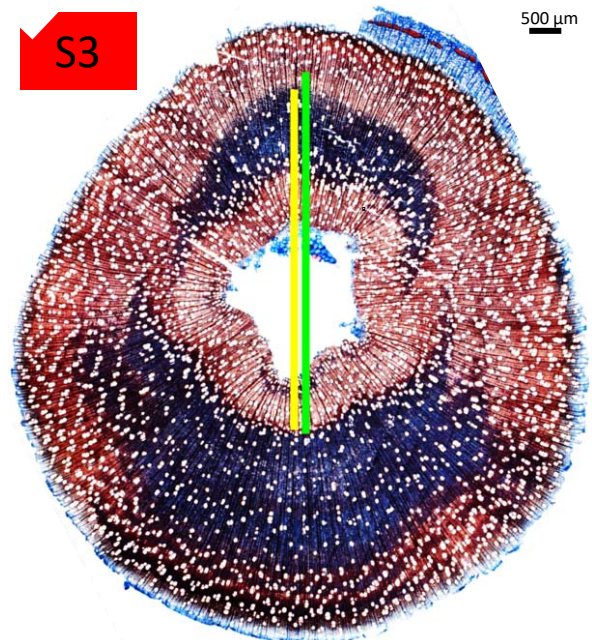
Ariane 6

S1



Spoutnik 2

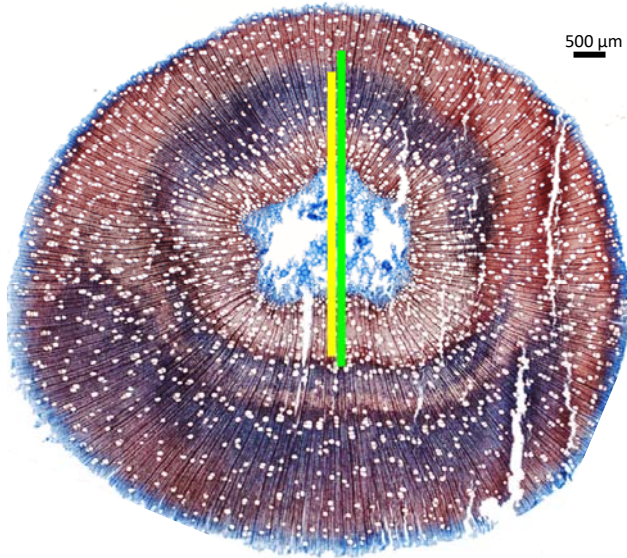
S3



Spoutnik 2

# Supplemental Data

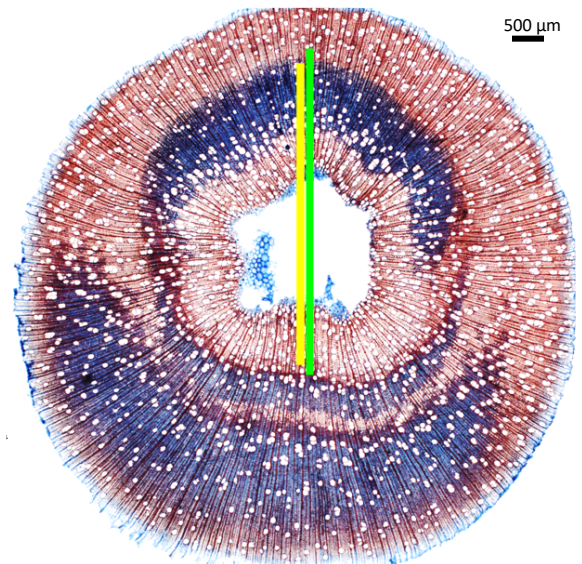
S1



Spoutnik 9

S3

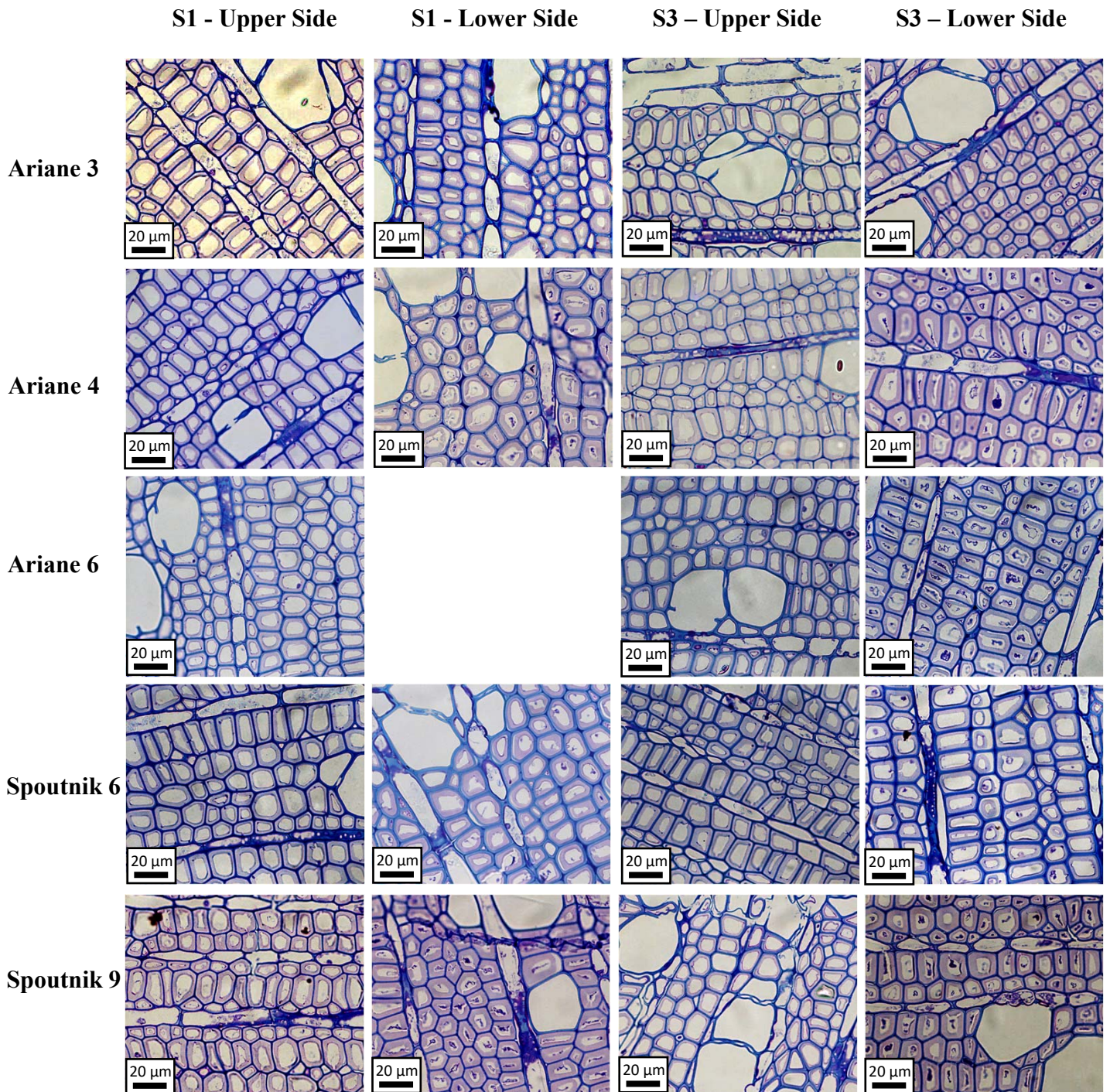
Haut – Bas : pas le plus  
grand diamètre : difficulté



Spoutnik 9

S7 : Identification of tension wood in poplar stems in the "Tilted then Clinostated trees" condition. Yellow segment represents stem diameter at clinostat activation. The green segment represents the stem diameter at the moment of peak bending.

# Supplemental Data

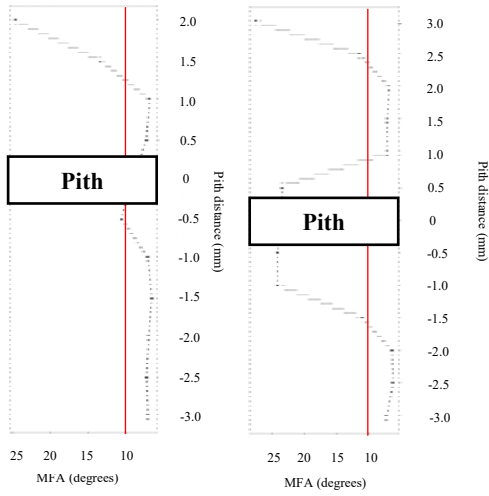


S8 : Evidence of G-layer tension wood in individuals of the "Tilted then Clinostated Trees" condition. Toluidine blue staining. Objective = x100.

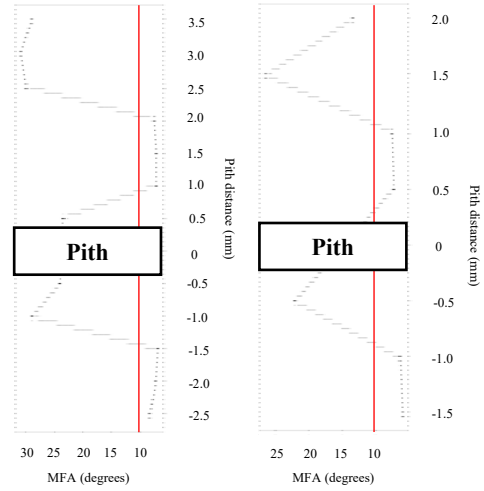


# Supplemental Data

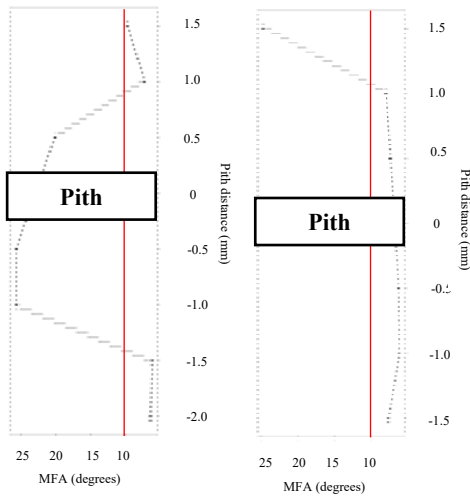
## ARIANE 3



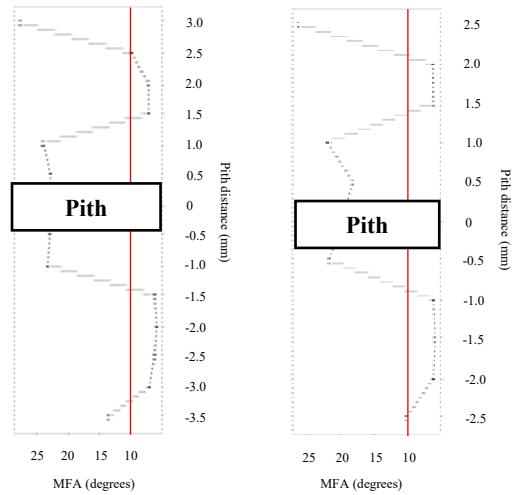
## ARIANE 4



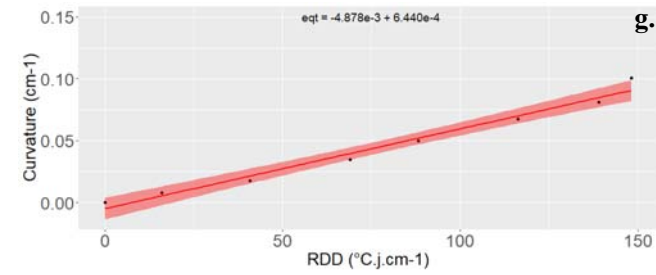
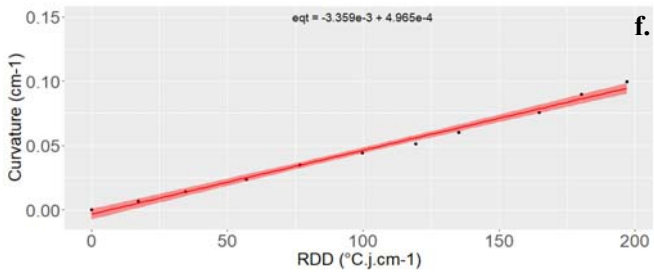
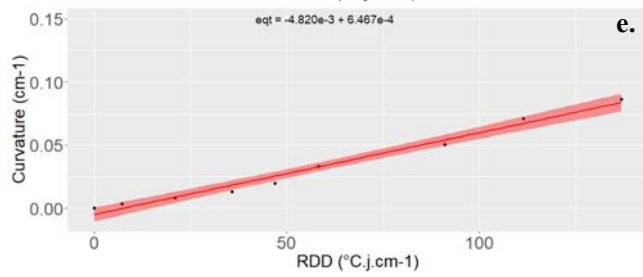
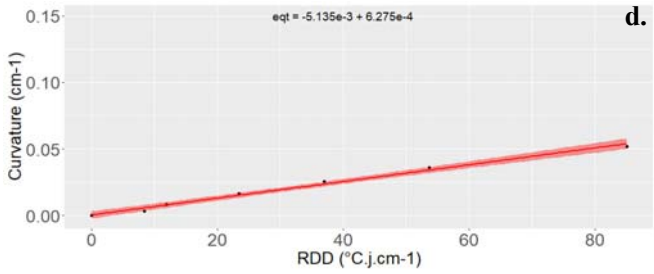
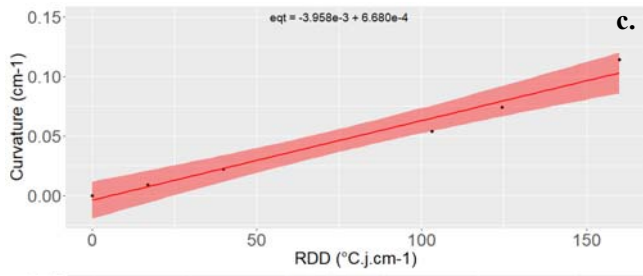
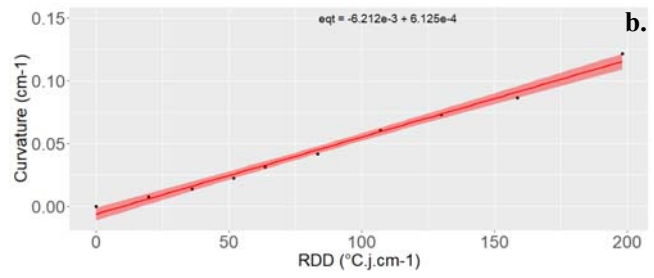
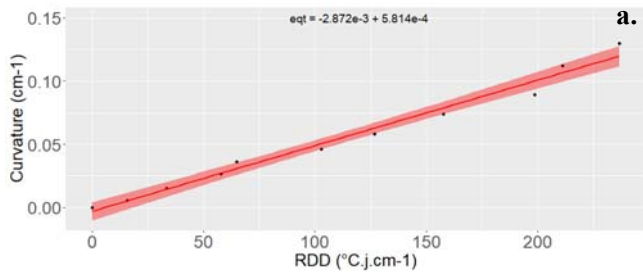
## ARIANE 6



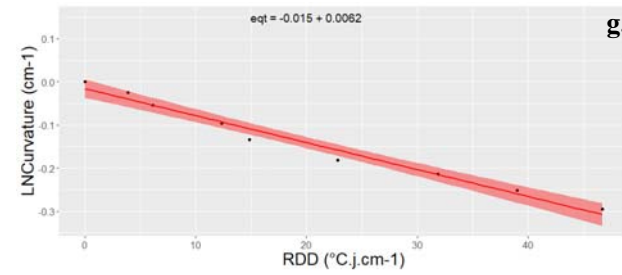
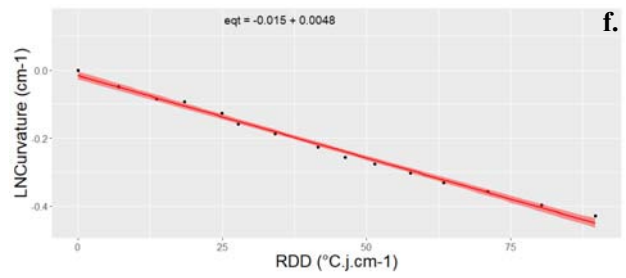
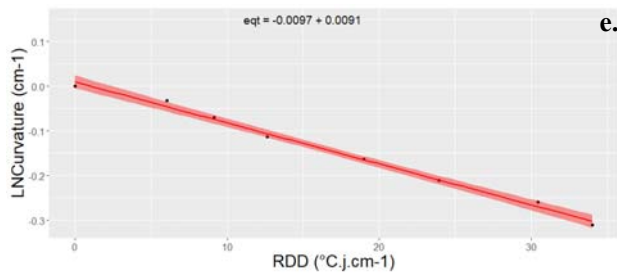
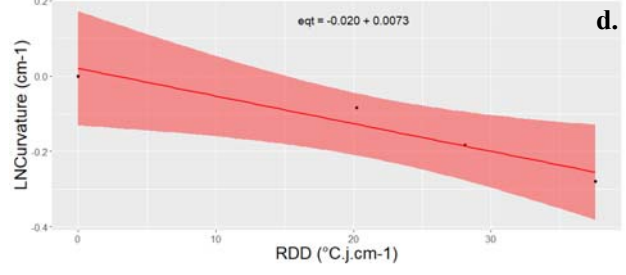
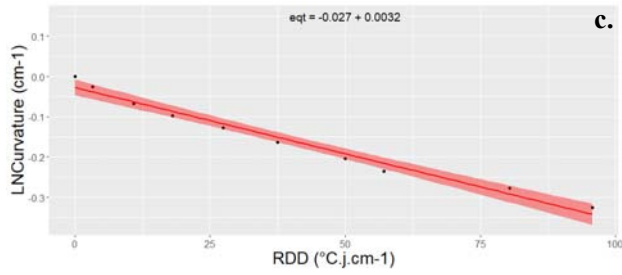
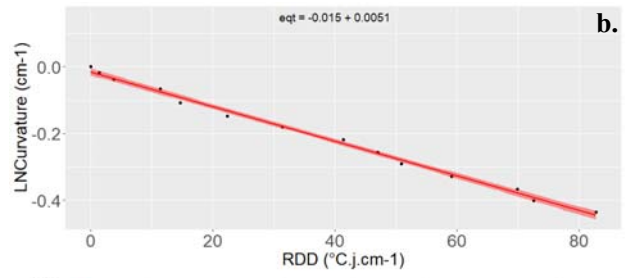
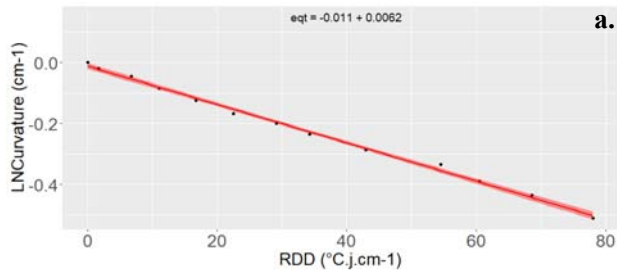
## Spoutnik 2



S9 : Evolution of MFA as a function of distance from the medulla. Positive values of distance to the medulla correspond to the upper side of the stem, negative values to the lower side.

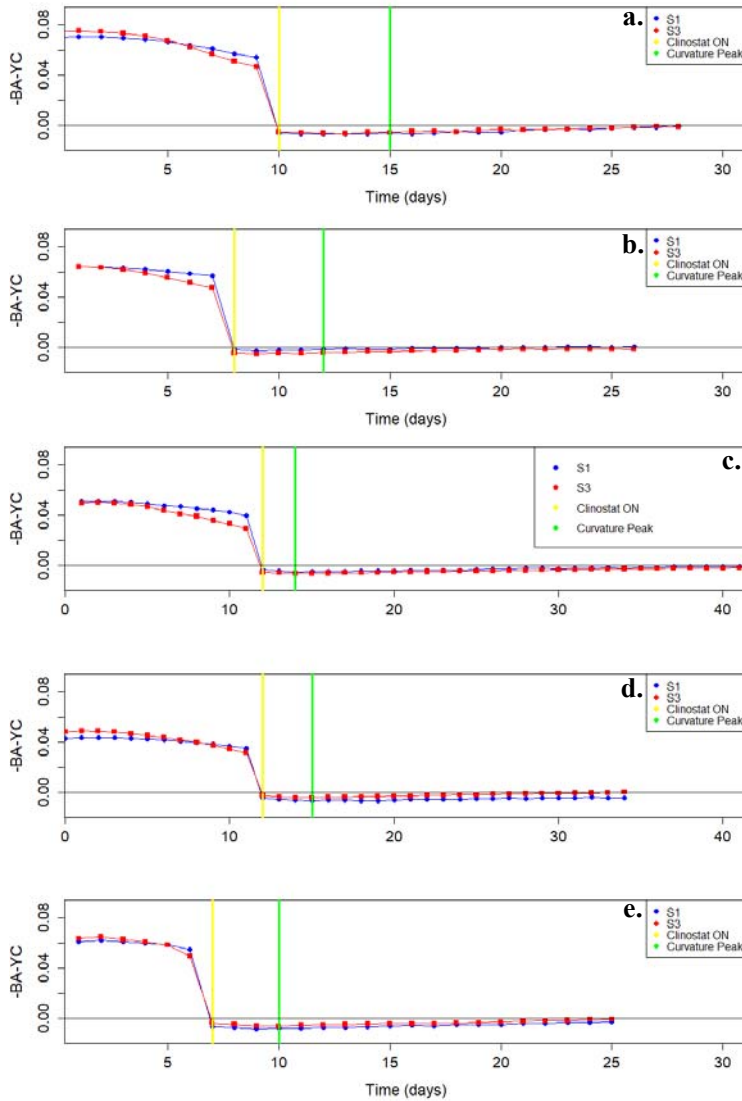


S10 : Linear regressions on the curvature phase of individuals in the experiment. The figure numbers (a to g) correspond to the different individuals.



S11 : Linear regressions on the autostraightening phase of individuals in the experiment. The figure numbers (a to g) correspond to the different individuals.

# Supplemental Data



S12 : Evolution of  $-\beta A - \gamma C$  as a function of time (day). The names of the figures (from a to e) represent the different individuals in the experiment.

Step 1 : Manual measurement of the samples intended for anatomy and stored in ethanol (noted -a) :

- Measurement of stem diameter  $\rightarrow D_{t-a}$
- Measurement of stem diameter without bark  $\rightarrow D_{b-a}$
- Difference  $D_{t-a} - D_{b-a} = E_a$  (bark thickness on anatomical section)

Our hypothesis (H1) is that the variation in stem diameter between the experiment and the water-ethanol treatments is essentially in the stem. The aim is to evaluate the thickness of the stem in  $E_i$  and not on the remaining samples :

The total in vivo Interekt diameter (+ 2 times the radius) noted  $D_{t-i}$ . At the end of the experiment, we have  $D_{t-i(tf)}$  so  $E_i = D_{t-i(tf)} - D_{b-a}$

Step 2 : Checking the plausibility of H1

$\rightarrow$  Verification of wood diameter in complementary experiment to assess the impact of water-ethanol treatment on wood diameter with and without bark and to evaluate shrinkage.

For this experimentation, samples of poplar stems were collected and underwent the fixation and dehydration protocol that we used in our previous experiments. Subsequently, they were immersed in ethanol for 1 month. After this waiting period, we measured the diameter of the samples with and without bark. Our results do not indicate any shrinkage of the stem during the experiment, but there is a slight shrinkage of the bark, approximately 27%, over the course of one month. The hypothesis H1 is indeed true, and we can proceed with our algorithm.

Step 3 : On anatomical sections, adjust the scale by taking the total value of the diameter of the stem under bark intended for anatomy,  $D_{b-a}$

Step 4 : Calculation and arrangement of the green segment (curvature peak) and the yellow segment (clinorotation activation) on the anatomical sections.

- Calculation of the green segment (Curvature peak) :
  - o From the obtained Interekt data, multiply the stem radius at the curvature peak by 2 to obtain the in vivo total diameter at the curvature peak (Value 1) =  $D_{t-i}(t_{Cmax})$
  - o With shrinkage primarily from the bark, and to obtain the estimated value of the in vivo wood diameter at the curvature peak (to reposition it later on the anatomical section), subtract the estimated value of  $E_i$  from value 1 :
$$D_{b-ia}(t_{Cmax}) = D_{t-i}(t_{Cmax}) - E_i(t_{Cf})$$
  - o The value obtained in centimeters is the length of the green segment to be repositioned on the anatomical section.

- Calculation of the yellow segment (Clinorotation activation) :
  - o From the obtained Interekt data, multiply the stem radius at the clinorotation activation by 2 to obtain the in vivo total diameter at the curvature peak (Value 1) =  $D_{t-i}(t_{CinoON})$
  - o With shrinkage primarily from the bark, and to obtain the estimated value of the in vivo wood diameter at the curvature peak (to reposition it later on the anatomical section), subtract the estimated value of  $E_i$  from value 1 :
$$D_{b-ia}(t_{CinoON}) = D_{t-i}(t_{CinoON}) - E_i(t_{Cf})$$
  - o The value obtained in centimeters is the length of the green segment to be repositioned on the anatomical section.

Step 5: Positioning the segments on the anatomical sections (to scale).

S13 : Algorithm for anatomical interpretation of characteristic experimental time (unit = cm)

Impregnation was carried out the following day. Our samples were impregnated in the following baths :

30 minutes in mixture : 2/3 Ethanol 100% + 1/3 LR-White resin at 4°C

30 minutes in mixture : ½ Ethanol 100% + ½ LR-White resin at 4°C

30 minutes in mixture : 1/3 Ethanol 100% + 2/3 LR-White resin at 4°C

1h in pure LR-White resin

Our samples were left for 3 to 5 days in pure resin in cold room at 4°C.

Once the plant material has been thoroughly impregnated with resin, it is placed in the desired orientation in resin-filled gelatin capsules using forceps. The capsules are completely filled using a syringe fitted with a needle fine enough to finish filling the capsule through a small hole previously made in the capsule cap. These capsules were placed at 50-55°C in a study to polymerize the LR-White resin, for a minimum of 24 hours. It is often necessary to add more resin to the capsules during polymerization. The plant material thus included has a long shelf life (several years). It is ready to be cut with a suitable microtome.

Our samples were cross-sectioned using an ultra-microtome (Reichert Om U2 - UltraMicrotome). The sections were made with a thickness of 3 µm, and were placed on SuperFrost slides on a hot plate. The slides were dipped in 1% Toluidine blue to allow differentiation and highlight the cell walls and visualize this organization within the wood. Subsequently, Eukitt (a mounting medium) was used to permanently fix our sections and to ensure that they could be stored for a long time. After drying for a few days, visualization was performed on a digital camera (AxioCam ICc 5, Zeiss) using Zen imaging software (Zeiss, Jena, Germany). Measurements of the thickness of the G layer within the tension wood were carried out using FIJI (Schindelin et al., 2012). 6 individuals from the TtC-trees condition were analyzed. This analysis was carried out on the tension wood of the upper face and that of the lower face, at the level of sections 1 and 3. In view of the thickness of the cuts, we decided to analyze only one cut per sample (the small thickness of the cuts means that there is no variability in all the cuts present). In this section, 3 photos of the center of the tension wood zone were analyzed. 10 wood fibers were analyzed per photo. A total of 30 G-layer thicknesses were measured per sample. The G-layer was measured by measuring the thickness of this layer at 8 different points in the fiber (Figure 3). These 8 values were then averaged to obtain an average value for this particular fiber. The average G-layer thicknesses between the top and bottom face, at section 1 and section 3, were analyzed using the Wilcoxon test.

#### S14 : Sample resin inclusion and cutting protocol