Compression Wood Distribution Models

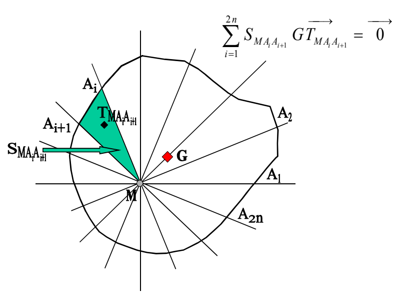
INRA

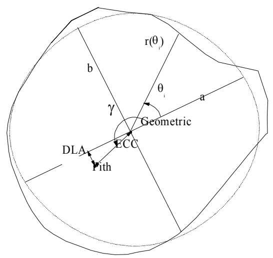
On a single tree, a model was developed to predict the location and proportion of compression wood using tree shape measurements obtained from WP2.2 and compression wood location obtained from WP3.2. The input variables used for transversal and longitudinal stem shape are described in Figure 1. The outputs of models are described in Figure 2.

It seems that from Figure 3a that the orientation of the compression wood area on a section is correlated with the orientation of the local inclination of the tree and from Figure 3b that the percentage of compression wood is correlated with the intensity of the inclination of the tree and the eccentricity. From Figure 3c it can be seen that the orientation of the compression wood sector in a disk is highly correlated with position of the pith.

Figure 1: Transversal and longitudinal stem shape descriptors proposed .

Variable	Definition
Surfaces	S
Gravity Centre	G
Eccentricity	ECC
Ellipticity	ELL
Irregularity	IRR



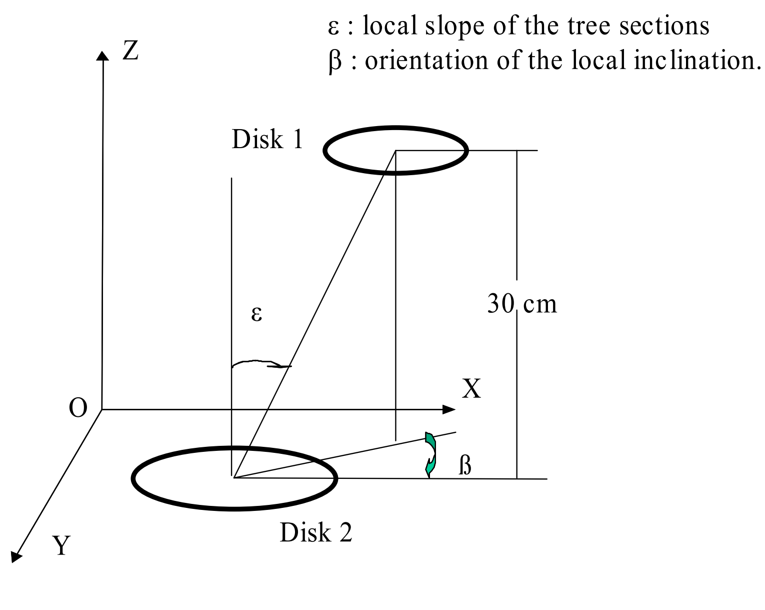


$$DIA = 2 * \sqrt{\frac{\sum_{i=1}^{36} r(\theta_i)^2}{36}}$$

$$ELL = \frac{a}{b}$$

$$IRR = \sqrt{\frac{\sum_{i=1}^{36} [r(\theta_i) - r_{est}(\theta_i)]^2}{36}}$$

Variables for ring and disk geometrical description.



Tree shape: Local angles.

Figure 2:Variables used to describe the compression wood location and quantity on disks.

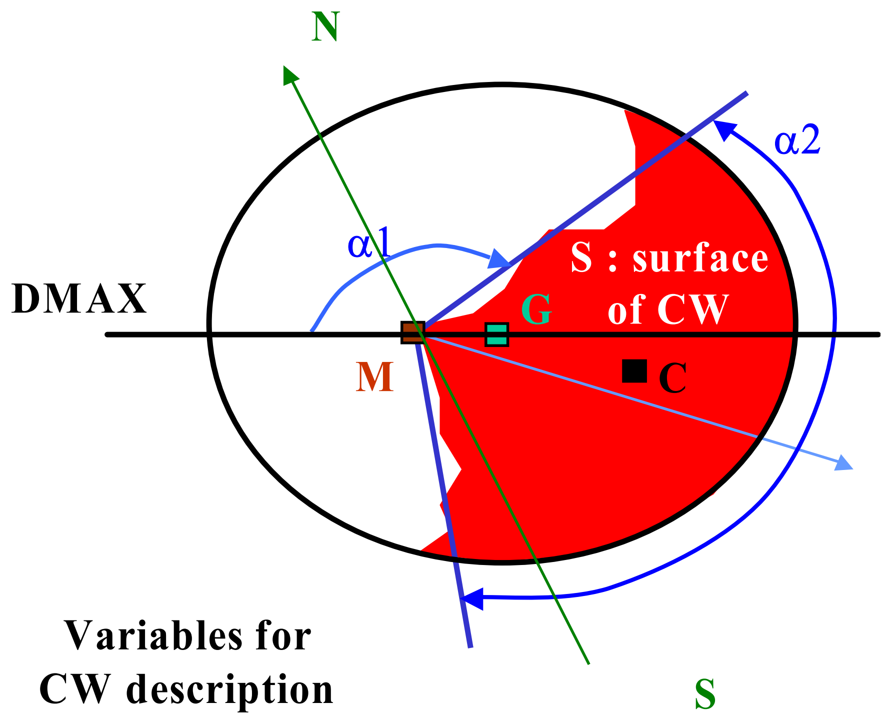
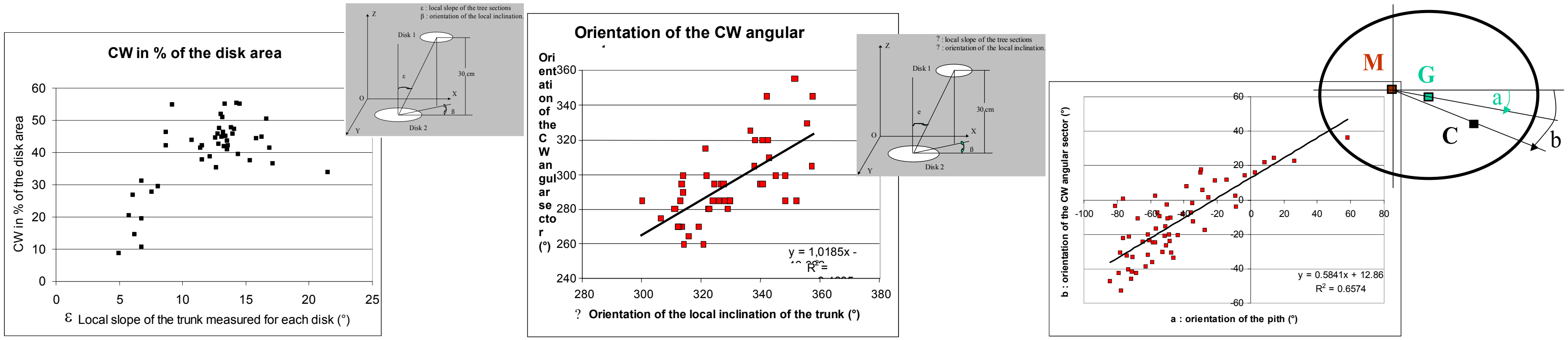


Figure 3: Correlation between CW location and proportion with local tree shape parameters (20a and 20b) and orientation of the pith.



3a 3b 3c

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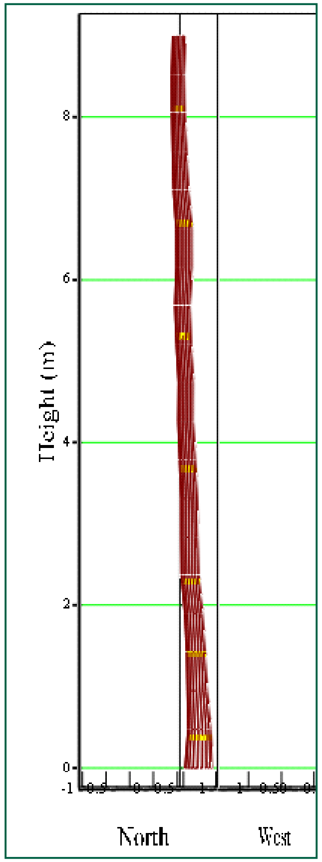
Further development of existing tree growth, yield and wood properties models (SHOOT and FinnFor) have been made to enable the effect of compression wood to be incorporated in the next reporting period. Within this reporting period, a new diameter growth distribution model has been developed and validated against Scots pine data. Within the next period, additional data for Scots pine provided by Participant 01 (FR) will be used to test the model too.

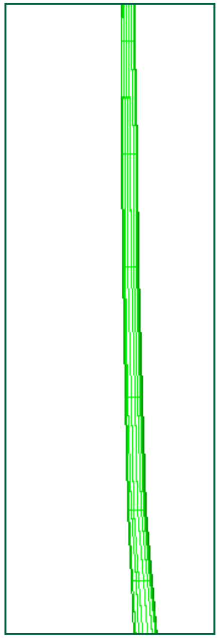
Preliminary simulations for diameter growth and its distribution along the stems of Scots pine have also been made using the FinnFor model. The work has also included preliminary analyses on how to incorporate the effect of compression wood of existing tree growth, yield and wood properties models. This will be continued in the next reporting period.

Forest Research

Work has been completed on developing a programme to display the external geometry of tree stems, together with the position of the discs cut for analysis, from the tree profile measurements completed in Workpackage 2 using a laser rangefinder. This allows the local slope of the stem and the orientation of the lean to be calculated at each disc position. This information will be used to model compression wood content as a function of stem shape. Comparison between the different methods of measuring stem shape being used by FR and INRA was undertaken in the 2 Scots pine experimental sites. All 36 scientific trees were measured by both methods and initial comparison has given good agreement, as shown below.



FR model, from laser measurements



INRA model, from photogrammetry

Photograph of sample tree