TECHNICAL SHEETS

atibt

FOR THE SUSTAINABLE MANAGEMENT OF TROPICAL FORESTS

FAIR & PRECIOUS BY atibt ÉDITIONS

1

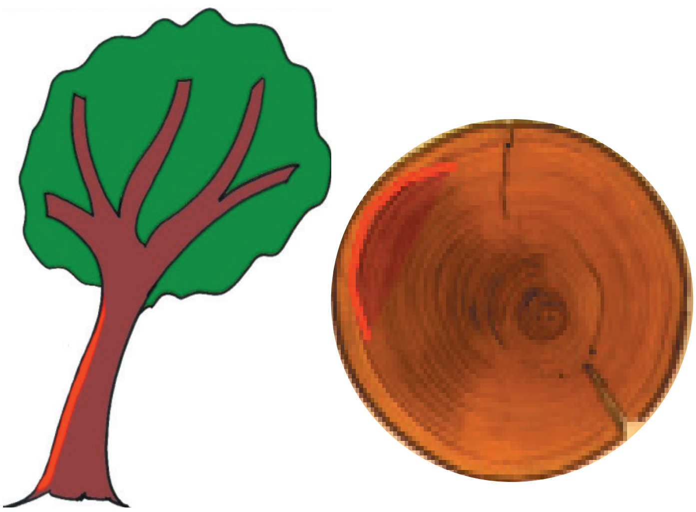
A FEW CLARIFICATIONS ARE IN ORDER!

REACTION TIMBER

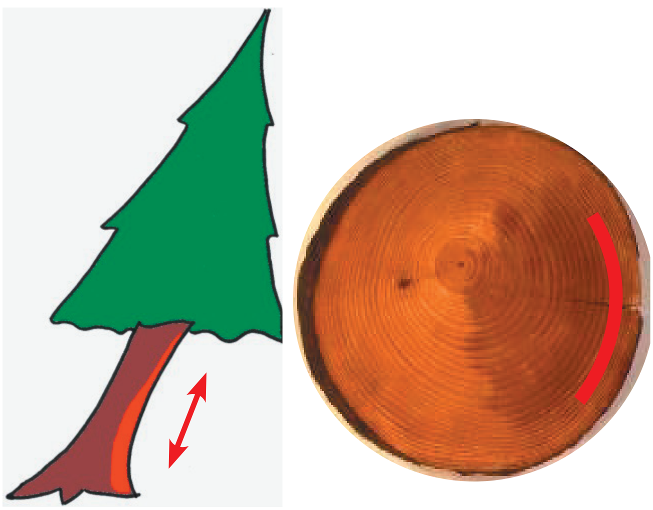
ORIGIN IN THE TREE

Throughout its growth, the tree produces its timber with a slight stress of tension (like springs stretched all around the tree). By pulling more or less on one side or the other, the tree adjusts its shape and maintains its verticality. When the tree undergoes an important imbalance (sloping ground, unidirectional wind, slight heaving following a storm, etc.) or has to support an inclined branch, it creates timber with a pre-stress that differs greatly from that of the opposite timber, generating a period of bending that balances the efforts. It therefore produces timber of a different nature than so-called "normal" timber; this is "reaction timber".

Softwoods and hardwoods have opted for two different strategies to achieve the same function. In hardwoods, the bending is produced by pulling harder on the upper face of the inclined axis than on the opposite side. This timber - which has a very strong pre-stress tension - is known as "**tension timber**". In softwoods, the bending is generated by pushing on the lower face, generating pre-stress compression timber known as "**compression timber**". In some species, reaction timber has a growth rate that is much higher than the opposite timber, which causes an offset of the pith. This growth differential increases the efficiency of the reaction via a "lever arm" effect.



Tension timber (hardwood)



Compression timber (softwood)

Reaction timber is systematically present in branches where mechanical stresses are very significant. It is for this reason in particular that the branches are not used for the production of lumber.

During a healing process (wound with or without inclusion of bark or inter-bark), the tree is also able to produce reaction timber locally. In the unstressed longer portion, the tree can also produce reaction timber via auxinic[1] actions, the mechanisms of which are not yet well known, and which may be linked to genetic aspects or to the environment.

Reaction timbers have a different cell structure and a different chemical composition, which sometimes make it visible to the naked eye. But above all, these differences in structure result in highly different mechanical and physical properties.

PARTICULARITIES OF THE CELLS

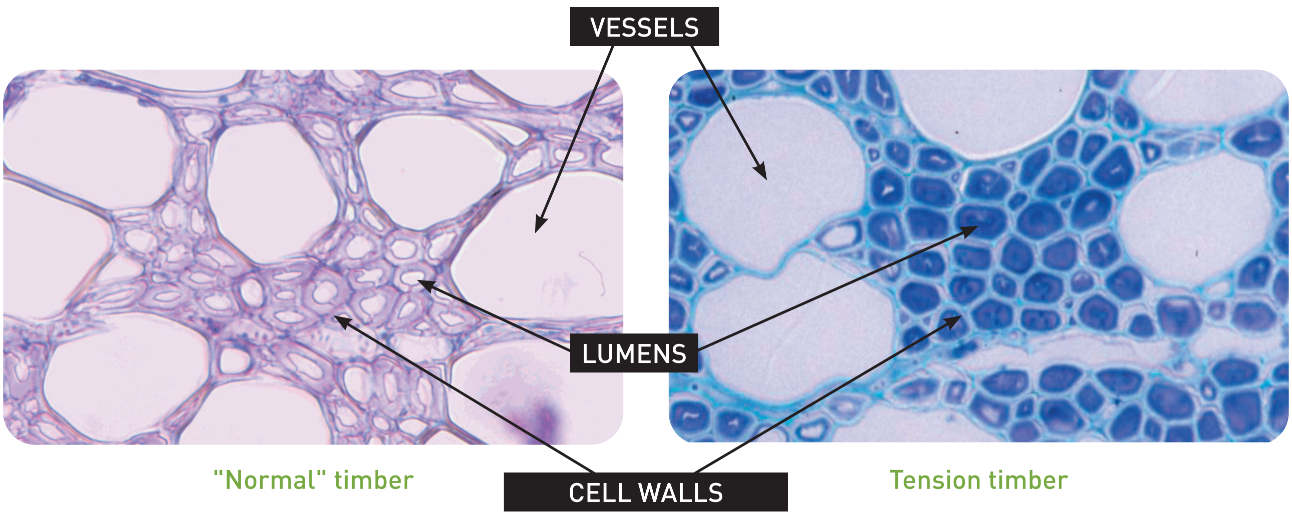
Reaction timber cells differ from regular cells in many respects, but in general:

In softwoods:

- the cells (tracheids) are shorter;
- the walls are thicker and more lignified;
- the cellulose micro-fibrils (organised in a spiral around the cell) are more inclined than in normal timber.

In hardwoods:

- there are fewer vessels (sap conducting cells);
- the fibres are longer and more cellulosic;
- the spiral inclination of the cellulose has a very small angle, close to the vertical;
- in some species, part of the fibre wall is replaced by a thick, lignin-free and highly hydrated layer.



"Normal" timber

Tension timber

1. Auxins are plant hormones, or phytohormones, found throughout the plant kingdom, which play a major role in controlling plant growth and development.

PROPERTIES OF REACTION TIMBER

Typically, compression timber is denser (reduced cell voids) and more coloured (high presence of lignin). This is not systematic in hardwoods. The compressive resistance properties of reaction timber are lower than those of normal timber. The shrinkage coefficients, especially those of axial shrinkage, can be ten times those observed in "normal" timber. Compression timber is less permeable, due to the thick cell walls and their sealed points, and is therefore harder to dry. In Sapelli, the reaction timber zones are called are known as **oily veins** (due to their oily appearance).

DETECTION

The detection and identification of reaction timber is not always obvious for loggers, both in terms of standing timber or green timber. It is usually during the drying process that the specificities of this timber become apparent. Under the microscope, one of the most effective colouring methods is the safranin[2] action, followed by green-light, which brings out red in normal timber and bright green in tension timber.

CONSEQUENCES FOR THE USE OF REACTION TIMBER

Apart from colour variations in dark red to brown tones, the most serious consequences in the use of reaction timber are revealed during drying, through localised breaks (cracks, honeycombs, etc.) and/or deformations (change in the shape of the section, bending, tiling, warping, etc.). The refractory nature of reaction timber during drying and very large dimensional shrinkage can provoke collapses. Collapses are a "breakdown[3]" of the cells which mainly occurs under both warm and humid conditions. In the case of reaction timber, collapses can occur during natural drying (without an increase in either temperature or humidity).

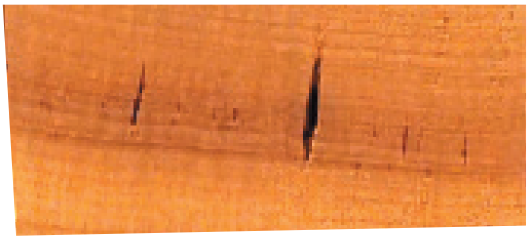
When reaction timber is located in localised areas, the defect appears as short, very wide cracks or deformations.

During peeling, the cells of reaction timber are crushed under the knife, resulting in a particularly fluffy surface.

Similarly, in reaction timber, the ends of the cells are less joined, which favours a fluffy texture of the cross-sections when the timber is being worked on.

2. Safranin is a dye.
3. The collapse of the cells is comparable to that of a tube undergoing an extreme vacuum.

Oily vein on Sapel-
li. The cells of the reaction timber shrink in length until they break. (115x40 mm cut piece)

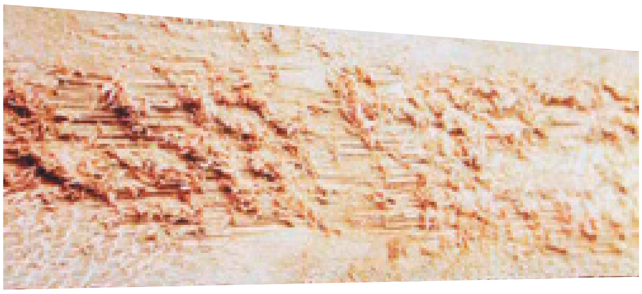


Oily vein on Sapelli. The reaction timber's cells favour collapse. (100x125 mm cut piece)

Oily vein on Sapelli. Transverse breaks. (120 mm wide piece)

Reaction timber inter-bark and pocket on Sapelli. (115 mm wide piece)

Deformation of
a piece of Sapelli
featuring an
oily vein on one
edge. (100x30
mm cut piece)



Rotary cutting
of Poplar containing
tension timber and
causing a fluffy surface.
(100 mm wide veneer)

Fair&Precious recommends the purchase of FSC® and PEFC-PAFC certified tropical timber.