

# Forest and Wood in 100 questions: a model to provide science based information on forest sustainability and wood utilization

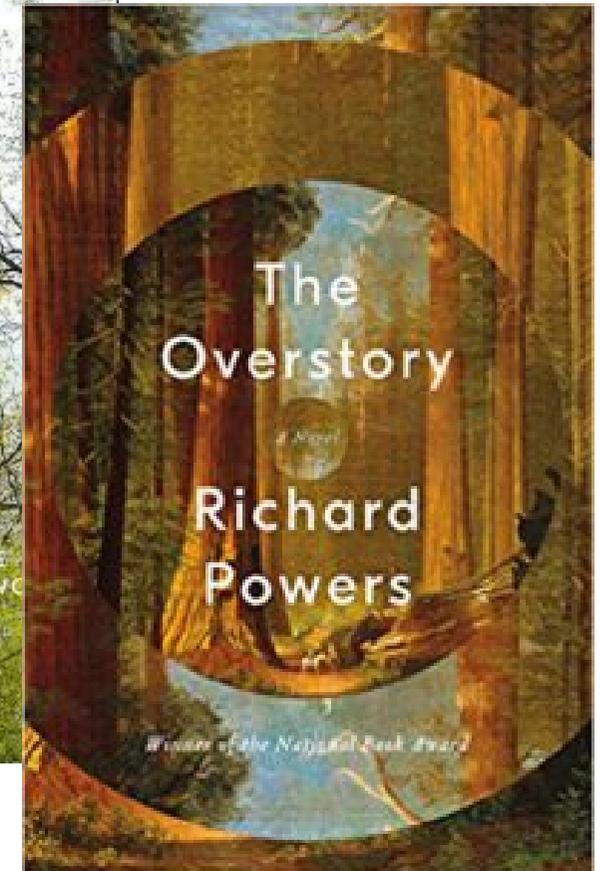
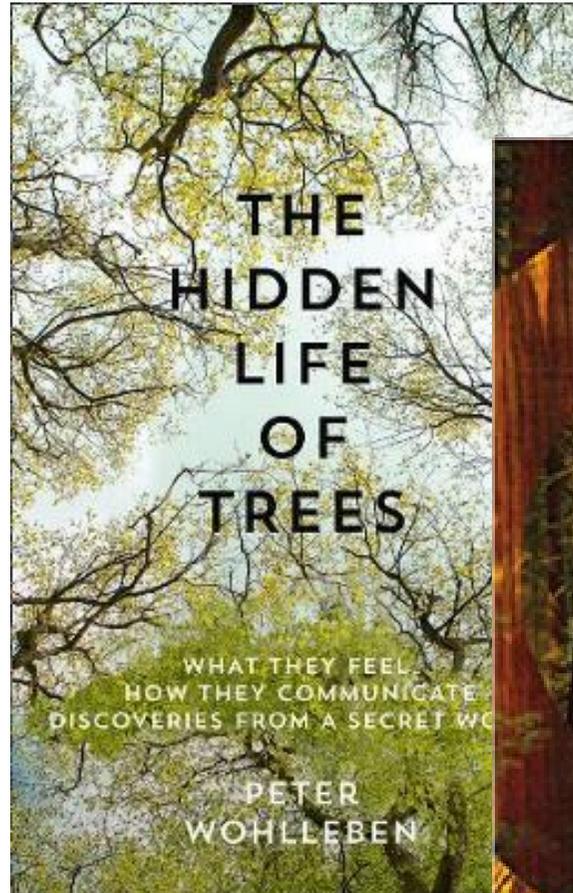
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French Academy of Agriculture and \*IAWS

# The context

**Communication on forest issues with public opinion is seldom the task of forest professionals and scientists.**

**Films and documentaries, best-selling books, focusing on excesses of forest management, on ecological or socio-cultural aspects, have a large audience.**

**They rarely deal with professional activities that contribute to a sustainable bio-economy.**

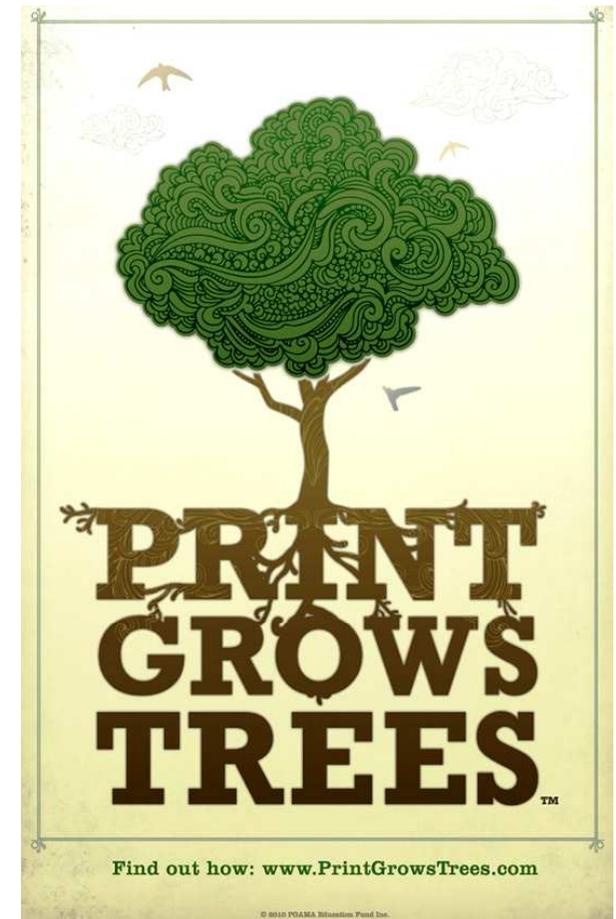


# The “storytelling”!

The French Academy of Agriculture (AAF) is structured in ten sections, the 2<sup>nd</sup> deals with forests and the forest-based sector.

Under the coordination of Yves Birot, honorary Head of Forest Research Department INRA, our 2<sup>nd</sup> section has developed a communication tool as digital book.

Based on up-to-date scientific and technical knowledge, it is intended to support the dialogue between science and society...and fight against falsehoods like: “Save the trees don’t print”



# The digital Book

- 10 Chapters
- 105 articles of 4 pages (each article addressing one question)
- 420 pages
- 60 authors, 50% academicians, 50% external experts
- website: <https://www.academie-foret-bois.fr/>  
where each article (in pdf format and French) can be **downloaded free of charge.....and translated on line, cautiously, if necessary!**

# Chapters

- 1 French forest-wood sector in a global context**
- 2 Forest ecosystems and their functions**
- 3 Wood, main product of the forest**
- 4 Other goods and services supplied by forests**
- 5 Risks affecting the forests**
- 6 Climate change**
- 7 Assets of the forest-wood sector in a "green economy"**
- 8 Sustainable forest management**
- 9 Policy and governance aspects**
- 10 Forest, wood and human society relationships**

## **Chapter 3: Wood, major product of the forest**

- 01 What is the annual harvest of wood in metropolitan France: is it sustainable?**
- 02 Which woods for which uses?**
- 03 What place for wood in construction in France?**
- 04 What place for wood in furniture?**
- 05 What place for wood in packaging?**
- 06 What place for wood in the paper and paperboard industry?**
- 07 Is wood still a source of energy?**
- 08 What uses of wood in art and crafts?**

**<https://www.academie-foret-bois.fr/chapitres/chapitre-3/>**

## Chapter 3: Wood, major product of the forest (cont'd)

9 Solid wood or engineered wood?

10 Are forestry resources matching the industrial demand ?

11 Do we find wood material where we expect it in our daily lives?

**12 Wood processing: what are the main technologies?**

13 Wood and cooperage: marriage of grapevine and forest?



# How to write an article?

- Title

- Introduction

- Size: 4 pages

- Same template for all articles

- Figures

**WOOD MAJOR PRODUCT OF THE FOREST**

3.12

on line, 3/11/2017

## Wood processing: what are the main technologies?

From the forest, wood is used, in order of importance by volumes consumed, as wood energy, timber and industrial wood (pulp and wood based panels) (Figure 1). This article will deal only with wood processing related to the transformations as follows: a) first transformation (sawing, slicing and peeling); b) second transformation (packaging, building and construction, furniture). Most of these transformations involve heavy operations using predominantly imported cutting and milling machines. The implemented processes are used in the timber industry, even though part of the secondary processing operations for solid wood or reconstituted are carried out at a craft scale.

**First Transformation:**  
Sawmills are the mainstay of the wood industry and condition most subsequent processing. Figure 2 shows the different steps in a sawmill. Log control and flow optimization can be performed using very modern methods such as CT (Scanner X).

Bois d'œuvre: pour la menuiserie, l'aménagement ou la construction

Brosses, dégraines: pour la pâte à papier et les panneaux

Écorce: pour l'énergie ou le compost

Solures: pour les panneaux ou l'énergie

**LA FILIÈRE BOIS**

Recyclage

Première transformation: Broyage

Deuxième transformation: Plaque de forestier, Granulés, Bûches

BOIS ÉNERGIE

BOIS D'ŒUVRE: Parage (Contreplaqué), Produits connectés, Pâte à papier, Papier

BOIS D'INDUSTRIE: Industrie papetière (papier et cartons), Meubles et ameublement

The sawing station (see Figures 3a, and next page 3b-3c) comprises a fixed frame on which is located the cutting tool, in this case a band saw, a reciprocating carriage on which is fixed the sawing log. Other types of saws are also used: circular saws, reciprocating saws and canters. (<https://www4.ac-nancy-metz.fr/pasi/IMG/pdf/88SaulxuresLPEXP2-2010am1.pdf>)

**Figure 3a. Band saw diagram**

**Figure 2. Sawmill steps**

**Figure 1. Wood sector - Source: Blog Christophe Chabbi**

**Figure 2. Sawmill steps**

3.12.1 LA FORÊT ET LE BOIS EN 100 QUESTIONS



Figure 3b. Sawing station. Source: Primultini



Figure 3c. Frame and cart. Source: Primultini

**Drying** is a very important step in a sawmill. The most widespread is convective drying at low or medium temperature, in air or in closed cells, cf Figure 4. The moisture content of the wood should be as close as possible to the point of equilibrium when it is used to reduce dimensional variations and increase its resistance to degradation. For example: 15% <H <18% Exterior joinery, carpentry; 12% <H <14% Glulam plywood; 10% <H <12% Interior joinery, furniture. 8% <H <12% Flooring.

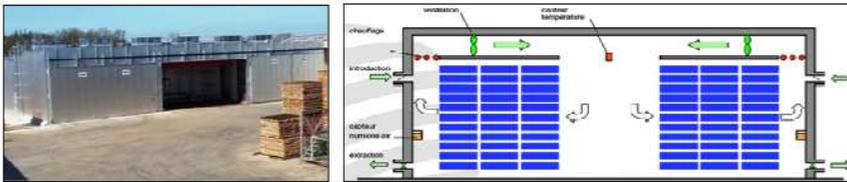


Figure 4. Convective dryers

**Preservation** of wood depends on tree species wood durability and on the conditions of use (frameworks, cladding, joinery ...). Two main techniques are used, soaking and vacuum to introduce preservations products inside the wood. Another more recent method is to heat the wood to 200 ° C to stabilize it against moisture and make it more resistant and durable.



Figure 5. Soaking



Figure 6. Pressure/vacuum autoclave



Figure 7. Heat treatment furnace

**Slicing** is a much less common process which corresponds to the most rewarding transformation (Figures 8). It involves slicing a piece of wood of rectangular shape, previously steamed, parallel to its axis to obtain a sliced veneer highlighting the aesthetics of the most beautiful veined wood (oak, ash, fruit, tropical ...). The material used is a veneered paper cutter. With a thickness that varies according to species, from 4 / 10th to 2 mm, these veneers are used in marquetry, cabinetry or panel veneer.



Figures 8 : Slicing: process, old horizontal slicers (Vallette et Gareau), cutter and products

**3.12 Wood peeling** is a lower value-added processing for packaging and plywood applications. A knife peels the wood as the axis rotates, see figure 9. Generally we peel out woods of homogeneous structure, quite soft or semi-hard parboiled, such as beech, okoumé, or soft like birch or poplar. It is possible to adjust the machine for thicknesses up to 5mm, to those of sliced veneers, especially for the uses of the packaging.

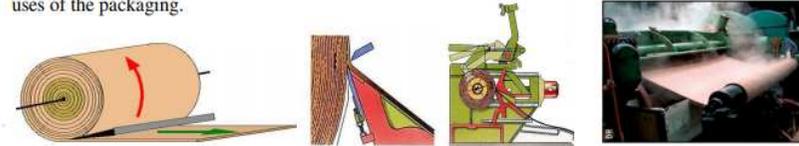


Figure 9: Peeling Important parameter: the position of the support bar with respect to the knife

**Splitting** can be considered as a **primary processing** operation and is not only used for the production of logs, but for the production of staves (Figure 10) which in a **second transformation** gives the staves forming the barrel wall (Figure 11).



Figure 10. From wood staves to barrel staves



Figure 11. From staves to barrels

The **second transformation** brings added value to products from the first processing and makes them available to the final consumer directly or indirectly through distribution.

Timber on lists, go directly to the construction (frames, roof trusses).

The co-products of the sawmill will be transformed first into **reconstituted wood**, cf article 3.09 "Solid wood or reconstituted wood" before being used in wood energy. The volume is important considering the material yields of sawmills, of the order of 65% for softwoods and 45% for hardwoods.

**Solid woods** can be butted and glued to obtain long pieces such as **glued laminates**. It is the same for massive panels from pieces of small section like **cross laminated timber (CLT)**.

The **industrial joinery** (doors and windows) and **furniture industries** use very advanced technologies allowing flexible manufacturing of different parts on the same line as in the automotive industry.

A whole series of machines will produce the necessary parts for the industrial and furniture joineries. The planing moulders, see Figure 13, or "four faces" machining and profiling parts moving at high speed according to the diagram of Figure 12.

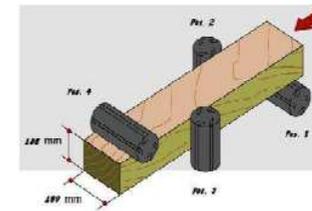


Figure 12. Four side planer scheme



Figure 13. Planing moulder Source : Weining

- Further reading

- What you must remember as a conclusion

Minimum one author

Minimum 2 reviewers

Permanent update easier on the Web than with a book



Figure 14: Planing tool holder



Figure 15: Four side planer Source: Weining



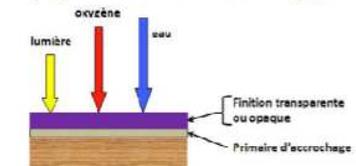
Figure 16: Transfer robot

**Robotization** is developing rapidly in the Wood Industry, just like the automotive industry, which is now completely robotic. The report on a seminar on robotization in the wood industries, held at ENSTIB, provides a comprehensive update on the current situation :

[http://www.fcba.fr/sites/default/files/fcbainfo\\_2015\\_1\\_restitution\\_du\\_colloque\\_sur\\_la\\_robotique\\_dans\\_les\\_industries\\_du\\_bois\\_et\\_des\\_espaces\\_de\\_vie\\_valerie\\_gourves.pdf](http://www.fcba.fr/sites/default/files/fcbainfo_2015_1_restitution_du_colloque_sur_la_robotique_dans_les_industries_du_bois_et_des_espaces_de_vie_valerie_gourves.pdf)

Robotization enables the transition from mass production to the flexible production of custom-made products, which has become indispensable in furniture and kitchen furniture, and improves the quality of production by eliminating human errors in sorting. Robotization also makes possible to better manage intermediate flows in the workshops and to save space. For employees, robotization reduces repetitive tasks and improves ergonomics.

**The protection** against weathering of solid or glued wood used in industrial joinery or furniture requires a final surface treatment. This is achieved by the application of finishes, barriers to water, oxygen and light:



**Three types of finishes** are used, **varnishes** (transparent), for the interior, **film-forming or non-film-forming stains** and **opaque paints**. These products are either in liquid form, organic solvent or water, or paste (resin without solvent) or powder.

The **processes** for industrial **applications** as well as for **curing**, depending on the parts, the finishing product and the subsequent use, are of several types: roller, pneumatic or electrostatic spraying, spraying or flow-coating, see fig. 17, soaking, curtain or cylinder. Curing is achieved either by evaporation / coalescence, chemical reaction, UV / Vis (Fig. 18) for liquid finishes, or by melting / baking for powder finishes:

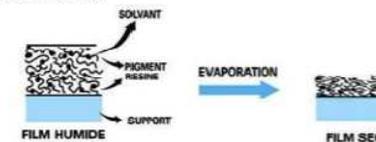


Figure 17: Chaîne de peinture



Figure 18: Séchage UV

### What you must remember

- Wood from forests is an industrial material which undergoes two major categories of transformation to produce the final product.
- The first transformation is mainly sawing which itself includes several stages, one of which is essential: drying.
- To be profitable and efficient, sawmills must be large enough to use new technologies such as CT (X-ray) scanners to optimize throughput.
- The second transformation results in the final product marketed or implemented. It uses advanced industrial equipment, mainly imported.
- Robotization/Automation is developing very quickly to make production competitive and less exposed to relocation.

# Conclusion

- **This digital book is competing inside a very dense Web and needs to be promoted!**
- **It could be perhaps a model which could certainly be adapted by IAWS to realize a common task.**
- **Such a joint work would help to develop a better involvement and cohesion of the fellows, together with dissemination of Wood R/D activities in the participating countries.**

**Acknowledgements to Yves Birot and Bernard Roman-Amat ,  
former and actual secretary of Section 2 French Academy of Agriculture**



**Thanks for your attention**

**Questions?**

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*Président d'honneur* : le Ministre de l'agriculture, de l'agroalimentaire et de la forêt

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