IMACFORD Task B1 meeting on Wood Quality and Wood Products

"Future Changes and Innovations in Wood Quality and Wood Products: Implications for Research"

12 December 2002 – INRA/LRBB - Bordeaux, France

Main points of discussion

<u>*Appendix*</u>
1 – List of participants
2 - Agenda
3 – Presentations
4 – Group reports

<u>Item 1. Overview of IMACFORD project and the 6th Framework Programme</u>

- Objectives of IMACFORD task B1 project:

(i) Improvement of research coordination within IEFC network,
(ii) Definition of **common issues concerning sustainability of cultivated forests**.

- Opportunities for forest and wood research sectors within the Work Programme of FP6:

In the process of construction of the European Research Area, the Commission wishes to improve the connections between forestry and wood sectors in order to ensure the sustainability of the complete forestry/wood chain (1.6.3.V.2.2).
Such potential partnerships to develop between forestry and wood sectors are currently discussed through the meetings organized within the IMACFORD project and within the ERA-WOOD project which aims at the preparation of the European wood research organisations and industries to FP6.

<u>Item 2. Trends in wood quality issues</u>

<u>2.1. Tree breeding and wood properties</u>

Within a breeding programme, wood quality can be a specifically targeted objective, or it can be indirectly affected as a consequence of selections based on other traits of interest.

- Breeding programmes for wood quality

From the identification of the genes coding for the traits of interest to the commercial exploitation of improved trees, improvement strategies on wood quality traits are really long term processes. In that context, **economic acceptability is the main factor of impediment** of a large scale deployment of breeding programmes on wood and fibre properties.
Taking into account this economic aspect, a few forest species are currently the objects of specific improvement programmes. Those forest species are intensively managed (poplars, maritime pines or eucalyptus for example) and industrial connections are already well developed.

- Site, silviculture and genetics regarding wood quality

Deployment of intensively managed forest species (for a higher growth rate, pest resistance, etc.) as an anthropic input in the environment causes relevant effects on wood quality that have to better understood. In that context, it is essential to define, to assess and to predict the impacts of **site, silviculture and genetics** and their interconnections regarding wood properties.

At INRA, studies on functional genomics of wood formation and wood quality (heartwood, durability, etc.) are led in parallel with research on genetic and environmental determinisms of wood formation.

2.2. Wood quality in plantation forests

Linking cultivated forests to wood quality, 3 potential impact factors can be highlighted: growth rate, models and logistics, and tree breeding.

- Impacts of growth rate on wood quality

Considering the impacts of climate change on forest stability, shortening the rotation age by increasing growth rate may represent a solution for profitability and risk management.

However, it has been shown that **wood and fibre quality parameters are very few in juvenile wood to mature wood** (micro fibril angle, moisture content, wood density or the importance of reaction wood for example), leading to a decreased quality and limited use.
Thus, silviculture regimes with shortened rotation may lead to unfavourable properties for both solid wood and fibres.

- Development of the connections between forest and the industry

Within a global wood quality strategy, **it is essential to evaluate and to segregate logs according to the wood quality parameters required by the end-users**.
Models and tools for optimising logistics are developed at AFOCEL. The aim is to provide qualitatively homogeneous logs to the industries and thus to enhance their flexibility and competitiveness. Moreover, through the assessment of the quality of their logs, forest owners and entrepreneurs can expect a fair price for their goods and services.

- Tree breeding and wood quality

AFOCEL has demonstrated the high variability of wood quality between Douglas fir clones selected on growth rate. Qualitative factors such as density of solid wood or fibre length have weak heritabilities (except for the lignin content for which breeding programmes are engaged) and for that reason those parameters are strongly affected when breeders only take the quantitative traits into account within the breeding programmes.

Wood quality is not a strictly phenotypic expression of the genetic pool. It's the result of a combination of genetic, environmental and silvicultural parameters. Studies have to be done on the **impacts of sites, silviculture and genetics on wood quality**.

2.3. SUSTAIN-WOOD: a proposal for the sustainability of the forest/wood chain

Barry Gardiner gave a short presentation of the SUSTAIN-WOOD EoI proposed for FP6 (Sustainability of the Forest-Wood Chain through improved understanding and utilisation).

To increase the consumption of wood as a raw material, SUSTAIN-WOOD proposes **a platform to better understand the natural processes affecting wood formation and the market requirements as well**. The 3 main issues retained are:

(i) How wood is formed?
(ii) How this is affected by environmental conditions?
(iii) What are the connections between wood microstructure and the wood properties of importance to the end-users?

To supply some elements to answer, the 3 following objectives are developed:

(a) Understanding the link between wood microstructure and end-use requirements.
(b) Develop methods for assessing timber quality throughout the wood chain.
(c) Understanding the impacts of tree breeding and silviculture on timber quality.

In a global wood quality strategy, it is essential to connect forests to the industrial needs and in this necessary linkage, forest and wood research organisation should play a key role.

2.4. OPTIM-OAK: a proposal to optimize the forest/wood chain for oak resource

The objective of the OPTIM-OAK proposal to FP6 is to supply an **evaluation of the amount and the quality of present and future oak resource** (sessile and pedunculate) through an empirical model simulating tree growth, harvesting, product manufacturing, and considering climate change, various silviculture regimes, various commercial wood products, carbon and energetic balances and social parameters like the employment for example.

Item 3. Market requirements and wood products

3.1. Engineered Wood Products EWP

EWP are attractive for wood and fibre companies because of their technical properties (better reliability than traditional wood for end-uses) and their economic opportunities (new markets). They also actively contribute to the optimisation of the resource (1m^3 of product from 1m^3 of raw material).

- Issues concerning the physical properties of EWP:

Until now, no studies have demonstrated the influence of raw material quality (moisture content, durability of the fibre) on the physical properties of EWP. And this issue should be more and more relevant in the future because of climate change and the development of innovations in forestry (genetic improvement and silviculture).

- Issues concerning the environmental impact of EWP process:

What's the environmental impact of the production processes, like gluing for instance, in terms of emission of pollutants? And what's the energetic balance of EWP considering their whole life cycle?

- Issues concerning the commercial development of EWP:

EWP represent an opportunity for the wood sector to penetrate new commercial niches like the construction one. Standardisation of the products and simplification of design rules have to be further studied to make EWP attractive for end-users.

3.2. Timber quality for construction

There are several factors of impediment to a large use of timber for construction (structural defects, spatial and temporal heterogeneity). So, the issues for timber companies are:

(i) To improve the reliability of the structural properties (global homogeneity),
(ii) To propose products complying with the concept of "Fitness for purpose" (sizes),
(iii) To standardise (measurements and qualities) and to eco-certify their products (preservatives).

- Research on technological aspects:

Industrial processes (drying and storage, sawing and green gluing) can avoid some timber defects (sizes, stability in time of the structural properties, stiffness). **So, there is a need to better understand those industrial processes, to improve them, and finally to reach builders requirements.**

- Research on commercial aspects:

To prevent end-users fears because of wood heterogeneity, strategies to **better specify wood quality** for specific end-uses should be developed (technical methods and commercial tools).
Also, to enhance the reactivity of wood companies and the image of wood in builder's mind, market needs have to be better understood.

- Connections with the forestry sector:

Methods cannot work miracles and the enhancement of timber employment in construction goes through the **offer of a basic grade of starting material from wood suppliers**. An other connection concerns the raw material supply and thus the organization of the forestry sector. Finally, customers want **ecologically friendly products** and the whole forestry sector has to enhance the transparency of its production process (sustainably grown timber, transport, and biodiversity for example).

3.3. Market requirements for fibre products

According to printing companies, “a product of quality” is (i) a homogeneous product, and (ii) a product which supports different kinds of printing processes without damages on technical and esthetical point of views.
To provide such quality to their customers, pulp and paper mills had transferred the market requirements on the forestry sector. **The objective is to have a forest/wood resource well adapted to the industrial processes**. In other words, it’s to feed the mills with a good industrially fibre. Such a fibre can be defined as: easy to beat and to bleach, high cellulose content and low lignin and resin content, high fibre strength and flexibility, low MFA and compression wood content.

To comply with the pulp and paper companies requirements for fibre properties, AFOCEL is developing research activities around those 4 complementary areas:

(i) Adapting the forest resource to the industrial needs (log segregation, specific plantations for fibres mixes)
(ii) Improving the supply chain management and the industrial control (logistics)
(iii) Enhancing the value of the local species (tree improvement and biotechnologies, silviculture, analysing the forest resources)
(iv) Optimizing the process with the wood supply (beating, bleaching),

Item 4. Life Cycle Assessment

LCA aims at the **evaluation of the environmental balance of a product considering its whole life cycle** (emission of pollutants, energy and material consumption). The environmental impact of each step of the life product is evaluated, from the forest to the end of life of the wood product through its utilisation as furniture for instance.

LCA is a developing area but it’s seen as an important tool because:

(i) It feeds the debate on the environmental impact of human and industrial activities,
(ii) It enables comparison between different materials used for the same purpose,
(iii) It provides information concerning the steps to be improved.

INRA Pierroton, Lerfob, and CTBA have jointly initiated a project which aims at the assessment of the environmental impact of several silvicultural regimes for Sessile oak and Maritime pine. The objective is to elaborate a **methodology to reason globally from the forest resources to the manufactured products**.
First results have demonstrated that within the forestry/wood chain, **log transport** is the main source of emission of greenhouse gases through the consumption of fossil energies.

Item 5. Group discussions - research topics to be further studied

Three groups were constituted. Each group was asked to discuss on the topics presented below, and to prepare a list of potential research topics to explore within FP6:

(i) Quality requirements
(ii) Sustainability of the forestry/wood chain
(iii) Utilisation of end-products