WOOD

The Most Interesting and The Best Material for Our Society

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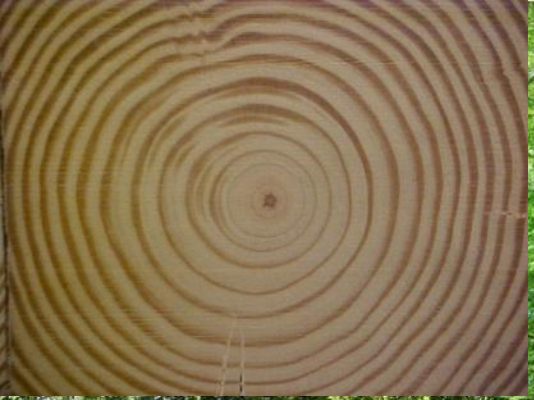




Use of wood benefits climate, environment, forest, human health, and economy.








WOOD

- Wood is the renewable, recyclable, biodegradable material.
- It is also highly recommended material for creation of beautiful, sustainable and earth friendly products.
- Today there is a lack of interest in wood products by the young generation and wood and wood products trade are losing its importance.
- There is a strong need to remind all potential users and the general public reasons why wood is the greatest material out there.

WOOD – Material with Superior Properties

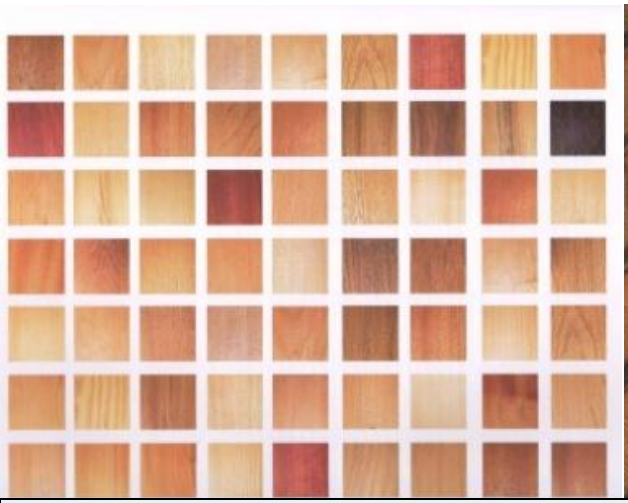
- Combination of highly valued physical, mechanical, aesthetic and environmental properties are unique only to wood.
- Wood is used by variety of users: architects, designers, product developers, artists or craftsmen.

Web Source Images

Properties

- Broad spectrum of natural colors, texture, variable density, strength, odor, thermal conductivity, acoustic insulation, electrical, friction, nuclear, nano-dimensional properties, and others are reasons why wood is used in so many unique applications.

natural color



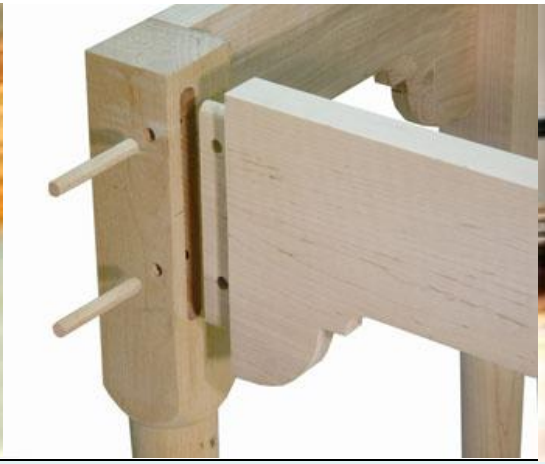
texture

density and strength

Source: Lefteri 2003

Physical Properties

- Properties such as wood - moisture relation and its result in dimensional instability could be perceived negatively, yet it could be also used as an advantage by the clever designer.
- Green furniture makers used shrink and swell techniques to built furniture which will get stronger over time.
- Examples of shrink and swell joinery are seen in Shaker's furniture, oriental furniture, and school furniture.

Strong and Durable by Structure

School furniture build with shrink and swell fit joinery.

Helping Around the World

The specialists are helping communities in less-fortunate areas to construct wooden school furniture that are stronger, more durable, and more affordable.

Physical Properties

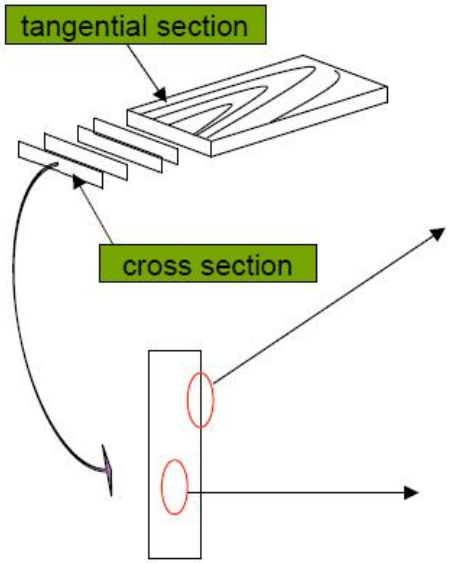
- Wood is orthotropic material and is perceived as a challenging material.
- There is great need to understand its behavior.
- Empirical knowledge of proper wood utilization is apparent in many great masterpieces created in the past.
- Wood could be also improved with finishes and treatments that could convert the hygroscopic nature of wood into a product with water resistant or even waterproof properties.

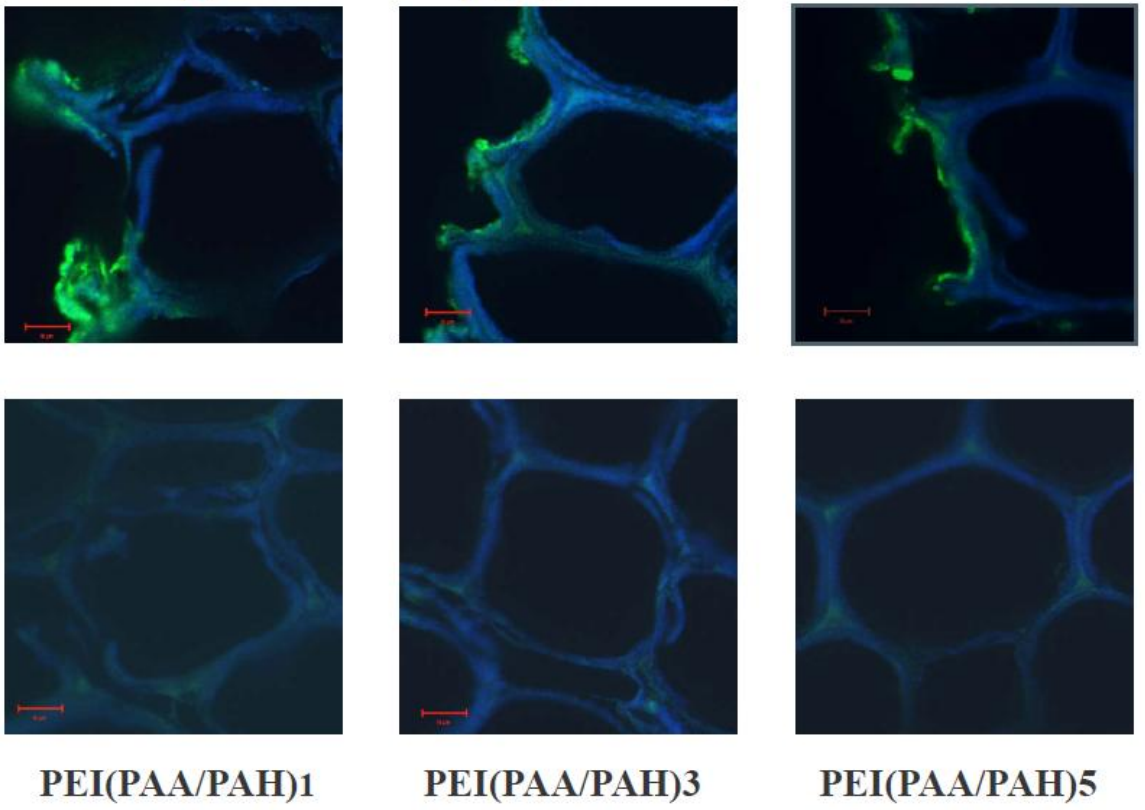
Improved for Waterproof

Web Source Images

LbL nanoscale coatings on wood surfaces using polyelectrolytes

- Confocal laser scanning microscopy (CLSM)





PEI(PAA/PAH)1 PEI(PAA/PAH)3 PEI(PAA/PAH)5

Fig.6. Images taken from the fluorescence-labeled polyelectrolytes treated wood

Source: Scott Renneckar, Assistant Professor, Greensboro, NC

Mechanical Properties

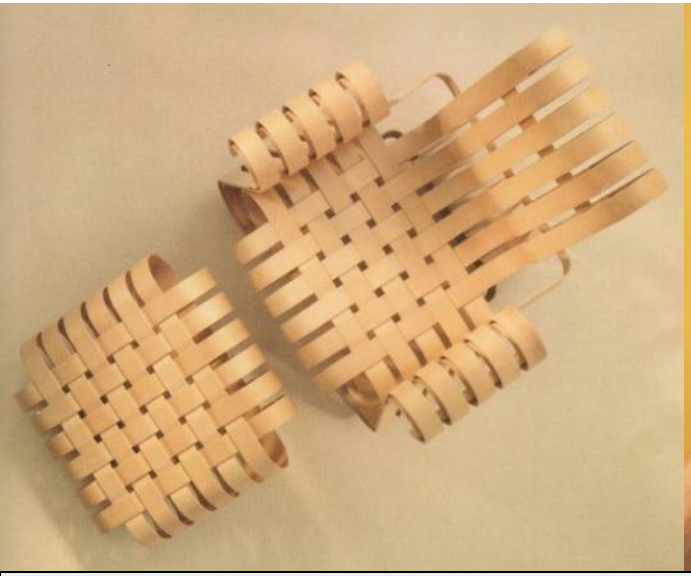
Variable strength based on different wood species, elastic properties such as flexibility, bendability and durability contributed to many products with long lifespan and great performance.

Strong and flexible

Source: Lefteri 2003

Bending Wood

- With help of plasticization treatments, craftsmen bent wood for centuries.
- Compression bending is an example of how we could obtain incredible shapes made of wood.



Source: Lefteri 2003



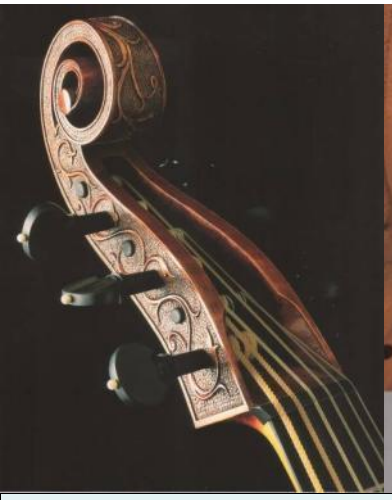
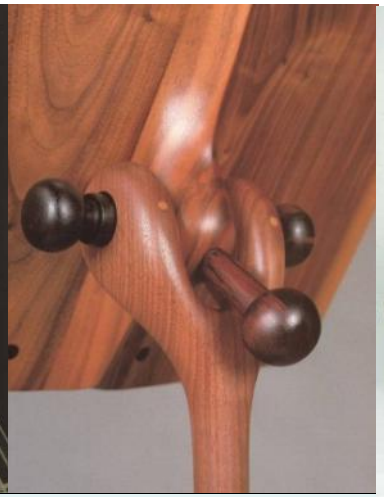




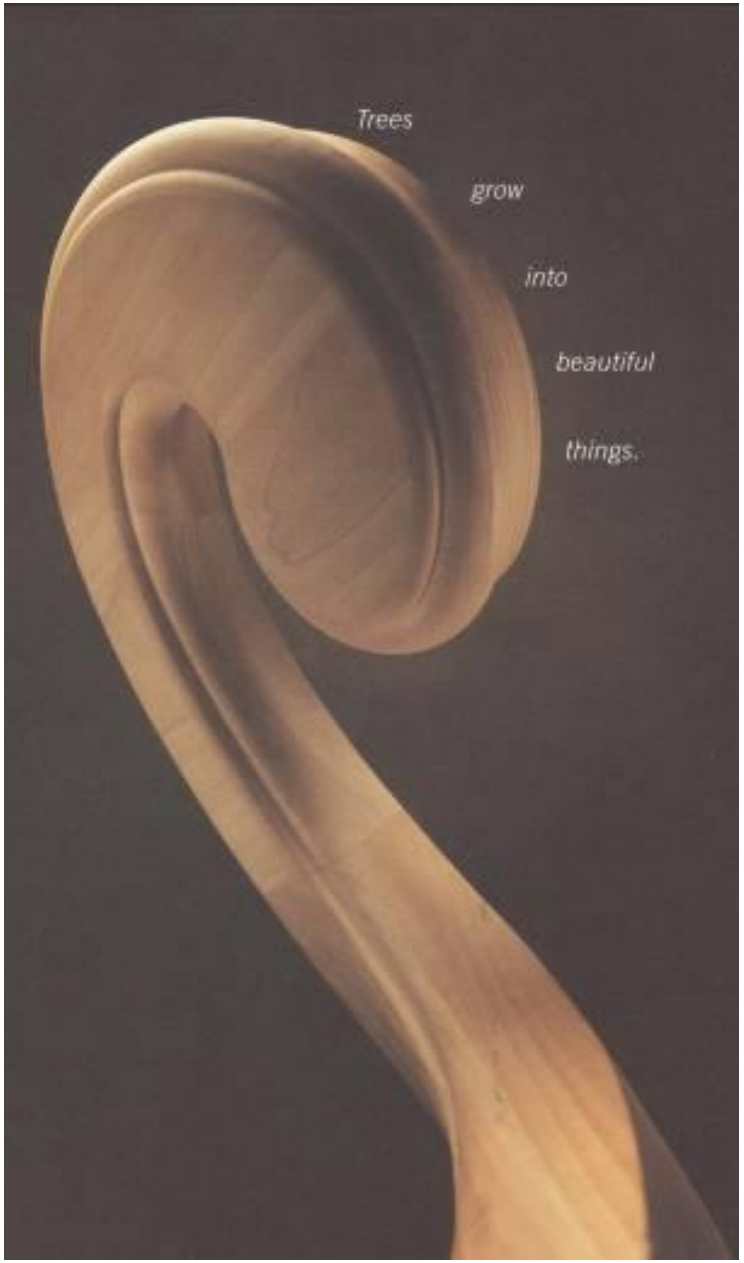


Aesthetic Properties

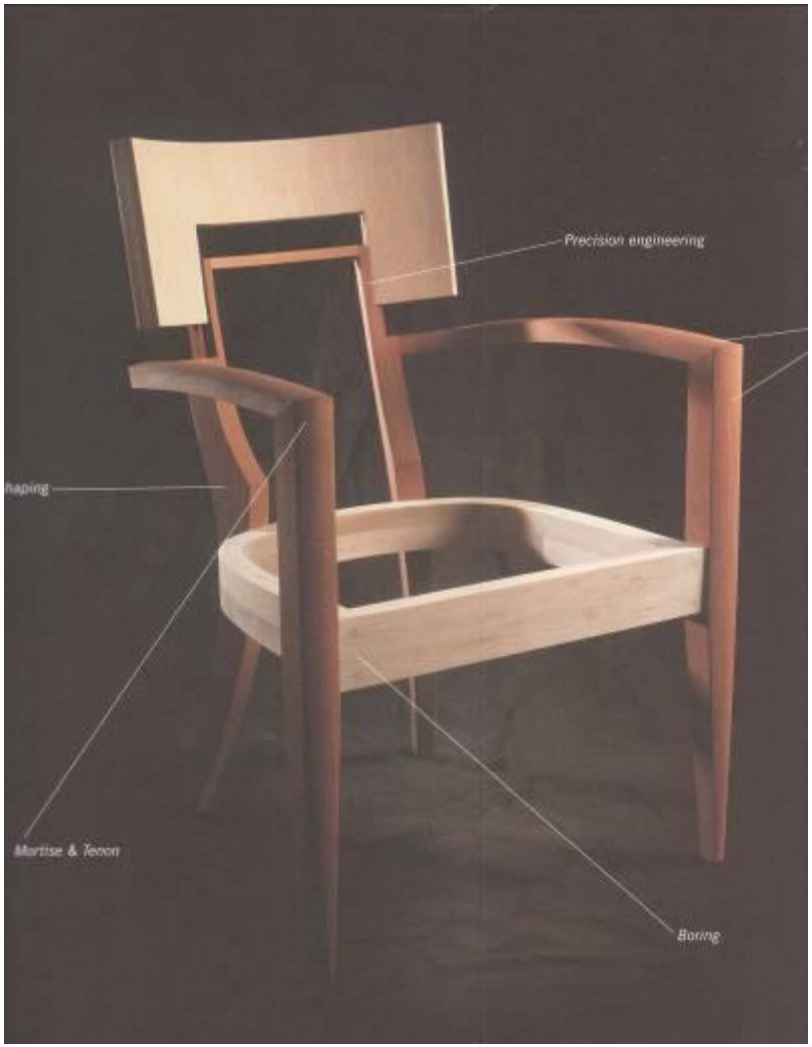
- Among many are variability in appearance based on color and texture, natural soothing feel, warmth and comfort.
- Wood is a material with status, graceful aging, and with presence of unique character marks.
- Above all, wood is the material of superior workability, chosen by many craftsman and artists.

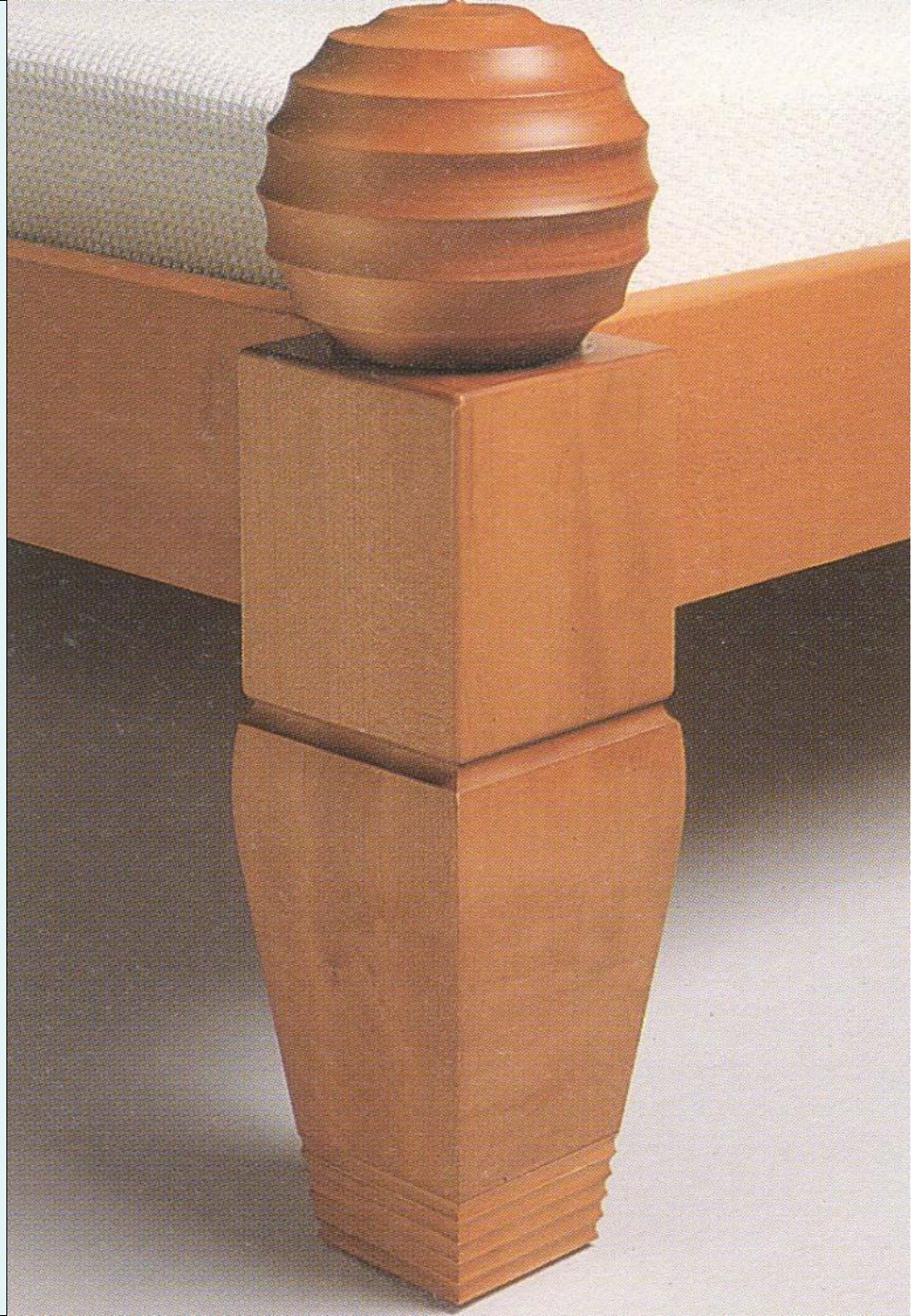



Source: Lefteri 2003 & web source images



Workability

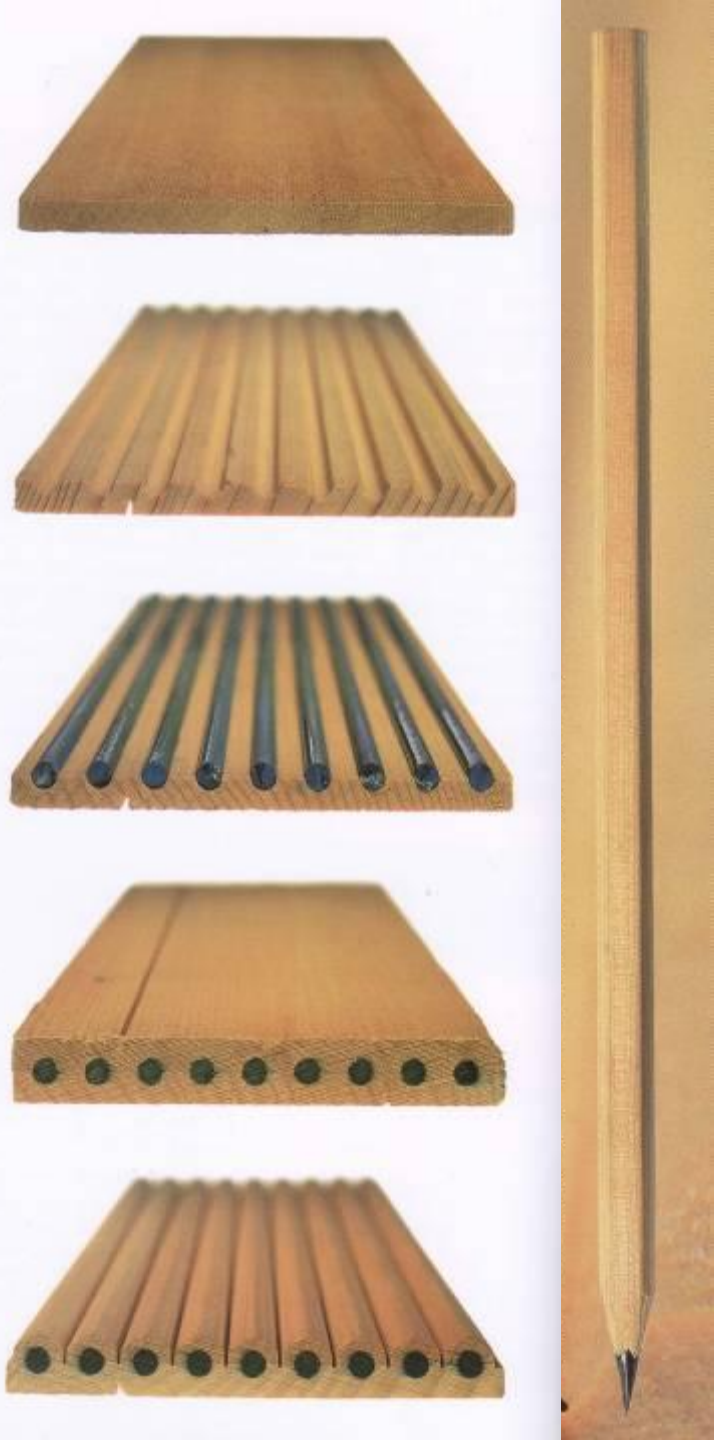




Leon Krier

Added Value

Various Forms

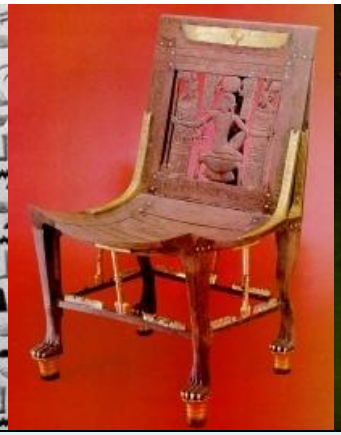


Mass Produced

Wood Utilization - Past to Present

- Wood has been serving humans as a superior material for centuries.
- Ancient drawings are documenting how need for wood conquered and transformed the world.
- Wooden artifacts with superior construction were found in Egyptian tombs and other places..






Source: Perlin 1989

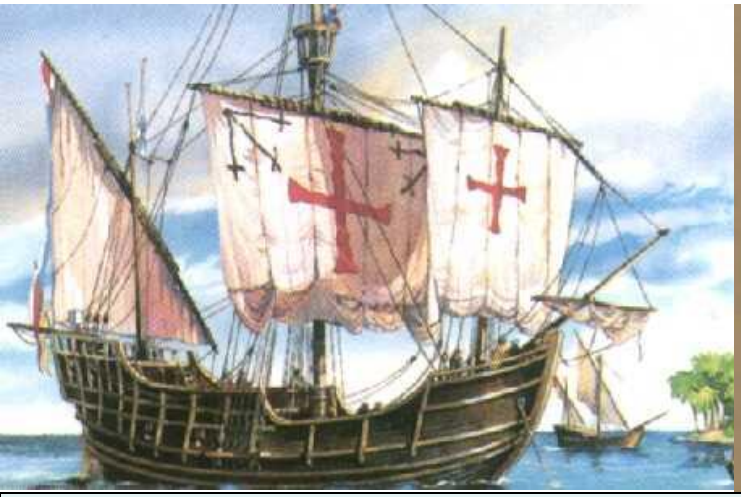
Wood Utilization

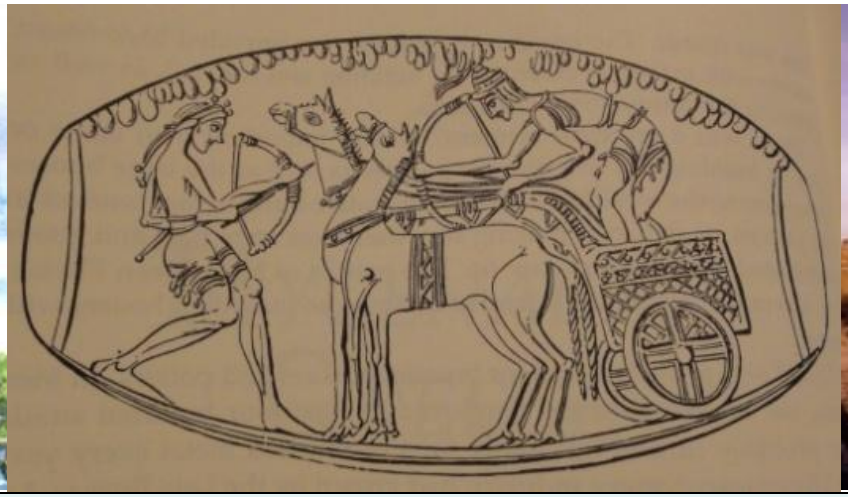
- Expanding empires, building cities and towns, metallurgy, glass production, and even a taste for sugar lead to massive deforestation.
- A movement to a new world with abundant wood resource and consequently to a great shift of power has occurred again and again until today.

Source: Perlin 1989

Wood for Transportation

- Wood made trade possible from ancient to present times. Ships, chariots, carts, wagons, and other transportation vessels were made for centuries from wood.





Source: Perlin 1989

Wood for Transportation

Source: web source images

Heating Power

and energy from wood residues is an important attribute in today's world.

- charcoal

Source: web source images

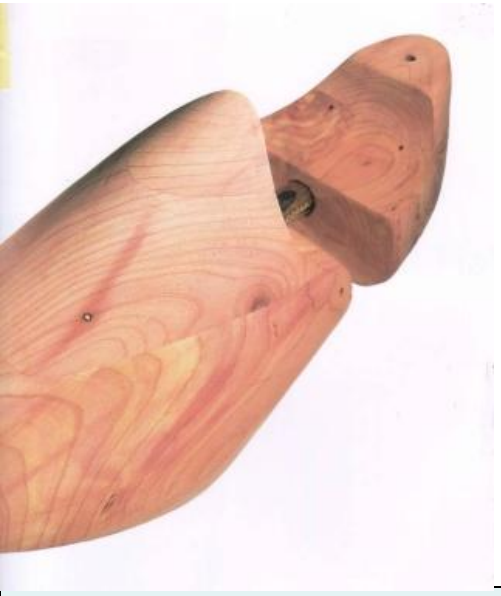
Wood for Musical Instruments

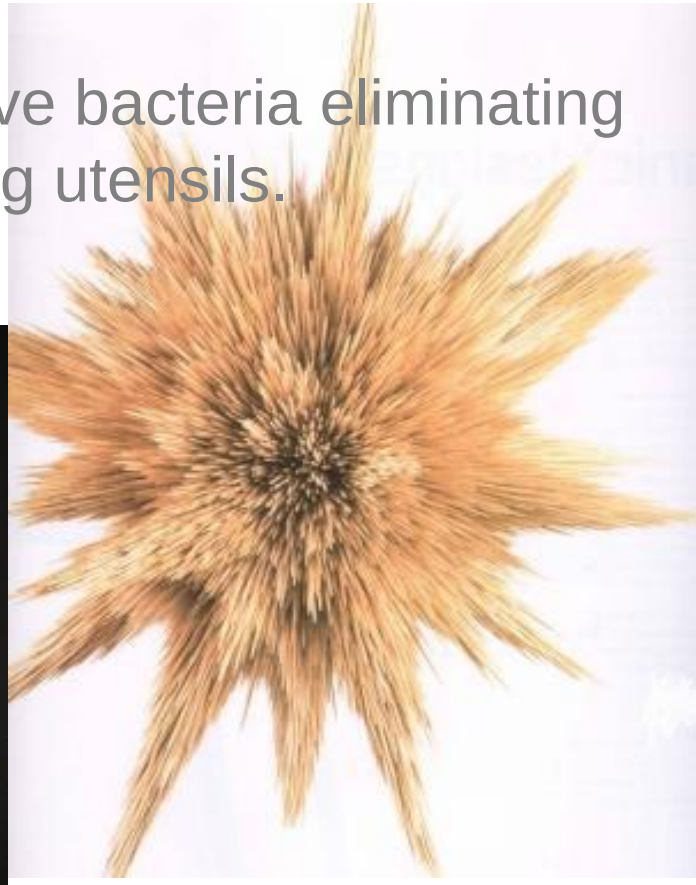
Acoustic properties of wood for production of musical instruments are perceived more like an art than science but proper selection of wood material is essential for production of high quality musical instruments.

Source: web source images

Wood for Incense and Cooking

- Sandalwood was prized as an incense wood in China.
- Cedar was traded by early civilizations and is still used today as an incense material for closets.
- Wood in hygienic and is claimed to have bacteria eliminating properties and is often used for cooking utensils.

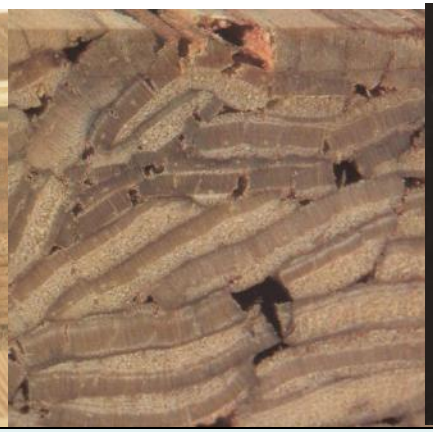


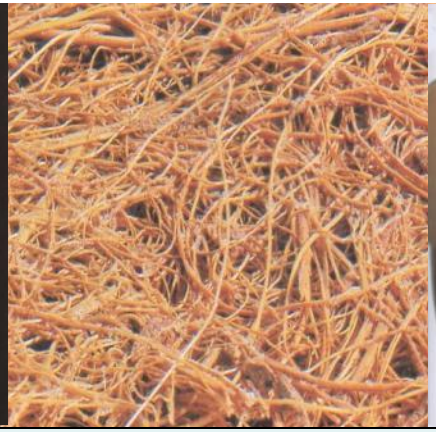


Source: Lefteri 2003

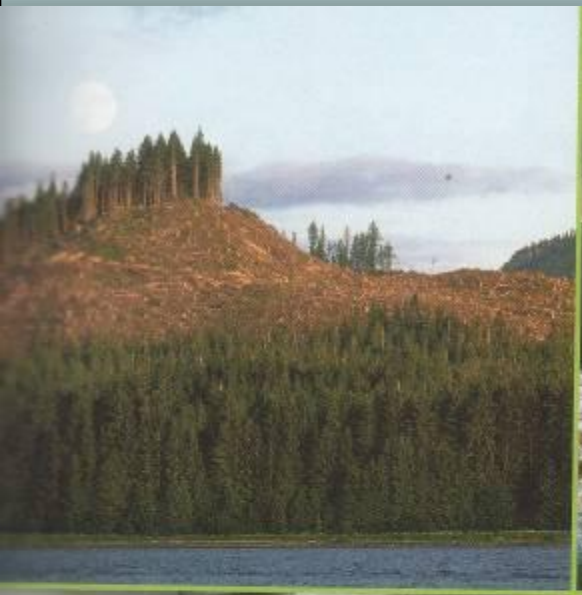
Wood fro Engineering Materials

- Variety of wood-based composite materials are created from big or small wood particles or residues.
- These materials are more uniform with specifically designed strength properties.
- They are more and more utilized to create unique small and large scale structures.




Wood for Pulp & Paper



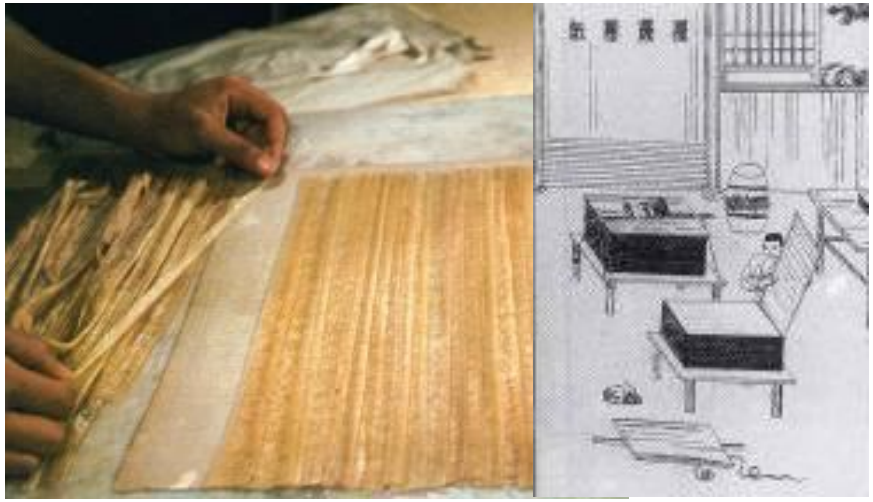
Worldwide –

300 millions metric tons of paper is made per year

Wood for Pulp and Paper

Past

Ancient Egyptians made papyrus sheet



Papermaking was invented in A.D. 105 by T'sai Lun in China.

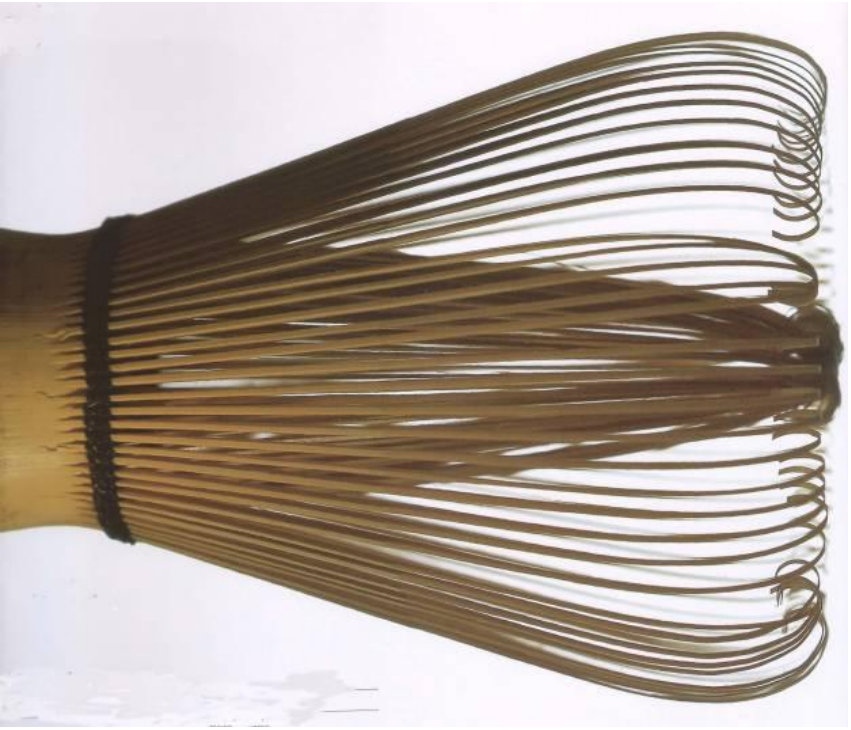
Present

Paper scientists re-invent paper and are employing nano-scale knowledge to optimize its properties, at low a cost.

Source: web source images

Non Wood Forest Products

- Bamboo is growing one meter a day and is an important material with more than 1,000 uses.
- Rattan and other similar materials are also of high importance.



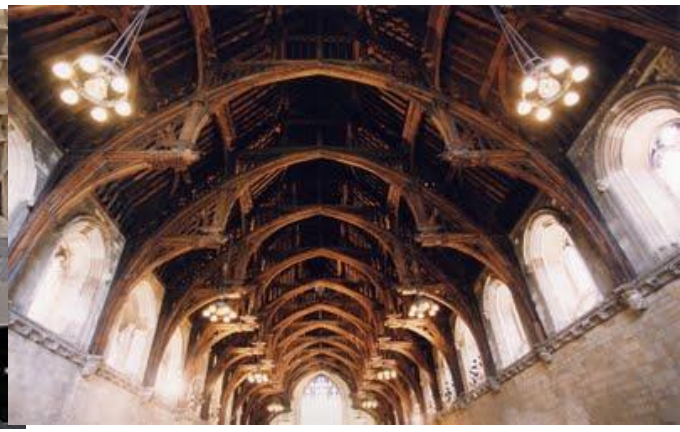
Source: Lefteri 2003

Wood for Structures

From the great architectural wonders of ancient civilizations to the contemporary structures with the most favorable ecological footprints, wood is the material of choice.

Examples:

- London Olympic Velodrom in England;
- Metropol Parasol in Sevilla, Spain;
- Westminster Hall, in London England;



Source: web source images

Wood for Structures – Examples from China

Hanging Temple of Mount Heng and in Shanxi province.
The Sakyamuni Pagoda of Fogong Temple of Ying County, - the oldest surviving fully-wooden pagoda;
Baoguo Temple – one of the oldest and most well preserved wooden construction.



Web Source Images

Biodegradable Architecture

Wood is also suitable for contemporary modular concepts, organic or biodegradable structures and modern homes with favorable eco footprints.

Re-assembled - Modular

Wood for Prized Objects

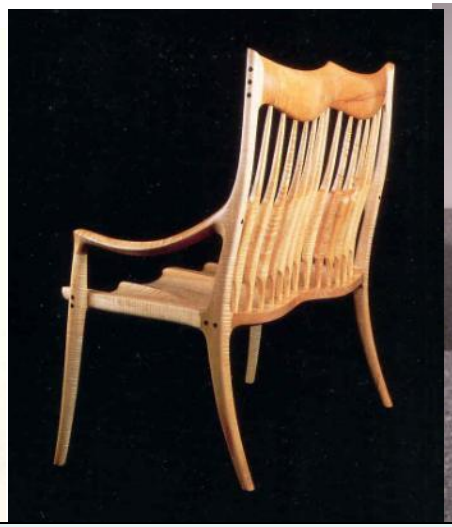
Wood shaping of any kind, especially wood carvings are the best examples how ageless value could be added to a natural material.

Web source and personal images

Wood for Furniture

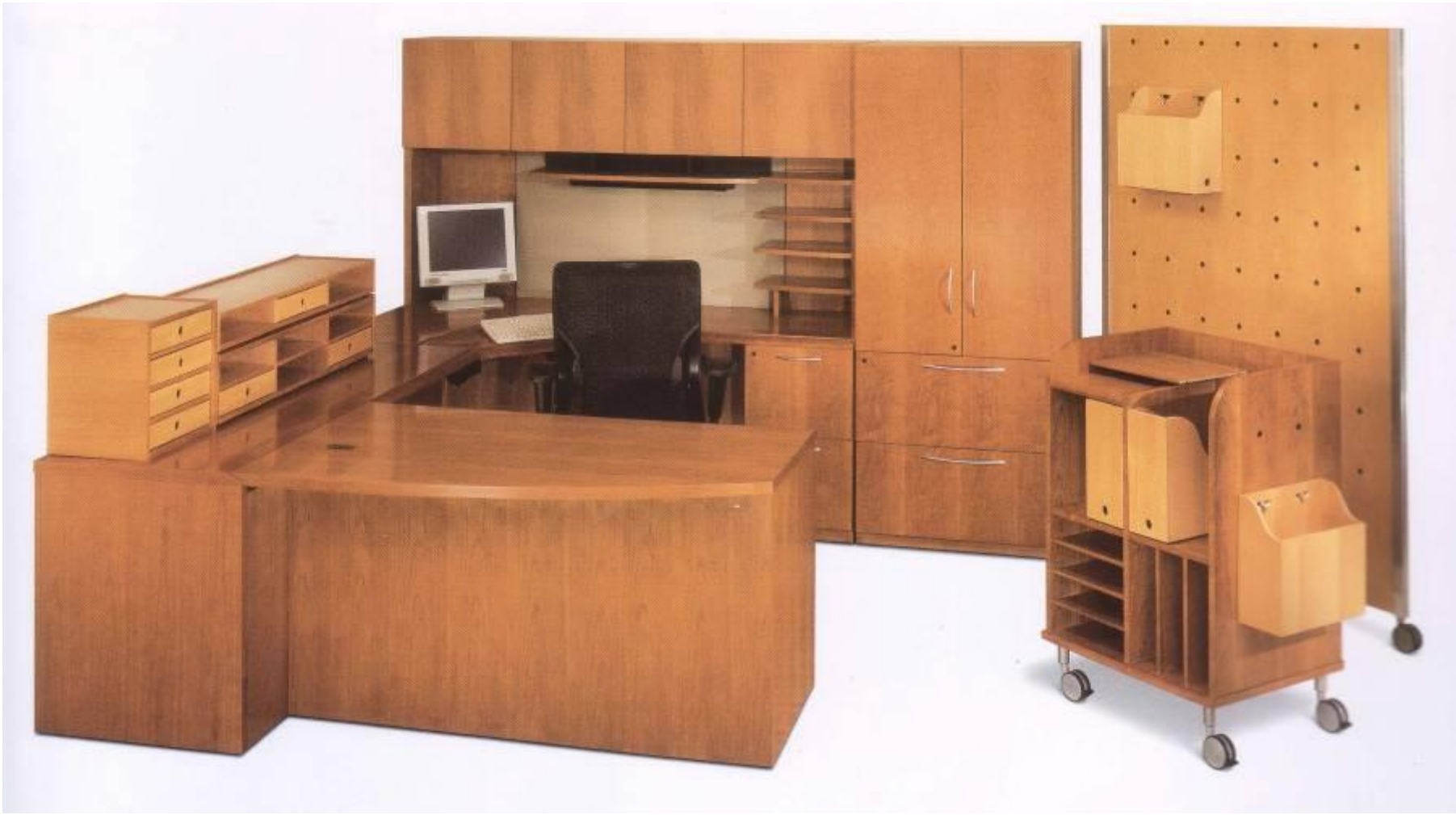
- Furniture evolved from prehistoric times and during all architectural periods.
- Wood has remained an essential material for furniture construction.






Source: Sam Maloof, web images

Wood as a Status



Comfort

Bertrand Schwaiger & Sam Maloof

Arts and Craft Furniture

Thomas Moser

Environmental Nature of Wood

- Wood is described by many as a green material, suitable for environmental applications.
- Life Cycle Analysis tools are indicating the superiority of wood when compared to other non-renewable materials.
- Wood has an ability to be preserved for centuries in durable (carbon sequestering) products..
- Wood creates no waste, but CO2 neutral energy when it is burned after its use.
- Wood is economical to use, and most people love wood products.

Source: The Danish Wood Institute, www.trae.dk

Wood is Good for all Senses

Wood is beautiful – available in variety of colors and grains.

Wood fells good – it is warmer and softer against the skin compare to metal, stone or plastic.

Wood sounds good – has the best acoustic properties & many musical instruments are made from wood.

Wood smells good – especially when is freshly cut and scents vary widely according to species.

Wood tastes good – such as wine maturing in oak barrels.

Source: The Danish Wood Institute, www.trae.dk

Certified wood comes from forests that can document sustainable forestry techniques (such as replanting after logging).

- Many certifications systems exist - FSC, FAS, etc.
- Globally forest area is decreasing due to clearing of tropical forests and converted to agricultural land.

Source: The Danish Wood Institute, www.trae.dk

Conclusions

There is a large amount of products made of wood and as we say, wood is with us almost every moment of our lives from cradle of wood to wooden casket.

Despite its vast importance, wood is currently undervalued as an essential ecological material.

Wood should be more appreciated and promoted for variable uses. There is a need to rediscover its uniqueness in order to better understand its large potential and importance in our societies.

Obligation of every educator in the forest products field is to cultivate love and passion towards wood as a superior material and to teach students and the general public how to use it responsibly and to its full potential.

Examples of Student Work

Let me present few examples from the Wood Research Laboratory at Purdue University, USA, where wood products design is approached in combination of aesthetic, strength, manufacturing and environmental design concepts.

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