Eco-Link

Linking Social, Economic, and Ecological Issues

Volume 11, Number 2

What's Good About Wood

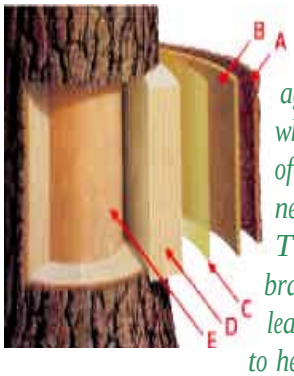
Wood is a remarkable fiber and a miraculous resource. It has played a major role in the development of civilizations for thousands of years. As John Perlin explains in his book, ***A Forest Journey,*** throughout the ages trees provided wood to make fire, the heat of which allowed our ancestors to reshape the earth for their use. With heat from wood fires, relatively cold climates became habitable; inedible grains were changed into a major source of food; clay could be converted into pottery, serving as useful containers to store food; people could extract metal from stone, revolutionizing the implements used in agriculture, crafts, and warfare; and builders could make durable construction materials such as brick, cement, lime, plaster, and tile for housing and storage facilities.

There are many reasons why wood is superior to other raw materials. Wood is available in many species, sizes and shapes to suit almost every need. It has a high ratio of strength to weight and a history of excellence in durability and performance as a structural material. Dry wood has good insulating properties against heat, sound, and electricity. It is easily shaped with tools and fastened with adhesives, nails, screws, bolts, and dowels. Wood resists oxidation, acid, saltwater, and other corrosive agents, and it can be treated with preservatives and fire retardants. While some wood can rot, most species can easily be treated with chemical preservatives. The grain patterns and colors of wood make it an esthetically pleasing material, and its appearance can further be enhanced by stains, varnishes, lacquers, and other finishes. In addition, damaged wood is easily repaired, and wood structures are easily remodeled or altered. It has high salvage value and can be combined with almost any other material for both functional and esthetic uses. More than 90% of the homes built in the USA use wood as a framing material.

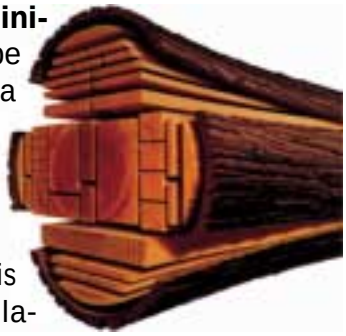
Wood comes from trees and trees are produced in forests. Hence, forests are natural wood-producing factories with free and unlimited supplies of all of the raw materials required for production. We only need "quality control."

Unlike other materials, wood is produced by trees in the forest. Trees are Primary Producers, meaning that they use natural resources to grow. Everything in a tree is built from raw materials gathered from soil and air and that is the secret to renew-ability. In a process called photosynthesis, trees use free water, carbon dioxide and sunlight to produce cellulose. Together with the lignin that binds it together, cellulose is the main component of this miraculous fiber called wood. It's the only raw material that is at the same time renewable, biodegradable, recyclable, durable, versatile, energy efficient and extremely beautiful. Learning about wood, its properties and its uses is an endlessly fascinating study. The more you know about wood, the more you'll want to know.

Wood is Life: **Wood is a resource to be conserved and developed, as we try to meet the needs of 10 billion people around the globe.** It would be hard to imagine a day without wood. There are over 5,000 uses for this fiber in our everyday lives. By weight it accounts for nearly 50% of all raw materials consumed in the world, yet only 4% of the energy needed to convert these raw materials into useful products goes to wood. That's critical, especially now, when most energy is produced by burning non-renewable fossil fuels. "Forestry is the most sustainable of all the primary industries that provide us with energy and materials," says Dr. Patrick Moore, who has detailed his ideas in a book titled ***Green Spirit: Trees Are The Answer***. "The cellulose that makes up 50 percent of wood is used in rayon and acetate as well as cellophane and explosives," he says. "However, it is the lignin portion that makes up 18-35% of wood (depending on species) that has the most potential for new materials." Lignin could readily form the basis for a chemical industry in the same way that petroleum does today."



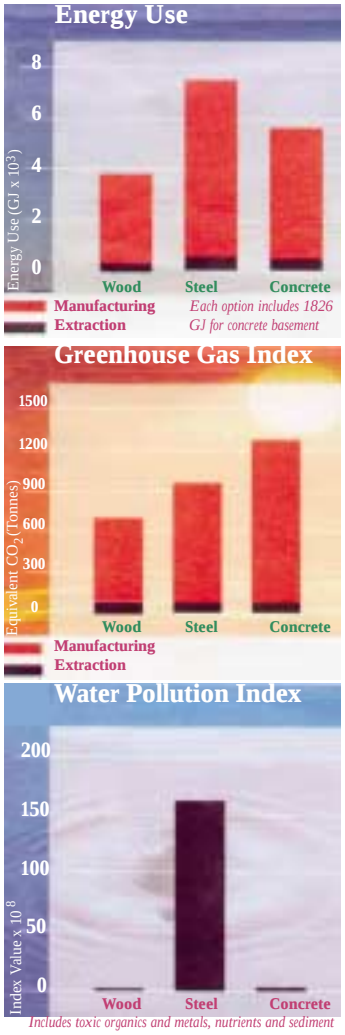
A. *The outer bark is the tree's protection from the outside world. Continually renewed from within, it helps keep out moisture in the rain, and prevents the tree from losing moisture when the air is dry. It insulates against cold and heat and wards off insect enemies.* **B.** *The inner bark, or "phloem," is the pipeline through which food is passed to the rest of the tree. It lives for only a short time, then dies and turns to cork to become part of the protective outer bark.* **C.** *The cambium cell layer is the growing part of the trunk. It annually produces new bark and new wood in response to hormones that pass down through the phloem with food from the leaves. These hormones, called "auxins," stimulate growth in cells. Auxins are produced by leaf buds at the ends of branches as soon as they start growing in spring.* **D.** *Sapwood is the tree's pipeline for water moving up to the leaves. Sapwood is new wood. As newer rings of sapwood are laid down, inner cells lose their vitality and turn to heartwood.* **E.** *Heartwood is the central, supporting pillar of the tree. Although dead, it will not decay or lose strength while the outer layers are intact. A composite of hollow, needlelike cellulose fibers bound together by a chemical glue called lignin, it is in many ways as strong as steel. A piece 12" long and 1" by 2" in cross section set vertically can support a weight of twenty tons.*



Wood We Use: **Trees are processed to optimize the volume and value while minimizing waste.** With today's engineered wood products, even small pieces can be recombined using adhesives to produce excellent products. From the bark of a tree to the core of a tree, everything is utilized. For example: **Bark** is used as fuel in mills and is also a source of chemicals, resins, waxes, vitamins, plywood adhesives, plastic fillers, lacquers and mulches. **Wood flour and Resins** using cellulose filler are principal components of dinnerware, electrical receptacles and parts, toys, handles for cooking utensils and camera cases. **Ethyl Cellulose** is used in making tool handles, photographic film and football helmets. Acetate filament yarns make textile products such as clothing, drapes and rugs. **Torula yeast** is a high-protein product which is fed wood sugars, a by-product of the pulping process in paper making. Type S Torula is used in baby food and cereals. Type F Torula is used in feed supplements for cattle, fish and chickens. **Turpentine and Tall Oil** are resinous materials also reclaimed from the paper pulping process. They are important ingredients in paint, varnish, adhesives, soaps and polishes. Synthesized essential oils are used in gum, toothpaste, detergents and shampoos.

Products From A Tree:
1. Lumber
2. Panels
3. Engineered-Wood Products
4. Pulp & Paper
5. By-Products

By-products: *Yeast, Acetone, Printing Inks, Steering Wheels, Paint Remover, Rakes, Roofing Compound, Baby food, Toothpaste, Barrels, Auto Body Undercoating, Charcoal, Varnish, Rubber Tires, Asphalt, Foam Rubber, Liquid Soap, Enamel and Wood Stain, Carpeting, Nylon, Artificial snow, Toilet seats, Boat Caulking, Adhesives, Artificial Vanilla Flavoring, Shoe Polish, Colognes, Filters, Chewing Gum, Aspirin, Tissue, Vinegar, Masking tape, Cosmetics, Corks, Fertilizer, Hair spray, Fuel, Nail polish, Rayon, Linoleum, Acetate, Medicines, Photographic Film, Fish Food, Cabinets, Alcohol, Football Helmets, Pianos, Bowling Pins, Ceramics, Photographic Slides, Sausage Casings, Draperies, Diapers, Diving boards and Turpentine.*



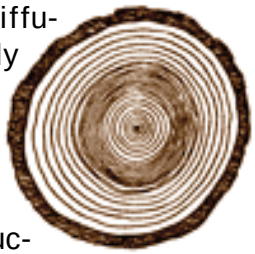
A comparison of a 4620 m^2(50,000 ft^2) three storey office building designed using wood, steel or concrete.
Source: Canadian Wood Council, The ATHENA Project

Build with Wood: Utilizing wood has positive impacts on the environment. It saves us from digging up fossil fuels, which have been buried for billions of years and ore, which requires extensive processing to become a useful product. Manufacturing wood products generates the least air and water pollution, emission of greenhouse gases, and solid waste. For example: As a building material, steel and concrete require 2.4 times and 1.7 times more energy than wood. Respectively, they produce 1.42 times and 1.67 times more airborne emissions with toxic or negative health effects. Wood manufacturing processes have the lowest water pollution. The results are not very different with greenhouse gas emissions.

Wood Properties: The fibrous nature of wood strongly influences how it is used. Properties such as the dimensional stability are affected by the characteristics and arrangements of these fibrous cells. Below are some of the most common wood properties analyzed before determining its use.

Durability: Moisture and temperature are two major factors that cause wood to decay. High altitudes, as a rule, are less favorable to decay than are low altitudes because the average temperatures at higher altitudes are lower and the growing season for fungi, which cause decay, is shorter. For low decay resistance wood in mild decay conditions, a simple preservative treatment is adequate, such as a short soak in preservative after cutting and boring.

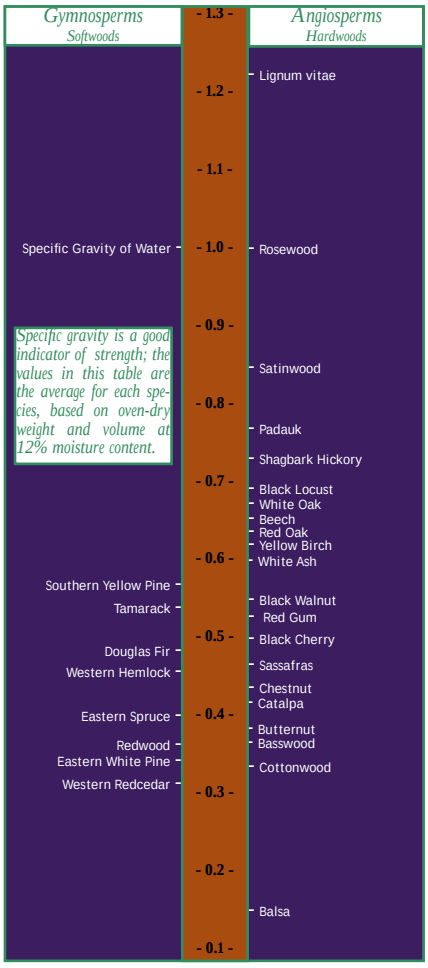
For more severe decay hazards, pressure treatment is often required. Even the very decay-resistant species may require preservative treatment for important structural uses or other uses where failure would endanger life or require expensive repairs.



Thermal Diffusivity: Thermal diffusivity is a measure of how quickly a material can absorb heat from its surroundings. It is the ratio of thermal conductivity to the product of density and heat capacity. Because of the low thermal conductivity and moderate density and heat capacity of wood, the thermal diffusivity of wood is much lower than that of other structural materials, such as metal, brick, and stone. That's why wood does not feel extremely hot or cold to the touch, as do some other materials.

Electrical Conductivity: The electrical conductivity of wood varies with moisture content. Examples of industrial wood processes and applications in which electrical properties of wood are important include poles for high voltage powerlines, utility worker's tools, and the heat curing of adhesives in wood products by high frequency electric fields.

Specific Gravity: The weight of wood per unit volume is referred to as the Specific Gravity. The specific gravity of water is one (1) and all wood is compared against this standard. Ironwood is very dense and sinks in water. Rosewood is a dense wood with the same specific gravity as water. Balsa wood, on the other hand, is very light and floats in water.



Generally, lumber is solid wood that is bought or sold for commercial use. Commercial lumber is found in a variety of forms, species and types. However, all of it is graded by standardized rules in order to uniform purchasing throughout the country.

Commercial lumber is divided into two major categories: hardwood lumber and softwood lumber. These terms don't necessarily refer to the actual hardness or softness of the wood. So, don't let the name fool you. Wood's strength depends largely on the specific gravity of the individual species.

Hardwood Lumber: Hardwood lumber comes from Angiosperms. Hardwood lumber is porous, which means it has vessels. Vessels are wood cells with open ends placed one above another to form a vascular system for transporting water and nutrients. Hardwood cell structure contains short fibers which are excellent for fine papers. Hardwood lumber is usually remanufactured into furniture, flooring, pallets, containers, dunnage, and blocking. It is also used in construction for flooring, architectural woodwork, interior woodwork, and paneling.

Angiosperms (commonly known as hardwood): trees that keep their seeds enclosed in the ovary of their flower. Visually, they have broad leaves and with a few exceptions in the temperate region, they lose their leaves during autumn.

Softwood Lumber: Softwood lumber comes from Gymnosperms. Softwood lumber is nonporous and does not contain vessels. The function of transporting water and nutrients is performed by dead, single-celled transport "pipes" called tracheids. Softwood cell structure contains long fibers which are excellent for papers requiring strength. Softwood lumber is commonly used in construction for building components, i.e. forms, scaffolding, framing, sheathing, flooring, molding, paneling, cabinets, poles and piles. It is also used in the form of shingles, sashes, doors, and other mill work, in addition to some rough products such as timber and round posts.

Gymnosperms (commonly known as softwood): trees (mainly conifers) that keep their seeds naked (not enclosed in the ovary of the flower). Visually, they are mostly cone-bearing plants with needle or scale-like evergreen leaves and only a few, such as larches and bald cypress, lose their needles during autumn.

Summary

Any way we analyze it, wood turns out to be the best choice. Whether it is the amount of energy used in producing it, the amount of pollution produced from manufacturing it, or disposing it as a biodegradable product, wood wins in every phase of any product's life cycle. It is easily renewable, which means we can keep on growing as much as we want. There are ways to be reassured that the wood we use is being produced using sustainable forestry practices. We can feel good about using wood and the wonderful people who are growing, processing and delivering this natural material to us while taking care of the soil, water, fish and wildlife and the whole forest ecosystem.

Glossary

Cambium: The thin layer of reproductive cells between bark and wood, which by cell division, forms new bark and wood cells. Cellulose: Comprises 50% of wood, it is a polymer chain carbohydrate, $(C_6H_{10}O_5)n$. Fiber: A specific cell type contributing to the strength of wood. Grade: A designing of the quality of a log, or of a wood product. Lignin: Comprises 18-25% of wood in softwoods and 25-35% in hardwoods, it is interspersed with cellulose as a bonding agent between cells. Specific Gravity: The ratio of the weight of a body to the weight of an equal volume of water.

Note: What we have given you is just a teaser about wood.
Please, visit our website at www.forestinfo.org, if you wish to learn more about wood.

Links & Resources

Wood as a Global Resource: www.extension.umn.edu/distribution/naturalresources/DD6507.html. U.S. Wood Fiber Supply & Demand Outlook: www.fs.fed.us/pnw/sev/rpa/ince_files/index.htm. APA-The Engineered Wood Association: www.apawood.org. Columbia Wood Gateway: www.woodgateway.com. EZ Wood: www.ezwood.com. Be constructive - Wood: www.beconstructive.com. Woods of the World: www.toolcenter.com/wood/. Forest Products Laboratory: www.fpl.fs.fed.us. Peaks to Prairies: www.peakstoprairies.org. The Idaho Forest: www.idahoforests.org. American Wood Council: www.awc.org. Canadian Wood Council: www.cwc.ca. Forest World: www.forestworld.com. Wood Works: www.wood-works.org.

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