Naturally Durable Wood Products – The Cornerstone of Sustainability and Green Building

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Naturally Durable Wood Products – The Cornerstone of Sustainability and Green Building

Presented By: Timber Holdings International
600 East Vienna Avenue
Milwaukee, WI 53212

Description: Provides an overview of naturally durable wood products, their role, and applications within the green building movement.

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Learning Objectives

Upon completing this course, you will be able to:

- identify species-specific forms of historical applications for naturally durable wood products as well as more recent applications and current trends
- describe the life-cycle benefits and durability ratings of commercially available naturally durable wood species in terms of both performance and sustainability
- discuss the laws, organizations and programs promoting sustainability, and
- explain the importance of working with experienced and knowledgeable vendors of naturally durable wood products to develop sustainable product specifications.

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Introduction

What Are Naturally Durable Woods?

Since the dawn of time man has recognized the beauty and performance benefits associated with naturally durable wood products.

Naturally durable hardwoods are a class of timbers that exhibit the best in durability and natural resistance to decay, rot and insect attack.

Species like Ipe, Greenheart, Garapa, Teak, Jarrah, Purpleheart, Ekki, and others are known to have incredible strength and decay resistance.

Today, the life-cycle performance and environmental benefits associated with naturally durable wood products are taking their rightful place within the sustainable design and green building movement.

Trends

Fashion and economics have driven design professionals and consumers away from the use of sustainable and renewable resource-based products, with little consideration for the environmental, health and safety issues.

- Plastic grocery bags versus paper
- Plastic soda water bottles versus returnable bottles or aluminum cans
- Steel framing versus wood framing

Wood is renewable, has low manufacturing environmental impacts, and is biodegradable. Plastic sits in landfills, and little is recycled; steel creates pollution during production, from mining to steel mills.

Today's green building and healthy living movements will likely be the catalyst that reverses this trend.

Naturally Durable Wood Products

These are the cornerstone of sustainability within the green building movement. They have a low environmental impact during their cradle to grave life cycle, and their low carbon emission levels during production limit global warming.

The non-renewable energy impacts associated with all materials used in the building and manufactured products industries are now being assessed for their entire life-cycle impact on our environment and on our health, safety, and welfare.

Buzz words like “organic,” “recycled,” and “certified” must be evaluated beyond their simplistic marketing appeal. The goal is to promote sustainability through design and living.

Product Assessment

Sustainability initiatives including carbon sequestering, the limiting of global warming, and the protection of forest-based resources against deforestation are bringing the environmental benefits of truly renewable resources, like wood, to the forefront of the green design movement.

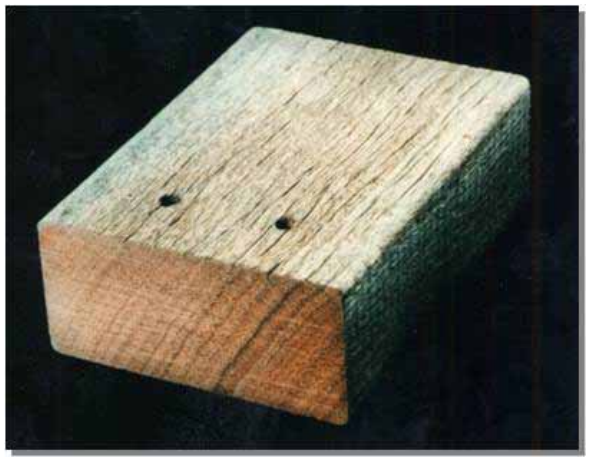
Use renewable timber to reduce the use of non-renewable resources, like petroleum-based products and those with high energy impacts, like steel and concrete.

History of Naturally Durable Wood Products

Benefits of Naturally Durable Wood

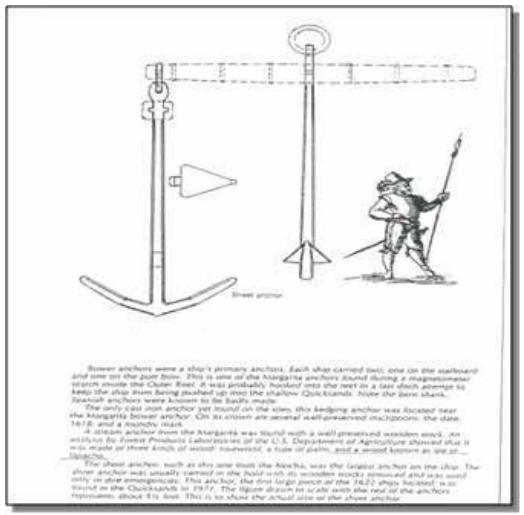
The benefits of naturally durable wood species have been recognized since man began to construct dwellings. Early civilizations quickly recognized, through trial and error, the natural resistance to rot and decay of one type of tree over another.

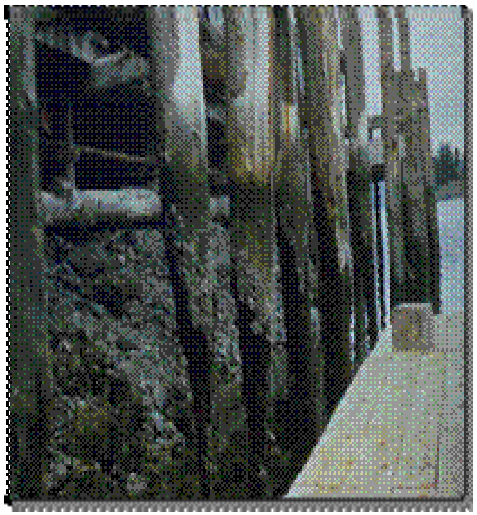
CCA treated Pine after
5 years on boardwalk



Ipe decking after
25 years on boardwalk

Archeological Discoveries



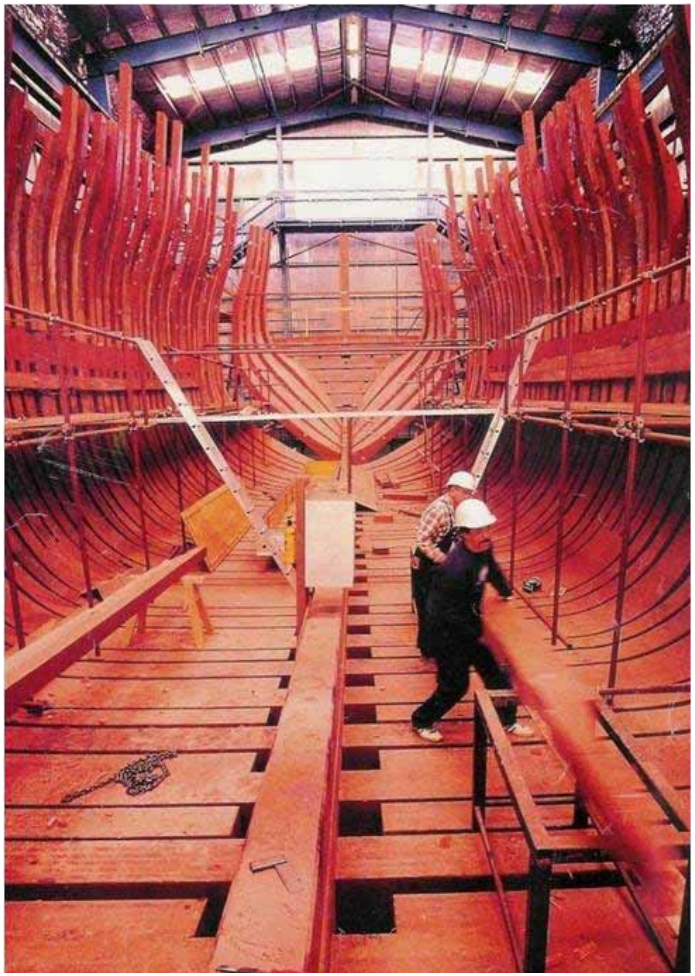


Marine borer damage

Faced with the need for materials that would resist attack from marine borers and other aquatic parasites, early shipbuilders began to experiment with the various timber species that were locally available in an effort to increase the service life of their vessels.

Recently, the discovery of the treasure ship the *Attocia* resulted in the excavation of anchor cross arms made from Lapacho, still intact after over 200 years of exposure to marine borers.

Early References



Early references to the durability and value of NDWs (naturally durable woods), like Jarrah, Teak, and Cedar, are found in periodicals like *Scientific American: Architects and Builders Edition*, 1886.

A natural progression for the use of these unique wood species was their use in pier, dock and bridge construction to support sea, rail, automobile, and pedestrian traffic.

"The most enduring of woods; it defies decay; time, weather, water, the white rot and the sea worms have no effect on it."

Evolution of the Boardwalk

World Famous Atlantic City Boardwalk

Our love of the sea and our desire to live near and be entertained by water resulted in the building of boardwalks in the 18th century.

That passion still thrives today.

St. Petersburg, FL

Pier Wisconsin
Milwaukee, WI

Liquid Storage

As the need to store liquids from water to wine evolved, so did the use of naturally durable wood species, as evidenced by their use in liquor production.

Certain species, like White Oak and Redwood, became valued for their natural resistance to acids and alkaloids.

As the chemical sciences advanced, like in the tanning of leather, various species of durable hardwoods became recognized for their resistance to deterioration from more corrosive chemicals.

Today, wood is still the primary material used to build tanks and vats for leather manufacture.

Formalized Wood Research

Scientific wood technology research became formalized in the United States in 1910 with the establishment of the U.S. Department of Agriculture Forest Service, Forest Products Laboratory.

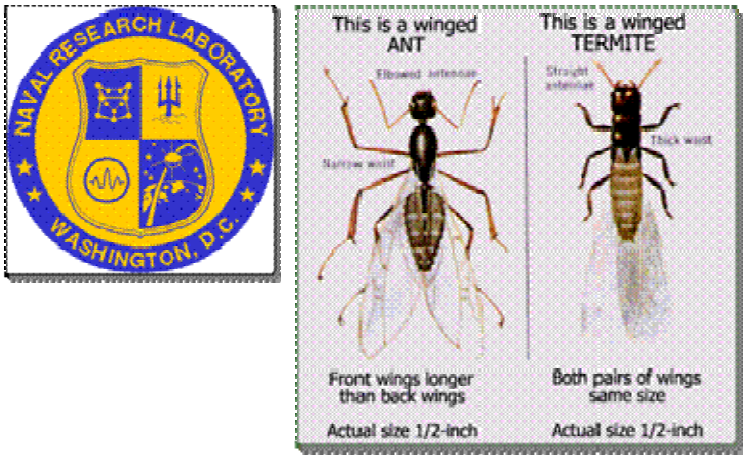
The Laboratory published the first edition of its *Wood Handbook – Wood as an Engineering Material*, a technical guide to wood and wood properties, in 1984, followed by *Tropical Timbers of the World* in 1987. Wood technologies research continues to this day as a focus degree program in many universities throughout the world.

U.S. Department of Agriculture Forest Service, Forest Products Laboratory

U.S. Naval Involvement

A more formal research approach to wood durability for both marine and in-ground environments was performed by the U.S. Naval Research Laboratory from 1962 to 1973 in an effort to determine the natural resistance of various wood species to types of wet and dry decay, marine borers, and termites.

These tests used wooden stakes driven into the ground in the Panama Canal Zone, starting back in 1962. The result was that certain species were naturally durable and withstood attack from termites and decay for many years, species like Ipe, Greenheart, and Teak.



Fungal decay

Naturally Durable Hardwood Applications

Applications

Marine Construction

- Piers
- Piling
- Marinas
- Docks
- Wharfs

Ship and Boat Construction

- Deck
- Rail
- Various wood components

Applications

Waterfront Development

- Atlantic City Boardwalk
- Pier Wisconsin
- Hudson River Park

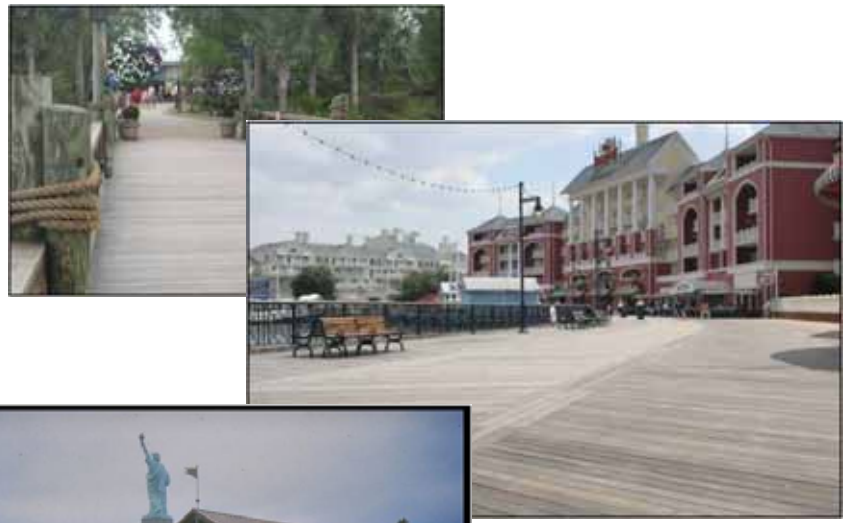
Parks and Recreation

- Marshland & Dune preservation projects
- Benches

Applications

Site Amenities

- Pergola/Arbors
- Benches
- Planters
- Decking



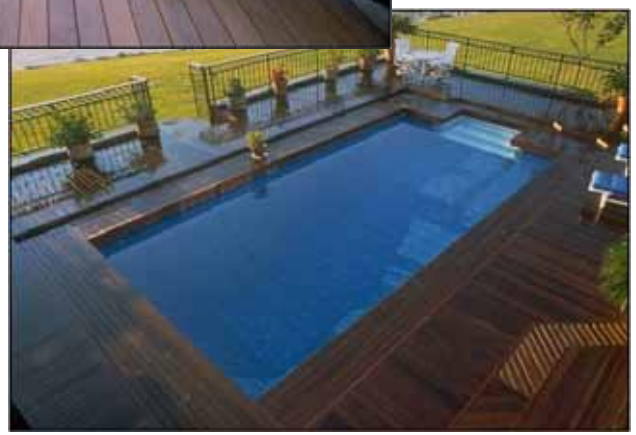
Attractions and Theme Parks

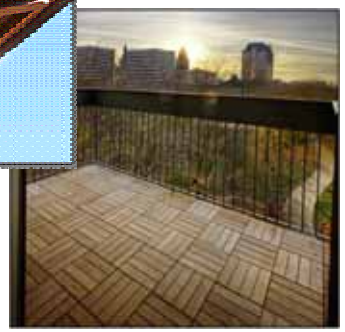
- Liberty Island, NY
- SeaWorld, FL
- Disney World, FL

Applications

Residential Decking

- Pool Decks
- Decks
- Permeable Driveways





- Balcony and Roof Deck Systems
- Green Roof Deck Tiles
- Architectural Millwork

Applications

Exterior Architectural Uses

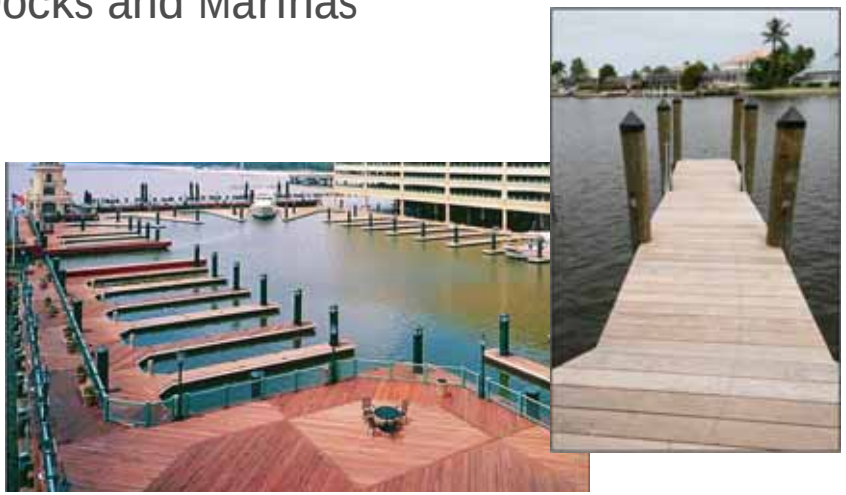
- Siding
- Rainscreen
- Sunscreen
- Trim

Industrial Applications

- Tanning Drums
- Wood Floors

Applications

Docks and Marinas



Railroad Construction

Monuments

Bridges

Applications

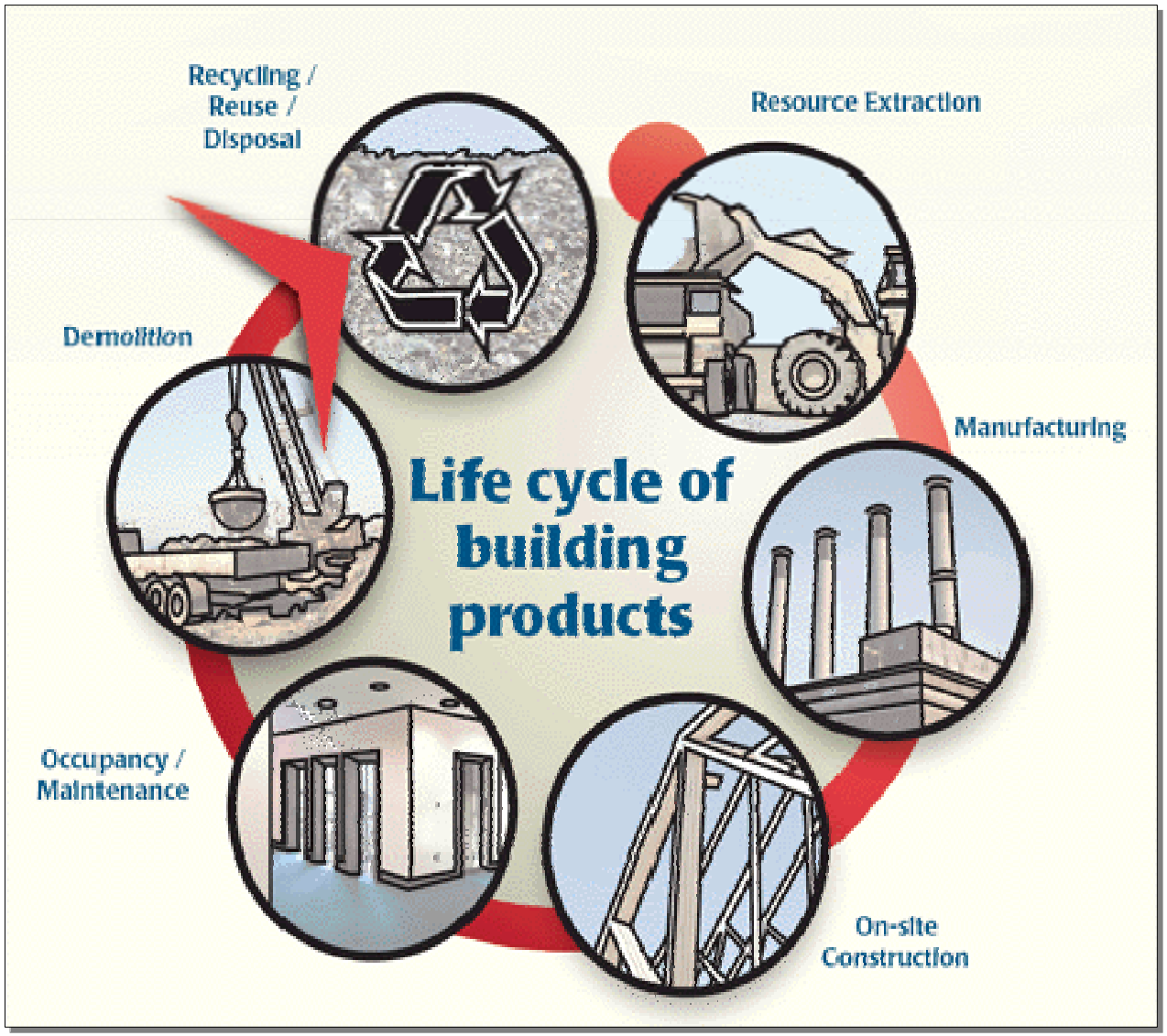
Heavy Timber

Site Furnishings

Exterior Railings

Life-Cycle Assessment (LCA)/ Life-Cycle Inventory (LCI)

Life-Cycle Assessment (LCA)



Life-Cycle Assessment (LCA)

LCA is an internationally recognized scientific method of examining the total environmental burden associated with a product and its use.

It is the only legitimate way of determining actual environmental cost, and its quality depends on the life-cycle inventory (LCI) data it uses.

LCA is the most credible means by which “green” product claims can be validated.

LCA tools, like those available from organizations such as the Athena Institute (http://www.athenasmi.org/about/lcaModel.html), should be used to determine the environmental impact of a product.

Life-Cycle Assessment - Impacts

LCA is a methodology for assessing the environmental performance of materials, assemblies and even whole structures over the course of their entire lives, from extraction through manufacturing, transportation, installation, use, maintenance and disposal or recycling.

Impacts are measured in terms of a wide range of potential effects, such as:

- fossil fuel depletion
- other non-renewable resource use
- water use
- global warming potential
- stratospheric ozone depletion
- ground level ozone (smog) creation
- neutrification/eutrophication of water bodies
- acidification and acid deposition (dry and wet), and
- toxic releases to air, water and land.

Life-Cycle Assessment - Phases

The goal of LCA is to compare the full range of environmental and social damages assignable to products and services, to be able to choose the least burdensome product.

Four Phases of LCA

- **Goal and Scope**: In the first phase, the LCA practitioner formulates and specifies the goal and scope of study in relation to the intended application.
- **Life-Cycle Inventory**: The second phase involves data collection and modeling of the product system, as well as the description and verification of data.
- **Life-Cycle Impact Assessment**: The third phase is aimed at evaluating the contribution to impact categories. Here, impact potentials are calculated based on the LCI results.
- **Interpretation**: The fourth phase is the most important one: an analysis of major contributions leads to the conclusion of whether the goal and scope of the LCA was met, and/or what was learned from the LCA.

Life-Cycle Inventory (LCI)

LCI is a quantitative assessment of environmental inputs and outputs associated with a product and is used as a part of the LCA assessment.

It begins with initial extraction of the resource and continues through manufacturing, distribution, use and disposal.

> *"We have to realize that wood, natural and renewable, requires less energy to produce than other major building materials including steel and concrete."*

James Bowyer
University of Minnesota
Tropical Forest Foundation Symposium
for Architects and Designers

Life-Cycle Inventory (LCI)

LCI INPUTS

- Raw material resources
  - ✓ Petroleum
  - ✓ Minerals
  - ✓ Metal
  - ✓ Water
  - ✓ Timber
- Energy consumed during the production cycle from fossil fuels and electricity

LCI OUTPUTS

- Air and water emissions
- Carbon dioxide
- Carbon monoxide
- Nitrogen oxides
- Hydrocarbons
- Suspended solids
- Hazardous chemicals
- Solids wastes gated during production, transport and product disposal

Life-Cycle Inventory (LCI)

LCI - A Comparative Overview of Resource Bases

	Wood	Chemically Impregnated Wood	Virgin Based Plastics	Consumer Recycled Plastic	Steel Concrete Aluminum
Renewable Natural Resource Base	Yes	Mixed	No	No	No
Alternative Land Use Resource Base	No	Mixed	Yes	Yes	Yes
Energy Source Required for Raw Material Prod.	Solar	Solar/Fossil	Fossil Fuel	Fossil Fuel	Fossil Fuel
Energy Source Required for Extraction	Fossil Fuel	Fossil Fuel	Fossil Fuel	Fossil Fuel	Fossil Fuel
Energy Source Required for Transport	Fossil Fuel	Fossil Fuel	Fossil Fuel	Fossil Fuel	Fossil Fuel
Energy Source Required for Production	Wood Waste / Fossil	Wood Waste/Fossil	Fossil Fuel	Fossil Fuel	Fossil Fuel
Comparable Energy Requirements for Production	Low	Medium	High	High	High
Carbon Sequestering	High	Mixed	None	None	None
Post Production Off-Gassing/Chemical Leach	None	High	High	High	None
Smoke Toxicity Under Combustion	Low	High	High	High	Low
Use and ReUse - Salvagability	Yes	No	No	No	Yes
Recycle vs. Reconstitute	Recycle	No	Reconstitute	Reconstitute	Recycle
Biodegradability of Post Manufacture Waste	Biodegradable	No	Non Bio	Non Bio	Non Bio
Biodegradability of Post Construction Waste	Biodegradable	Non Bio	Non Bio	Non Bio	Non Bio
Biodegradability of Post Life-Cycle Waste	Biodegradable	Non Bio	Non Bio	Non Bio	Non Bio
Post Life-Cycle Land Fill	No	Yes	Yes	Yes	Recycle
U.S. Green Building LEED® Credits	May Qualify	May Qualify	NO	May Qualify	May Qualify
American Lung Association "Health House"	May Qualify	No	May Qualify	May Qualify	May Qualify

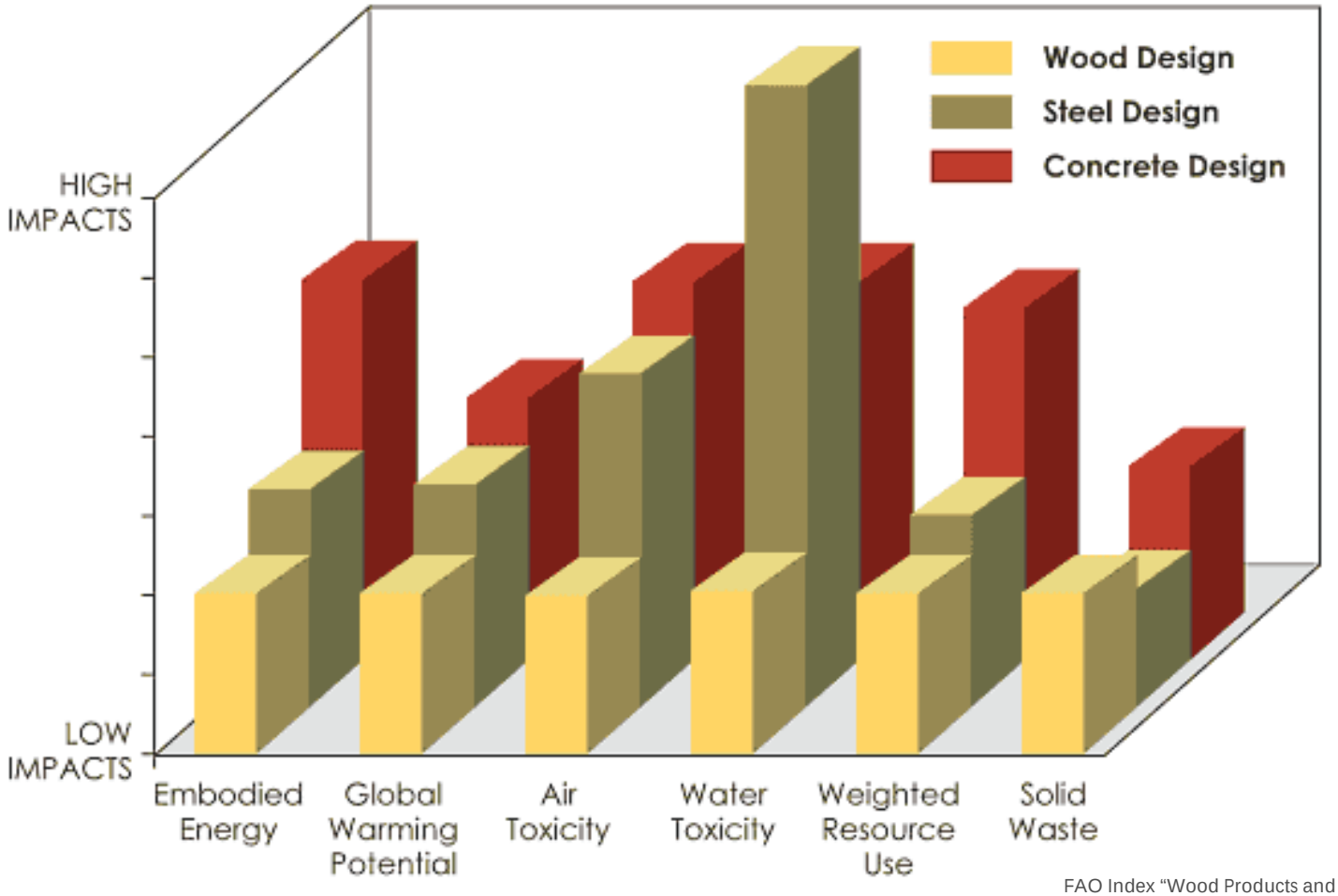
LCI – Wood is Good

By designing and building with the environment in mind, and wisely combining products made of wood, steel, concrete, plastic, and other substances, we can have buildings that are energy-efficient, healthier for occupants, and environmentally sustainable.

NDW's have superior LCA and LCI.

- ✓ Renewable resource
- ✓ Low energy requirements for extraction, transport, and production
- ✓ Low production effects: no off-gases, leaching, or smoke toxicity
- ✓ Biodegradable
- ✓ No need to landfill
- ✓ Can qualify for LEED credits

Life-Cycle Analysis



FAO Index "Wood Products and Sustainable Construction"

A comparative life-cycle analysis of environmental impacts for residential home construction shows wood is a better choice than steel or concrete.

Life-Cycle Benefits of NDW's

Life-Cycle Benefits

Wood processing utilizes 100% of raw material resources, eliminating entirely the negative environmental impacts resulting from the inorganic production waste associated with other materials. It requires less overall energy consumption and demand on non-renewable energy resources, most of the energy being generated from its own organic waste stream. It also generates lower levels of $C0_2$ emissions than any other material during its production process.

Life-Cycle Performance Benefits

- Strength and bending properties – extremely strong; for example Ipe bending strength is 3.14 million psi- Oak is only 1.78 million psi
- Resistance to fungal attack and rot – more than 25 years natural durability rating from *Tropical Timbers of the World* data
- Resistance to marine borers and termites – top performers in termite resistance from the U.S. Naval Study in the Panama Canal
- Resistance to elements from salt spray to freeze/thaw cycles - proven in over 25 years on seaside boardwalk installations
- Resistance to wear - twice as hard as Oak; for example, Oak has a side hardness of 1360 lb. at 12% MC - Ipe is 3650 lb. at 12% MC
- Resistance to chemical absorption and deterioration – their high density limits absorption
- Resists deterioration from UV exposure – no loss in performance after decades of exposure on commercial projects

Natural Durability Ratings

Class	Durability	Years in Ground	Years Above Ground	Species
1	High	25+	50+ untreated	Ipe, Cumaru, Greenheart, Purpleheart, Teak, Ekki
11	Durable	15+	30+ untreated	Garapa, Cambara, Western Red Cedar, Alaskan Yellow Cedar, Redwood
111	Moderately Durable		15+	Douglas Fir, White Oak

Aesthetics

There is no substitute for the natural beauty of wood. Every piece of wood is unique in grain and appearance, like a snowflake.

Born of earth, sun, and water, like everything organic, wood products are a reflection of nature's diversity.

And so we surround ourselves with wood because like us, it is an extension of our natural world. It reminds us of the beauty of that which can never be manufactured.

Environmental Benefits

Forests are a self-sustaining ecosystem. Wood processing requires less overall energy consumption and demand on non-renewable energy resources (most of the energy generating from its own organic waste stream).

Forests, as natural and renewable resources, use solar energy to convert carbon, minerals, and organic matter to raw material. Timber harvest sequesters carbon indefinitely into finished wood products and therefore generates very low levels of carbon dioxide emission during the production process.

Environmental Benefits

Carbon dioxide sequestration is the term given for locking up CO_2 somewhere other than the atmosphere; the carbon dioxide may be broken down into its component parts, and the carbon stored away while the oxygen is released into the atmosphere.[1]

Carbon sequestering is accelerated through natural forest regeneration.

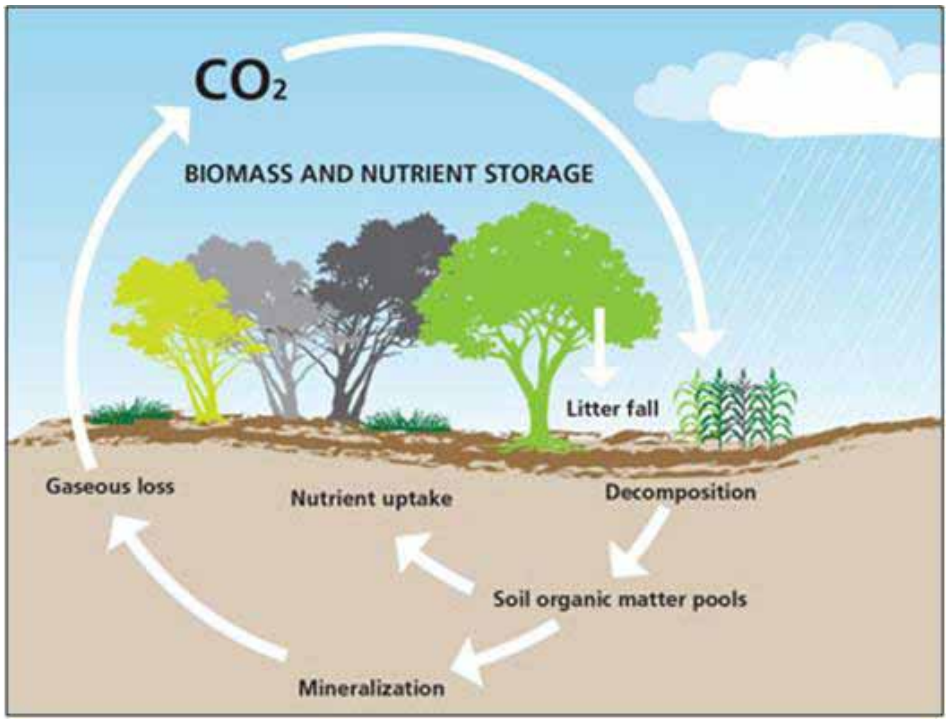
Forests are preserved when their economic value as a producer of forest products exceeds the value of converting forests to alternative non-forest uses, ie. agriculture or infrastructure.

[1] Source: http://www.ourclimate.net/sequestration.htm

Carbon Sequestering

In biological sequestration, carbon is naturally sequestered in plants, soils, and ocean life.

Timber can play an important role as a carbon sink, storing carbon in the lumber. Trees absorb carbon dioxide from the atmosphere through photosynthesis and store it as carbon in biomass. There is also considerable carbon sequestering below-ground in soils, deposited as dead plant material.



Health, Safety and Human Service Benefits

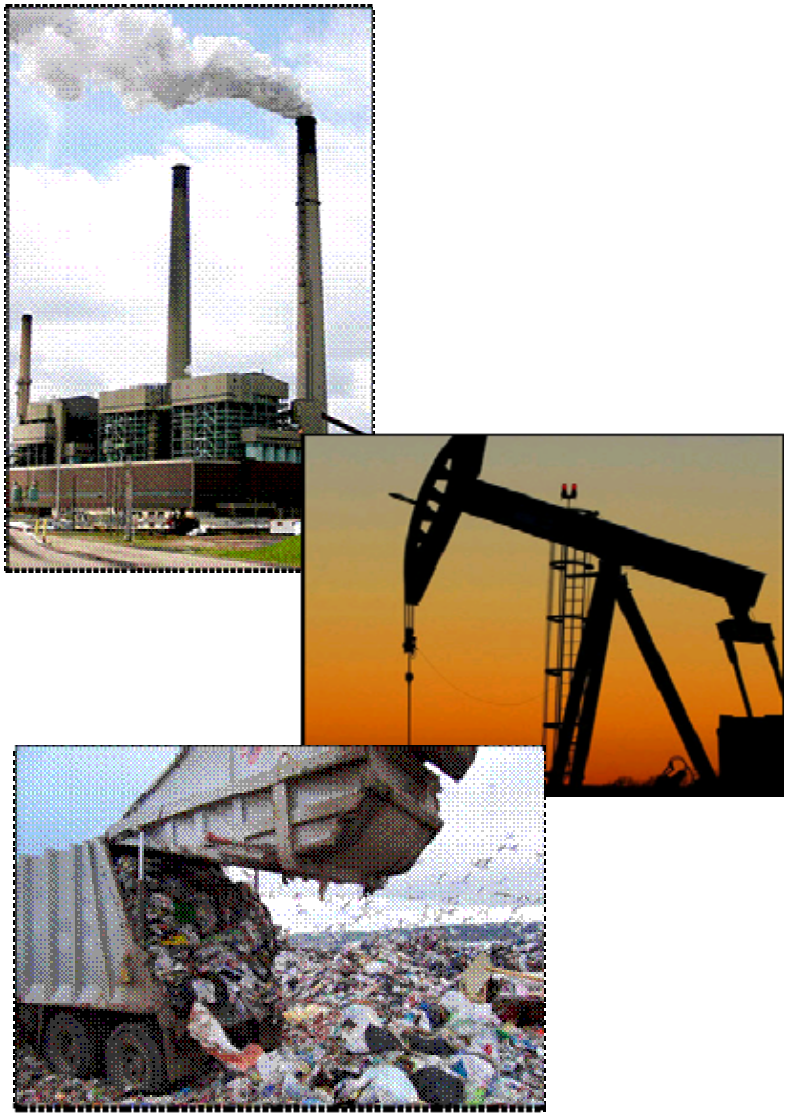
- Natural product - no off-gases as in the production of plastics
- High resistance to combustion and flame spread
- Naturally forgiving walking surface – wood is easier on feet than concrete
- Meets ADA requirements for slip resistance – ASTM C1028 wet static coefficient of friction
- Superior heat dissipation properties – concrete holds heat
- Insulator against static or non-static electricity – plastic is a conductor
- Resists vandalism - ease of graffiti removal
- Biodegradable – no landfill impact

"In a holistic sense, wood products help safeguard our environment."

Wood Design Focus

Wood Substitutes and Deforestation

Wood Substitutes



The development of substitutes for natural wood products has grown substantially since the early 19th century.

Driven by:

- Advances in technology
- Competitive industries
- Economic factors

Most substitutes were developed during a time when there was little concern for human health, safety, welfare, and environmental impact.

The impacts of these substitute advances have only begun to be measured in the last few decades.

Wood Substitutes

"The employment of alternative materials as a substitute for wood without due consideration can ignore associated environmental impacts of even greater consequence than posed by the use of wood, whether certified or not."

Jim Bowyer
University of Minnesota
Tropical Forest Foundation Symposium
for Architects and Designers

"To assure optimum environmental outcomes, require that alternative materials be evaluated carefully and factor in issues such as embodied energy and toxicity.

Consider impacts over the full life cycle, including extraction, production, installation, maintenance and disposal."

Policy for the Purchase and Procurement
of Forest Products - MetaFore

Wood Substitutes – Pros and Cons

Wood Substitutes	Pros	Cons
Aluminum	Recyclable	High energy needs to produce, emissions from production
Steel	Recyclable, strong	High energy needs to produce, emissions from production, maintenance cost
Concrete	Low cost, durable	High energy production and transportation costs
Plastics	Low cost	Off-gassing from production, petroleum based, high disposal costs
Chemically treated wood	Use abundant non-durable species, cost varies	Shorter useable life, high disposal costs, unknown toxic chemical effects

Greenpeace Opinion

"Greenpeace has clear, systematic steps that we ask building and design professionals to adopt:

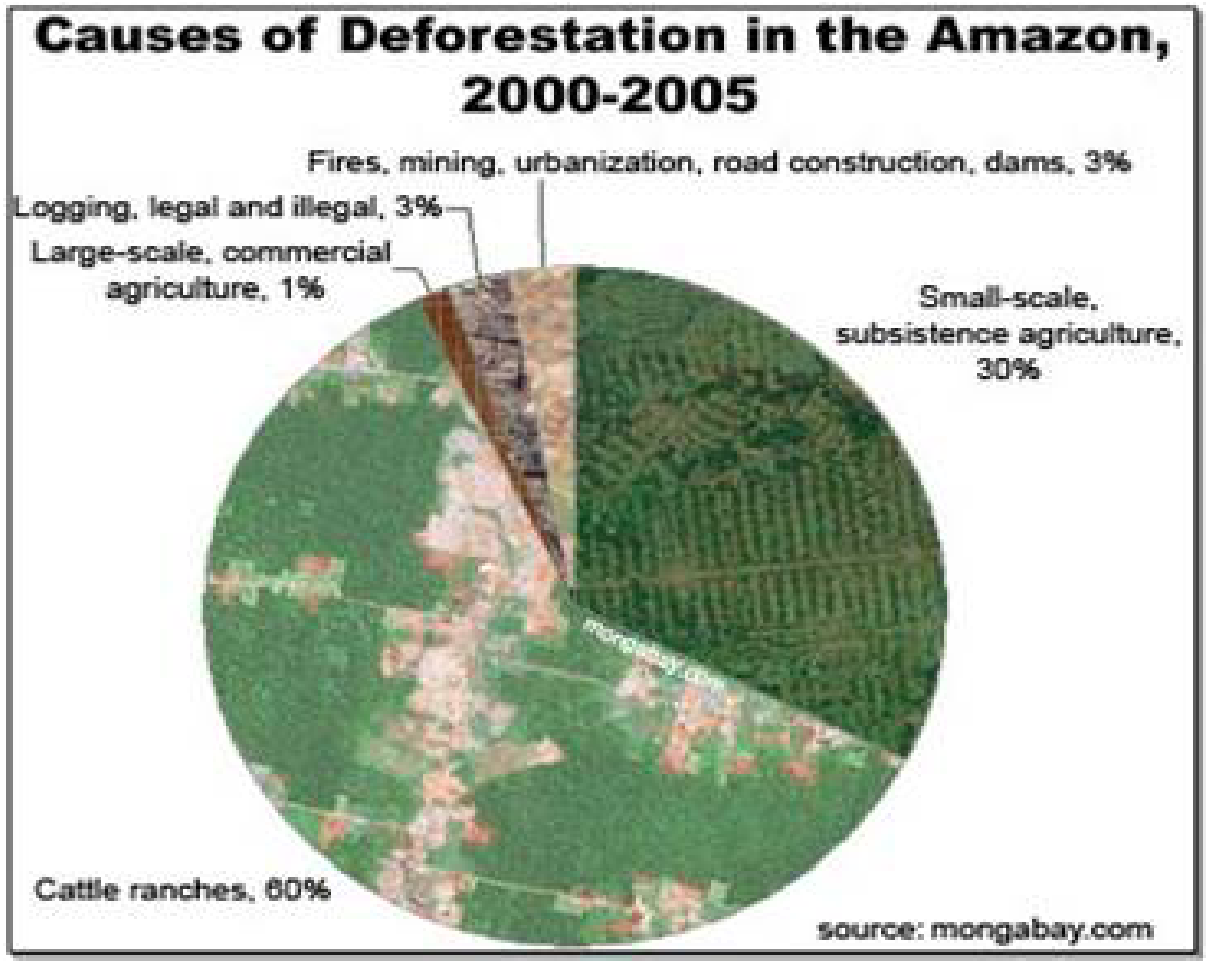
Do not use PVC products nor substitute plastic products for lumber."

Greenpeace
An open letter to U.S. Architects

Common Misconceptions

Over the last two decades, a growing misperception by the public, encouraged by well-meaning environmental organizations and fostered by competitive industries, has served to accelerate the use of non-forest-based substitutes for wood without consideration for the related environmental consequences, like production pollution and disposal issues.

Land conversion (accounting for at least 90% of deforestation) is by far the greatest threat to the health of the tropical forest ecosystem.



Silent Boycotts

Dr. Jim Bowyer responded that *"this kind of 'silent boycott' may cause a result just opposite to that desired; avoiding the use of tropical wood may cause devaluation which tends to lead to conversion of these forest lands to other uses."*

"Some architects frankly admitted that they avoid using tropical woods because it is just too difficult to obtain information about the sustainability of the practices used to extract them."

Tropical Forest Foundation

Tropical Forest Foundation Opinion

"Bans and boycotts serve no constructive purpose in encouraging tropical countries to conserve and properly manage their forests…forestry must compete with other forms of land use…depress[ing] the value of hardwood and the forests that contain them, thus diminish[es] the incentives to conserve, manage and regenerate these forests in the face of alternative land uses which lead to their destruction."

Tropical Forest Foundation

"…boycotts convince concerned consumers that they are contributing to a solution when in all likelihood they are not."

Chris Wille
Rainforest Alliance

Natural Wood Substitutes

Despite all technological advances, no single product can provide all the full life-cycle benefits associated with NDWP's.

Mold on composite decking

Composite flaking

Primary International and Domestic Initiatives

Responsible Forestry Practices

The responsibility for enforcement of environmental regulations and quality control rests almost entirely in the hands of importers. Choosing a principled company with sound industry experience is the most effective means for acquiring the highest quality, most sustainable products available.

"Seek manufacturer and vendor relations with businesses that have a demonstrated commitment to transforming markets towards a socially and ecologically sensitive model."

Policy for the Purchase and Procurement of Forest Products 1998, Certified Forest Products Council

CITES/Lacey Act

"CITES is an international agreement between governments. Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival."

Source: www.cites.org/
Convention on the International Trade in Endangered Species

Lacey Act

- Current U.S. government initiative designed to eliminate the importation of illegally harvested forest products.
- Importers of legally harvested forest products are required to certify compliance with international laws and regulations included in CITES.
- Holds management criminally liable for the acts of a corporation with no corporate veil of protection.
- Compliance with provisions assures legality of wood product's sourcing.

U.S. Green Building Council/ALA

USGBC

- The USGBC is a 501(c)(3) non profit composed of leaders from every sector of the building industry working to promote buildings and communities that are environmentally responsible, profitable and healthy places to live and work.
- USGBC works to expand green building practices and education and implemented the Leadership in Energy and Environmental Design (LEED) Green Building Rating System™.

American Lung Association

- Sets healthy home guidelines and builder certifications for the construction of lung-healthy living environments.

FSC/ Rainforest Alliance

FSC/Forest Stewardship Council™

- Independent, non-governmental, established to promote the responsible management of the world's forests.
- Develops clear forest management criteria that forest managers must implement to receive FSC certification.
- Provides sustainable forest management and forest products' certification audits and accountability.
- FSC certification is currently the recognized certification body of the USGBC LEED building credit program.

Rainforest Alliance – SmartWood Program and Scientific Certification Systems

- Provides evaluation, certification and audit services to companies seeking forest and forest products' Chain of Custody certifications under FSC guidelines.

metaFore® / Tropical Forest Foundation

metaFore®

- Formerly the Certified Forest Products Council.
- "501 (c)(3) organization that specializes in working with businesses to implement innovations related to evaluating, selecting and manufacturing environmentally preferable wood and paper products."

Tropical Forest Foundation

- Non-profit educational institution dedicated to the conservation of tropical forests through sustainable forestry.
- Primary focus is worldwide training of sustainable forest management practices and low-impact logging techniques.

IWPA

International Wood Products Association®

- Is a hardwoods trade promotion organization with environmental education programs aimed at increasing the value and preservation of forest-based resources through improvement in trade.

Please remember the **exam password** FOREST. You will be required to enter it in order to proceed with the online examination.

Sustainability Solutions

Sustainability

"In our role as forest stewards we support all efforts to protect the demand and value of forest-based resources both tropical and non-tropical as the cornerstone of sustainability."

Brian Lotz
Founder, FIELDS TO FORESTS™
A Voluntary Reforestation Program
in Cooperation with TATF
(Tropical American Tree Farms)

Fields to Forests™

Fields to Forests™ is a reforestation program that promotes sustainability of global forests and the availability of hardwoods (through plantation-grown sources), and reduces future pressure on natural forests.

NDW's are planted and established in well-managed, productive tropical forest plantations in natural forest lands, formerly cleared for farms and ranches.

The timber products derived from these plantations will reduce pressure on the natural forest, while meeting future user demands.

To participate in the program, you simply calculate how many trees were required for the product or project you built using a simple formula (500 board feet equals one tree) and send an order to Fields to Forests™ to have that many trees, or more, planted.

FIELDS TO FORESTS™
REFORESTATION PROGRAM

Responsible Forestry Practices

To reinforce environmentally responsible forestry practices:

- Seek manufacturer and vendor relations with businesses that have a demonstrated commitment to transforming markets towards ecologically sensitive models through membership and participation in environmental organizations and programs dedicated to achieving forest sustainability.
- Seek manufacturer and vendor relations with businesses that have a demonstrated commitment to the rehabilitation of denuded and degraded forestlands into well-managed community-owned forests and plantations.
- Seek manufacturer and vendor relations with businesses that have a demonstrated commitment to the implementation of low-impact logging techniques.
- Prohibit the purchase of any forest product derived from a species listed in the CITES Listing of Endangered or Threatened Wood Species.

Responsible Forestry Practices

- Require, at a minimum, that all forest products vendors provide proof of full compliance with all legal requirements for forest management and harvest at their point of origin.

- Require that wood is not harvested from forest areas having high conservation values which are threatened; is not harvested from forest areas where traditional or civil rights are violated; is not harvested from genetically modified trees; and, is not from natural forest that was converted to plantations or non-forest use.

- Choose wood materials that have had value added at the point of origin, and

- Direct, as available and appropriate, wood material selections towards underutilized species, character grades, and reused/reclaimed materials.

Solutions

Who is responsible for enforcement of laws and regulations for harvest and trade?

- Government and non-government organizations
- Forest product industry
- Forest product specifiers
- End users

Choosing a principled company with sound industry experience is the most effective means for acquiring the highest, most sustainable NDWP's.

Solutions for Specifiers

- As specifiers you are empowered to reverse the trend away from non-sustainable alternatives.
- This can be done by the specification language that promotes the use of legally harvested and traded natural wood products as well as sustainability initiatives.

Sample Specification

A. Lumber - Naturally Durable Hardwood: to be Iron Woods™ Ipe, Tabebuia Lapacho species.

A-1. Moisture Content - All lumber shall be partially air dried to a moisture content of 18%-25%.

A-2. Surface/Dimension - Lumber shall be specified in actual or net dimensions. Example - NET 1.5" thick x 5.5" wide x 12' long. All lumber to be supplied S4S (surfaced four sides), E4E (eased four edges). Edges shall be eased to a radius of 1/8". Dimensions shall be plus or minus 0.125" in width and .065" in thickness, measured at 25% moisture content.

A-3. Overlength - All lumber shall be supplied 1 to 2 inches over the specified length, to allow for final trim and proper fit in the field.

A-4. End Coating - All lumber is to be supplied with the end sealed with "Anchorseal," or equal aqueous wax log end sealer.

B. Mechanical Properties - The Iron Woods™ Ipe supplied shall meet or exceed mechanical properties as defined by U.S. Forest Product Laboratories testing methods. The values for mechanical properties based on the 2" standard are as follows:

MC%	Bending Strength	Modulus of Elasticity	Max. Crush Strength
AD	22,475 psi	3,145,000 psi	13,140 psi

- Janka side hardness is 3,595 lb. at 12% MC.
- Average air-dry density ranges from 56.7 to 59.3 pcf.
- Basic specific gravity ranges from 0.85-0.97.

Sample Specification

C. Friction Properties: Iron Woods™ Ipe supplied shall meet or exceed the Static Coefficient of Friction for both neolite rubber and leather shoe soles in accordance with ASTM Test Method C1028

SHOE MATERIAL	WET___
Neolite	.69 force in lbs.
Leather	.79 force in lbs.

D. Fire Rating - Lumber supplied shall be naturally fire resistant without the use of any fire resistant treatments to meet NFPA Class A, 1989 edition.

E. Grade - All lumber shall be graded as per Iron Woods™ Premium-CAH (Premium-Clear All Heart) grading rules, defined as follows:

1. Lumber shall be graded both faces, and both edges.
2. Lumber shall be straight grained and parallel cut without heart center.
3. Lumber shall be clear all heartwood, no sapwood allowed, and in sound condition.
4. Not allowable imperfections are defined as: longitudinal heart cracks, internal cracks, firm or soft sap wood, fungi affects (blue to gray, brown to red, white to yellow, or incipient decay), deformation (twisting or bow) which cannot be removed using normal installation methods and tools.
5. Allowable imperfections include natural drying checks and discoloration caused by weathering or chemical reaction.

Sample Specification

F. Packaging

F-1. Stickers - All lumber is to be stacked with evenly spaced stickers between each layer of boards, to promote proper drying and reduce the possibility of water stain.

F-2. Bundles - Lumber is to be packaged in bundles of equal length pieces not to exceed 2300 lbs. each. These bundles are to be individually strapped using the highest strength nylon strapping available with a minimum of 4 straps per bundle to eliminate the possibility of strap stain.

F-3. Units - Bundles are to be combined into units of equal length pieces not to exceed 5600 lbs. Units are to be individually strapped to wood pallets using high strength steel strapping, with a minimum of 4 straps per crate. Boards will be used to prevent direct contact between the steel strapping and the lumber to protect against strap stain. Units are to be crated with wood protection on four sides to prevent forklift and transportation damage. All crates are to be clearly marked with the THL Purchase Order number.

G. Installation - Naturally durable wood (insert type here) to be installed as per manufacturer's installation recommendations.

H. Sources – Manufacturer's contact numbers and address.

Sample Specification

I. Submittals

I-1. Mechanical - A certificate from an independent U.S. testing laboratory indicating conformance to Iron Woods™ Ipe mechanical properties shall be submitted with the material bid.

I-2. Fire Rating - A certificate from an independent U.S. testing laboratory indicating conformance to NFPA Class A, 1989 edition, shall be submitted with the material bid.

I-3. Coefficient of Friction Certification - A test report from an independent U.S. testing laboratory confirming compliance with Iron Woods™ Ipe Decking Coefficient of Friction in accordance to the procedures outlined in ASTM Test Method C1028-89 shall be submitted with the material bid.

I-4. Inspection - An independent third party inspection and grading agency shall provide a Certificate of Grade and Inspection indicating compliance with material specification as to producing mill, Premium CAH grade, species, dimensions, quantity, condition, packaging, and documentation. Inspection will include the physical examination of 100% of the timber produced against the buyer's order, piece by piece, prior to packaging. Inspections are to take place at the mill throughout production and the certificate is to be submitted prior to delivery to jobsite.

Sample Specification

I-5. Controlled Wood Environmental Submittals

I-5a. Copy of an Official Export "Certificate of Origin" - indicating LEGAL EXPORT with species name/common name of wood supplied and country of origin.

I-5b. Declaration of Environmental Compliance/Legal Log Harvest - supplied by the producing source confirming that the wood products supplied were produced from legally harvested logs, and in compliance with all foreign and domestic laws and regulations pertaining to the international trade of wood products.

I-5c. Copy of Lacey Act - confirming registration of legal log harvest claim to the U.S. Department of Agriculture and U.S. Customs.

I-5d. Supplier Declaration of Source - confirming that the wood products supplied have NOT come from: forest areas where traditional or civil rights are violated, forest areas having high conservation values or which are threatened, wood harvested from genetically modified trees, illegally harvested wood, natural forest that was converted to plantations or non-forest uses, or woods listed in CITES, Appendices I, II or III, without authorization documentation.

I-6. Fields To Forests™ Tropical Reforestation Program - For every 500 board feet of lumber ordered for this project a tropical tree shall be planted by Fields to Forest™. This program plants tropical trees in a well-managed diversified forest plantation. All trees will be planted on land that was once forest, cleared and burned for agriculture, and is now being reforested to provide certified plantation-grown wood for the future. All suppliers are to show verification of participation in a certified plantation program for the last three years.

Sample Specification Installation Notes

Adequate ventilation of the deck is essential for long-term stability of NDWP's. Proper air ventilation allows air to flow in from outside the deck area, under the joists and up through the gaps between the deck boards.

Stainless steel fasteners installed through the face are generally recommended for use with NDWP to assure that the fastener service life and performance meets or exceeds the wood product's reasonable service life.

If a "hidden fastener" appearance is considered: most systems have a weaker connection of the decking to the joist and may cause problems with movement like cupping, bowing or inconsistent gaps. In light load applications the use of 5/4x4 can minimize these issues. Systems that have at least one screw through the decking into the joist are preferable to those without a direct mechanical connection. Replacement of damaged decking can be difficult.

Specifying LEED and Healthy Home NDW Products

- Recognize that there is no one international standard for grading lumber.
- A specifier should consult with reliable producers and sources to assist in specification of species, grade or product for a given application.
- Compare LEED credits with what products are available to meet performance criteria.

Specifying LEED and Healthy Home NDW Products

Forest Products LEED Matrix

Credit	Threshold	Salvaged Wood	Recycled Wood	Rapidly Renewable Products	FSC Certified Wood	Regional Mfg.	Regional Extraction	Non Certified Wood	Re-mfg. Wood
MR 3.1	Resource Reuse 5%	x				x	x	x	x
MR 3.2	Resource Reuse 10%	x				x	x	x	x
ID	Resource Reuse 15%	x				x	x	x	x
MR 4.1	Recycled Content 10%		x						
MR 4.2	Recycled Content 20%		x						
ID	Recycled Content 30%		x						
MR 5.1	Regional Materials 20%	x	x		x	x	x	x	x
MR 5.2	Regional Materials 10%	x	x		x	x	x	x	x
ID	Regional Materials 40/20	x	x		x	x	x	x	x
MR 6.1	Rapidly Renewable 5% $			x	x	x	x		
ID	Rapidly Renewable 10% $			x	x	x	x		
MR 7	Certified Wood 50% $			x	x	x	x		
ID	Certified Wood 95% $			x	x	x	x		

X = Possible category implementation

Specifying LEED and Healthy Home NDW Products

Specify qualified vendors to provide:

- technical data and performance experience with different NDW species
- design and engineering tools required
- CSI and environmental specification language for use in project documentation
- assistance in development of specification for USGBC - LEED credit requirements, and
- installation and maintenance specifications.

Summary

Summary

Naturally durable hardwoods are a class of timbers that exhibit the best in durability and natural resistance to decay, rot and insect attack.

Sustainability initiatives are bringing the environmental benefits of truly renewable resources, like naturally durable wood products, to the forefront of the green design movement.

Among the life-cycle benefits of NDW's are that wood processing utilizes 100% of raw material resources, requires less overall energy consumption and demand on non-renewable energy resources and generates lower levels of $C0_2$ emissions than any other material during its production process.

The responsibility for enforcement of environmental regulations and quality control rests almost entirely in the hands of importers; therefore, it is paramount to choose a principled company with sound industry experience in order to acquire the highest quality, most sustainable products available.

Conclusion of This Program

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