

American Hardwoods Enhance Healthy, Healing Spaces

Meeting the exacting requirements of aesthetics, sustainability, durability

Provided By: *The Hardwood Council*

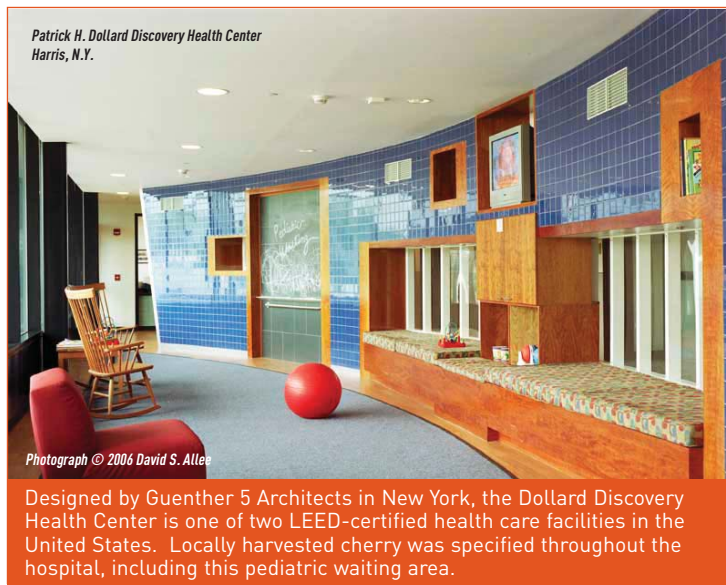
Hardwood floors, cabinets, furniture and trim have brought warmth and beauty to the built environment for centuries. With more than 20 species offering aesthetics, durability and ease of maintenance, American hardwoods are an important component of green, occupant-centered design and architecture. They are specified and used effectively in buildings where sustainability, life-cycle costing and enhancing occupants' health and well-being are design priorities.

Health care settings in particular, from retirement and assisted living facilities to acute care hospitals, are turning to hardwoods to "warm up" their interiors. Thanks to low-volatile organic compound (VOC) wood finishes and non-toxic cleaning products, hardwoods are used in public and patient areas to create a stress-reducing, home-like environment that promotes healing while standing up to the health care sector's rigorous requirements for durability, indoor environmental quality and infection control.

American hardwoods not only meet health care's unique challenges, they also are part of the green building movement gathering steam in commercial, institutional and residential settings. They contribute to project cost-effectiveness and sustainability, environmental quality and user satisfaction—all while bringing a sense of hospitality and visual richness to the built environment.

American Hardwoods Defined

Hardwoods are deciduous trees that have broad leaves, produce a fruit or nut and generally go dormant in the winter. American forests grow hundreds of varieties of hardwood trees



that thrive in this country's temperate climates. In fact, the U.S. has the world's most diverse temperate hardwood forests, with more variety in such hardwood species as oak, ash, alder, maple, cherry, hickory and poplar. The most prevalent hardwood species in the U.S. is oak: together, red and white oak represent 52 percent of all hardwood trees growing in the U.S. forests.

As temperate species, American hardwoods have growing seasons that produce the growth rings that result in the varied grain patterns when sawn. In contrast, tropical species' appearance is more uniform and patternless precisely because they do not have distinct growing seasons.

Research and Environmental Design

An emerging body of research and observation is showing that natural materials are more than substitutes for toxic building materials: They are important in achieving occupant health and well-being, stress reduction, healing and increased productivity.

In a 1984 study, Roger Ulrich, Ph.D., Professor of Architecture and Landscape Architecture at Texas A&M University, showed that patients recovering from gall bladder surgery recovered more quickly and required less pain medication if their hospital room window had a view of trees rather than a brick wall—findings with clear cost-related implications. Some 20 years later, the Center for Health Design in Concord, California, published a watershed report written by Ulrich and others. It summarizes the findings of more than 600 studies that link design decisions to clinical outcomes. Research is substantiating that patients in home-like, reduced-stress health care environments require less medication or experience shorter hospital stays, thereby reducing costs. Natural materials including native hardwoods are an important part of these settings.

Patients in home-like, reduced-stress health care settings may require less medication or experience shorter hospital stays.

"It's been proven that nature really lowers your anxiety level," says Ana Maregatti, IIDA,

CONTINUING EDUCATION

Use the learning objectives below to focus your study as you read **American Hardwoods Enhance Healthy, Healing Spaces**. To earn one AIA/CES Learning Unit, including one hour of health safety welfare credit, answer the questions on page 5, then follow the reporting instructions on page 6 or go to the Continuing Education section on archrecord.construction.com and follow the reporting instructions.

LEARNING OBJECTIVES

After reading this article, you will be able to:

- Discuss the latest research on the use of natural materials in healing environments
- Identify the performance characteristics and qualities of American hardwoods in healthy spaces
- Evaluate the occupant-centered design considerations in specifying hardwoods
- Analyze considerations for hardwood care and non-toxic cleaning in health care settings

President, Maregatti Interiors, Indianapolis, Indiana. "Ninety percent of people will say they feel best somewhere outdoors. It could be in the mountains, by a creek or the ocean. So how do we bring the outdoors inside to create a healing environment with the natural materials? We're not only talking wood, but we also bring a lot of natural stone, slate floors, or glass to show some transparency in the space to make it more nurturing and inviting."

Throughout the design and building community there is growing enthusiasm for incorporating nature into the built environment. Key underpinnings of this trend include:

Biophilia: Popularized by Harvard biologist Edward O. Wilson in his 1984 book, *Biophilia: The Human Bond with Other Species*, biophilia is defined as "the connections that human beings subconsciously seek with the rest of life." As translated into the built environment, biophilia signifies such design features as use of local, natural materials; natural ventilation and opportunities to have contact with nature both physically and visually.

The Planetree Principles: In 2003, Susan B. Frampton, Laura Gilpin and Patrick A. Charmel published the Planetree principles for patient-centered health care in their book: *Putting Patients First, Designing and Practicing Patient-Centered Care* (Jossey-Bass).

The Planetree model aims to transform health care settings from high-tech and sterile to warm, comfortable, nurturing, stress-reducing and people-centered. In the Planetree approach, design can help to create a healing environment and is an integral part of the patient's experience of health care.

When it comes to non-toxic and natural materials, the authors note: "The use of different textures is also important to minimizing the institutional feel of a hospital. Our homes are filled with a variety of rich textures and the presence of different tactile elements can remind patients of home." They add that designers and architects can achieve that objective by using, among other things, wood furnishings and cabinetry throughout health care facilities.

Evidence-based design: A natural corollary to evidence-based medicine, evidence-based design (EBD) uses research and project experience to develop appropriate individual design solutions. In health care design, testimony is accumulating that natural materials, daylight and views of nature appear to affect healing outcomes in measurable ways.

"The whole field of evidence-based design is a new and emerging area," says Jocelyn Stroupe, IIDA, AAHID, Director of Healthcare Interiors and Principal, OWP/P Architects, Chicago, Illinois. "There's just so much more awareness right now from our health care clients and they like to do anything possible to help their patients heal faster and enable their staff to deal with the work-related stress."

Anjali Joseph, Director of Research at the Center for Health Design says, "In hospitals, many studies have shown that people do prefer natural environments over urban environments, and many studies have also shown that people prefer views with nature." She adds the center is working on ways to help architects who are conducting, or interpreting the type of primary research that is the hallmark of evidence-based design.

Leading architects are bringing nature indoors via hardwoods and other natural materials to the benefit of patients, their families and even staff. While occupant-centered and evidenced-based design are becoming accepted practice in health care, the knowledge is pertinent to any building used for living, working, playing or learning. Architects who ignore this growing body of knowledge may be missing a point of competitive advantage.

"The hardwood gives them an impression of something that is less institutional looking."

According to Katrina Barnett, AIA, of Radelet-McCarthy in Pittsburgh, Pennsylvania, her firm not only used hardwoods in the public spaces of several Pittsburgh hospitals, but also in patient care areas, "to make the patients feel more comfortable. The hardwood, a natural material, gives them an impression of something that is less institutional looking; it adds some warmth to the space."

Scott McFadden, Vice President and Director of Design at Maregatti Interiors, echoes that sentiment, saying that when his firm has used hardwoods, "We were trying to create an environment that felt very home-like and very friendly and we were trying to use materials that people would be comfortable with, products they maybe even have in their own home. Natural materials like wood and stone really do seem to help people feel more comfortable and heal as if they are in a more home-like environment."

In her health care designs, Ana Maregatti says she is "trying to evoke confidence, trust and comfort. We know that confidence goes with longevity and the materials we're selecting have to have longevity. That's why we're going to use natural materials like wood: it's been since the beginning of life. It's a material that gives you something you can count on."



Design Considerations

A hardwood product's durability, sustainability, life-cycle costing, environmental certification potential and aesthetics are all important design considerations.

Durability

Pro basketball is played on maple floors; freight trains run on oak rail ties; American hardwoods are durable under intense usage. However, some hardwoods are stronger than others and not all species are equally suited for all applications. The toughest commercially available American hardwood is hickory, and it is five times denser than aspen, one of the "softer" hardwoods which is not used for flooring. In descending order of durability on the Janka hardness scale, hickory, hard maple, red and white oak, birch, ash, walnut and cherry are the woods generally used for flooring and they all offer more than sufficient durability in active settings. The other American hardwood species work well in furniture, cabinetry, trim and architectural detailing.

In the 120,000-square-foot Lewis and Clark State Office Building for the Missouri Department of Natural Resources, Houston-based Berkebile, Nelson, Immenschuh and McDowell (BNIM) Architects specified locally harvested oak as a durable, sustainable flooring material for high-traffic areas such as the four-story atrium lobby and elevator areas. "We used solid white and red oak for flooring in the common areas," explains Kimberly Hickson, AIA, Principal and Manager of BNIM's Houston, Texas, office. "With any wood, if we are specifying it for flooring, we are looking at it for its durability."

In March, 2005, the Lewis and Clark building achieved LEED-Platinum status, one of only 14 other buildings in the U.S. that met the LEED-NC Platinum requirement of a minimum of 52 out of a possible 69 points.

American cherry was chosen for durability at the Hansen Center at Mary Margaret Community Center, Batesville, Indiana. "Primarily we used cherry because we needed it to function well, to hold up well, in a place that can be pretty abusive and we wanted to get the warmth of the richness of the color and the grain," says McFadden of Ana Maregatti Interiors. Cherry also was used for the bump rails that protect hospital walls from damage from equipment and medicine carts and patient guernies.

Only about 5 percent of the tropical forests covered by a recent extensive study are sustainably managed.

Sustainability

While many tropical hardwoods rank high on the Janka hardness scale, density is one criterion among several to be considered when specifying hardwood products. Architects concerned with product sustainability should also consider whether the wood is harvested legally and responsibly. The first steps are to determine whether the species is on any CITES (Convention on International Trade in Endangered Species) lists, and whether the supplier participates in a certification system.

Beyond that, Jim Bowyer, Ph.D. of Dovetail Partners, Inc. notes the International Tropical Timber Organization stated in July, 2006 that only about 5 percent of the tropical forests covered by a recent extensive study are sustainably managed.

In contrast, he says questions about the sustainability of U.S. tree species are more easily answered because, "We would find current and trend data regarding net annual growth and removals for that tree species, as well as information about volume by age and size class and by forest ownership category. There also would be reasonable certainty that harvesting was done in accordance with municipal, county, state and federal forest management guidelines and regulations." He elaborates in an August, 2006 report titled, *Have Tropical Woods in your Product Line? How to Know If They Were Harvested Legally, Responsibly.* (www.dovetailinc.org).

"When we specify wood, for sustainability reasons we make sure to use what we call 'regional native species.'"

While it's widely recognized that natural materials enrich the built environment, some architects may hesitate to specify American hardwoods out of concern for their sustainability. However, every year, U.S. hardwood forests grow far more hardwood than is harvested. The U.S. Forest Service states that the hardwood volume in American forests increases by 10.2 billion cubic feet yearly, while annual removals total only 6 billion cubic feet. Consequently, the volume of American hardwoods is 90 percent larger than it was 50 years ago.

Across the U.S. hardwood-growing areas, climate and soil vary, favoring different species. Hard maple, for example, grows in the northern states, but not in the Mississippi Delta. Choosing from regionally native species adds to a design's sustainability.

BNIM's Hickson notes that native species were specified for the LEED Platinum Lewis and Clark Building. "Oak is readily available in the Midwest so it was a perfect match for our needs," she says. "The red and white oak used for the flooring applications was harvested from a sustainably managed forest in Missouri."

Peter Syrett, AIA, Principal, Guenther 5 Architects, New York, New York, also believes in using materials native to the region. He specified cherry for the 28,000-square-foot Patrick H. Dollard Discovery Health Center in upstate New York, one of only two U.S. LEED-certified health care facilities, and New York's first medical facility to implement green building standards that meet state Department of Health requirements. "The Northeast has the greatest variety of hardwood trees in the entire country," says Syrett, explaining Guenther 5's decision to use cherry as the featured hardwood in the project. "When we specify wood, for sustainability reasons we make sure to use what we call 'regional native species.' We chose to work with cherry for this reason, but also because it is a beautiful wood that worked very well with the rest of the palette."

Syrett focused the use of hardwood in patient recovery rooms, administrative offices and detailed accents throughout the facility in applications including paneling, millwork and cabinetry. "While most of the hardwood used was veneer, all edging and trim was crafted from solid stock," says Syrett. "After three years, there have been no care or maintenance issues with the cherry wood products used in the facility."

Life-Cycle Cost

When it comes to choosing interior surface materials, health care facilities often have opted for synthetic products because of their durability, ease of maintenance and "sanitary look." But these materials may contain harmful polyvinyl chloride and volatile organic compounds (VOC).

What's more, architects have begun to challenge the notion that synthetic materials are less expensive than natural products. Sue Tartaglio, Interior Designer, Burt Hill, Butler, Pennsylvania, has developed a life-cycle cost comparison of a dozen frequently used synthetic and natural flooring products, based on manufacturers' published maintenance data/life-cycle costs, and conversations with manufacturers' representatives. The matrix shows that in facilities with a lifetime use of more than 15 years, hardwood flooring, while it may have higher upfront costs, has life-cycle costs that are significantly lower.

The daily maintenance on these floors is really greatly reduced. Frequently, it's a matter of sweeping or damp mopping them to remove surface soil. And with their smooth surfaces, hardwood floors don't harbor animal dander, fleas, dust, mites, pollen or other allergens—the reason that doctors often recommend them for patients with allergies and respiratory problems.

"Over the long run, acrylic impregnated hardwoods, in fact, have one of the lowest life-cycle costs," says Tartaglio, referring to pre-finished hardwood floor products in which acrylic has been forced into the wood pores, creating an extremely hard surface.



At Margaret Mary Community Hospital in Batesville, Indiana, an American cherry ceiling serves as a "positive distraction" for patients undergoing a procedure in the Linear Accelerator Suite.

In the comparison, average installed costs per square foot range from \$1.45 for vinyl comp tile to \$12 for bamboo and hardwood, with linoleum, cork, rubber, sheet vinyl, carpet and ceramic tile falling in between. Since the comparison considers useable product life, replacement, cleaning and labor cost over 15 years, products with some of the lowest initial costs wind up having among the highest total life-cycle costs. In fact, hardwood, rubber and bamboo flooring have the lowest total cost at 15 years among the 12 flooring materials compared.

Of the more than 1,200 species of fast-growing grasses known as bamboo, the Moso bamboo species is considered optimal for use in flooring, with a few caveats: the bamboo should be properly aged and only the middle section of each stalk should be used in order to deliver the proper strength and moisture content. In addition, architects should ask bamboo flooring suppliers whether the bamboo plantations use pesticides and chemical fertilizers, and what type of resin is used to bond the grass stalks in the flooring manufacturing process.

Green Certification

While environmental certification and sustainability are not necessarily synonymous, many architects and clients opt to pursue ratings through LEED, GreenGlobes™ and the Green Guide for Health Care™.

Currently, LEED standards extend credits only to hardwoods certified by the Forest Stewardship Council (FSC). However, there is extremely limited availability of FSC-certified hardwoods because more than three-quarters of U.S. hardwood forests are in private ownership. This fragmented ownership among millions of different individuals and families has posed an obstacle in enrolling hardwood forests in the fee-based, third-party FSC certification program established in the 1990s.



Tias and Surya Little Residence
Santa Fe, New Mexico

Photographs © 2006 Laurie E. Dickson Photography

Maple floors and other hardwoods are integral to the healthy home environment created for Tias and Surya Little, two internationally renowned Yoga instructors, by Paula Baker-Laporte, AIA.

Even for architects and clients eager to achieve LEED certification, budget constraints are an important consideration. When pursuing a LEED credit in one area becomes too costly, architects can recoup points in another category. With the Lewis and Clark office building, both architect and client agreed that the cost to procure FSC-certified ash and oak would be too great. Forgoing the LEED-NC materials certification point, the design team made a conscious effort to instead pursue the regional sourcing credit (MR 5.1). This credit requires a minimum of 20 percent of building materials that are manufactured within 500 miles of the project.

"FSC certification is an extra expense that we just didn't have room for in the budget. This client came to BNIM wanting the greenest building possible with the money they had. Cost was a major factor in the decisions we made," notes Hickson.

Obtaining Environmental Credits for Hardwoods

American hardwood products can contribute to a building's green rating under sections of three leading certification systems.

LEED

The LEED (Leadership in Energy and Environmental Design) Green Building Rating System® is a voluntary, consensus-based national standard for developing high-performance, sustainable buildings.

- MR5.1 – Regional materials: 20% manufactured regionally
- MR5.2 – Regional materials: 50% extracted regionally
- MR7 – certified wood

Green Globes™

The Green Globes™ system is a green management tool for integrating environmentally friendly design into commercial buildings.

- E.1 Materials with low environmental impact
- E.2 Minimized consumption and depletion of material resources
- G.2.9 Materials specified low-VOC emitting and third-party environmentally certified

Green Guide for Health Care™, the healthcare sector's first quantifiable sustainable design toolkit, largely mirrors the LEED credit structure.

- MR 5.1-5.2 – Regional Materials
- MR 7 – Certified Wood

Trend Toward Pre-Finished

In health care settings, the trend is toward use of pre-finished hardwood flooring, millwork and casework products. Reasons include improved quality control, cost-effectiveness and indoor air quality.

When it comes to indoor air quality in residential settings, Paula Baker-Laporte, AIA, Principal and Owner of Baker-Laporte and Associates, Santa Fe, New Mexico, stipulates that two groups of people must be considered when designing a healthy home: those who are chemically sensitive and those who aren't, but desire a healthful space.

"For people who are very chemically sensitive, I recommend a factory U.V. floor finish so that they don't have to refinish in their home. Pre-finished materials are off-gassed under controlled conditions and the client receives an inert product," elaborates Baker-Laporte. "In the case of healthy people without chemical sensitivities, there are many low- or zero-VOC finishes that work within the parameters of healthy design."

Low-VOC Finishes

For on-site finishing, the best option remains polyurethane. Waterborne finishes are not suitable for finishing casework, millwork or flooring onsite, according to the Architectural Woodwork Institute (AWI). AWI cautions that “governments, owners, and design professionals who insist on waterborne finishes at this time in their development must assume the responsibility for the inherent risk that the finish will not appear and/or perform as well as a comparable solvent-based product.”

Finish costs vary greatly and although superior performance finishes are most expensive, overspecification can add unnecessary costs.

Surface finishes are durable, moisture resistant, easy to maintain and appropriate for many applications. Available top coats include oil-based urethane; water-based urethane; moisture-cured urethane and conversion varnish. Some polyurethane finishes contain aluminum oxide to enhance a floor’s abrasion-resistance qualities.

Acrylic-impregnated floor finishes, among the most expensive, are used in ultra high-use commercial settings, institutional or health care settings, for an extremely hard, durable barrier to dirt, moisture, and wear.

“We reserved the acrylic-impregnated woods primarily for hardwood flooring in our hospitals as well as some of our corporate environments,” says McFadden. “We have used a catalyzed finish on some of these hardwoods and wood veneers, wherever we’re going to have any sort of water coming in contact. For instance, we’ve used catalyzed finish in a serving area within a hospital mainly so that it can hold up and withstand the steam that is coming off the food. Typically, throughout all of our regular corridors we really have used a very light stain or else just a clear finish with just a polyurethane-type sealer.”

At the Dollard Health Center, a low-VOC finish was used to seal and preserve the woodwork. “The indoor air quality issues surrounding hardwoods are very good,” says Syrett. “Guenther 5 uses an index similar to William McDonough’s, where healthy materials are given a ‘green’ rating and materials to avoid are given a ‘red’ classification. We place hardwoods in the green category as long as the substrate is done right and a proper sealer/finish is used.”

In the Lewis and Clark Building, the design team specified two field-applied low-VOC finishes, both meeting SCAQMD (South Coast Air Quality Management District) Rule 1168. The purpose of Rule 1168 is to reduce emissions of VOCs and to eliminate emissions of chloroform, ethylene dichloride, methylene chloride, perchloroethylene, and trichloroethylene from the application of adhesives, adhesive bonding primers, adhesive primers, sealants, sealant primers, or any other primers.

The oak floor finish contained only 70 grams per liter VOC; it was a waterborne natural clear finish with a rapid dry time and high scuff resistance. The product’s spec sheet recommends sealing the unstained floor with one coat of sealer, and then applying two coats of the 70 finish.

In a house she designed in Sante Fe for yoga instructors, Baker-Laporte used the principles of Bau-Biologie, a movement promoting healthy building as a way to improve living and work spaces and the health of people who occupy them. She specified a field-applied breathable hard wax finish that will be reapplied every few years. The wax was made from readily renewable and natural ingredients.

“A material that is harder and can be cleaned easily and well is good for everybody—it doesn’t accumulate dust and it doesn’t accumulate mold,” says Baker-Laporte. “Hardwoods have the perfect combination of durability and give. A hardwood floor,

depending on its installation, is much more giving than a concrete or tile floor. It’s kinder to the body.”

Aesthetics

Each hardwood board has a unique life story. During the approximately 60 years it takes for an American hardwood to mature, each tree develops a unique grain pattern and texture. Even boards from the same hardwood tree will show significant variation in color.

Wood Anatomy and Characteristics

The tree’s newest wood, closest to the bark, is known as sapwood; it is lighter in color and without knots or other character markings. This is the highest grade and most expensive lumber. The oldest wood toward the center of the tree is the heartwood. The heartwood is more character-marked than clear wood; it is darker and denser. As the tree grows, knots mark the points where branches joined the trunk.

Both clear and character-marked wood have value in the built environment, and eco-effective designs make fullest use of the resource and reflect the tree’s entire history. By specifying only wood that is free of knots and other visible marks, architects can either miss opportunities for rich visual qualities or ways to reduce costs.

Grain pattern

Grain pattern or figure is created when the log is sawn into lumber; it not only affects aesthetics and budget, but also is an important consideration in green and sustainable design.

In flat- or plain-sawn hardwood boards, growth rings are parallel to the board’s surface and create the distinctive flame-shaped, arch or cathedral grain pattern. Flat-sawing, representing 95 percent of all commercial U.S. hardwood lumber, produces the most lumber and the widest cuts at the lowest cost.

In quarter-sawn lumber, the growth rings are perpendicular to the board’s broad face, producing a vertical and uniform grain pattern. Quarter-sawing yields fewer, narrower boards per log than flat-sawing, adding to the cost. Structurally, quarter-sawn pieces have good dimensional stability, but not necessarily better than properly kiln-dried flat-sawn lumber. Quarter-sawn boards are popular for decorative applications such as cabinet faces or wainscoting and many species display a striking ray-like pattern.

Rift-sawing at a 30-degree or greater angle to the growth rings produces narrow boards with accentuated vertical or “straight” grain patterns. With their straight grain, quarter-sawn and rift-sawn flooring expand and contract vertically, as opposed to flat-sawn boards which expand horizontally. Nonetheless, all hardwood products will expand and contract as they reach balance with the relative humidity of their surroundings.

Combinations of Woods

Hardwood species and grain patterns are often used in combination to impressive visual effect.

In the Lewis and Clark Building, BNIM used solid quarter-sawn ash to build the fixed window units and the decorative trim. All office doors in the facility are made of solid ash, while locally-sourced ash veneer was applied over a non-formaldehyde substrate in cabinetry, wall panel and casework applications.

“Since we used two species of oak for flooring applications, the ash really complemented the aesthetics of the other materials that were specified,” notes Hickson. “We were especially excited about the ash wall panels because it creates a much different atmosphere than if they were made from drywall.”

The Future of Environmental Design

In coming years, it is likely that evidence-based and patient- or occupant-centered design will gain momentum and inform the practice of green and healthy design. Across the board, architects and clients are moving toward healthy and green design in buildings of all types. Architect Paula Baker-Laporte notes, "There is still some confusion surrounding the topic of healthy design, but I definitely see a merger with green design occurring. Healthy design is clearly registering on people's radar. When I first started looking into the topic, it was really only for people with chemical sensitivities. What I have seen recently is a tremendous shift from sick people to healthy people wanting to remain healthy."

Anjali Joseph, of the Center for Health Design, observes, "In a health care environment that's well-designed and attractive, if there are green elements and natural materials, it's very difficult to say if it's attractive because of the biophilia—attraction toward nature—or if it's because it's a well-designed environment." She predicts that in coming years, more researchers will be exploring the benefits of natural materials in the built environment because, "We're all in the early stages of learning about these issues." ■

Cleaning Hardwoods—What Architects Need to Know

For architects concerned with a project's life-cycle costs and sustainability, non-toxic care and cleaning of American hardwood products are important considerations in their own right. Architects should also note the Centers for Disease Control guidelines stipulate that hand hygiene is the most significant factor in reducing transmittal of infection—thus paving the way for green cleaning rather than the use of harsh disinfectants on hardwood surfaces in health care settings.

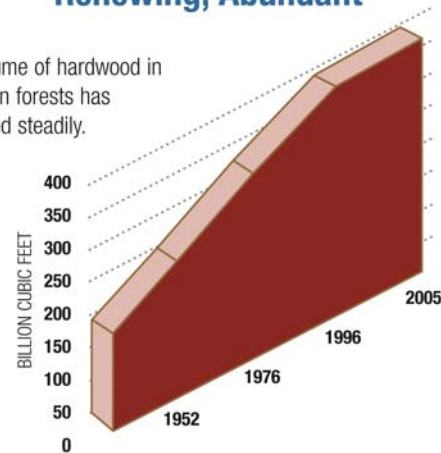
Mike Sawchuk, Vice President and General Manager of Enviro-Solutions, offers the following eco-friendly guidelines for keeping hardwood floors clean:

- Warm soapy water should not be used to clean hardwood floors, because the soap may leave a film that could become slippery when wet.
- Consider cleaning products that are either Green Seal or EcoLogo certified.
- Use pH neutral cleaners.
- An effective matting system should be used at each entrance. "Approximately 80 percent of soils are walked into a building on the soles of footwear," says Sawchuk. "By having 15 to 20 feet of matting that scrapes and then wipes dry footwear, assuming the matting is adequately vacuumed and dried as required, between 70 and 80 percent of the soil will be captured at the entrance matting and not allowed to spread throughout the facility."
- Dust mop frequently with a microfiber mop. This type of mop will typically cut chemical use and waste by 80 percent, increase performance up to six times, and reduce labor fatigue by up to 70 percent.

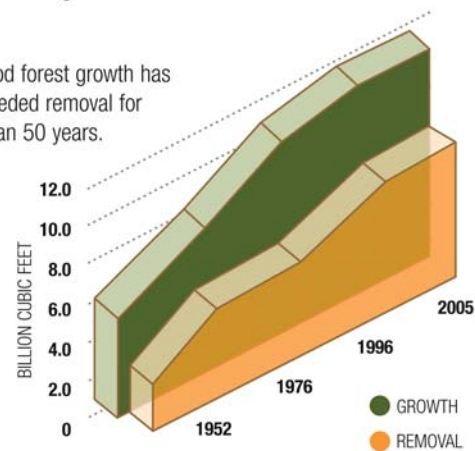
At the Lewis and Clark office building, "Our janitorial cleaning contractor worked with the state throughout the building design phase to assist in making determinations of how surfaces should be cleaned, or not, using environmentally friendly cleaning products. This is one step usually not taken in the building design phase," according to Dan A. Walker, Division of Administrative Support, Missouri Department of Natural Resources. He adds, "We've found the cleaning product market makes significant changes to meet the needs of the rapidly developing sustainable building industry."

American Hardwoods: Renewing, Abundant

The volume of hardwood in American forests has increased steadily.

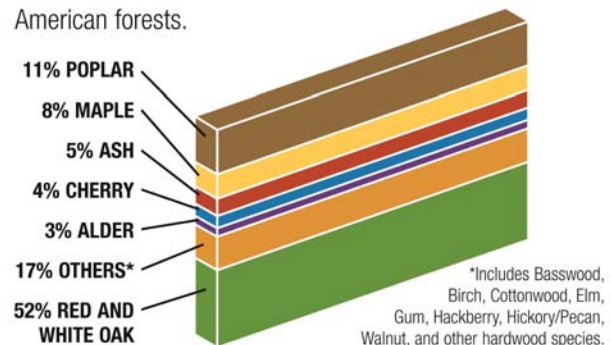


Hardwood forest growth has far exceeded removal for more than 50 years.



What's Growing in the Forests?

American hardwoods renew and regenerate themselves abundantly. Some species have been and will continue to be naturally more plentiful than others. The oaks make up more than half of all hardwood trees in American forests.





CLICK FOR ADDITIONAL SUPPLEMENTAL READING

The article continues online at <http://www.archrecord.com/resources/conteduc/archives/0611hardwood-1.asp>



LEARNING OBJECTIVES

After reading this article, you will be able to:

- Discuss the latest research on the use of natural materials in healing environments
- Identify the performance characteristics and qualities of American hardwoods in healthy spaces
- Evaluate the occupant-centered design considerations in specifying hardwoods
- Analyze considerations for hardwood care and non-toxic cleaning in health care settings

INSTRUCTIONS

Refer to the learning objectives above. Complete the questions below. Go to the self-report form on page 6. Follow the reporting instructions, answer the test questions, and submit the form. Or use the Continuing Education self-report form on *Record's* web site—archrecord.construction.com—to receive one AIA/CES Learning Unit including one hour of health safety welfare credit.

QUESTIONS

1. The most prevalent hardwood species in the U.S. is:
 - a. ash
 - b. pine
 - c. oak
 - d. cherry
2. American hardwoods have distinctive characteristics that result in one-of-a-kind applications. In contrast to American hardwoods, tropical species:
 - a. have an appearance that is more uniform and patternless
 - b. have similarly varied grain patterns
 - c. are less durable
 - d. have more growth rings
3. The Planetree model for health care design:
 - a. recommends building antiseptic-looking facilities
 - b. suggests the use of wood furnishings to give hospitals a more home-like feel
 - c. assigns points for green and sustainable building practices
 - d. develops designs that save money and increase health care provider convenience
4. American hardwoods are considered sustainable because:
 - a. U.S. hardwood forests grow far more wood than is harvested every year
 - b. Use of hardwoods are encouraged by LEED
 - c. Natural materials enrich the built environment
 - d. Climate and soil favor different species
5. Compared to other flooring materials, hardwood floors have:
 - a. high life-cycle costs
 - b. one of the lowest life-cycle costs
 - c. higher life-cycle costs than synthetic flooring products
 - d. lower upfront costs
6. Using regionally sourced hardwoods in a health care project
 - a. can help control material costs
 - b. is a sustainable design strategy
 - c. can earn LEED credit
 - d. all of the above
7. For hardwood products in health care settings, it is recommended to:
 - a. apply waterborne finish onsite
 - b. field-apply linseed oil
 - c. finish offsite at the manufacturer
 - d. use wax made from natural products
8. Used predominantly in ultra high-use commercial settings, they provide an extremely hard, durable barrier to dirt, moisture and wear:
 - a. surface finished floors
 - b. acrylic impregnated floors
 - c. stains
 - d. wax coatings
9. In flat- or plain-sawn hardwood boards, growth rings are parallel to the board's surface and create:
 - a. a vertical and uniform grain pattern
 - b. accentuated vertical or "straight" grain patterns
 - c. narrow boards
 - d. distinctive flame-shaped, arch or cathedral grain pattern
10. One aspect of keeping hardwood floors clean is to:
 - a. dust frequently with a micro fiber mop
 - b. use hot, soapy water
 - c. sponge down with disinfectant
 - d. use a wax buffer system



The Hardwood Council serves architects, designers and builders by providing useful information about American hardwoods in sustainable design and building. As an independent, nonprofit organization, the Council advances better understanding of hardwood flooring, furniture, cabinetry and millwork, without bias toward specific products or manufacturers.

The Council's Web site, www.hardwoodcouncil.com, offers basic information about dozens of American hardwood species, background on sustainable forestry, and overviews of sustainable specifying, design, installation and finishing practices.

**For more information about the Hardwood Council, and American hardwoods, please visit www.hardwoodcouncil.com or contact us at:
The Hardwood Council, 400 Penn Center Boulevard, Suite 530, Pittsburgh, PA 15235**

CIRCLE 68 ON READER SERVICE CARD OR GO TO ARCHRECORD.CONSTRUCTION.COM/PRODUCTS/

Program title: **"American Hardwoods Enhance Healthy, Healing Spaces," (11/06, page 205)**

AIA/CES Credit: This article will earn you one AIA/CES LU hour of health, safety, and welfare credit. (Valid for credit through November 2008.)

Directions: Select one answer for each question in the exam and completely circle appropriate letter. A minimum score of 80% is required to earn credit.

Take this test online at <http://archrecord.construction.com/continuing/default.asp>

- | | | | | | | | | | |
|-------------|---|---|---|---|--------------|---|---|---|---|
| 1. a | b | c | d | e | 6. a | b | c | d | e |
| 2. a | b | c | d | e | 7. a | b | c | d | e |
| 3. a | b | c | d | e | 8. a | b | c | d | e |
| 4. a | b | c | d | e | 9. a | b | c | d | e |
| 5. a | b | c | d | e | 10. a | b | c | d | e |

Last Name _____ **First Name** _____ **Middle Initial or Name** _____

Firm Name _____

Address _____ **City** _____ **State** _____ **Zip** _____

Tel. _____ **Fax** _____ **E-mail** _____

AIA ID Number _____ **Completion date (M/D/Y):** _____

Check one: \$10 Payment enclosed. (Make check payable to Architectural Record and mail to: Architectural Record/Continuing Education Certificate, PO Box 5753, Harlan, IA 51593-1253.) For customer service, call 877/876-8093.

Charge my: Visa Mastercard American Express **Card#** _____

Signature _____ **Exp. Date** _____

Check below:

To register for AIA/CES credits: Answer the test questions and send the completed form with questions answered to above address, or fax to 609/426-5592.

For certificate of completion: As required by certain states, answer test questions, fill out form above, and mail to above address, or fax to 888/385-1428. Your test will be scored. Those who pass with a score of 80% or higher will receive a certificate of completion.

Material resources used: Article: This article addresses issues concerning health and safety.

I hereby certify that the above information is true and accurate to the best of my knowledge and that I have complied with the AIA Continuing Education Guidelines for the reported period.

Signature _____ **Date** _____