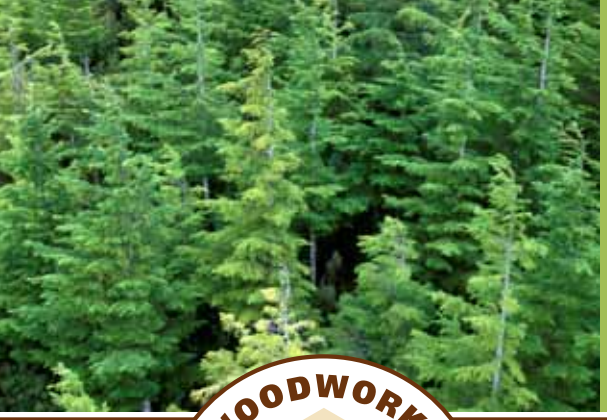


Sustainable Forestry in North America

Wood Design & Building Series

As green building has evolved beyond its initial emphasis on operational energy efficiency, greater attention has been given to the choice of structural and finish materials and the degree to which they influence a building's environmental impact. In particular, the use of wood from sustainably managed forests offers significant benefits when compared to materials such as steel and concrete that require large amounts of fossil fuels to manufacture—but how can design and building professionals be sure that the wood they specify comes from a sustainably managed resource? As this paper will demonstrate, the answer is to choose North American wood products.

Earn one AIA/CES LU (HSW/SD) by reading this document and taking a short online quiz. For details and learning objectives, visit the Online Training Library at *woodworks.org*. WoodWorks is an approved AIA provider.

The State of North America's Forests

The United States and Canada together have about 15.5 percent of the world's total forest cover and, although the two countries differ in terms of forest ownership and laws, governments and the forest industry on both sides of the border share a demonstrated commitment to sustainability.

Both countries have roughly the same amount of forested land now as they did 100 years ago.[i] The U.S. has about 745 million acres of forest, or 72 percent of the original forest cover[1] that existed prior to European settlement. Canada has about 995 million acres of forest, or 91 percent of its original forest cover, more than any other country.

In the U.S., 57 percent of the forested land base is privately owned—by corporations, investment funds and other entities, as well as some 10 million family forest landowners—and sustainability is a prerequisite for landowners seeking to ensure a positive return on investment over the long term. The rest is owned by public entities such as national, state and regional governments. There are a large number of federal policies covering U.S. forests, and the state and local legal requirements are also extensive. During the past 50 years, less than 2 percent of the standing tree inventory in the U.S. was harvested each year, while net tree growth was 3 percent.[ii]

In Canada, 93 percent of the forests are publicly owned and forest companies operate under some of the most stringent sustainability laws and regulations in the world. Less than one half of one percent of the managed forest is harvested annually, and the law requires all areas to be promptly regenerated.[iii]

In the U.S. and Canada, the rate of deforestation, which is the permanent removal of forest in a given area, has been virtually zero for many decades.[vii] In this photo, seedlings are being planted after harvest.

[1] *The term "original forest cover" refers to the geographic area that was covered by forests at the time of European settlement.*

Certified and Protected Forests

Wood is the only building material that has third-party certification programs in place to demonstrate that products being sold have come from a sustainably managed resource. North America has more certified forests than any other jurisdiction.

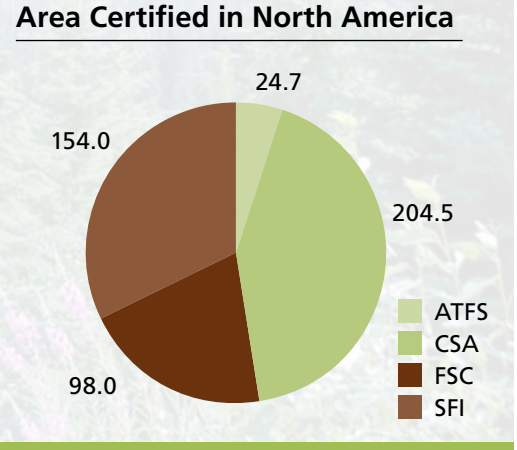
Sustainable forest certification allows forest companies to demonstrate the effectiveness of their practices by having them independently assessed against a standard that goes beyond regulatory requirements and takes into consideration environmental, economic and social values.

The U.S. and Canada have world-leading forest management practices, and the quality of these practices has been verified by a host of independent sources. There are more than 480 million acres of third-party certified forests in the two countries, representing over half of the world's certified forests.

Certified forests undergo annual inspections to verify that global standards of responsible forest management are being followed. These global standards include protections for wildlife habitat, water and soil resources, and many other environmental safeguards. Certification standards also address the risks of illegal practices, assurance of worker safety, fair labor practices, and other social and community considerations.

Forests in North America are certified through four main certification programs: the American Tree Farm System (ATFS), Canadian Standards Association's Sustainable Forest Management Standard (CSA), Forest Stewardship Council (FSC), and Sustainable Forestry Initiative (SFI).

In addition to forest certification, conserving a range of biologically and ecologically diverse ecosystems across the land base is an important management strategy. It ensures that valuable areas are set aside for scientific studies, recreational and tourism opportunities, and the fulfillment of cultural and



This regenerating pine and spruce forest was harvested in 1988 and planted with spruce in 1989.

Graphics are based on 2008 year-end data from:
www.pefc.org, www.fscus.org, www.fsccanada.org, www.fsc.org, www.certificationcanada.org, www.mtc.com.my

Photo: Sandy McKellar

On the left: Eroded farmlands in the 1930s that became the Shawnee National Forest in Illinois
On the right: Shawnee National Forest today

Photos: (l) The Forest History Society, (r) USDA Forest Service

spiritual needs. Tens of millions of acres of North America's forests are protected within wilderness areas and parks and through regional and local programs. Forests are also protected by established conservation easements developed through the work of local land trusts.[iv]

Forestry in the 21st Century

Forestry as a profession in North America is about 100 years old. Over the past century, the field has evolved from practices that were focused on maximizing timber values to approaches that are deeply rooted in ecology, science, and principles of sustainability. Forest research is ongoing and continues to support improvements in the practice of forestry. Modern day foresters complete rigorous college programs and participate in continuing education, certification, and licensing programs to establish and maintain professional credentials, much the same process as other professions such as engineering and architecture.

Forest management in North America operates under layers of federal, state/provincial, and local regulations and guidelines that foresters and harvesting professionals must follow to protect water quality, wildlife habitat, soil, and other resources. Laws addressing safety and workers' rights also govern forestry activities. Training, continuing education and certification for loggers and foresters support continuous improvement and use of the latest information and best practices in forest management.

Modern Day Forestry Practices

Today's forestry involves many different management tools and techniques. A common approach is ecosystem-based management, which is an integrated, science-based approach to the management of natural resources. This approach aims to sustain the health, resilience and diversity of ecosystems while allowing for sustainable use of the goods and services they provide. Foresters use different ecosystem-based management techniques depending on forest conditions, tree species, management objectives, and other factors.

The practice of caring for and cultivating forest trees is known as *silviculture*. Silviculture treatments are used to guide the establishment, growth, composition, health, and quality of forests and trees. Through the use of diverse silviculture practices, foresters are able to influence forest conditions and provide a variety of benefits that support landowner objectives and a full range of social, economic, and ecological values.

Silviculture practices are often applied to mimic natural disturbances and the cycles of nature that are associated with a specific region, forest type, or species. Natural disturbances, including windstorms, hurricanes, ice storms, forest fires, and insect or disease outbreaks, are a fact of life in the forest. To mimic these events, foresters vary the size of the openings created by forest management, the intensity of the management and the frequency with which management occurs.

One of the most versatile silviculture tools available to a forester is an intermediate treatment—examples of which include understory thinning harvests as well as understory planting, weeding and cleaning, salvage and sanitation cutting, and prescribed fire. These treatments are applied to sustain ecosystem health and function, improve stand quality, and increase large-diameter, high-quality trees that provide important economic and ecological values. Intermediate treatments can provide income to the forest owner while also improving wildlife habitat and increasing forest biodiversity.

These photos show the same forest before treatment (left) and afterwards (right). The goals of this partial cut were to 1) remove hardwood trees, some of which were dead and dying, to improve the health and growth of the remaining hardwoods, and 2) provide opportunities for pine species, which create winter cover for wildlife habitat and increase biodiversity.

Photo: Aitkin County

Thinning is a common example of an intermediate treatment. Although there are many possible approaches, the basic concept of thinning is to remove some trees while leaving others to continue growing. As a result, the trees that are left to grow will have more space and therefore less competition for sunlight, water, and soil nutrients. After thinning, growth of remaining trees is typically more rapid, with the result that the trees ultimately live longer and grow to larger diameter. These results can have economic benefits as well as benefits for wildlife habitat and the environment.

One way to think of forest thinning is to compare it to techniques that are used in tending a garden. For example, when harvesting tomatoes, apples or other fruits and vegetables, it is appropriate to focus on picking the ones that are ripe. A gardener may also remove fruit that is damaged or showing signs of rot. In a garden, it is also common to thin a row of young carrots, beets or radishes so the ones that remain are healthier and can grow bigger. Finally, as garden plantings mature, it is sometimes necessary to remove or divide plants that have become crowded or overgrown. These same concepts are applied in forest thinning treatments.

Determining which trees to remove in a thinning treatment and which to leave to continue growing is a very important management decision. The tree selection and overall number of trees removed will depend on the goals of the thinning—and each treatment may have several different goals that are being addressed. For example, thinning where a greater number of trees are removed can allow sunlight to reach the forest floor and increase the growth of the ground plants and shrub layer with potential wildlife food and cover benefits. A thinning that removes fewer trees can focus on creating extra growing space for the remaining trees while removing trees that may be in decline. In some cases, trees that might be expected to die due to natural competition and crowding are harvested and utilized; this approach is sometimes described as "capturing mortality." Although thinning is an important tool, it is not always an appropriate technique to use in a particular forest. Its use and design need to be tailored to the forest conditions. Species such as oak, maple and other hardwoods can often benefit from thinning, as can some pine species and mixed forest types.

Clearcutting or clearfelling within a forest is another management method used in certain circumstances. Species such as aspen, Douglas-fir, some pine and spruce, some oak and other forest types can be managed using clearcutting methods. Clearcutting is employed when young trees need an abundance of sunlight in order to compete successfully with grasses and other plants, and is usually designed to mimic the natural disturbance that occurs in forests that have been impacted by windstorms or wildfire. Again, there are parallels with gardening. For most garden and landscape plants, there are guidelines for identifying species that require full sun (e.g., roses and daylilies), those that can tolerate partial sun (e.g., bergamot and bleeding heart), and those that do well in the shade (e.g., ferns and hostas). Tree species fall into similar categories and each tree's level of shade-tolerance is an important factor in management decisions.

In a clearcut treatment, the size and width of the opening that results from cutting will influence the species that dominate the new forest as well as the wildlife habitat it provides. For example, openings that are more than two tree heights in width will have core areas in the middle that are

largely unaffected by the surrounding forest in terms of moisture and temperature conditions. In other words, openings of this size can provide habitats and forest conditions that are distinct from adjacent areas. Therefore, clearcutting is an effective way to accomplish at least two goals: 1) regenerate a species that requires a lot of sun, and 2) create a forest type that is different from surrounding forests both with regard to species and tree age and thereby introduce diverse structure and habitats.

The debate over the pros and cons of clearcutting as a silviculture method has included the fact that it often generates negative public opinions. The social reaction to clearcutting is an important consideration for foresters, especially those managing public lands. Clearcutting is heavily regulated and supervised in the U.S. and Canada.

In addition to thinning and clearcutting systems, there are also many different approaches to partial cutting systems such as shelterwood harvesting and group tree selection. In a shelterwood system, partial harvesting allows new trees that can survive in some shade to grow up under an overstory of maturing trees. The new trees can result from natural seeding and sprouting, or planting. Mature overstory trees are typically removed once the new trees are well established, usually five to ten years after the initial shelterwood treatment.

In a group tree selection system, the goal is to create scattered openings in the forest that allow species with a range of shade tolerances to become established. A partial cutting can also include what are called legacy patches, reserve trees or reserve areas. These legacy patches preserve biodiversity from the previous forest. They also help foresters meet goals for providing structural elements that address specific objectives for biodiversity, wildlife, stand structure, or other forest values. Foresters must also meet requirements for keeping protective buffers of standing trees along streams and rivers and around lakes and wetlands. These buffers further protect water resources and habitat values.

Training, continuing education and certification support continuous improvement and use of the latest information and best practices in forest management.

Photo: www.naturallywood.com

The use of responsible forest management in North America has resulted in more than 50 consecutive years of net forest growth that exceeds annual forest removals.[v]

Forest management is often described as a blending of art and science. Foresters must follow the regulations and best practices of forestry and apply forest science and the results of ongoing research. Foresters must also nurture the art of recognizing the unique features of a specific forest and site and develop the management design that will meet diverse environmental, economic and social interests, including the needs and objectives of the owner. The incorporation of art and science that occurs in forest management is similar to what occurs in a building project. Architects and builders must also address both the technical requirements and obligations of their profession while taking into consideration the tastes and desires of the project partners and owners. Today's foresters are well trained and have a large number of management tools and techniques that allow them to care for the forest while meeting the needs of the environment and their community.

Responsible forest management in North America has resulted in more than 50 consecutive years of net forest growth that exceeds annual forest removals.[v] This track record of annually growing more wood than is harvested has continued despite increasing demands and growing populations. It is a testament to North America's leadership in forestry practices and sustainability.

Deforestation and Illegal Logging

Up until the early 20th century, settlers coming to North America cleared an average of 2.1 acres of forest per person to survive and grow food.[vi] The establishment of industrial agriculture and other changes in land use have mitigated forest clearing in North America since that time, and forest acreage has been stable for over a century. The rate of deforestation in the U.S. and Canada has been virtually zero for many decades. The U.S. reported an annual increase in forest area of 0.12 percent in the 1990s and 0.05 percent from 2000 to 2005, while Canada reported no change.[vii]

Outside North America, however, the conversion of forestlands to non-forest uses continues at a significant rate, predominantly in developing tropical countries. Deforestation is the permanent removal of forests so that land can be used for other purposes, and globally it accounts for 17 percent of the world's greenhouse gas emissions. More than two-thirds of global forest loss is still attributed to clearing for agriculture. When forested land is converted to other uses, a portion of the deforestation can be offset by afforestation—such as the planting of trees on land that has been bare of trees for a long time. According to the *State of the World's Forests* report, 2007, "the world lost about 3 percent of its forest area from 1990 to 2005; but, in North America, total forest area remained virtually constant."

Illegal logging contributes to deforestation, habitat destruction and climate change. It also undermines the viability of legally harvested and traded forest products, and is a serious detriment to forest sustainability. The root causes of illegal logging include poverty, weak governance and corruption. Illegal logging, which continues to have a tremendous negative impact in many tropical countries, is not an issue in North America thanks to a multi-faceted governance structure for sustainable forest management, which includes well-developed public policies, legislation and regulations, enforcement, regular monitoring, and public reporting. However, recognizing the global concerns about illegal logging, the U.S. and Canada are committed to working with international organizations to find solutions that minimize its impacts on the world's forests, people who depend on those forests, and forest product markets.

Photo of a clearcut area one year after harvest. In the foreground there are 4-to-5-foot-tall aspen trees regrowing. The taller trees were left during the harvest to provide environmental benefits such as biodiversity and wildlife habitat.

Photo: Dovetail Partners, Inc.

People, Fire, and Forests

People have had an intimate relationship with North American forests for thousands of years. From the ancient cities of the Pueblo Indians and the Mississippians[viii] to the modern day metropolises of New York and Los Angeles, wood has played a critical role in North American societies. Forests have helped build our homes, develop our industries, and raise our spirits. Over the centuries, humans have learned to live with and adapt the forest to our needs. Today, our interactions with the forest are focused on meeting our needs without compromising the needs of future generations.

There is often a debate about whether humans should let nature take its course or whether we should take an active role in managing the landscape. Forest fires lie at the heart of this debate. Before European settlement of North America, Native Americans used periodic burning in the forest for many centuries. Among other things, fire has been used as an effective forest and habitat management tool, and to promote ease of travel, assist with agriculture and food production, and reduce insects or disease.

Forest management in North America continues to use prescribed fire when possible to achieve some of the same benefits. Other forest treatments are used to mimic fire—such as harvesting of undergrowth and removal of small and dead or dying trees through thinning. These treatments are necessary in part because wildfires are no longer allowed to burn unchecked because of the danger to human life and property. As a result, many forests have become overly dense with excess growth and debris which, combined with weather events such as high temperatures and drought, has caused an increase in both the number and severity of fires. Forest harvesting and treatments that reduce excess "fuel" in the forest mimic fire by removing some of the accumulated material, while also providing wood that can be used for bioenergy and other products.

Although fire is part of the natural forest cycle, the practice of fighting fires to protect human life and property can result in a build-up of excess growth and debris—which become fuel for fires that burn hotter and are more intense, causing a greater level of destruction.

Photo: iStock

Wood and Green Building

Providing it comes from a sustainably managed resource, wood has many attributes that make it an inherently 'green' building material.

Life cycle assessment (LCA) studies show that wood requires less energy across its life cycle than other structural building products, and is better for the environment in terms of greenhouse gas emissions, air and water pollution, and other impact indicators.[ix]

One of the reasons for this is that wood grows naturally, using energy from the sun, and the fossil fuel-based energy needed to manufacture wood into products is very low compared to other construction materials.

To further reduce the use of fossil fuels, the forest industries of the U.S. and Canada use bark, sawdust and other renewable biomass to produce their own electrical and thermal (or heat) energy. In 2008, 65 percent of the energy used to manufacture paper products in the U.S., and over 73 percent of the energy used to manufacture wood products, was renewable energy.[x] In Canada, waste-based biomass constitutes nearly 60 percent of the energy used by the forest industry.[xi]

Because of its low embodied energy, using wood instead of steel or concrete results in 'avoided' greenhouse gas emissions. However, this is only part of the reason wood contributes to a building's low carbon footprint. Most people know that trees help clean the air by absorbing carbon dioxide (CO_2). They release the oxygen (O_2) and use the carbon to produce sugars for growth, incorporating it into their leaves, twigs, solid woody stems and surrounding soil. Lesser known is the fact that wood products continue to store much of this carbon, which is kept out of the atmosphere for the lifetime of the product—longer if the wood is reclaimed and used elsewhere.

Wood's environmental benefits also include efficient use of resources. Today's wood manufacturing is very much focused on reducing waste and increasing recycling and reuse. Modern mills utilize 98 percent of every tree that is harvested and brought to a mill[xii]—from the bark and sawdust to the boards that are sawn. Mills also utilize recycled and reclaimed materials, including wood from deconstructed buildings and materials collected from other manufacturers. Products such as particleboard can contain up to 100 percent post-industrial recycled content.

Finally, there is wood's adaptability. In North America, buildings are often demolished long before the end of their useful service lives because of changing needs and increasing land values as opposed to performance issues.[xiii] When one considers the embodied energy in these structures and issues related to disposal, the adaptability of wood structures and building systems, either through renovation or deconstruction and re-use, is a significant environmental advantage.

North American Wood Products: The Natural, Sustainable Choice

As a design or building professional, you make choices about the materials you use in your projects. When the objective is minimized environmental impact and a low carbon footprint, there is no better choice than wood from North American forests.

Photo: www.naturallywood.com

ADDITIONAL RESOURCES

American Forest Foundation
www.forestfoundation.org

Dovetail Partners Inc.
www.dovetailinc.org

Forest Products Association of Canada
www.fpac.ca

Forestry Innovation Investment
www.naturallywood.com

State of the World's Forests, United Nations Food and Agriculture Organization
www.fao.org/docrep/011/i0350e/i0350e00.htm

The State of America's Forests, Society of American Foresters
www.safnet.org/publications/americanforests/StateOfAmericasForests.pdf

The State of Canada's Forests, Natural Resources Canada
http://canadaforests.nrcan.gc.ca/rpt

Forest Certification

American Tree Farm System
www.treefarmsystem.org

Canadian Standards Association
www.csa-international.org

Forest Stewardship Council
www.fscus.org

Sustainable Forestry Initiative
www.sfiprogram.org

END NOTES

[i] *State of the World's Forests* reports, 1997 through 2009

[ii] *The State of America's Forests*, M. Alvarez, 2007, Society of American Foresters

[iii] Natural Resources Canada, http://canadaforests.nrcan.gc.ca/article/publicownership; Forest Products Association of Canada, www.fpac.ca

[iv] Federal Sustainability Report 2010

[v] Natural Resources Canada; USDA Forest Service

[vi] *American Forests*: *A History of Resiliency and Recovery*, Douglas W. McCleary, 1997, Forest History Society

[vii] *The State of America's Forests*, M. Alvarez, 2007, Society of American Foresters; *State of the World's Forests Report*, 2007, United Nations Food and Agriculture Organization

[viii] *Chaco Canyon Pueblo Indians built five and six-story buildings with up to 700 rooms with a combination of stone and wood beams. The Mississippian city of Cahokia in Southwest Illinois was as large as London in 1250 AD.*

[ix] *A Synthesis of Research on Wood Products & Greenhouse Gas Impacts*, 2nd Edition, Technical Report No. TR-19R, 2010, Sathre, Roger, Jennifer O'Connor, www.forintek.ca/public/pdf/Public_Information/technical_rpt/TR19%20Complete%20Pub-web.pdf

[x] American Forest & Paper Association, 2010

[xi] Forest Products Association of Canada, 2011, www.fpac.ca

[xii] *The Fibre Cycle in Canada and the US, The Fibre Cycle Technical Document*, 2006, Metafore

[xiii] *Survey on Actual Service Lives for North American Buildings*, O'Connor, Jennifer, FPInnovations, 2004, www.cwc.ca/NR/rdonlyres/67D42613-BF5D-4573-BD43-C430B0B72C08/0/Service_Life_E.pdf

Cover photos: (top) www.naturallywood.com, (bottom) Festival of Forestry

WoodWorks is an initiative of the Wood Products Council, a cooperative venture of major North American wood associations.