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DOCUMENTING THE ENVIRONMENTAL PERFORMANCE OF WOOD BUILDING MATERIALS

The environmental friendliness of wood products is best determined and promoted with scientific evidence. To that end, the Consortium for Research on Renewable Industrial Materials (CORRIM) was formed in 1996 to document the environmental performance of wood products manufactured in the United States. It systematically identified the factors affecting energy and material use in a product's life cycle from the growing of trees, through its manufacture, use, maintenance, and eventual disposal or recycle. CORRIM saw a need for a scientific database to help assess the performance of wood materials in terms of resource use, energy use, global warming, greenhouse gases, carbon storage, and a number of other environmental impacts. Its goal is to make the database and the related analyses readily available to the public, industry, government agencies, and life-cycle practitioners.

CORRIM is a group of universities and research institutes formed to update and expand a 1976 National Academy of Science's study on the effects of energy consumption when using renewable building materials. Funding to write the study plan was provided by the U.S. Department of Energy through the American Forest and Paper Association's Agenda 2020 program. The study involves 22 modules that assess the life cycle of all wood products in the U.S. The study's research protocol is based upon International Organization for Standardization and ATHENA Sustainable Materials Institute guidelines for conducting life-cycle assessments. To initiate the study, a Phase I agenda was identified covering six of the modules. The Phase I effort was partially funded by the USDA Forest Service Forest Products Laboratory, with additional funding provided by consortium members and private industry. This phase studied the life-cycle assessment of wood building materials produced in the Pacific Northwest and the Southeast from the resources grown in the region through the products' eventual disposal or recycle. These life-cycle inventory and assessment studies documented the environmental performance of wood building materials by assessing all the impacts resulting from their use. Teams of scientists from CORRIM, with expertise in each study area, were assigned to conduct the research.

Life-cycle inventory (LCI) accounts for all inputs into a process in terms of materials, fuels, and electricity, and for all outputs in terms of product, co-products, and emissions to air, land, and water. Life-cycle assessment (LCA) evaluates environmental impacts of using a product, and is usually defined in terms of environmental indices such as energy use, global warming potential, air pollution, water pollution, and solid waste. These indices allow comparisons between different scenarios such as process improvements, product and fuel substitution, and building design and use changes. The Phase I effort for the life-cycle inventory and assessment studies used primary data collected through surveys of manufacturing operations, and secondary data for the production and delivery of fuels and electricity, adhesives, transportation, and construction, use and maintenance of residential buildings, and the disposal and recycle of products.

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The LCA analysis provides an important framework for comparing the environmental impact of using such material as nonrenewable steel or concrete as an alternative to wood. Since wood is renewable, it is more difficult to draw comparisons between these materials as they relate to material depletion and land use. As an alternative, CORRIM developed indices to quantify key ecological characteristics for the land base for the Pacific Northwest, the region where forestry issues have been under the greatest environmental scrutiny.

For carbon accounting, CORRIM develops alternatives to a steady-state LCI/LCA framework showing the dynamic impact of carbon in the forest and in products, including the displacement aspects of biomass energy for fossil energy and wood products for fossil fuel intensive products. The dynamic tracking of carbon reveals a substantial increase in carbon pools over time that is not shown by an LCI/LCA analysis.

The CORRIM reports have been extensively reviewed by the many research institutions involved in CORRIM, by industry experts, and also by external reviewers. An interim report was developed in 2002 and extensively reviewed, leading to a number of refinements in the process of completing the Phase I report. The final report was also reviewed by international LCI/LCA experts, and their conformity report is published in the main report available on the CORRIM web site (www.corrim.org).

The study's life-cycle database is available to the public, government agencies, industry and others through comprehensive reports (www.corrim.org), through the articles in this special issue that summarize the results, and through the U.S. LCI Database (www.nrel.gov/lci/). A variety of users can benefit from these reports including forest resource managers, industry managers, and government policy-makers by using them as a benchmark for process and management improvements targeted at environmental enhancement. For architects, designers, and builders, use of these data will likely be through software packages such as the ATHENA Environmental Impact Estimator and BEES (Building for Environmental and Economic Sustainability) for assessing environmental performance of residential buildings and materials, and through green building standards such as the U.S. Green Building Council's LEED (Leadership in Energy and Environmental Design) program that may base future standards on life-cycle assessments of building systems using data from the U.S. LCI Database. Federal purchasers will rely on software like BEES, which is being further developed to assess environmental performance of bio-based products for purchasing.

CORRIM has begun a Phase II effort to expand upon the research reported in this special issue. The new effort expands the geographic region for forest resources to softwoods in the Inland West (IW), North Central (NC), and Northeast (NE), and hardwoods in the NC and the NE. Additional products are also being considered, including hardwood lumber for the NC and NE, softwood lumber for the IW, oriented strandboard for the NC and NE, and particleboard and medium density fiberboard. Common use adhesives for the wood composites included in both phases of CORRIM's research will also be covered. Expanded product use will be covered to include several additional residential housing sites and multi-family residences, as well as a variety of wall, roof, and floor subassemblies. All will examine both the life-cycle inventory and assessment aspects to document environmental performance.

CORRIM extends appreciation to the Society of Wood Science and Technology and *Wood and Fiber Science* for their support and willingness to publish this special issue on the results of our effort to document the environmental attributes of wood building materials.

JAMES B. WILSON

Vice President
CORRIM, Inc.
and Professor Emeritus
Oregon State University