CORRIM: The 20th Anniversary That Was More Than 40 Years in the Making*

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Abstract

In commemorating almost anything, it can be easy to forget what came before the event celebrated. In the case of the Committee on Renewable Resources for Industrial Materials (CORRIM) or, more accurately CORRIM II, the roots are deep, extending at least back to 1970. This report chronicles the events leading up to the creation of the original CORRIM effort, outlines the early history of CORRIM II, and includes observations regarding future directions. The story begins around the time of the first Earth Day, involves a congressionally authorized initiative focused on industrial raw materials that largely ignored renewables, leads to action by the wood science and technology community to include consideration in federal policymaking of wood and agriculturally derived material, and results in the formation of CORRIM I. After a period of several decades during which raw material issues loom progressively larger, the story resumes with the reengagement of the wood science community concurrent with development of a new environmental impact evaluation tool—life-cycle assessment—and concludes with incorporation of CORRIM II in 1996. The end of the story, however, is also the beginning, with much already accomplished but much yet to be done.

Materials, Environment, and CORRIM I

Industrial raw materials security was very much on the national agenda during and immediately following World War II. Findings were not encouraging. The final report of the President's Materials Policy Commission (1952), commissioned by Harry Truman, referred to a ''large and pervasive materials problem.'' Outlined was a situation of rising consumption and increasing reliance on imports for critical raw material supplies. Environmental concerns were peripheral although clearly in the background in discussion of domestic materials policy.

Environmental concerns were brought into the discussion through a report of a National Academy of Sciences (1969) committee that had been convened 3 years earlier. The report examined resource adequacy, population growth, the potential for increasing or extending food, mineral and energy resources, and relationships between resource needs and environmental degradation. Recommendations centered on population control as a solution.

The following year, among the measures enacted into law by Congress and ratified by President Nixon were the National Environmental Policy Act (NEPA) and the National Materials Policy Act (1970). NEPA established enhancement of the environment as a critical role of the federal government and created the President's Council on Environmental Quality. NEPA would subsequently often serve as a basis for weakening or nullifying attempts to increase domestic raw material production.

The National Materials Policy Act established the National Commission on Materials Policy (NCOMP). Made up of representatives of the private sector and government, the new commission was charged with developing a

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national raw materials policy that would ‘‘decrease and prevent wherever necessary a dangerous or costly dependence on imports’’ while also ‘‘protecting or enhancing the environment.’’ The commission was also charged with formulating recommendations for implementing such a policy.

The final report of the NCOMP (1973) set forth a number of recommendations for addressing the nation’s raw material needs but included only passing reference to timber and wood resources. This omission was particularly striking in view of the fact that the commission had engaged retired Forest Service Chief Edward Cliff to prepare a document focused on renewable materials (Cliff 1973), a document that did not appear in print until 3 months following release of the NCOMP report, or perhaps related to the fact that President Nixon had 2 years earlier created an advisory panel on timber and the environment, the final report of which (President’s Advisory Panel on Timber and the Environment 1973) also appeared several months after that of NCOMP. Neither report received the attention of the earlier released document. In any event, the result was that wood and wood products were essentially omitted from the critical assessment of national raw material needs. In response, several wood scientists, including Steve Preston, associate dean of the School of Natural Resources at the University of Michigan, and Peter Koch, chief scientist of the Southern Forest Experiment Station, approached the Science and Technology Policy Office, led by the science adviser to the president, asking that a renewable materials–focused document be commissioned. In 1974, with support from the National Science Foundation, the Board on Agriculture and Renewable Resources of the National Research Council appointed the Committee on Renewable Resources for Industrial Materials (CORRIM)—a committee chaired by Dr. James Bethel, dean of the College of Forestry, University of Washington—to study the role of renewable resources in meeting future material needs. Included among the areas to be studied were energy and environmental implications of renewables production.

The new committee established six panels, one of which—Panel II—was assigned the task of taking a look at the use of wood for structural and architectural purposes. This panel, led by Dr. Preston, also included Peter Koch; Conor Boyd, manager of Roundwood R&D, Weyerhaeuser; Herb McKean, vice president R&D, Potlatch; Charles Morchauser, technical director of the National Particleboard Association; and Fred Wangaard, former head of the Department of Forest and Wood Sciences, Colorado State University.

The Panel II subcommittee report (Boyd et al. 1976) was published as a special issue of *Wood and Fiber*. The report examined manpower, energy, and capital requirements for the production of primary structural materials and included flowcharts of raw material inputs, products, and wastes for a broad array of wood products. Energy use associated with production of nonwood materials was also examined. The team conclusively demonstrated, more than a decade prior to the introduction of the field of life-cycle assessment, the low embodied energy of wood products in comparison to other common building materials.

Following issuance of reports of the National Commission on Materials Policy and that of CORRIM, there was little evidence of change in federal or state policy regarding raw materials sourcing. In fact, public resistance to domestic production of raw materials intensified over the succeeding decades, with increasing challenges to domestic extraction activity often based on NEPA. Import dependence for raw materials of all kinds continued to rise as environmental protection moved to center stage in national policy, and harvesting of trees for any purpose was increasingly viewed as environmentally damaging.

The Birth of Life-Cycle Assessment

In the early 1970s, a group of environmental scientists recognized that standardized methods for assessing environmental impacts, risks, and trade-offs associated with industrial processes and products did not exist and that better approaches to solving environmental problems were needed. To address this need, in 1979 the Society of Environmental Toxicology and Chemistry (SETAC) was founded for the purpose of creating a forum for the exchange of information and ideas among environmental scientists, managers, and other professionals regarding the analysis and solution of environmental problems.

About a decade following the establishment of SETAC, a system for systematically evaluating environmental impacts through the life cycle of products emerged. At the first SETAC-sponsored international workshop in 1990, the term ‘‘life-cycle assessment’’ (LCA) was coined. Three years later, the International Organization for Standardization asked a small group of SETAC LCA experts to develop recommendations for standardizing LCA. In 1997, the ISO 14040 standard for LCA was released.

Reemergence of CORRIM

In the fall of 1991, the Forest Products Society (then the Forest Products Research Society) sponsored a conference, ‘‘Wood Product Demand and the Environment,’’ in Vancouver, British Columbia, in which topics ranging from world population growth and increasing global demand for raw materials, to environmental aspects of forest harvest and wood use were discussed (Forest Products Research Society 1992). An informal meeting of interested parties at the end of the second day of that meeting, held for the purpose of discussing possible next steps, resulted in the formation of an ad hoc committee tasked with charting a course of action. The agreed focus of effort was expansion of the 1976 CORRIM I findings to include the investigation of a wide range of environmental impacts, including impacts beyond those related to energy consumption.

What followed was a search for funding, with the initial approach to seek sponsorship from the US Environmental Protection Agency, Resources for the Future, or the National Academy of Sciences (NAS). Legislative approaches to funding at the federal level were also pursued. None of these initiatives succeeded, although they did stimulate interest on the part of the NAS that eventually led to, among several initiatives, a 1996 symposium, ‘‘Wood in Our Future: The Role of Life Cycle Analysis,’’ sponsored by the Board on Agriculture (National Academy of Sciences 1997). The funding search also served to make those involved aware of the need to succinctly identify exactly what was envisioned and how a research entity might operate. Subsequently, a workshop was held in Seattle wherein a research and work plan was developed that provided the blueprint for successful fund-raising.

Almost 5 years would pass before the formal establishment of CORRIM II. On April 5, 1996, CORRIM was incorporated in the state of Washington as a nonprofit corporation composed of 15 research organizations. Stated objectives were the following:

- Create a consistent database of environmental performance measures associated with the production, use, maintenance, reuse, and disposal of alternative wood and nonwood materials used in light construction.
- Develop an analytical framework for evaluating life-cycle environmental and economic impacts for alternative building materials in competing or complementary applications so that decision makers can make consistent and systematic comparisons of options for improving environmental performance.
- Make source data available to many users, including resource managers and product manufacturers, architects and engineers, environmental protection and energy conservation analysts, and global environmental policy and trade specialists.
- Manage an organizational framework to obtain the best scientific information available as well as provide for effective and constructive peer review.

An initial version of CORRIM research guidelines was prepared under a grant agreement with the US Department of Energy as part of the American Forest and Paper Association's Agenda 2020 research priorities. The final report (CORRIM 1998) outlined guidelines for the conduct of life-cycle inventory and economic analysis, providing specifics regarding data collection, standards, and procedures applicable to the production and use of wood materials. Thereafter, CORRIM formed a partnership with the Athena Sustainable Materials Institute and harmonized CORRIM guidelines with those of Athena (Briggs 2001).

Since that time, CORRIM has produced a number of scientific reports covering a broad spectrum of structural and nonstructural wood products and brought about collaboration with scientists around the world. While there are many journal articles, grant research reports, and other publications based on CORRIM's research (www.corrim.org), three special journal issues were published by CORRIM researchers to make the data and analysis readily available: CORRIM 2005, LCAs for wood buildings and their structural products produced by the Pacific Northwest and Southeast supply regions; CORRIM 2010, extensions covering the Northeast/North-Central and Inland-West supply regions and West Coast seismic building codes plus medium-density fiberboard and particleboard as high-volume nonstructural products; and CORRIM 2012, environmental performance of wood-based biofuels. Many other researchers have developed life-cycle data on many products and processes (Gustavsson and Sathre 2011).

Looking back, the organization has succeeded (and continues to succeed) in bringing the relatively new field of LCA to the assessment of building material alternatives. Work of consortium members has consistently demonstrated the low embodied energy of wood products and also revealed environmental advantage across a wide array of performance measures. In addition, findings have provided a basis for understanding the carbon dynamics of wood products manufacture and use, something that would not have been possible without application of systematic assessment to product and process evaluation.

What is less well understood is how to use life-cycle data to improve performance, such as for carbon mitigation, perhaps the most pressing environmental issue of modern times. Tracking carbon is complex, requiring thorough assessment to understand carbon flows, with data used for evaluation preferably collected on a work station or machine center basis. Further, when seeking to determine opportunities for improvement, it is not sufficient to simply compare two options because optimization requires identification and consideration of all possible alternatives.

Looking Forward

Going forward, the need for LCA-based information will be greater than ever. Emphasis can be expected to shift from individual materials and assemblies to the assessment of entire structures—a development which is currently under way. Moreover, LCA will be increasingly used by all industries to inform product and process design and building systems development so as to minimize environmental degradation. In this regard, it cannot be automatically assumed that wood products will continue to enjoy environmental superiority without continued advancement in product design, production processes, and performance.

Studies completed by CORRIM to date have identified high environmental burdens associated with the adhesives used in composite products and with wood drying in all product categories, suggesting the need for strategic investment in these areas to reduce the environmental footprint of products and processes. Recent studies have also pointed out the low recovery and recycling rate of discarded wood building materials and products (Falk 2012, Falk and McKeever 2012, Howe and Bratkovich 2013), a reality that impacts LCA results when system boundaries are extended to include end of life. Scenario assessment in this case could be used to clarify tangible environmental benefits of waste recovery for energy recovery versus waste recovery for recycling to structural and nonstructural products. Lippke and Puettmann (2013) demonstrated a range of impacts for different uses of collected demolition wood and forest residuals compared with landfill end-of-life impacts.

An important role of CORRIM is in improving environmental performance by evaluating various scenarios to determine the effects of changes in process inputs on various impact indicators. CORRIM data are also part of the US Life Cycle Inventory Database and have been incorporated into several widely used LCA tools for building design and construction. In addition, inventory data provide a foundation for development of environmental product declarations and have been used extensively for this purpose. Another role for CORRIM is in keeping nonwood manufacturers honest as they develop product life-cycle information. An example is provided by reported steel recycling rates used in all North American LCAs completed to date. Recent investigation (Bowyer et al. 2015) has shown that assumed recycling rates used in assessments are far higher than they actually are, translating to unrealistically low impact indicators for steel products. Corrections are needed. Future assessments should also fully consider inputs in the production of alloys and end-of-life issues in metals separation and source mixing.

When CORRIM was formally created as a not-for-profit research corporation in 1996, the board of directors, representing the initial 15 research institutions involved, emphasized that development of credible data was the first priority, with the assumption that this would be used by others as a basis for informing decisions regarding material use and environmental performance. While the focus on the development of credible data and associated impact assessment has been very successful, subsequent use by industry, green building advocates, government policy makers, and others has been inconsistent. As a result, there remain enormous opportunities for environmental improvement through the adoption of guidelines, practices, and policies supportive of routine incorporation of LCA into decision making. Much work remains to be done to familiarize building materials producers, specifiers, users, environmental advocates, and those in the policy arena with the nature and power of LCA and how to interpret and use results.

A final observation about life-cycle costing: life-cycle cost information for wood buildings is today largely unavailable in the public record. Moreover, published information regarding expected lives of wood in service that is currently used in life-cycle cost assessments appears to have no scientific basis, with unrealistically low product lives often attributed to wood products in comparison to nonwood alternatives. Whether CORRIM is the right organization to take on the task of creating public life-cycle cost assessment information is an open question, but the need is great, and it is important that some organization take on this task—and soon.

CORRIM currently has 20 member organizations (though three are currently inactive) and remains quite active in developing and updating life-cycle inventory data for a broad array of forest-derived products. CORRIM currently has funding to update life-cycle inventory data for medium-density fiberboard, particleboard, inland softwood lumber, Northeast/North-Central region softwood lumber, and eastern hardwood lumber and flooring. Information about the CORRIM structure, member organizations and affiliates, and publications is available at http://www.corrim.org.

Conclusions

As the history and successes of CORRIM are celebrated, it is important to remember the work of those who came before and how their efforts laid a foundation for current work. Although much has been accomplished, work remains to be done. In addition to keeping assessments up to date, there is a role for CORRIM in helping to improve the environmental performance of products, in keeping watch on assessments produced by others, and in pointing out inaccuracies when they occur. There is also the possibility (and great need) to expand activity to include life-cycle cost assessment.

Literature Cited

Bowyer, J., S. Bratkovich, K. Fernholz, M. Frank, H. Groot, J. Howe, and E. Pepke. 2015. Understanding steel recovery and recycling rates and limits to recycling. http://www.dovetailinc.org/report_pdfs/2015/dovetailsteelrecycling0315.pdf. Accessed March 8, 2017.

Boyd, C., P. Koch, H. McKean, C. Morschauser, S. Preston, and F. Wangaard. 1976. Wood for structural and architectural purposes—Special CORRIM Panel II report. *Wood Fiber* 8(1):1–73. https://wfs.swst.org/index.php/wfs/article/viewFile/1824/1824.

Briggs, D. 2001. Research guidelines for life cycle inventories. http://www.corrim.org/pubs/reports/2010/phase1_interim/CORRIMResProtocols.pdf. Accessed March 6, 2017.

Cliff, E. 1973. Timber: The Renewable Material; Perspective for Decision. US Government Printing Office, Washington, DC. http://trove.nla.gov.au/work/21688719?q&sort=holdings+desc&_=1493769355794&versionId=45248379.

Consortium for Research on Renewable Industrial Materials (CORRIM). 1998. Environmental performance research priorities: Wood products. Final report on the research plan to develop environmental performance measures for renewable building materials with alternatives for improved performance. DOE Agreement No. DE-FC07-96ID13427, subcontract 417346.

Consortium for Research on Renewable Industrial Materials (CORRIM). 2005. Special Issue: CORRIM Reports on Environmental Performance of Wood Building Materials. *Wood Fiber Sci*. 37. http://www.corrim.org/pubs/reports/2005/swst/index.asp.

Consortium for Research on Renewable Industrial Materials (CORRIM). 2010. CORRIM Special Issue: Second Report. *Wood Fiber Sci*. 42. http://www.corrim.org/pubs/reports/2010/swst_vol42/index.asp.

Consortium for Research on Renewable Industrial Materials (CORRIM). 2012. CORRIM Special Issue: Environmental Performance of Wood-Based Biofuels. *Forest Prod. J*. 62(4):244–334. http://www.corrim.org/pubs/articles/2012/FPJ_vol62_num04/index.asp.

Falk, B. 2012. North American Wood Waste Forum: Summary of Group Feedback, February 2–3, 2012. General Technical Report FPL-GTR-216. USDA Forest Service, Forest Products Laboratory, Madison, Wisconsin. https://www.fpl.fs.fed.us/documnts/fplgtr/fpl_gtr216.pdf.

Falk, B. and D. McKeever. 2012. Generation and recovery of solid wood waste in the U.S. *BioCycle* 53(8):30–31. https://www.fpl.fs.fed.us/documnts/pdf2012/fpl_2012_falk001.pdf.

Forest Products Research Society. 1992. Wood Product Demand and the Environment: Proceedings, International Conference, November 13–14, 1991, Vancouver, British Columbia, Canada; Forest Products Research Society, Madison, Wisconsin.

Gustavsson, L. and R. Sathre. 2011. Energy and CO_2 analysis of wood substitution in construction. *Climate Change* 105(1–2):129–153.

Howe, J. and S. Bratkovich. 2013. The current state of wood reuse and recycling in North America and recommendations for improvement. http://www.dovetailinc.org/report_pdfs/2013/wood_reuse_and_recycling/current_state_wood_reuse_recycling_namerica.pdf. Accessed March 8, 2017.

International Organization for Standardization (ISO). 1997. Environmental management—Life cycle assessment—Principles and framework. ISO 14040. ISO, Geneva.

Lippke, B. and M. Puettmann. 2013. Life cycle carbon from waste wood uses for district heating and other alternatives. *Forest Prod. J*. 63(1–2):12–23. http://www.corrim.org/pubs/articles/2013/fpj-d-12-00093.pdf.

National Academy of Sciences. 1969. Resources and Man: A Study and Recommendations. National Research Council, Division of Earth Sciences. W. H. Freeman and Company, San Francisco.

National Academy of Sciences. 1997. Wood in Our Future: The Role of Life-Cycle Analysis: Proceedings of a Symposium. Board on Agriculture. National Academies Press, Washington, DC. https://www.nap.edu/download/5734.

National Commission on Materials Policy. 1973. Material Needs and the Environment Today and Tomorrow. Final Report. US Government Printing Office, Washington, DC.

National Materials Policy Act. 1970. Public Law 91-512, 91st Congress, H.R. 11833, October 26. https://www.jstor.org/stable/40921856?seq=1#page_scan_tab_contents. Accessed March 6, 2017.

President's Advisory Panel on Timber and the Environment. 1973. Report of the President's Advisory Panel on Timber and the Environment. US Government Printing Office, Washington, DC. http://babel.hathitrust.org/cgi/pt?id=mdp.39015054145746;view=1up;seq=7

President's Materials Policy Commission. 1952. Resources for Freedom, Volume I—Foundations for Growth and Security. US Government Printing Office, Washington, DC. https://www.nsf.gov/od/lpa/nsf50/vbush1945.htm.