Solid Hardwood Flooring in the United States: Inventory and Sustainable Building Implications

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Topics

- Project Overview
- Objectives; Scope; System Boundary
- Methodology
- Results
- Lessons Learned
- Next Steps
- Questions

Project Overview

A Gate-To-Gate Life Cycle Inventory (LCI) of solid hardwood flooring in the eastern United States

Part of larger initiative generating US regionally based LCI's and life cycle assessments of wood products

Conducted in accordance with ISO 14000 series standards and protocol guidelines outlined in (CORRIM 2001)

Project Overview

The Consortium for Research on Renewable Industrial Materials (CORRIM):

1. 15 US and Canadian Research Institution members

2. Goal of developing a transparent database of information which can:
    - Quantify environmental & economic impacts associated with wood building materials from phases of planting, growing, manufacturing, construction, operational use, and demolition.
    - Assist policy makers, building designers, the general public, and manufacturers.

Project Overview

CORRIM works closely with the Athena Institute

- Athena Institute:
  - Not-for-profit providing scientific information and tools addressing the sustainability of built environments for the general public and building industry
- Athena compiling database of life-cycle inventories for widely used products and processes.
- Currently possible to perform impact comparisons for over 1,000 building assimilations through the database.
  - Projected for public availability; housed at the National Renewable Energy Laboratories (NREL).
  - www.nrel.gov/lci

Project Overview

"Decisions that discourage the use of wood and other non-wood building products are made each day at all levels of industry and government. While many decisions may be motivated by a desire to protect the environment, individuals making these decisions may not consider the negative consequences associated with using non-wood substitutes."

-taken from CORRIM website

(USGBC/LEEDS: wood 13 of 69 possible pts.
Where does life-cycle thinking fit in?)

http://www.corrim.org

Solid Hardwood Flooring Defined in Study

Flooring Classification	Face Widths Inches (cm)	Thickness Inches (cm)
Solid Strip Hardwood	**1.5 (3.81), 2.25 (5.71), 3.25 (8.25)**	**1/3 (0.84), 1/2 (1.27) 3/4 (1.90)**
Solid Plank Hardwood	**3.0 (7.62), 8.0 (20.32)**	

Most common thickness for both flooring classifications is ¾" but does range (Hosterman 2000)

Note:

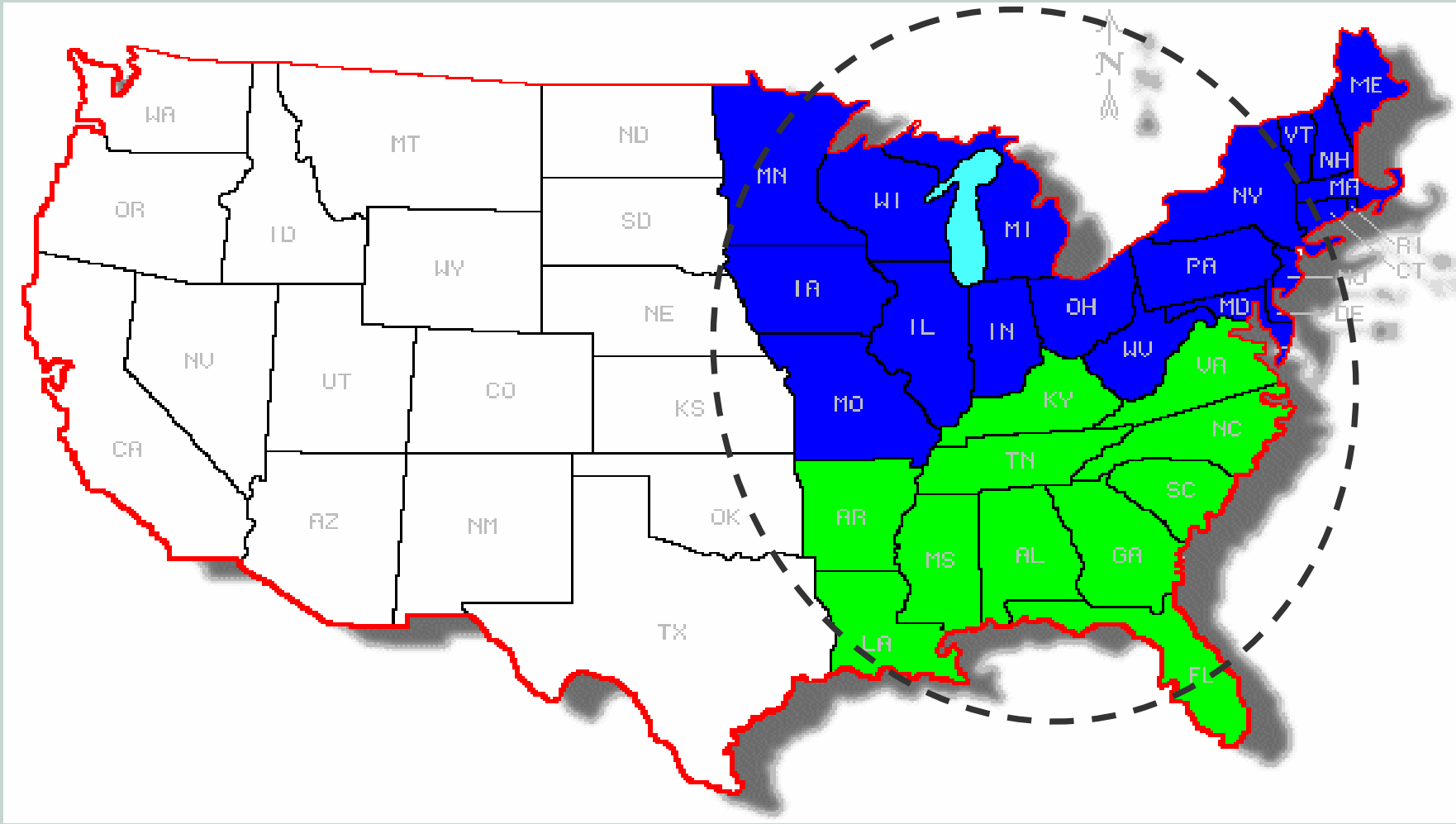
Parquet and engineered flooring not considered in this inventory

Only domestic hardwoods

Project Overview

- Common U.S. domestic hardwood species for solid flooring: Red Oak, White Oak, Sugar Maple, Red Maple, Ash, Birch, Walnut, Cherry, Beech, Hickory, Pecan
- Red Oak nearly 70% of the market
- All results of this inventory are normalized to the defined functional unit of 1.0 m^3 of Solid Hardwood Flooring

Study Region



North East/North Central (blue) ; Southeast (green)

Goal and Scope

The goal of this study is to satisfy the following objectives:

- Develop baseline information on resource use, energy use and generation, and emissions associated with solid hardwood flooring manufacture in the eastern United States.

- To compare baseline information for solid wood flooring to that of substitute or alternative floor coverings derived from non- wood material inputs.

Goal and Scope

Goal…

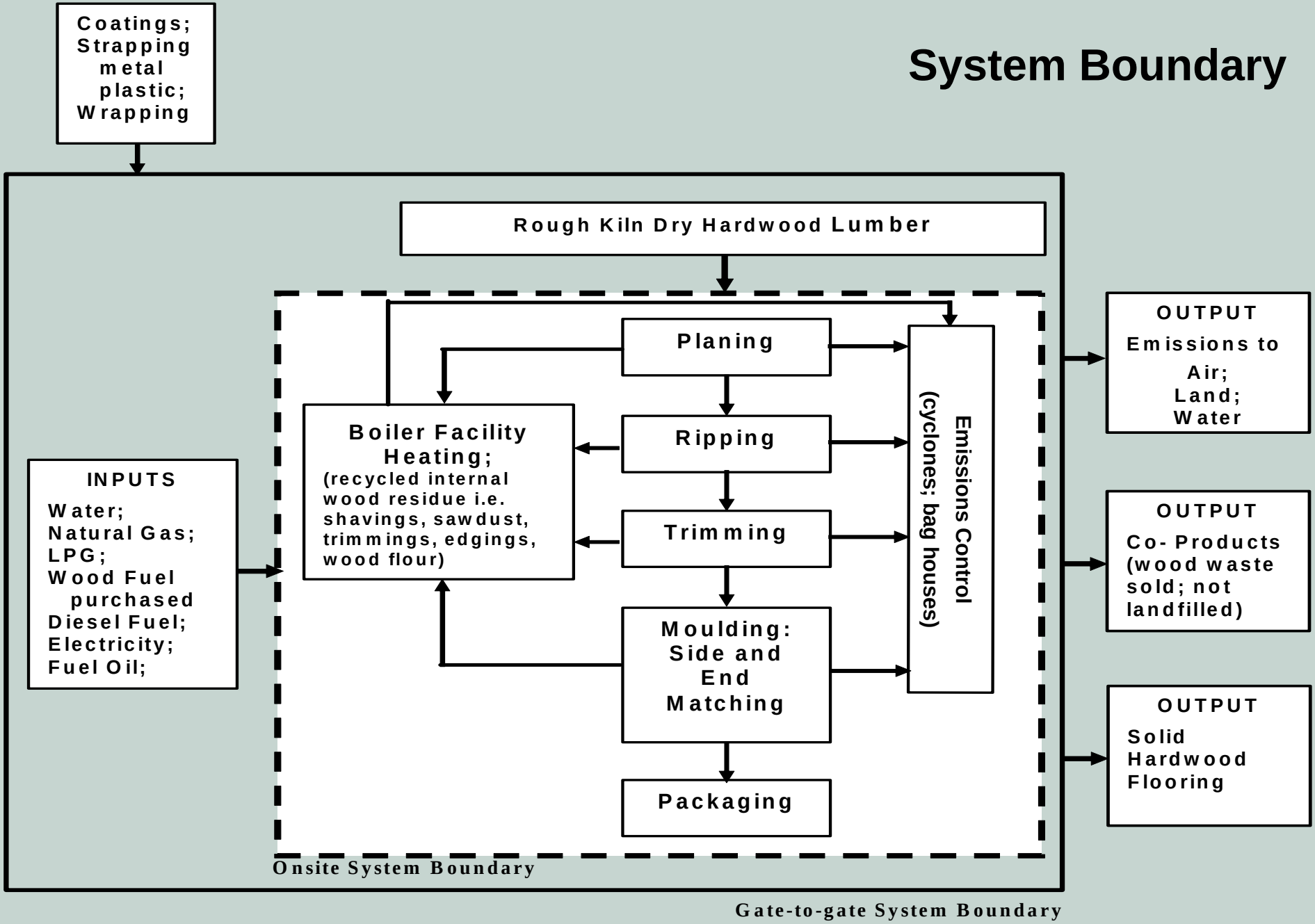
- To extend findings into opportunities for waste reduction, improved energy and resource efficiencies, and scenario modeling.
- To furnish the inventory data to CORRIM for that organizations use in developing cradle to grave life cycle assessments.
- To communicate the inventory findings transparently to flooring manufacturers, policy makers, and the general public.

Goal and Scope

Scope:

- 2006 US production of solid hardwood flooring estimated at 483.1 million ft^2 (Wahlgren 2007)
- Want 20-50% of eastern production (currently have 10 mills ~ 28% of Total US hardwood flooring production)
- Target mills are of mid to large size with average industry technology
- Data is weight averaged and modeled using SimaPro software version 7.0

System Boundary



System Boundary

Considerations:

Kiln drying process

- omitted from gate-to-gate model (survey length; secondary data from hardwood lumber module)
- will be reflected in final cradle to gate model

Pre-finishing

- most mills indicate that pre-finish applications are done at separate facilities
- quality of current data for this process not adequate

Methodology

Primary Data Collection (CORRIM & ISO):

- Survey instrument (18 pp)
- Capturing data for materials and delivery to mill, products and co-products, energy, and emissions (reporting year 2006)

Methodology

Primary Data Collection:

- National Wood Flooring Association (NWFA) identified representative mid to large size flooring mills and contacts
- April 2007: 18 surveys sent to 10 companies with dedicated production of solid hardwood flooring (no exotic species, engineered, or parquet flooring)

Captured Data from Completed Questionnaires:

- Input into excel spreadsheet
- Checked for outliers/agreement with similar sized mills
- Follow-ups for missing or suspicious data
- Mass basis calculations made from reported dimensions
- Units harmonized, weight averaged, and converted to SI units

To Date:

Received and managed data for 10 completed surveys

~ 28% of total US hardwood flooring production

Several mills still working on survey

Model Inputs by Type for Production of 1.0 m^3 of Solid Hardwood Flooring

Inputs	Quantity	SI Units per m^3
Material Use		
Wood		
Rough Kiln Dry Hardwood Lumber	1419.74	kg
Solid Hardwood Flooring	656.99	kg
Wood Co-Product (Residue Sold)	762.75	kg
Water		
From Ground	6.21	L
Packaging		
Steel Strapping, cold rolled	0.15	kg
Fuel Use		
Electricity		
Purchased	48.49	MJ
Wood Hogged Fuel		
Wood Residue Produced On-Site	29.17	kg
Wood Residue Purchased	0	kg
Fossil		
Natural Gas	0.89	m^3
Fuel Oil #6	0.01	L
On-Site Transportation		
Propane	0.12	L
Gasoline	0.02	L
Off-Road Diesel	0.27	L
Emissions		
To Air		
Volatile Organic Compounds	0.002	kg
Particulates, unspecified	0.01	kg
Particulates <10 um	0.007	kg
To Water		
Discharged to Sewer or Surface	0.01	L
To Land		
Fly Ash	1.32	kg

Weight averaged data from 10 mills; all data allocated by mass to production of 1.0 m^3 hardwood flooring (OD basis 656.99 kg/ m^3)

Next Steps

1. Receive and process anticipated surveys

2. Final mass balance; Weight average data; Finalize model in SimaPro 7.0; Reports

3. Creation of a full cradle-to-gate LCI

   (Hardwood Forest Resource to Hardwood Lumber to Solid Hardwood Flooring)

lessons learned

Importance of understanding the process:

- Kiln drying: significant impacts
- Pre-finishing: data should be captured at finishing facilities and be imported as stand alone process

Realistic level of detailed data collection in survey:

- Unit process model approach shifted to black box model

Support of Industry Association:

- = key to getting mills and data for a survey of this detail and time commitment

Importance of careful documentation and data management for LCI

- It takes patience and time

Acknowledgements

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Participating flooring mills


Questions?

Sources

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