

Mark Rudnicki, Ph.D.

Executive Director, Michigan Forest Biomaterials Institute

Professor of Practice, Forest Biomaterials, Michigan Technological University

WOOD RECYCLING



The Michigan Forest
Biomaterials Institute



Michigan Technological University
School of Forest Resources
and Environmental Science



- Wood waste represented 10.9 percent of waste at MSW landfills and 40 percent of waste at C&D landfills in 1998

(Corr 2000 – Virginia Tech)

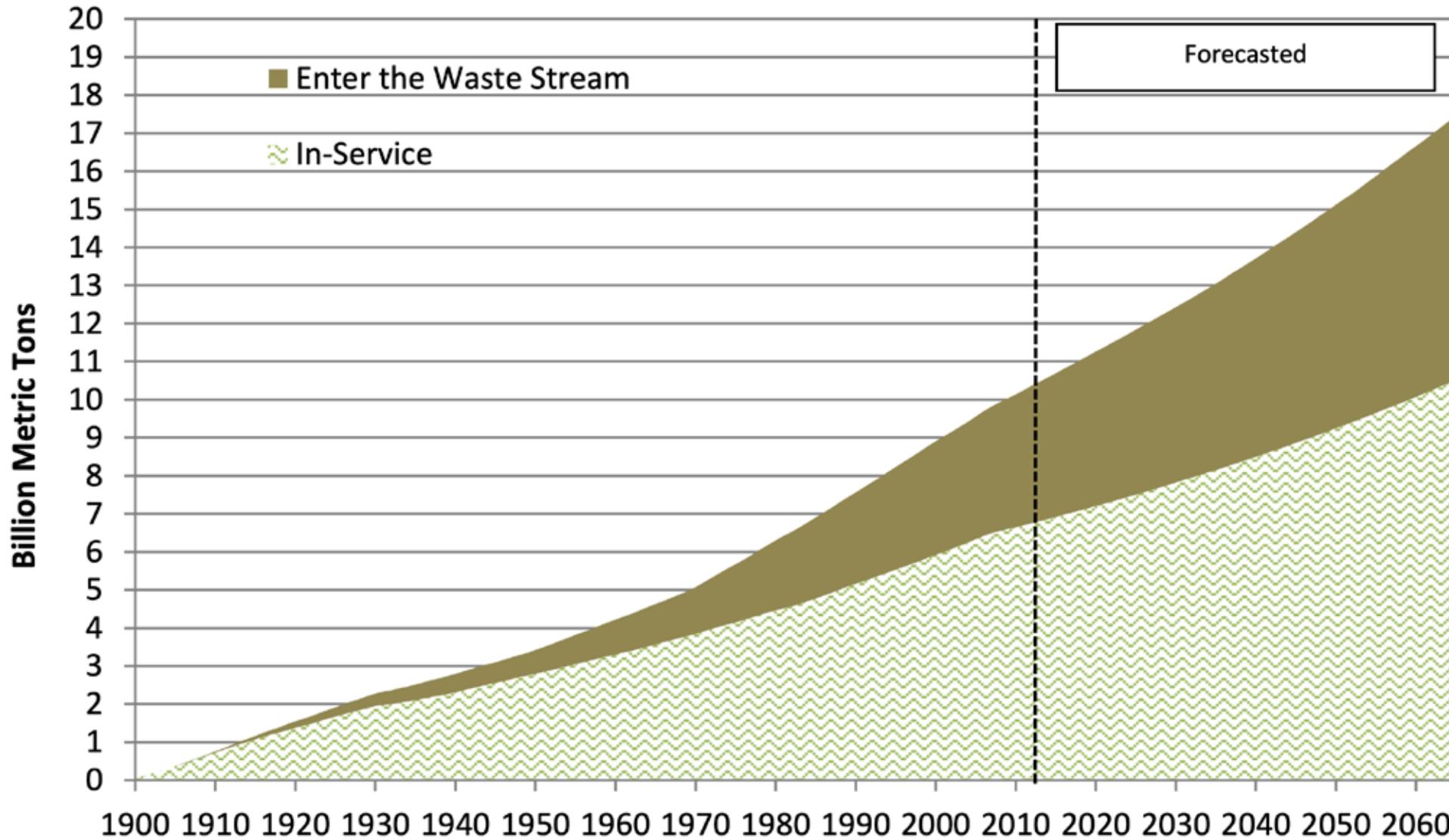
WOOD WASTE STREAMS

- MSW – municipal solid waste
- C&D – construction and demolition
- Primary manufacturing - sawmills

- In 2000 approximately 14.5 million tons of urban tree and woody yard residues was generated
- In 2000, just over 12 million tons of timber was harvested from all National Forests in the US



Cumulative Amounts of Wood Entering the Waste Stream and Wood Remaining In Service in the United States, 1900–2065



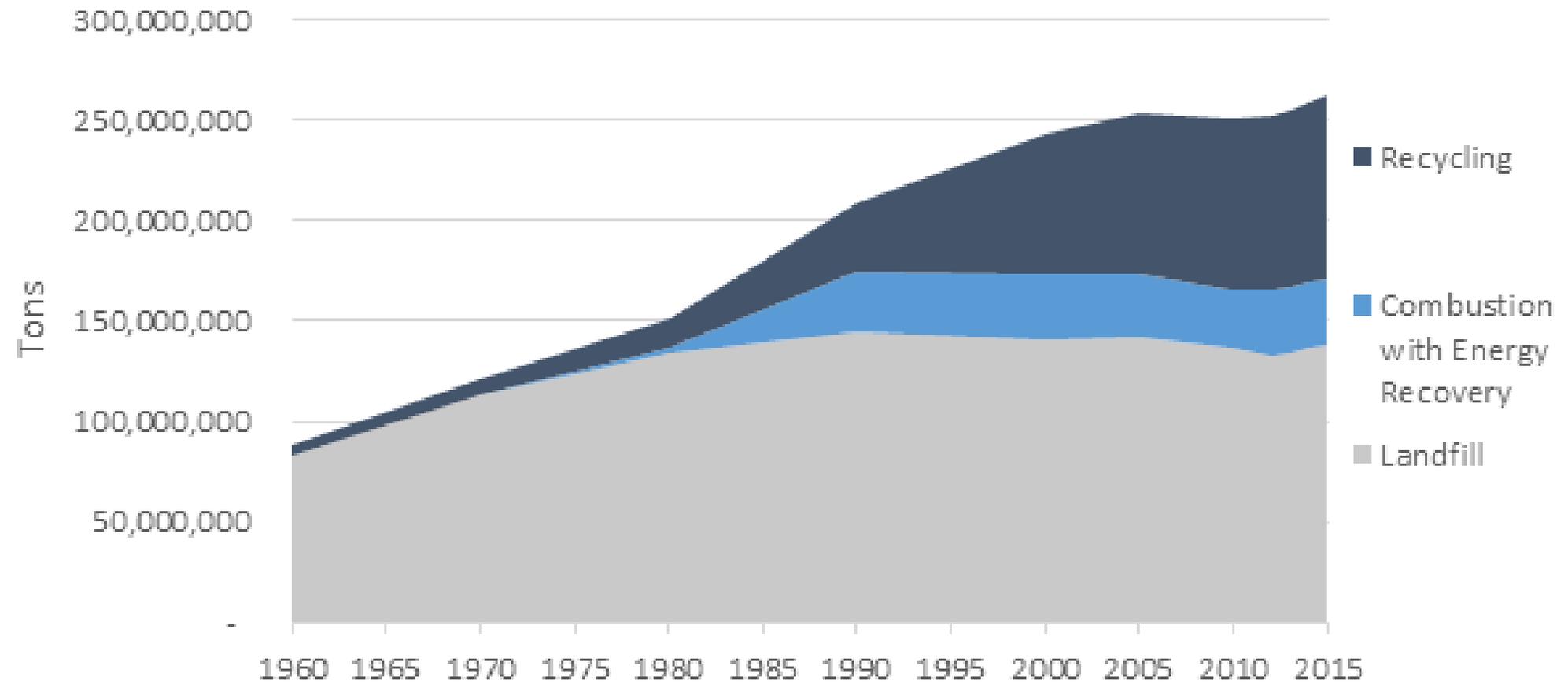
Wood Waste Inventory:
Final Report
EPA/600/R-18/262
July 2018

Table 1. Wood residues and waste wood generated, recovered, combusted or not usable, and available for recovery in the United States, 2010¹

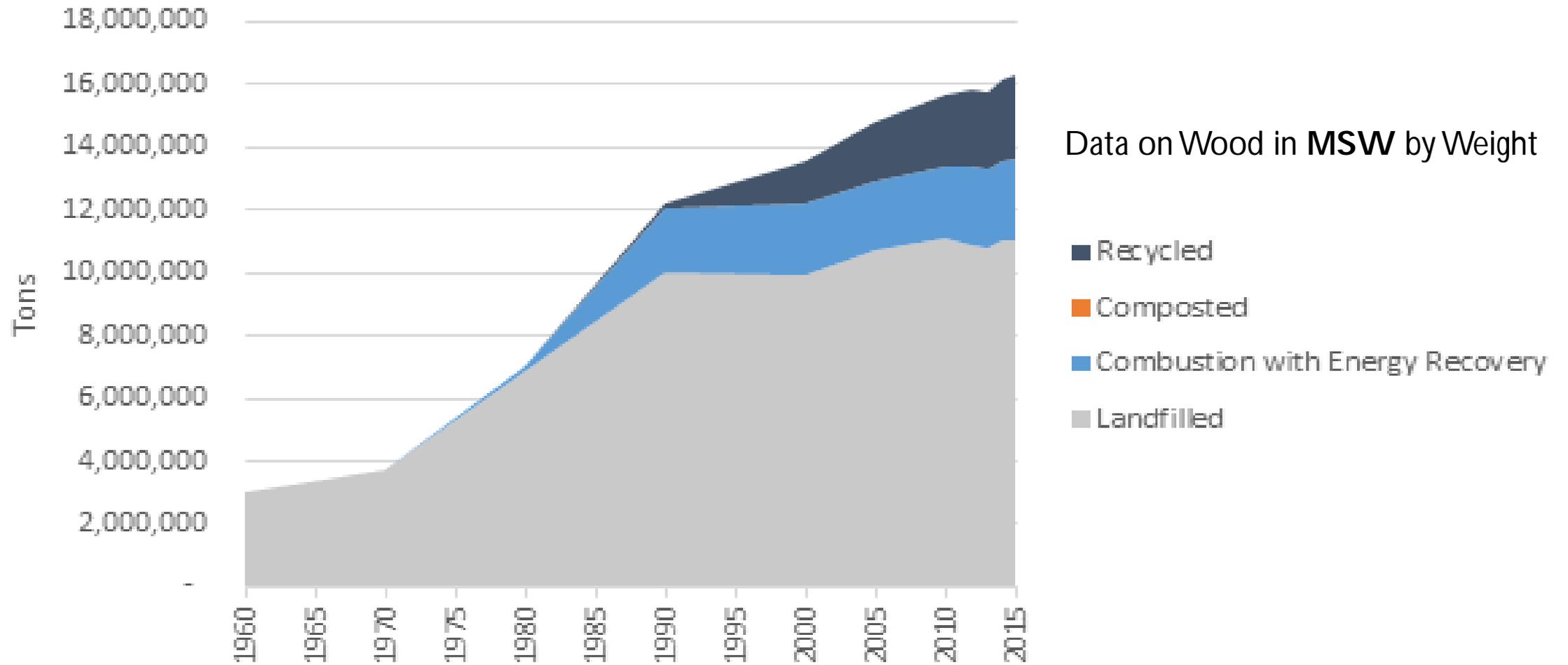
<i>Source</i>	<i>Generated</i>	<i>Recovered Not Usable</i>	<i>Combusted</i>	<i>Available For Recovery</i>
	<i>million tons</i>			
Primary timber processing residues				
Wood residues	59.6	58.7		0.9
Bark residues	23.8	23.5		0.4
Total timber residues	83.4	82.1		1.3
Urban wood waste				
Municipal solid waste				
Wood component	15.9	8.6		7.2
Woody yard trimmings	18.4	14.4		3.9
Total, MSW	34.3	23.1		11.2
Construction & demolition waste				
Construction waste wood	6.7	1.8		4.8
Demolition waste wood	29.7	17.2		12.5
Total, C&D	36.4	19.1		17.3
Total, Urban wood waste	70.6	42.1		28.5

Forest Service estimates based on updated demand drivers and estimated recovery rates

Municipal Solid Waste Management: 1960-2015



Wood Waste Management: 1960-2015



Recovery and reuse of lumber

- Rapidly growing but still tiny niche in terms of overall volume.
- Recovered wood is increasingly coveted by architects and homeowners.



Recovery and reuse of lumber

Sells at a premium to new material, due to the labor involved in deconstruction and further processing to remove old nails or to re-machine.

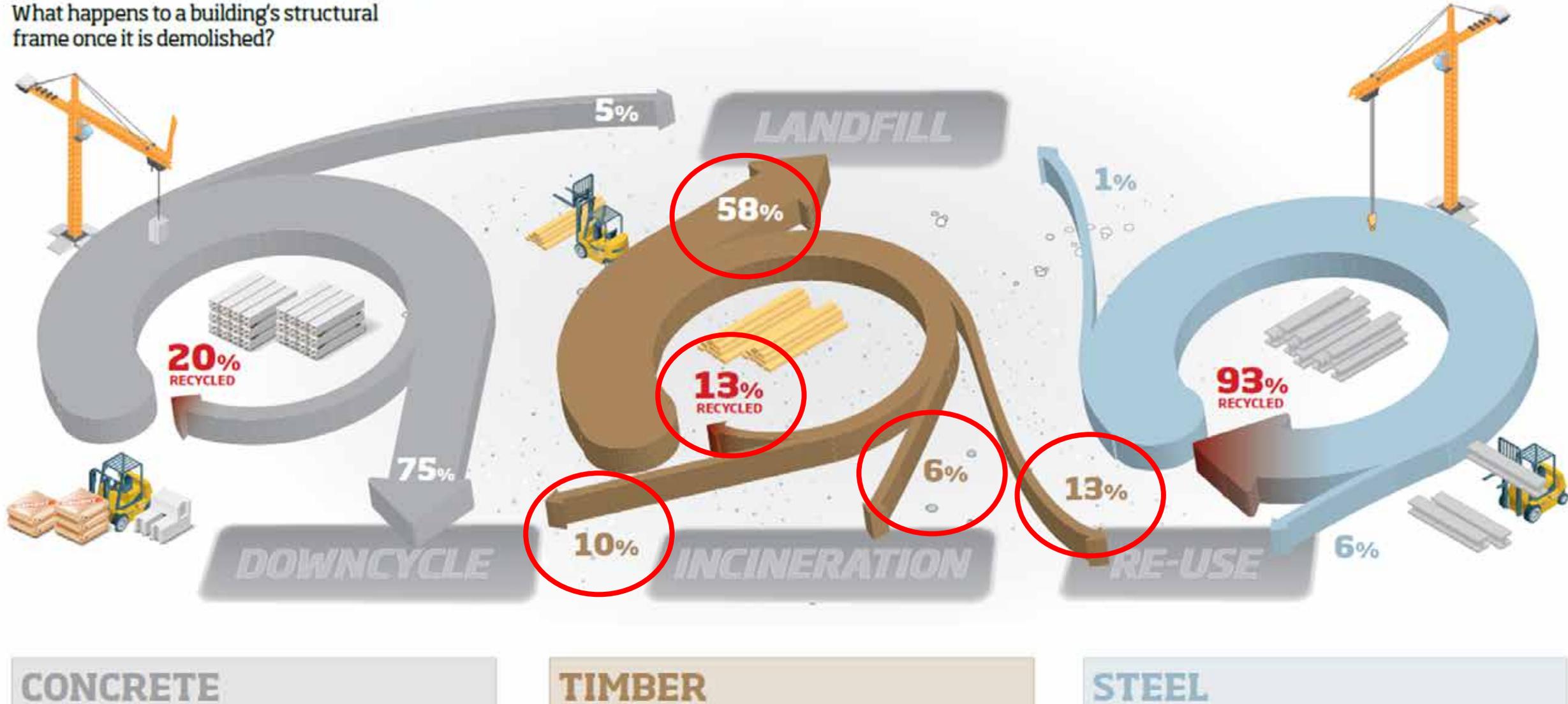


CONSTRUCTION AND DEMOLITION

END-OF-LIFE SCENARIOS

(UK analysis)

What happens to a building's structural frame once it is demolished?





524 Baker St., Lansing - Demolition

Floor Area:	1,100 SF
Labor:	4 workers (1 excavator operator, 1 ground person, 2 truck drivers)
Time:	40 worker hours - 4 ppl x 8 hours demolition: 32 hrs - 2 ppl x 4 hours restoration: 8 hrs
Unit Time:	0.036 worker hours/SF
Job Potential:	100 1,200 SF homes = 2.08 FT jobs



1214 Massachusetts Ave., Lansing - Deconstruction

Floor Area:	1,232 SF
Labor:	6 workers (5 workers, 1 de-nailer)
Time:	260 worker hours - 5 ppl x 3-4 days deconstruction: 134 hrs - 1 ppl x 126 hours de-nailing
Unit Time:	0.211 worker hours/SF
Job Potential:	100 1,200 SF homes = 12.17 FT jobs

Source: Anuranjita, A. (2017). Life Cycle Assessment Framework for Demolition and Deconstruction of Buildings. MS Report, Michigan State University.



Challenges to wood recovery:

1. Deconstruction and salvage are costly
2. Regulatory barriers (wood not structurally rated/usable)
3. Lack of consistent markets



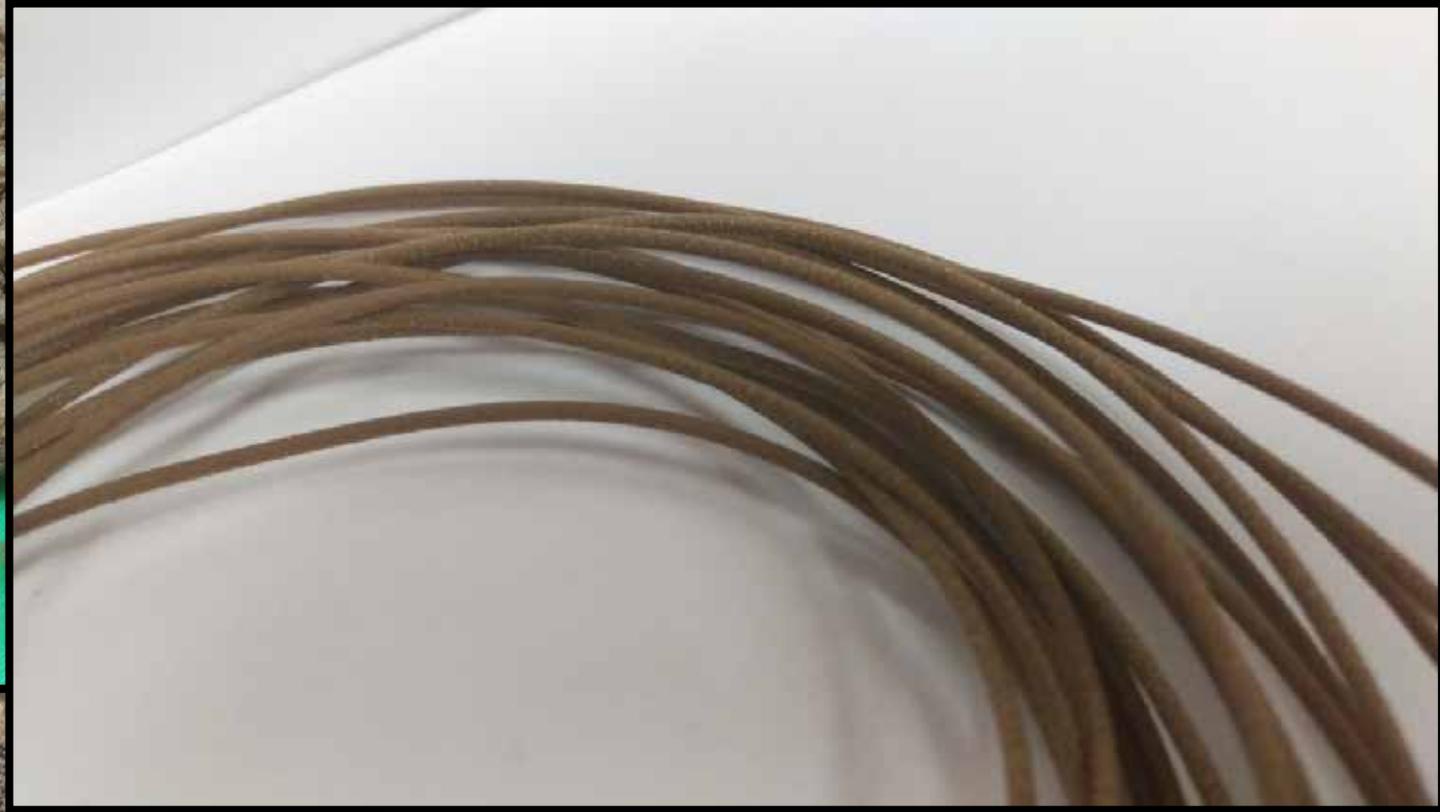
Opportunities for wood recovery:

1. Job creation
2. Automation
3. Upcycling – high value reuse

100 tons per day
of wood waste

Grand Rapids
Office furniture
industry





Michigan Tech



Michigan Tech

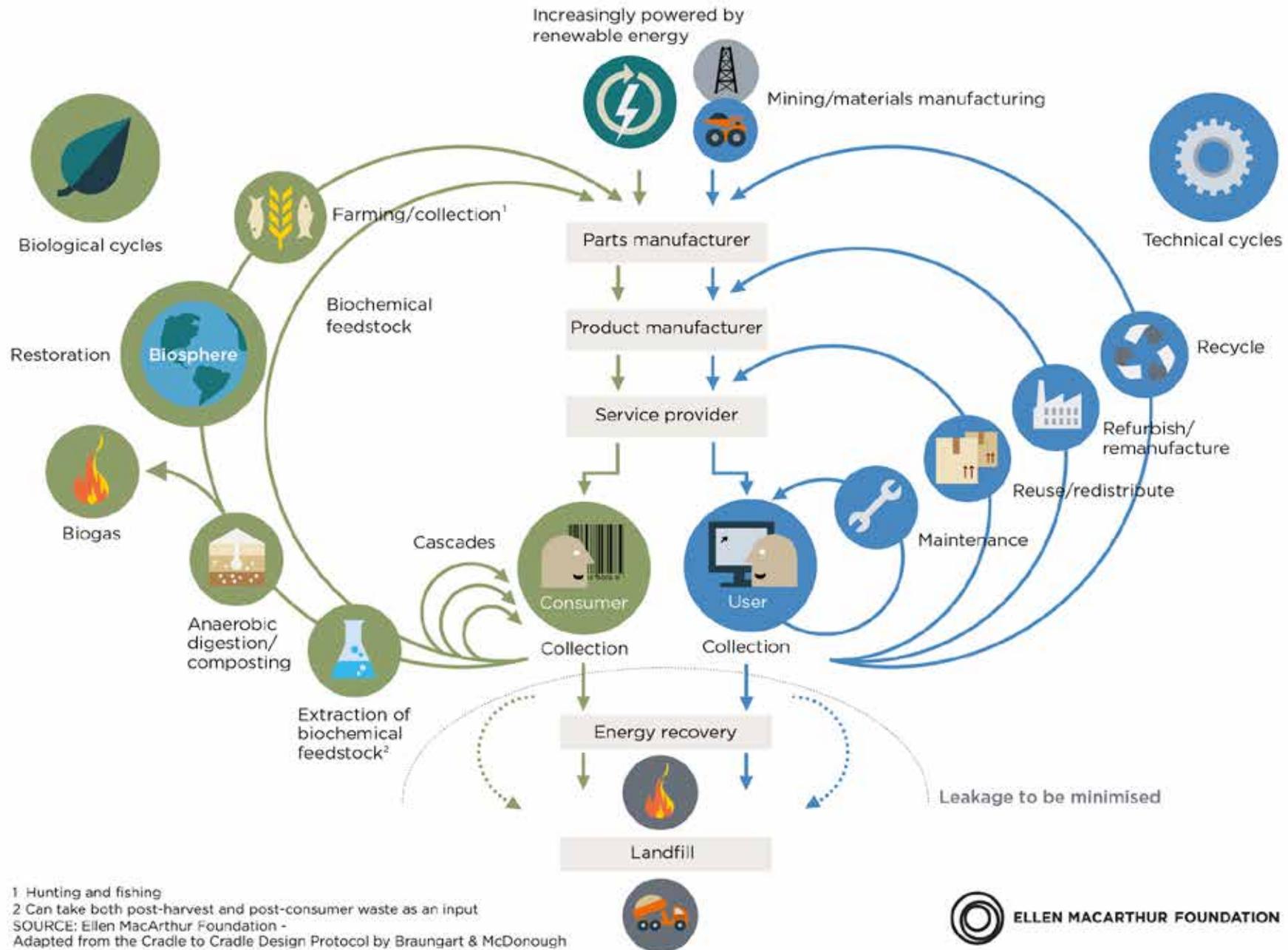
1885



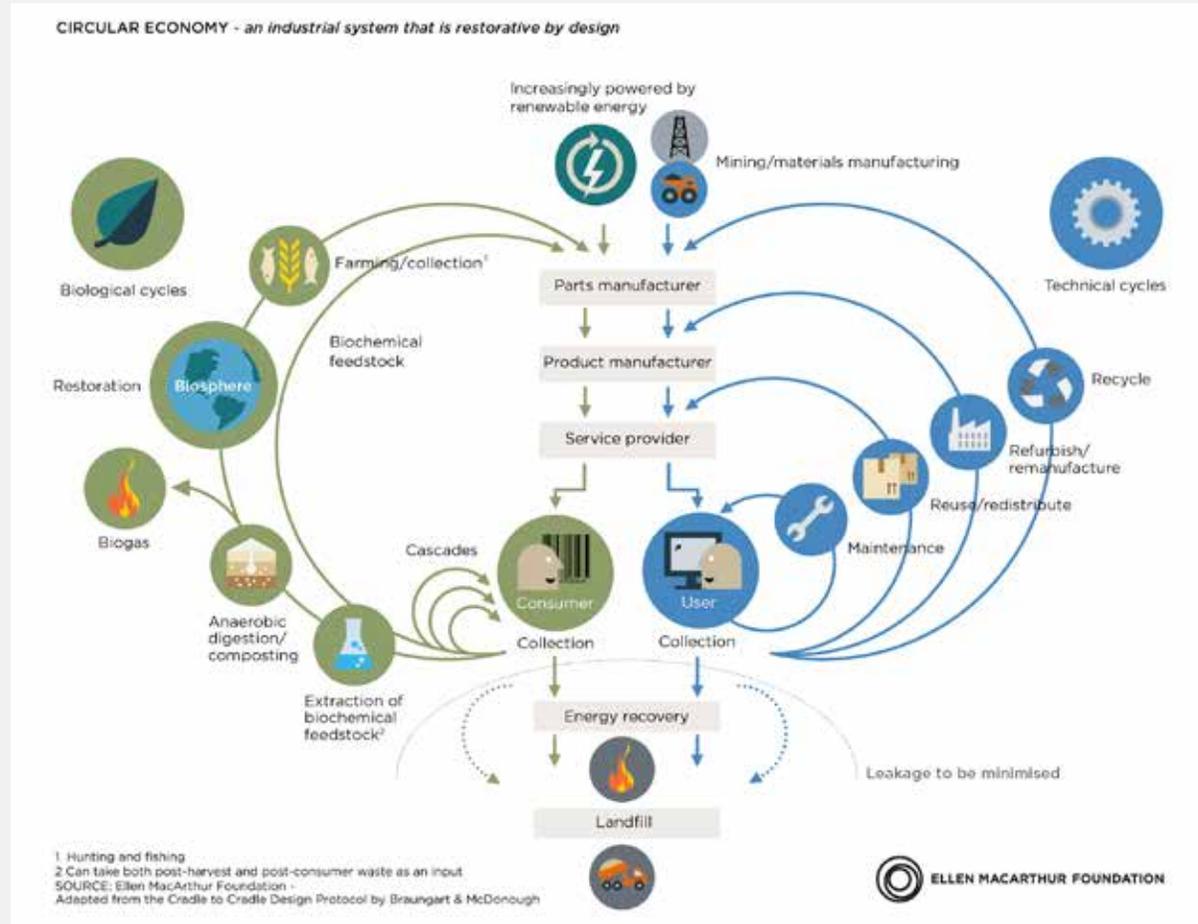
MiFBI provides education and strategic vision to grow the forest bioeconomy in Michigan.

est. 2016 as a charitable nonprofit 501(c)(3)

Circular economy vs. Bioeconomy?



What's wrong with the butterfly?



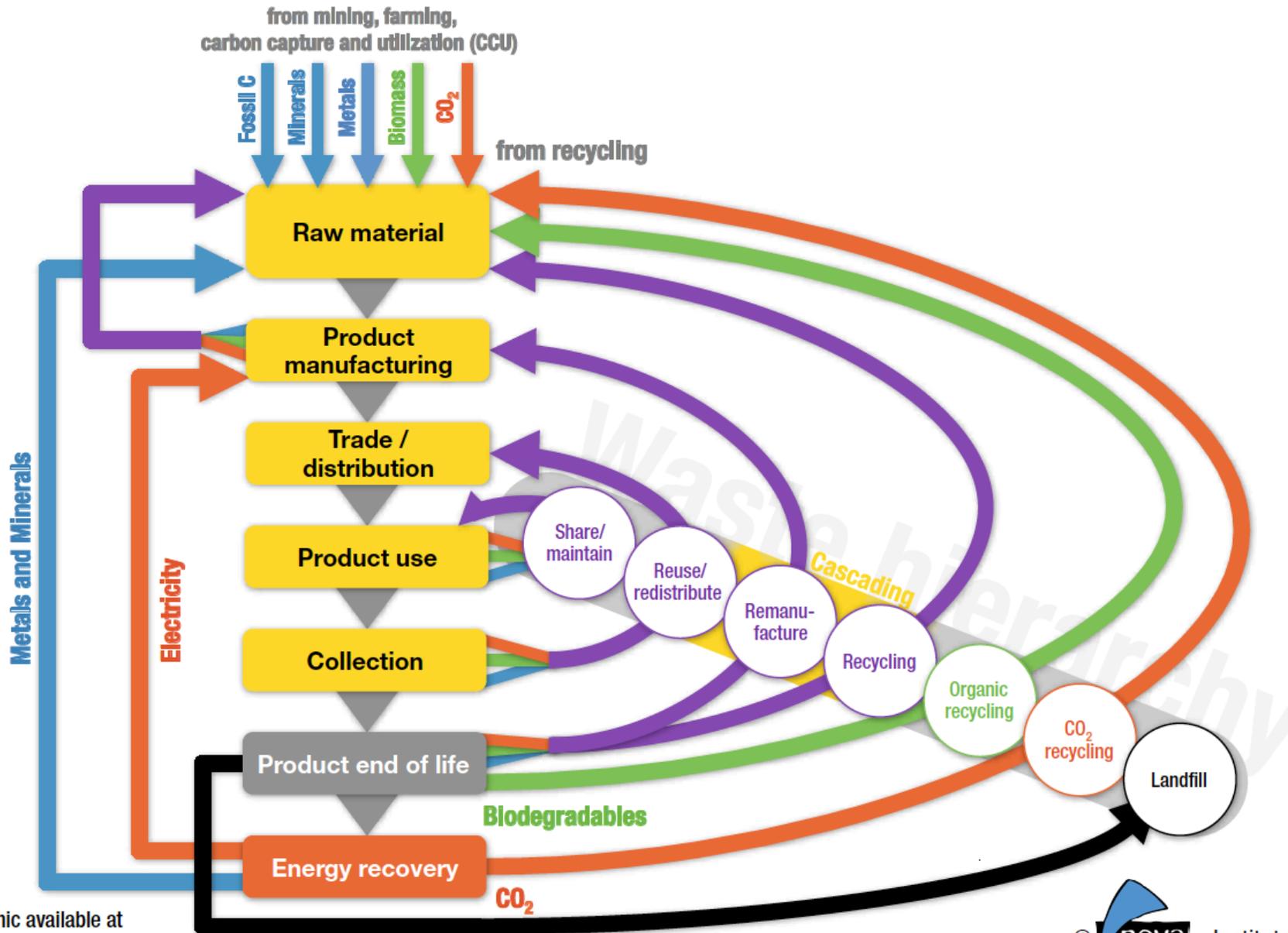
Almost all attention goes to the technical cycle:

Maintain, Reuse, Remanufacture and Recycle.

In reality, the majority of bio-based products enters the technical cycle and only a small share enters the biological cycle (biodegradation).

Think, for instance, paper and pulp. And biobased chemicals and plastics.

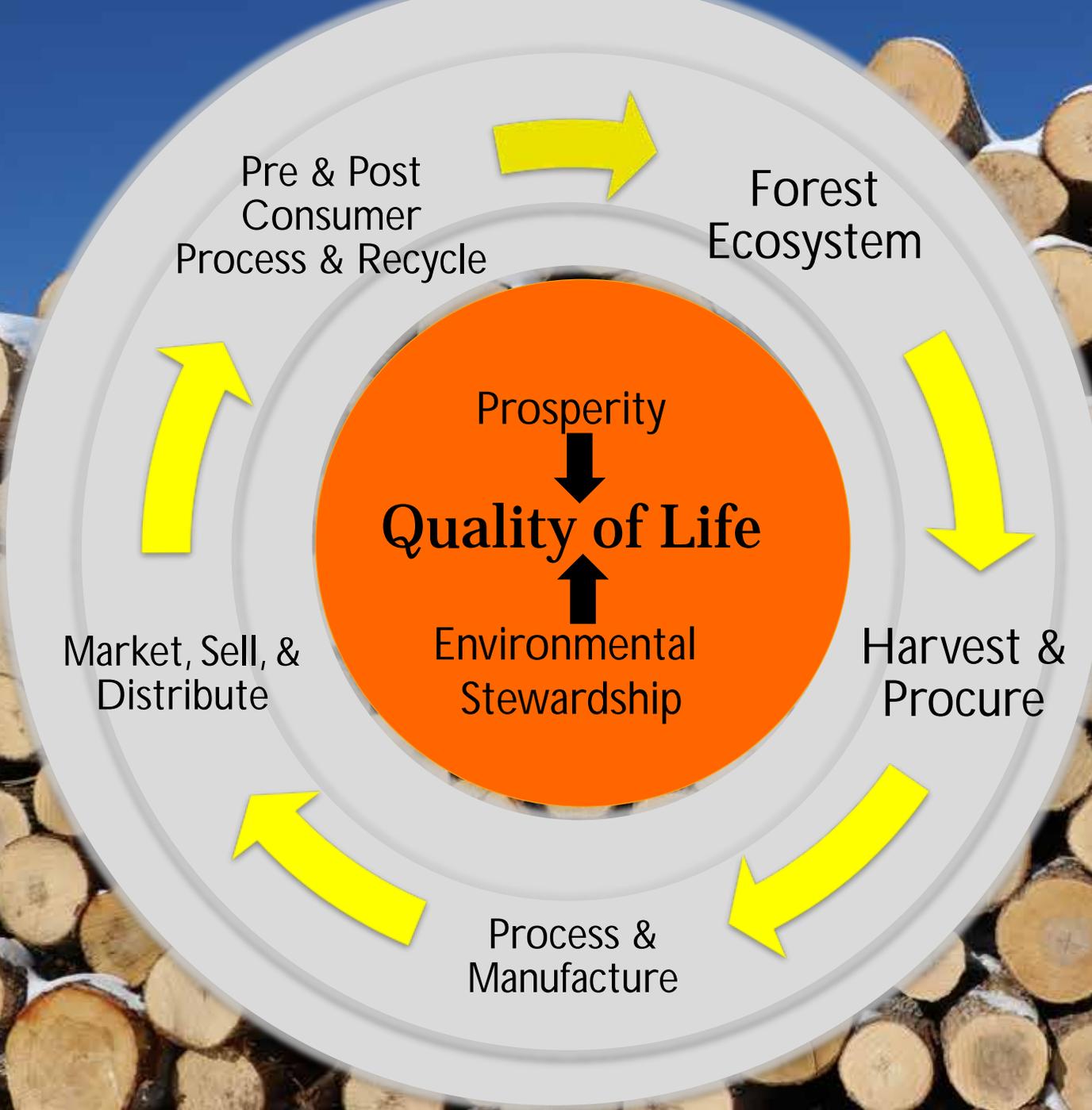
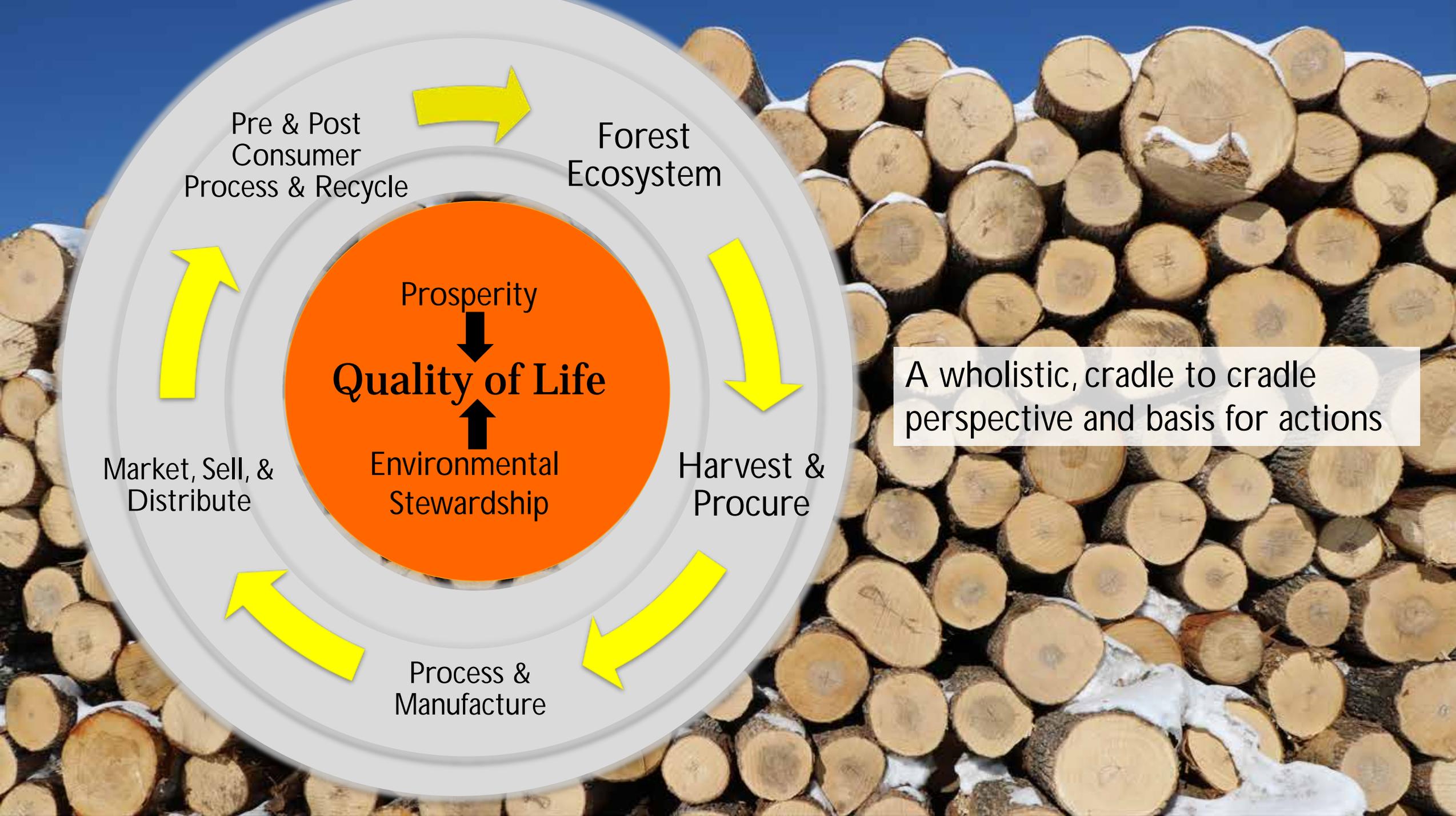
Comprehensive Concept of Circular Economy



‘Biomass’ includes all kinds of biomass, from agriculture, forestry and marine environments as well as organic waste streams (Carus 2017)

TOWARD A CIRCULAR BIOECONOMY

- Concepts of circular economy and bioeconomy overlap but unique
- Need each other/unification
- Ultimately, we need to increasingly shift to renewable resources and to use and reuse all materials and resources wisely – CIRCULAR BIOECONOMY



A wholistic, cradle to cradle perspective and basis for actions

A Forest Bioeconomy HAS Taken Root in Michigan



Michigan Tech
School of Forest Resources
and Environmental Science



Current Board of Directors:

- Robert Kreipke
Ford Motor Company (retired) (Chair)
- Terry Sharik
Michigan Technological University (Vice Chair)
- Donna LaCourt
MI Department of Agriculture and Rural Dev. (Secretary)
- Warren Suchovsky
Michigan Timberman, MI Farm Bureau (Treasurer)
- Brian Craig
Kendall School, Ferris State University
- Brenda Haskill
MI Department of Natural Resources
- Jake Hayrynen
JM Longyear
- Richard Kobe
Michigan State University
- Julie Manley
Guiding Green LLC
- Jack Schinderle
MI Department of Environment, Great Lakes, and Energy

Current Staff:

- Mark Rudnicki - Executive Director
- Darlene Comfort- Executive Assistant
- Emily Barkley – Program Associate (AmeriCorps Member)



Fostering Wood Recycling in Michigan: Workshop Summary and Recommendations



There were 55 attendees in total, representing interests across a wide variety of sectors.

- Herman Miller
- Haworth
- Steelcase
- Arauco
- AJD Forest Products
- Packaging Corporation of America
- Consumers Energy
- Goodwill
- Detriot Audio Lab
- Mid-Michigan Recycling (and several others)

- Michigan Technological University
- Michigan State University
- University of Michigan
- Grand Valley State University
- Ferris State University

Workshop Sponsors:



The Michigan Wood Innovation Team:



- Department of Natural Resources
- Department of Environmental Quality
- Kent County Department of Public of Works.

FOSTERING WOOD RECYCLING IN MICHIGAN

- The three teams were sent to separate rooms for three 45-minute discussion sessions that built on previous sessions throughout the day. The wood recycling sessions focused on:
 - Identifying Interests and Issues
 - Developing and Evaluating Solutions
 - Agreements for Action



FACILITATORS

- Kelsey Block - Michigan Department of Natural Resources
- Julie Crick - Michigan State University Extension
- Mary Goodhall - Michigan Department of Environmental Quality
- Brenda Haskill - Michigan Department of Natural Resources
- Paige Perry - Michigan Department of Natural Resources
- Georgia Peterson - Michigan State University Extension



RECOMMENDED POINTS OF ATTACK FOCUSED ON 7 AREAS

- Address wood contamination concerns
- Create recycling initiatives
- Expand Biofuel Opportunities
- Create educational efforts
- Revise Regulations
- Identify funding for R&D
- Establish Supply Chain Info Network

REPORT CAN BE FOUND: MIFBI.ORG/events



THANK YOU