

Biomaterials and the Rebranding of Wood: Opportunities and Challenges

10th Annual Sustainable Forestry Conference

April 10, 2014

Florence, WI



Forest Resources &
Environmental Science

MichiganTech

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Resources and Dean

School of Forest Resources & Environmental Science,
Michigan Technological University

Michigan Tech Founding Charter

"Public Act 70 of 1885 as amended in 1964 and set forth in 1965 Cumulative Supplement of the Michigan Statutes says of Michigan Technological University: The institution shall provide the inhabitants of this state with the means of acquiring a thorough knowledge of the mineral industry in its various phases, and of the **application of science to industry**, as exemplified by the various engineering courses offered at technological institutions, and shall seek **to promote the welfare of the industries of the state**, insofar as the funds provided shall permit and the board shall deem advisable."

My Story

Biomaterials

“any organic materials that are extracted from ecosystems”

- of which wood (and its derivatives) is the most common in the state
- also includes, but is not limited to, mushrooms, edible berries, plant sap in terrestrial ecosystems, and algae in aquatic ecosystems.

Alternative name list for “Biomaterials” – October, 2013

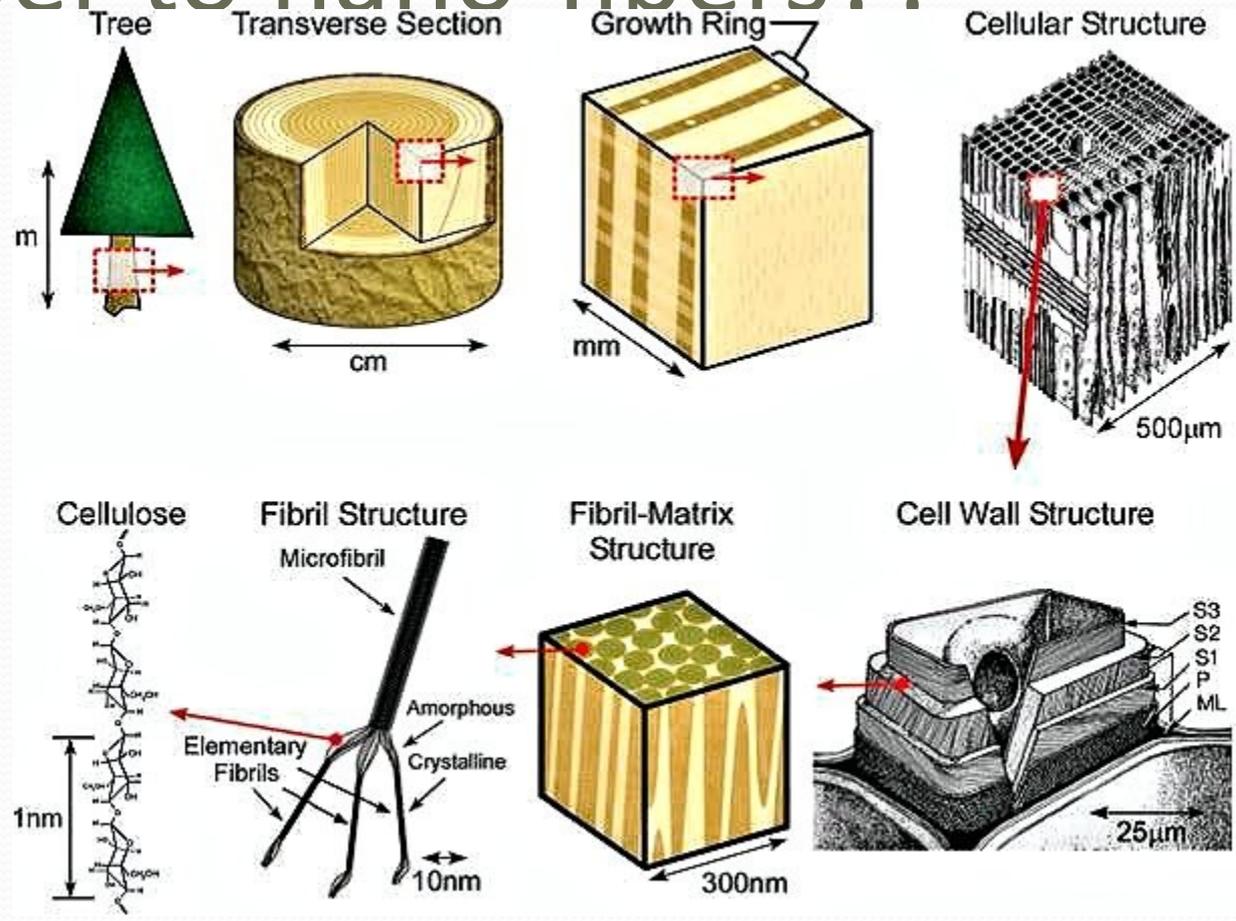
Table 2. Alphabetical list of alternative names for “Biomaterials” suggested from break-out sessions and group summaries at MI Biomaterials Conference.

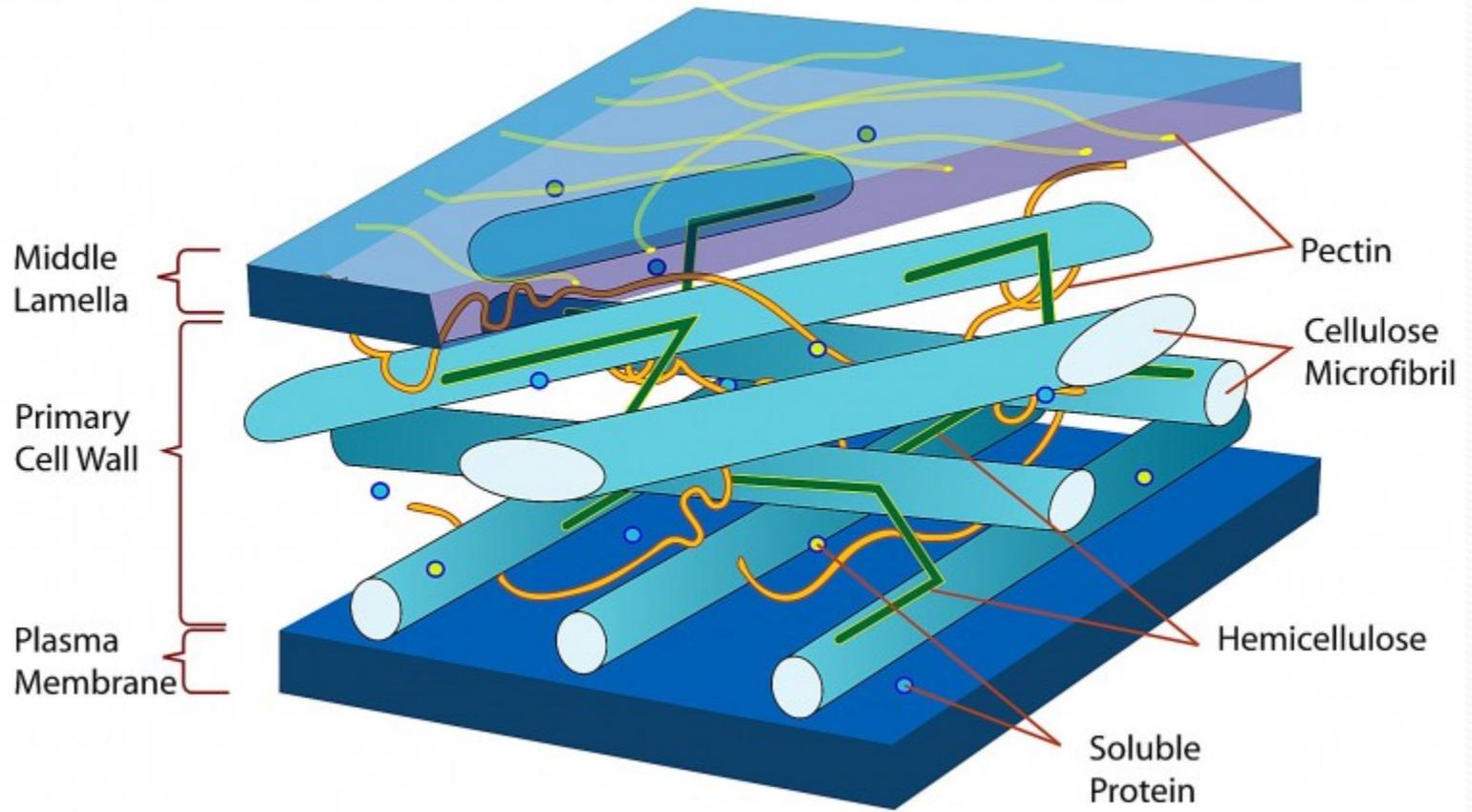
Bio-based Products	Renewable Ecosystem Resources*
Biocyclical Materials	Renewable Forest Materials*
Biocyclical Products*	Renewable Forest Products
Biocyclical Resources	Renewable Materials
Bioproducts*	Renewable Natural Resources
Bioproducts Utilization	Renewable Resources Bioproducts
Ecomaterials	Sustainable Biomaterials
Forest Biomaterials	Sustainable Ecomaterials
Forest Engineers	Sustainable Ecosystem Resources
Forest Resources	Sustainable Ecosystem Utilization
Green Materials	Sustainable Forest Biomaterials
Green Products*	Sustainable Forest Bioproducts
Natural Resource Utilization	Sustainable Forest Materials
Renewable Earth Materials	Sustainable Forest Products*
Renewable Ecosystem Materials	Sustainable Natural Products*
Renewable Ecosystem Products	

***indicates a preferred name from group summaries**



Getting from trees to logs, to lumber to nano-fibers??







Electricity/Steam/Heat

- Heating is one of the oldest uses of wood – *firewood!*
- And converting wood fiber to heat/steam/electricity has been going on for decades at paper and forest product mills
- Only in recent decades have electric generating facilities been converting boilers to burn wood fiber; driven by cost and availability of traditional fuels – coal, fuel oil, natural gas
- And the wood pellet industry has blossomed even more recently

Liquid bio-fuels

- not a very new technology; the Germans ran their vehicles on wood alcohol during WWII, when allied blockades severely limited their sources of petroleum.
- In the US, we have finally been driven by a desire to get off foreign oil dependence and rising fuel cost
- First to produce auto fuel from sugar cane and corn;
- And then to move into advanced “bio-fuels”.
- Where this goes in the future driven by economics, policy, politics, social acceptance, and probably several other factors.

Nano-crystals/fibers

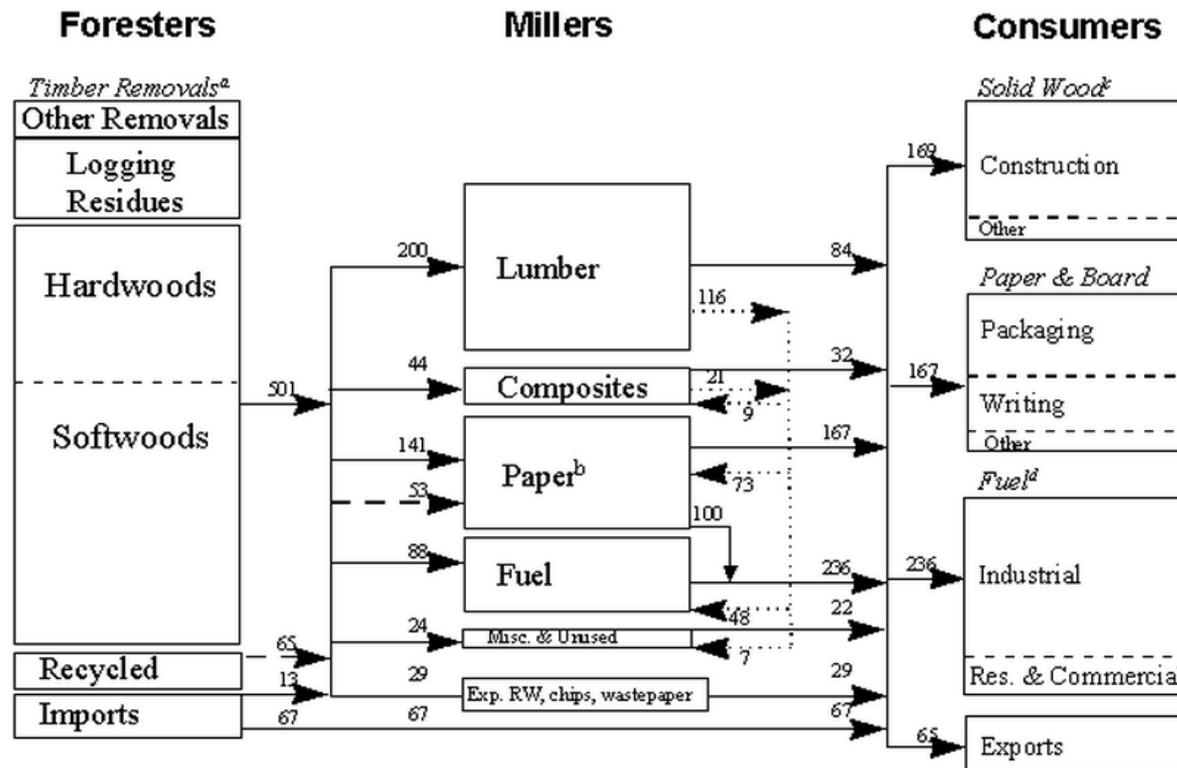
- New and innovative use of wood fiber
- Tremendous strength properties; It's what holds trees up;
- Supposed to have the stiffness of steel, but with less weight
- Applications are envisioned in electronics, autos, medical devices, building materials, and aerospace
- Nano-fibers offer a green alternative for nano-tubes for reinforcing materials such as polymers and concrete

Nano-crystals

- Researchers are talking about “bio-degradable plastic bags “-
- Textiles and wound dressings
- electrically conductive paper
- flexible batteries
- special filters for water purification
- and the list goes on.
- **Wood pulp extract stronger than carbon fiber of Kevlar**
*Can you imagine,the wood pulp cellulose we're familiar with,
.....that when dry is like lint, and has strength of a wet paper napkin,
.....might be the source of the strongest materials known to man?*

Carbon Sequestration Markets

- Managing forest lands to remove carbon from the air and store it in wood fiber
- Creating plantations for same purpose



Box Heights Are To Scale. All Values in Million Cubic Meters.

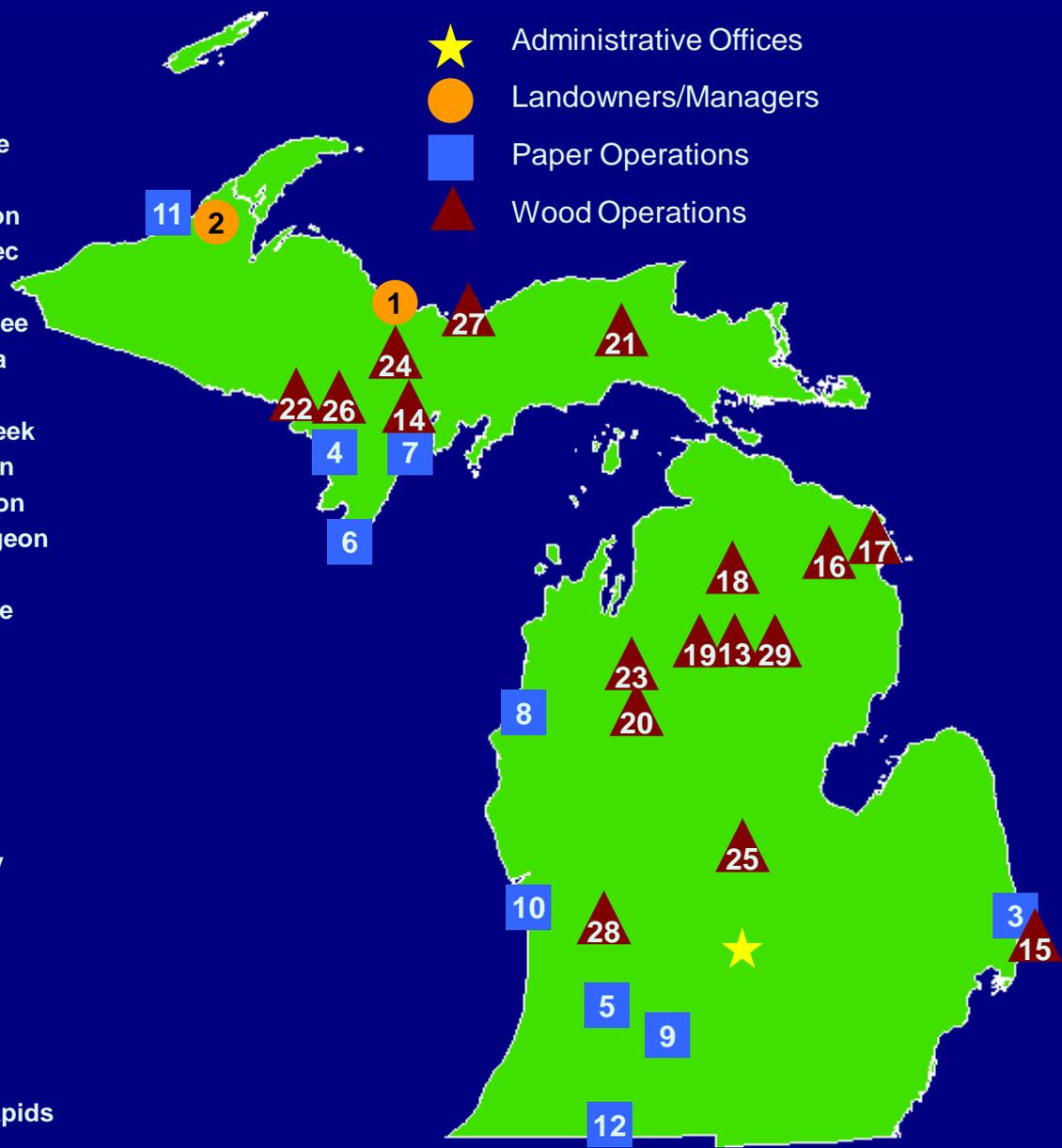
Figure 2. Flow of forest products, in millions of cubic meters, in the United States in 1993. We use volume instead of mass to eliminate variables like changing moisture content, mineral fillers, and synthetics in products; 1 cubic meter of wood is considered equivalent to 0.5 metric ton of paper. The dotted rules show the flow of residues in mills. Notes: Timber removals are based on the ratio of logging residues (15.1 percent) and other removals (6.6 percent) to all removals for 1991. Dashed lines represent recycled paper. Construction includes millwork, such as cabinetry and moldings. Other paper and board includes industrial uses, such as materials handling, furniture, and transport. Fuel: The ratio of end uses relies on Btu data from the Energy Information Administration; fuel includes 100 million cubic meters burned by paper mills for energy. Residential and commercial fuel includes electric utilities. Sources: Ince 1994; Energy Information Administration 1994; USDA 1993; US Bureau of the Census 1996; American Forest & Paper Association 1995; Smith et al. 1994; and data from the Engineered Wood Products Association, Tacoma, Washington; and the Western Wood Products Association, Portland, Oregon.



- 1 J.M. Longyear, LLC
- 2 The Forestland Group
- 3 Domtar Industries
- 4 International Paper
- 5 Menasha Corporation
- 6 Menominee Paper Company
- 7 NewPage Corporation
- 8 Packaging Corporation of America
- 9 Rock-Tenn Company
- 10 SAPPI Fine Paper, North America
- 11 Smurfit-Stone Container Corporation
- 12 White Pigeon Paper Company
- 13 AJD Forest Products
- 14 Besse Forest Products Group
- 15 Biewer Lumber
- 16 Crawford Forest Products
- 17 Decorative Panels International
- 18 Georgia Pacific Corporation
- 19 Georgia Pacific Corporation
- 20 Hydrolake Leasing & Service Co.
- 21 Louisiana-Pacific Corporation
- 22 Louisiana-Pacific Corporation
- 23 Pine Tech
- 24 Potlatch Corporation
- 25 Primary Power
- 26 Sagola Hardwoods
- 27 Timber Products
- 28 Universal Forest Products
- 29 Weyerhaeuser Company

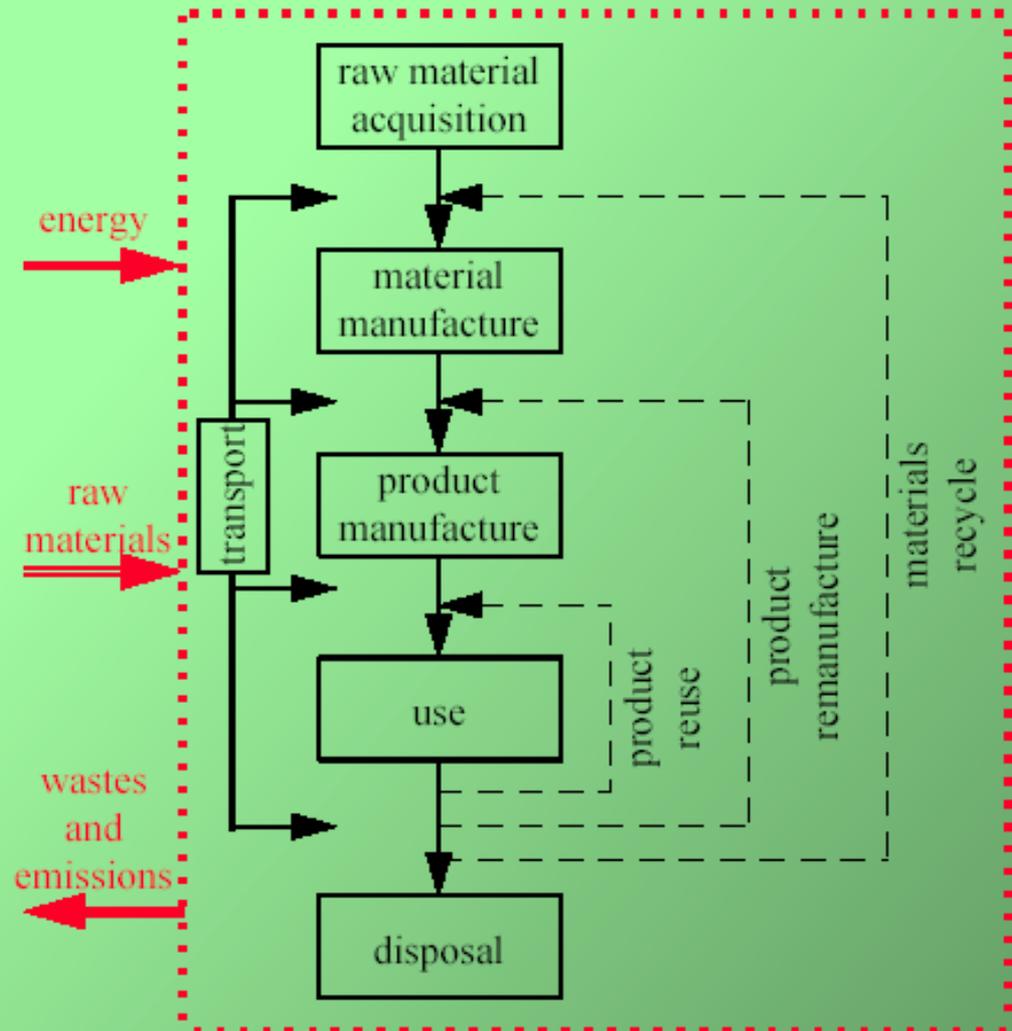
- Marquette
- Toivola
- Port Huron
- Quinnesec
- Otsego
- Menominee
- Escanaba
- Filer City
- Battle Creek
- Muskegon
- Ontonagon
- White Pigeon
- Grayling
- Gladstone
- St. Clair
- Hillman
- Alpena
- Gaylord
- Grayling
- McBain
- Newberry
- Sagola
- Lake City
- Gwinn
- Ithaca
- Sagola
- Munising
- Grand Rapids
- Grayling

-  Administrative Offices
-  Landowners/Managers
-  Paper Operations
-  Wood Operations



Life Cycle Stages of a Product

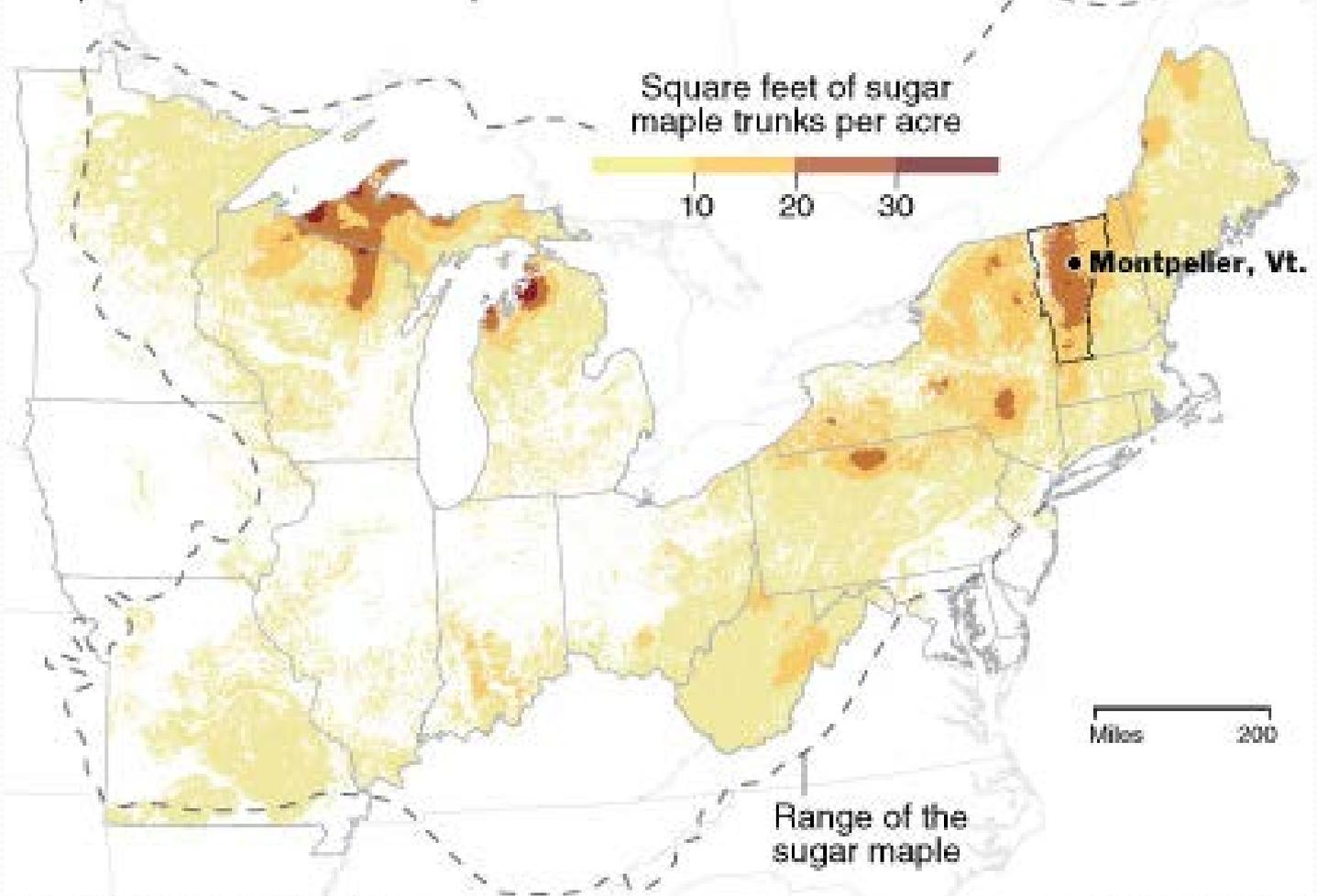
What is a “product life-cycle?”



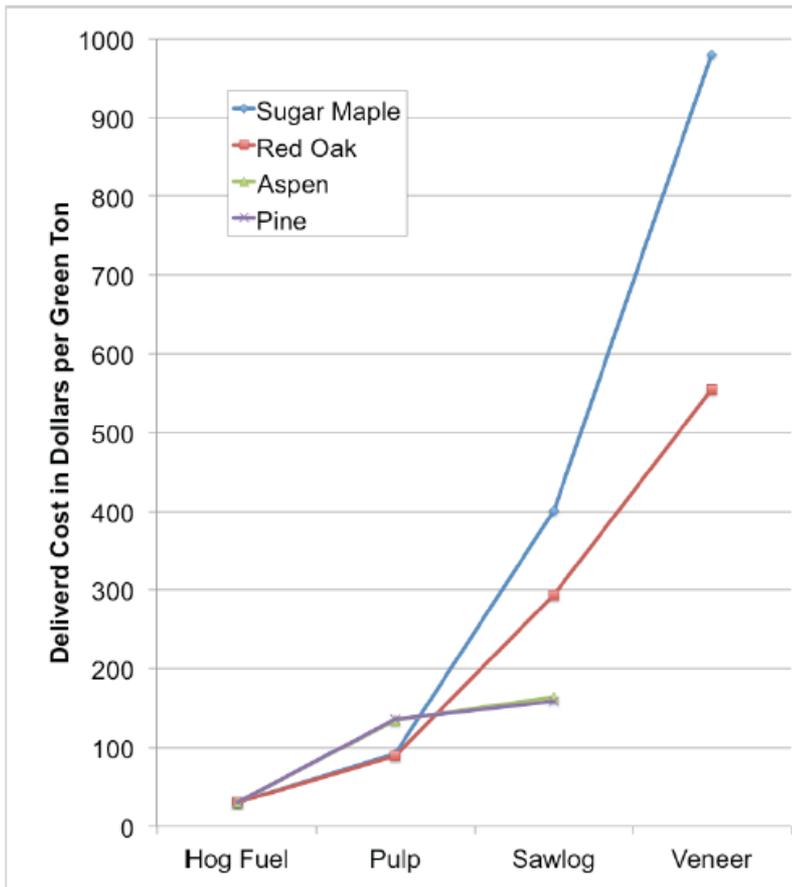
D.T. Allen, University of Texas – Austin
“Life Cycle Assessment: Lesson 1”

Sugar Maple Tree Distribution

Sugar maple tree sap, which can be processed into syrup, is generally collected when below-freezing nighttime temperatures and mild daytime temperatures cause the sap to flow.



The marketplace ensures highest and best use for different grades of raw material



Source: Prentiss & Carlisle (2010), Timber Mart North, 16(2)

- Pulpwood is 200-300% more valuable than hog fuel
- Sawlogs are 400-1200% more valuable than hog fuel

MichiganTech

Froese, 2014

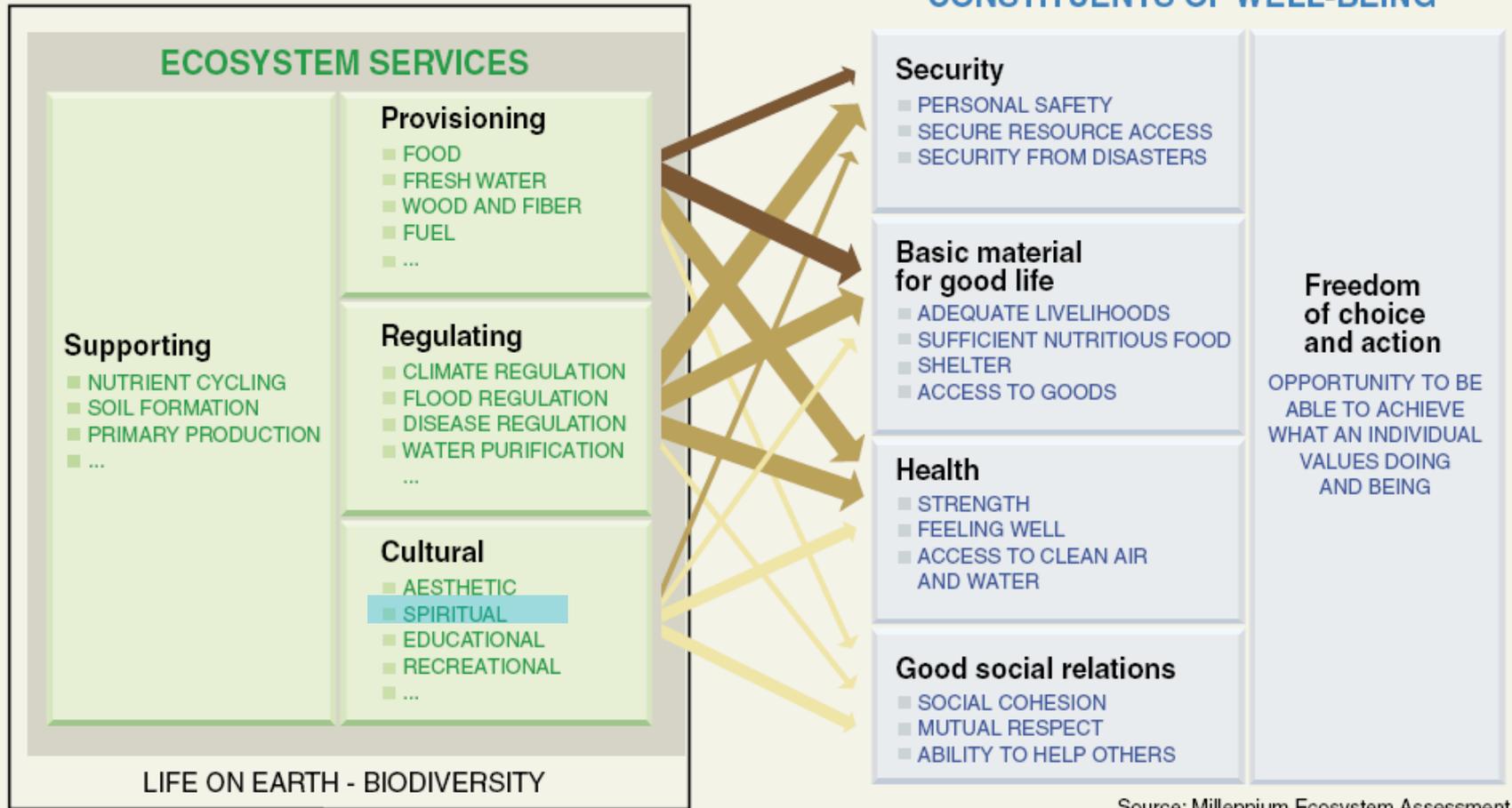
Relative stumpage value of wood

Hard maple, or high quality mixed hardwoods per cord
(128 cu ft gross, approx. 80 cu ft wood)

<u>Biomass x 4 = Pulpwood x 4 = Bolts x 4 = Sawtimber x 4 = Veneer</u>				
\$4	\$16	\$64	\$256	\$1024
2.6 tons	1 cord	1 cord	~550 bd ft	~550 bd ft
<u>\$1.50/ton</u>	<u>\$16/cd</u>	<u>\$64/cd</u>	<u>\$469/mbf</u>	<u>\$1900/mbf</u>

The highest value product for the landowner can be worth 250 times as much as the lowest value product, and is achieved through stand management and optimal tree/log processing.

Ecosystem Services



Source: Millennium Ecosystem Assessment

ARROW'S COLOR

Potential for mediation by socioeconomic factors

Low

Medium

High

ARROW'S WIDTH

Intensity of linkages between ecosystem services and human well-being

Weak

Medium

Strong

Linkages between ecosystem services and human well-being (MEA 2005)

Ecosystem Services

GLOBAL

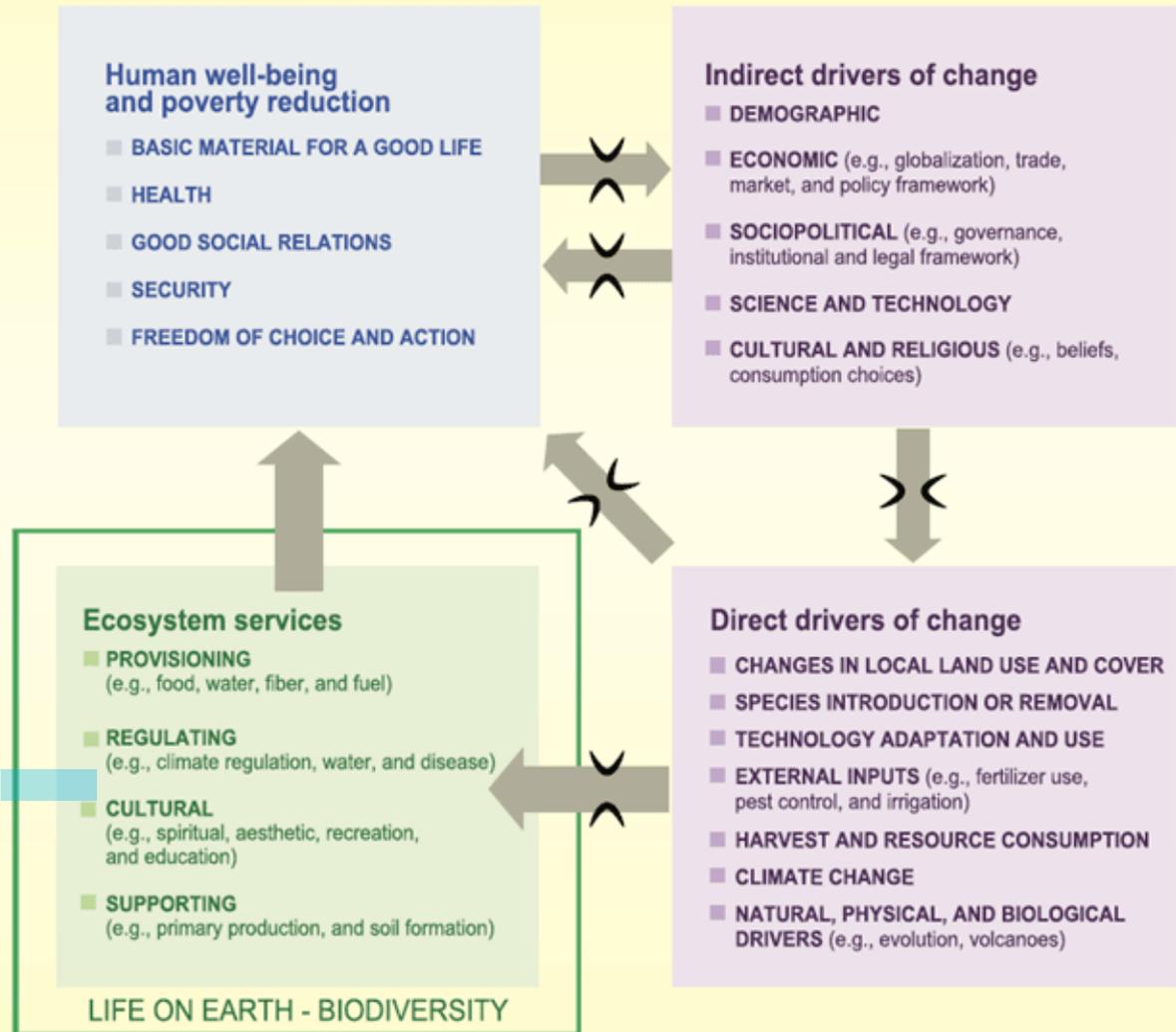
← short-term →

← long-term →

REGIONAL

LOCAL

Conceptual framework of interactions between biodiversity, ecosystem services, human well-being, and drivers of change (MEA 2005).



Ecosystem Services

Provisioning Services

- Products obtained
- Traditional domain of natural resources management
- Examples include
 - Food
 - Fiber
 - Fuel
 - Genetic resources
 - Biochemicals, natural medicines, pharmaceuticals
 - Ornamental resources
 - Fresh water

Ecosystem Services

Regulating Services

- Regulation of ecosystem processes
- Traditionally the domain of Environmental Management
- Examples include
 - Air quality regulation
 - Climate regulation
 - Water regulation
 - Erosion regulation
 - Water purification
 - Disease regulation
 - Pest regulation
 - Pollination
 - Natural Hazard Regulation

Ecosystem Services

Cultural Services

- “Non-material benefits”
- Traditionally the domain of social sciences and the arts
- Examples include
 - Cultural diversity
 - Spiritual and religious values
 - Knowledge systems
 - Educational values
 - Inspiration
 - Aesthetic values
 - Social relations
 - Sense of place
 - Cultural heritage values
 - Recreation and ecotourism

Ecosystem Services

Supporting Services

- Necessary for the production of all other services
- Traditionally the domain of the basic bio-physical sciences
- Examples include
 - Soil formation
 - Photosynthesis
 - Primary production
 - Nutrient cycling
 - Water cycling

Ecosystem Services

Box 2.1. ECOSYSTEM SERVICES

Ecosystem services are the benefits people obtain from ecosystems. These include provisioning, regulating, and cultural services that directly affect people and the supporting services needed to maintain other services (CF2). Many of the services listed here are highly inter-linked. (Primary production, photosynthesis, nutrient cycling, and water cycling, for example, all involve different aspects of the same biological processes.)

Provisioning Services

These are the products obtained from ecosystems, including:

Food. This includes the vast range of food products derived from plants, animals, and microbes.

Fiber. Materials included here are wood, jute, cotton, hemp, silk, and wool.

Fuel. Wood, dung, and other biological materials serve as sources of energy.

Genetic resources. This includes the genes and genetic information used for animal and plant breeding and biotechnology.

Biochemicals, natural medicines, and pharmaceuticals. Many medicines, biocides, food additives such as alginates, and biological materials are derived from ecosystems.

Ornamental resources. Animal and plant products, such as skins, shells, and flowers, are used as ornaments, and whole plants are used for landscaping and ornaments.

Fresh water. People obtain fresh water from ecosystems and thus the supply of fresh water can be considered a provisioning service.

Fresh water in rivers is also a source of energy. Because water is required for other life to exist, however, it could also be considered a supporting service.

Regulating Services

These are the benefits obtained from the regulation of ecosystem processes, including:

Air quality regulation. Ecosystems both contribute chemicals to and extract chemicals from the atmosphere, influencing many aspects of air quality.

Climate regulation. Ecosystems influence climate both locally and globally. At a local scale, for example, changes in land cover can affect both temperature and precipitation. At the global scale, ecosystems play an important role in

climate by either sequestering or emitting greenhouse gases.

Water regulation. The timing and magnitude of runoff, flooding, and aquifer recharge can be strongly influenced by changes in land cover, including, in particular, alterations that change the water storage potential of the system, such as the conversion of wetlands or the replacement of forests with croplands or croplands with urban areas.

Erosion regulation. Vegetative cover plays an important role in soil retention and the prevention of landslides.

Water purification and waste treatment. Ecosystems can be a source of impurities (for instance, in fresh water) but also can help filter out and decompose organic wastes introduced into inland waters and coastal and marine ecosystems and can assimilate and detoxify compounds through soil and subsoil processes.

Disease regulation. Changes in ecosystems can directly change the abundance of human pathogens, such as cholera, and can alter the abundance of disease vectors, such as mosquitoes.

Pest regulation. Ecosystem changes affect the prevalence of crop and livestock pests and diseases.

Pollination. Ecosystem changes affect the distribution, abundance, and effectiveness of pollinators.

Natural hazard regulation. The presence of coastal ecosystems such as mangroves and coral reefs can reduce the damage caused by hurricanes or large waves.

Cultural Services

These are the nonmaterial benefits people obtain from ecosystems through spiritual enrichment, cognitive development, reflection, recreation, and aesthetic experiences, including:

Cultural diversity. The diversity of ecosystems is one factor influencing the diversity of cultures.

Spiritual and religious values. Many religions attach spiritual and religious values to ecosystems or their components.

Knowledge systems (traditional and formal). Ecosystems influence the types of knowledge systems developed by different cultures.

Educational values. Ecosystems and their components and processes provide the basis for both formal and informal education in many societies.

Inspiration. Ecosystems provide a rich source

of inspiration for art, folklore, national symbols, architecture, and advertising.

Aesthetic values. Many people find beauty or aesthetic value in various aspects of ecosystems, as reflected in the support for parks, scenic drives, and the selection of housing locations.

Social relations. Ecosystems influence the types of social relations that are established in particular cultures. Fishing societies, for example, differ in many respects in their social relations from nomadic herding or agricultural societies.

Sense of place. Many people value the "sense of place" that is associated with recognized features of their environment, including aspects of the ecosystem.

Cultural heritage values. Many societies place high value on the maintenance of either historically important landscapes ("cultural landscapes") or culturally significant species.

Recreation and ecotourism. People often choose where to spend their leisure time based in part on the characteristics of the natural or cultivated landscapes in a particular area.

Supporting Services

Supporting services are those that are necessary for the production of all other ecosystem services. They differ from provisioning, regulating, and cultural services in that their impacts on people are often indirect or occur over a very long time, whereas changes in the other categories have relatively direct and short-term impacts on people. (Some services, like erosion regulation, can be categorized as both a supporting and a regulating service, depending on the time scale and immediacy of their impact on people.) These services include:

Soil Formation. Because many provisioning services depend on soil fertility, the rate of soil formation influences human well-being in many ways.

Photosynthesis. Photosynthesis produces oxygen necessary for most living organisms.

Primary production. The assimilation or accumulation of energy and nutrients by organisms.

Nutrient cycling. Approximately 20 nutrients essential for life, including nitrogen and phosphorus, cycle through ecosystems and are maintained at different concentrations in different parts of ecosystems.

Water cycling. Water cycles through ecosystems and is essential for living organisms.

Ecosystems and Human Well-Being. Millennium Ecosystem Assessment (2005). Island Press (ISBN 1-54726-040-1)

Michigan's Forests

Existing Forest Cover



MI Counties with Commercial Forest



Timberland Ownership

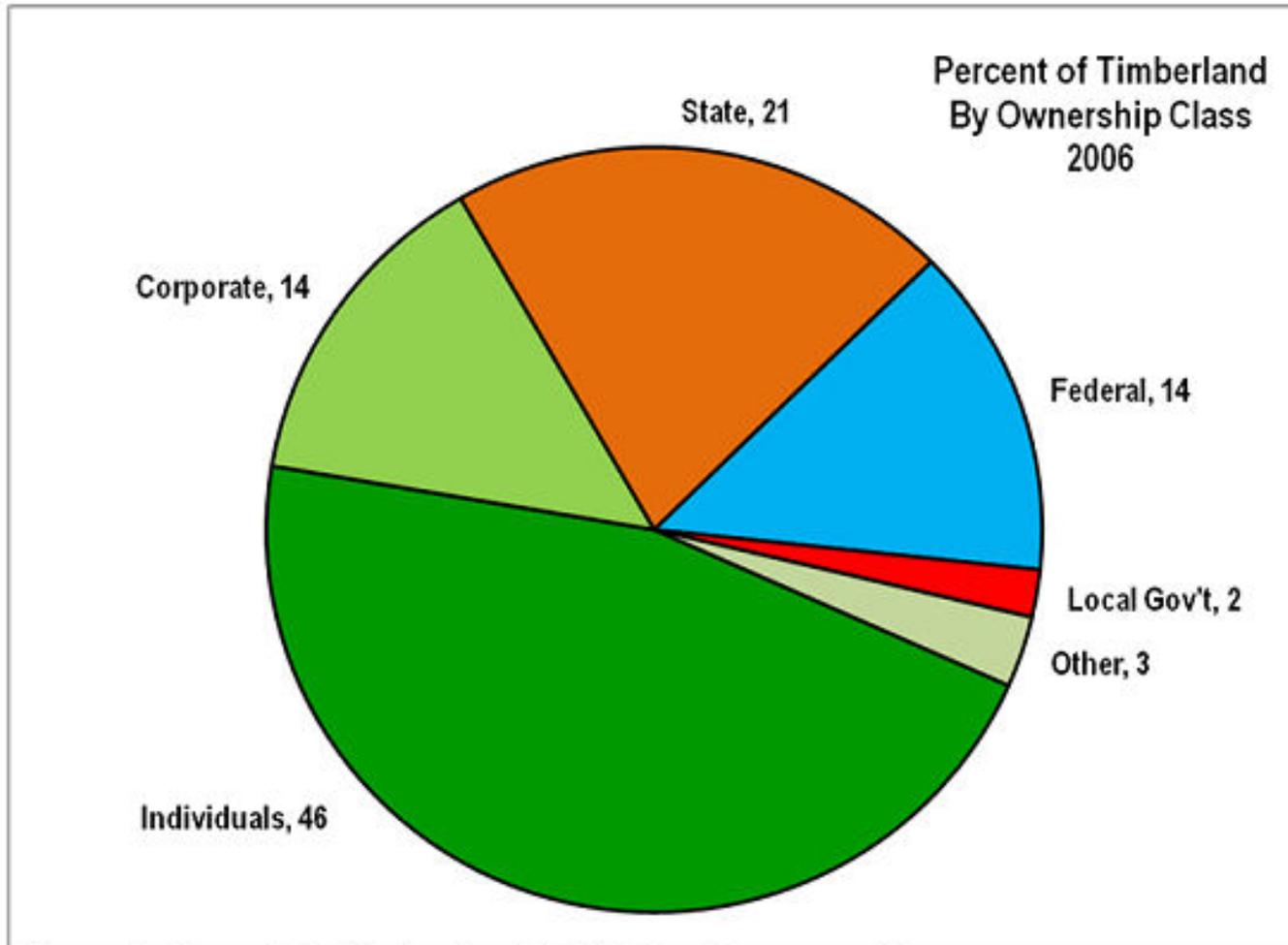
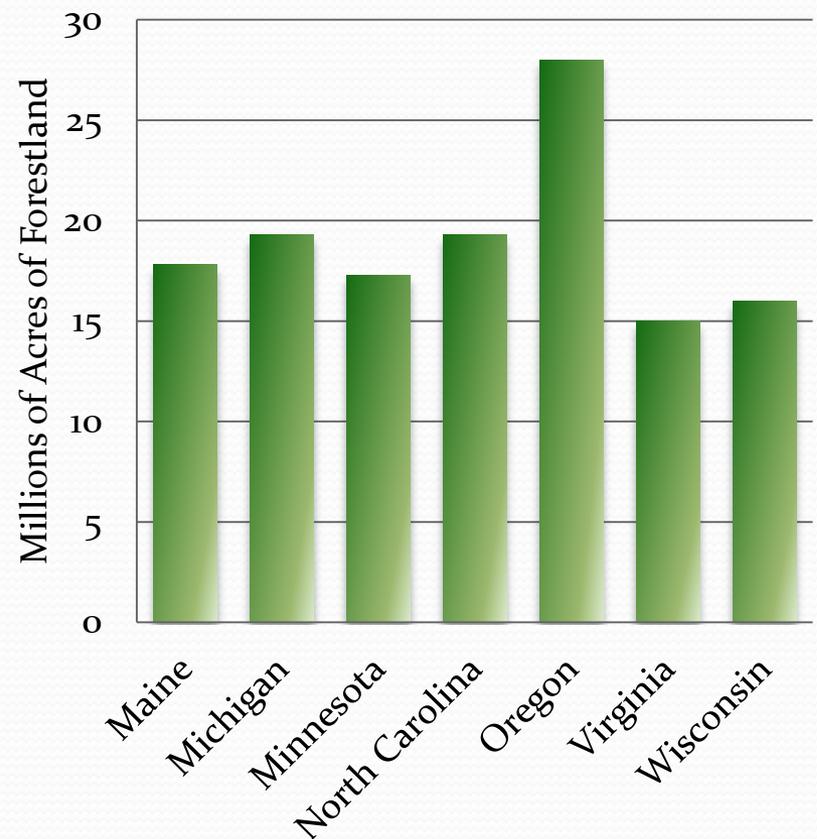


Figure 3. Percent of timberland in Michigan by ownership.

Michigan has the resource...

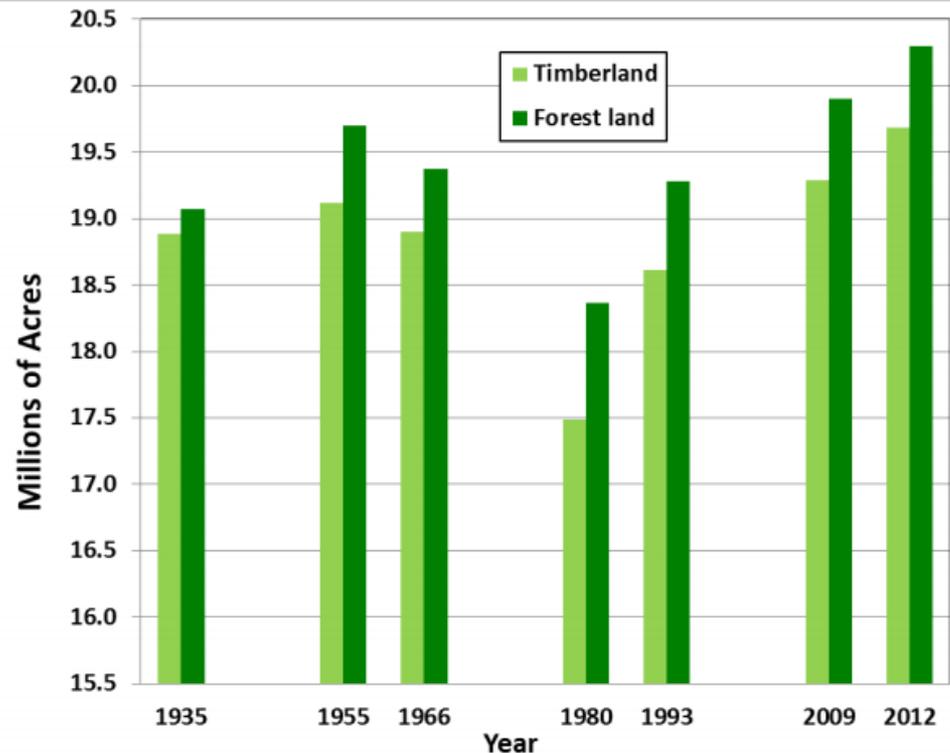
- Michigan ranks 8th in the 54 states and territories receiving federal formula funding for forestry research.
- Michigan has the largest state forest system in the nation (3.9 million acres).



Michigan's Growing Forests

- Michigan's annual forest growth is ~2.3 times the amount harvested
- "If you have a growing resource, you need a growing industry"
 - Dr. Larry Leefers, Michigan State University, Governor's Forest Products Summit, 2013

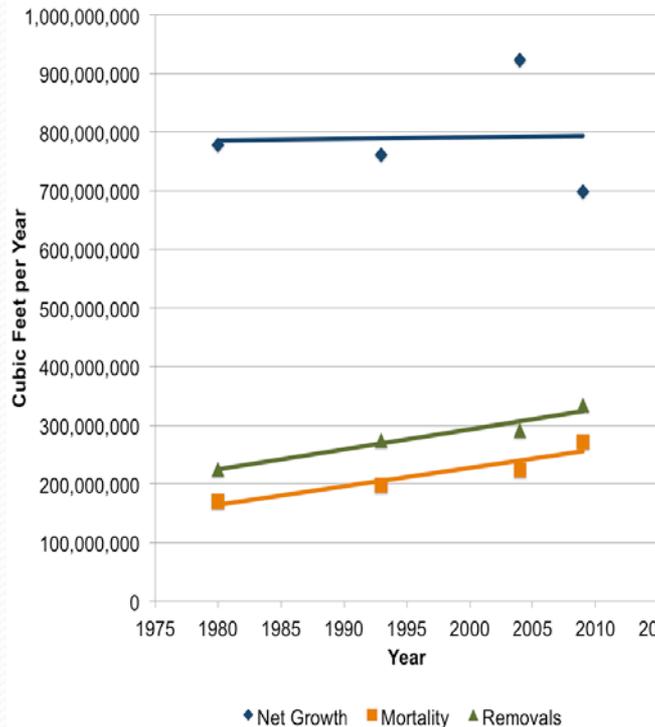
Forest land and timberland area, 1935-2012



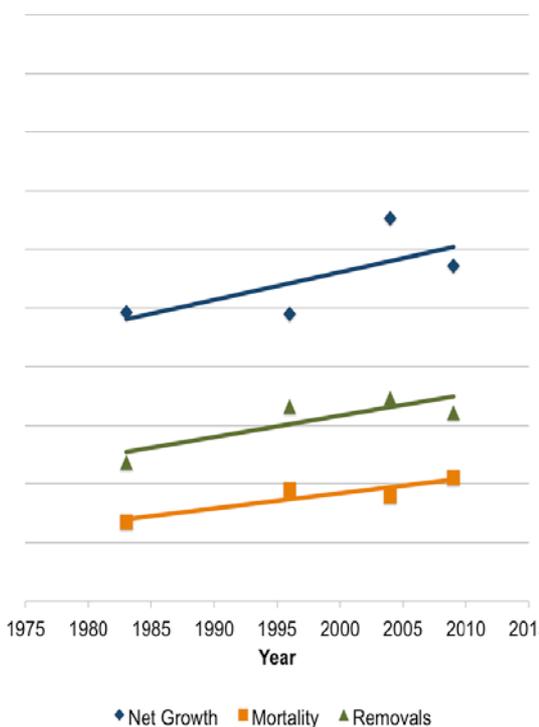
Source: Pugh, 2013

Native Forests are UNDERUTILIZED

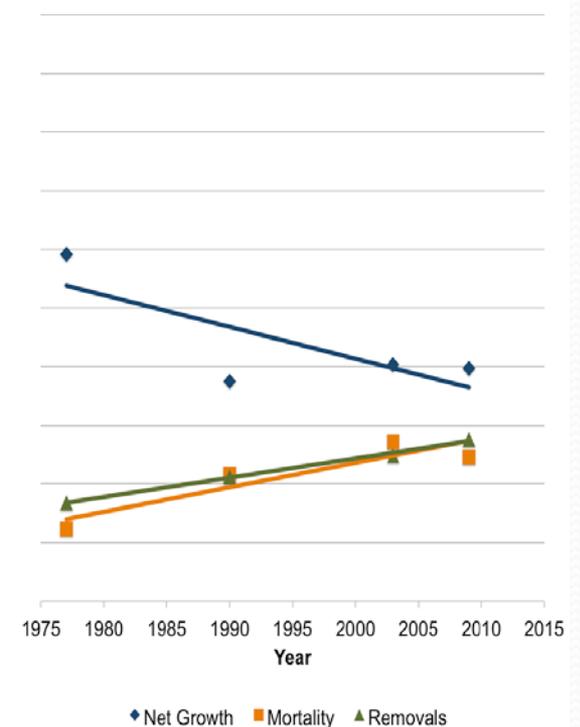
Michigan



Wisconsin



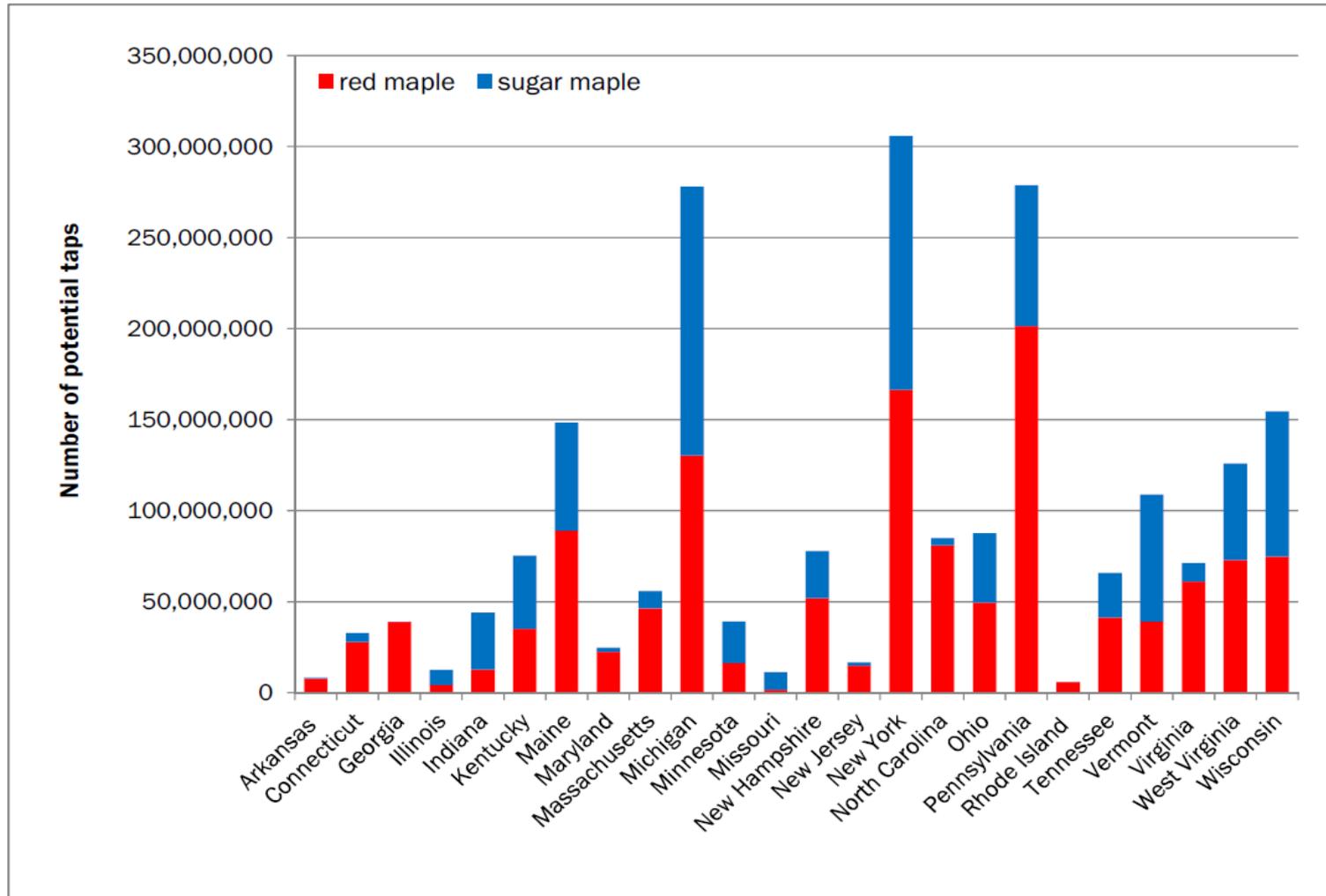
Minnesota



Source: USDA Forest Inventory and Analysis

Froese, R. 2012. "Biomass: Michigan's Forest and Land Resources"

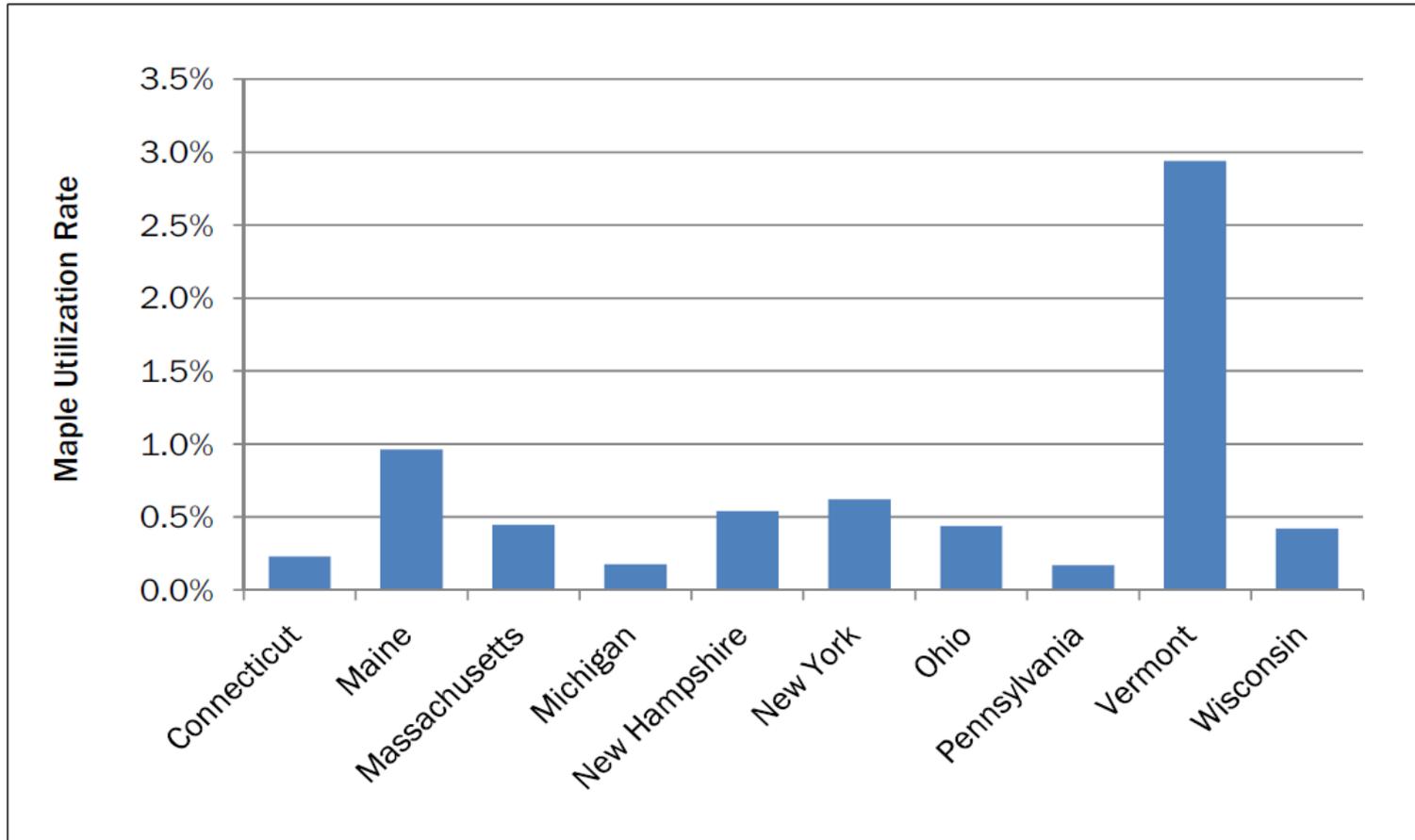
Figure 5. Total Number of Potential Sugar and Red Maple Taps for 24 States in the United States, 2011



Source: U.S. Department of Agriculture. Forest Service. (2010).

Farrell, M.L., & Chabot, B.F. (2012). Assessing the growth potential and economic impact of the U.S. maple syrup industry. *Journal of Agriculture, Food systems, and Community Development* 2(2): 11-27.

Figure 6. Utilization of the Maple Resource for Syrup Production, 2011



Note: Results based on NASS Maple Syrup Crop Report (2010) and U.S. Forestry Service FIA data (2010) on the number of tappable sugar and red maple trees.

Farrell, M.L., & Chabot, B.F. (2012). Assessing the growth potential and economic impact of the U.S. maple syrup industry. *Journal of Agriculture, Food systems, and Community Development* 2(2): 11-27.

Economic Impact of Michigan's Forests

- Timber industry alone generates \$14.6 billion annually to state's economy
- Over 27,000 jobs directly in Michigan forest products industry
- Over 136,000 jobs supported by Michigan forests (MSU extension, 2010)

Michigan Timber Market Analysis

MI DNR Report, March 10, 2008

“Compared to some benchmark states in the major forest regions of the country, Michigan’s forest products industry ranks toward the bottom of the spectrum in employment and production.

Compared to its Lake State neighbors, Michigan’s industry is larger than Minnesota’s, but much smaller than Wisconsin's due to Wisconsin's large pulp and paper sector.”

Governor's Forest Products Summit

April 23, 2013, Lansing, MI

5-year goals as part of the outcome:

- Increasing economic impact of timber industry in the state from \$14 billion to \$20 billion
- Increasing export of value-added timber products by 50%
- Increasing forest products-related careers by 10%
- Supporting existing industry
- Encouraging regionally based industry development

Governor's Forest Products Summit

April 23, 2013, Lansing, MI

Key actions to take were:

1. **Identify opportunities and challenges** for the forest products industry, including emerging markets
2. **Develop a framework for communication and collaboration** among the forest products industry, financial community , economic development support network, government, and **universities**
3. **Align resources** with state government and **universities** to address goals and actions identified in summit
4. **Increase public awareness** of Michigan forest products industry

Governor's Forest Products Summit

April 23, 2013, Lansing, MI

“How can Michiganders support Michigan Forest Products Industry Growth?” (Allan Wieman, GE Capital)

- Build awareness of consensus in support of forest products
- Use timber resource for sustainable business growth
- Continue to leverage educational and research institutions
- Prudently invest in infrastructure
- Promote export markets for Michigan hardwood lumber

White papers from Michigan Timber Advisory Council (under review)

2013 Michigan Forest Products Summit Top Priorities:

- Exports
- Marketing/utilization & data analysis
- Value added/processing
- Private lands
- USFS management/supply
- Biomass



Michigan Biomaterials Conference

October 3rd & 4th, 2013 Traverse City, Michigan



Conference Guide

Sponsors

10-3-13



Michigan Tech



The
Forestland
Group,
LLC



Michigan Forest Products Council
Business Advocacy for the Forest Products Industry



MSU FORESTRY



Plum Creek



SAGOLA HARDWOODS, LTD.

Bob & Nancy Ross

Sectors with a vested interest

- Academicians
- State Government
- Community and Economic Development Leaders
- Industry
- Landowners
- Legislators/Policy Makers
- Natural Resource and Related Agencies



Overall Goal of the Biomaterials Conference – October 2013

- Position institutions of higher learning in the state of Michigan to **work with other sectors** around biomaterials
- In turn, increase the **economic well-being** and **overall quality of life** for all Michigan citizens while maintaining the **health of the ecosystems** upon which they depend

Overview MI Biomaterials Conference- Expected Outcomes

- Greater understanding of why the most highly regarded wood science and products academic programs in the country are **rebranding** themselves
- Greater understanding of how academic institutions in other states are reaching out to others in **partnerships** as part of this rebranding and realigning themselves with various industries given the new economic environment
- Identification of **barriers** to Michigan being a more significant player in the biomaterials industry
- Development of an **educational program** (2-year, 4-year, graduate, and continuing) in biomaterials that encompasses requisite knowledge, skills and abilities, and behaviors
- Identification of **gaps in knowledge/research and technology** related to biomaterials

This is a call to action

“I suspect that you’ve hit the hurdles when it comes to funding forestry programs in Michigan. Of the four states that I’ve worked in, Michigan is by far the least interested in forests...yet has a huge resource and huge potential for sustainable economic development and sustainable community economies. For over a decade, I have been absolutely befuddled as to why Michigan could care less about forests.”

(Anonymous 2013)

Fragmentation

Fragmentation of Effort

Fragmentation of Thought (Systems Thinking)



Proceedings of the Conference on a
Michigan Biomaterials Initiative:
The Role of Education, Research, and Technology



Organized by Michigan Technological University
&
Hosted by
Michigan Society of American Foresters

October 3-4, 2013

Traverse City, Michigan

NC State Department of Forest Biomaterials

- Home to 20 full-time faculty, 12 active adjunct faculty, 9 staff members, 5 research associates
- 150 undergraduate students and 48 graduate students, participating in both on-campus and distance education curriculum.

Virginia Tech Department of Sustainable Biomaterials

- Established in 1979 as Wood Science and Forest Products
- 2012 became the Department of Sustainable Biomaterials
 - • 5 tech. and administrative staff
 - • 15 tenure/tenure track faculty
 - • 2 professors of practice
 - • 40+ graduate students/post docs.
 - • 80+ undergraduates

Oregon State University

- Rebranded Wood Science and Engineering degree program as **Renewable Materials**
- Created new curriculum and launched Fall 2010
- Approximately 70 undergrads
- Educating the workforce for the future “green” economy

University of Maine

- BS in Forest Operations, Bioproducts & Bioenergy
- the efficient and environmentally acceptable growth, management, extraction and transportation of timber for the manufacture of forest products.

Proceedings, October 2013

available online @
www.mtu.edu/forest/biomaterials

Barriers to Michigan Being a Leader in The Biomaterials Sector



Figure 5. Word cloud of the number of responses in each broad category as identified by breakout session groups during the Michigan Biomaterials Conference.

Proceedings, October 2013

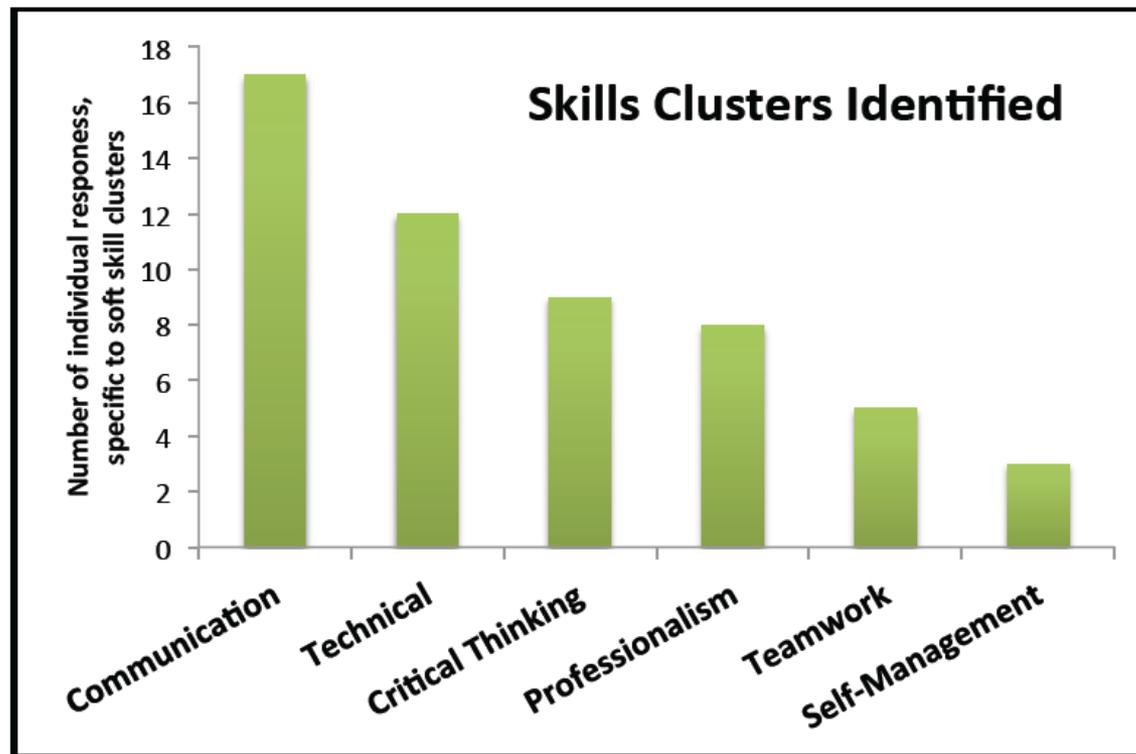


Figure 10. The relative number of responses of specific skills clusters identified by participants in the Michigan Biomaterials Conference as being desirable of students in biomaterials related industries in Michigan.



First Meeting of MI Biomaterials Initiative Steering Committee
Houghton, MI
March 26-27, 2014

Steering Committee Meeting Agenda

March 26

2:00-5:00 pm: (ATDC)

Welcome and Introductions (Sharik)

Overview and Expected Outcomes (Sharik)

Exercise – developing vision and mission
(Storer)

Break

Working groups on information
management, critical issues, and
demonstration projects (Sharik)

5:30-8:30 pm: (Magnuson Franklin Square Inn,
820 Shelden Ave.)

Dinner and Social

March 27

7:30-8:00 am: (ATDC) Continental Breakfast

8:00-11:30 am: (ATDC)

Report out on mission and vision (15-20 min.)

Report out on working groups (15min/group)

Break

Discussion

Develop a plan for moving forward

11:30-1:00 pm: (Forestry building) Lunch

Expected Outcomes for Steering Committee Meeting

1. Review of what has been done to date
2. Formulate a vision and mission for the initiative
3. Formulate a topical and organizational structure for
 - a. Compiling and making available information on biomaterials
 - b. Identifying critical issues within topical areas related to MI biomaterials
 - c. Identifying demonstration projects on biomaterials
 - d. Developing strategies for working on these critical issues and demonstration projects
 - e. Formulating measures of success, target levels, and timelines
4. Initiate 3a, 3b and 3c above
5. Develop working groups to move forward
6. Identify an oversight entity for managing the Biomaterials Initiative
7. Determine gaps in expertise needed on the steering committee and suggest people to fill the gaps
8. Establish frequency of working group and steering committee meetings
9. Set date for next meeting

Resources for this Meeting

- Proceedings of the Governor's Forest Products Summit, April 2013
- Proceedings of the Michigan Biomaterials Initiative Conference, October 2013
- "The State and Future of U.S. Forestry and the Forest Industry" Report, M. Goergen et al., 2013
 - Summary of Chapter Headings
- Summarization of Survey Responses
 - Why hasn't MI been a bigger player in Biomaterials Industry?
 - What needs to happen to make Biomaterials more important in MI?

Vision

- The Michigan Biomaterials Initiative:
Leading innovation of the public and private sectors in biomaterial production, utilization, and education to improve the quality of life in Michigan

Mission

- The Michigan Biomaterials Initiative works to promote economic development centered around the growth, utilization and recycling of biomaterials. We aim to identify resources and incentives for the research, education and industry needed to develop a high, sustainable quality of life in Michigan through the optimal use of natural resources.

Survey Questions

- 1. Why hasn't MI been a bigger player in Biomaterials industry regionally, nationally, and globally?*
- 2. What needs to happen to make Biomaterials a more important part of the economy and quality of life for the citizens of MI?*

Respondents:

- Academician: 10
- Forester (including education, government, and industrial): 9
- State/Local Government: 3
- Forest Products Scientists: 2
- Logger: 2
- Not for Profit: 2

Survey Questions – Major Themes

1. Why hasn't MI been a bigger player in Biomaterials industry regionally, nationally, and globally?

- Various **industry business cycles** in the past have shuttered opportunities and this has led to disenchantment
- Michigan's **automotive culture** maintains the state government's focus on heavy manufacturing at the expense of other industries
- A sense of **fragmentation** in the industry, in the non-industrial private forest land base, and in thinking in regards to the traditional and non-traditional forest products industry and leadership

Survey Questions – Major Themes

2. What needs to happen to make Biomaterials a more important part of the economy and quality of life for the citizens of MI?

- **Invest in education**—this involves outreach and research as well as the need to impress upon Michigan’s citizens the need to actively manage forests. The scope of products that can be derived from forests should be explained. There is a need to continue to improve, innovate, and evolve the entire supply chain from ecosystem to market
- **Develop robust markets**
- **Collaboration** motivated by business interests that should result in increased investment in research and development

The State and Future of U.S. Forestry and the Forest Industry

Washington, DC • May 29-30, 2013

Workshop Report and Recommendations

Prepared by Michael Goergen, James Harding, Carlton Owen, Mark Rey, and Lynn Scarlett

1. Trends and future of US forest products markets
2. Private forest land tenure and ownership
3. Health and integrity of the current supply chain in US forest products manufacturing
4. Ecological health and vulnerability of federally owned forest
5. Forest policy issues in the US

Topical Areas for addressing critical issues related to Michigan Biomaterials

1. Trends and Future of Biomaterials Markets
2. Private lands: stability and potential to provide sustainable sources of biomaterials
3. State and Federal lands: stability and potential to provide sustainable sources of biomaterials
4. Health and integrity of biomaterials supply chain
5. Policy issues related to biomaterials

Number of responses to survey questions

1. *Why hasn't MI been a bigger player in Biomaterials industry regionally, nationally, and globally?*

2. *What needs to happen to make Biomaterials a more important part of the economy and quality of life for the citizens of MI?*

Identified by Category (Chapters in Goergen et al., 2013)	# 1	#2
Trends and future of biomaterials markets	23	23
Private lands: stability & potential to provide sustainable sources of biomaterials	3	0
State and federal lands: stability & potential to provide sustainable sources	5	2
Health and integrity of biomaterials supply chain	16	18
Policy issues related to biomaterials	49	54

A person may have indicated more than one area in their response.

Total # persons responding = 36



Michigan Biomaterials Initiative Steering Committee Meeting

3-28-2014

Breakout Group Reports

Summarized by 5 Topical Areas for addressing
critical issues related to Michigan Biomaterials

1. Trends and Future of Biomaterials Markets

Priority Trends and Issues of Concern

- *Limited value-added markets*
- *R & D new biomaterials markets and products*
- *Undervalued non-timber products*
- *Demographics*
- *Public Perception*
- *Transportation is a limitation*

Measures of Success- Action Items

- *Reevaluate current industry*
- *Increase younger workforce*
- *Increase investment in R & D of product improvement, markets*
- *Increase focus on higher value products*
- *Demo. projects for non-timber value from forest*
- *Branding and public relations*
- *Infrastructure investment and improvement*

2. Private lands: stability and potential to provide sustainable sources of biomaterials

Priority Trends and Issues of Concern

- *TIMOs and REITs already harvesting*
- *Non-industrial private landowners*
 - *Cognitive dissonance*

Measures of Success- Action Items

- *Need better understanding of non-industrial resource*
- *Expand markets for non-industrial landowners*
- *New mechanisms to engage landowners*
- *Communication education for workers in contact with public*

3. State and Federal lands: stability and potential to provide sustainable sources of biomaterials

Priority Trends and Issues of Concern

- *Not harvesting allowable cut*
- *Policy limits some nontraditional biomaterials from public lands*
- *Nontraditional markets undervalued in management plans*

Measures of Success- Action Items

- *Pursue partnerships, stewardships with industry, other agencies*
- *Support rural development*
- *Support innovative R & D of biomaterials*
- *Demonstrations to engage public, investors*

4. Health and integrity of biomaterials supply chain

Priority Trends and Issues of Concern

- *Uncertainty about resources, markets*
- *Lack of markets, not supply*
- *Geography and Infrastructure*
- *Atmosphere of competition, not collaboration*
- *Biosecurity with invasives, climate change*

Measures of Success – Action Items

- *Gather literature, information and make available for informed discussions*
- *Improve business case, develop industries*
- *Support training programs for workforce*
- *Invest in transport infrastructure*
- *Update policy and plans for biosecurity threats to be proactive, not reactionary*

5. Policy issues related to biomaterials

Priority Trends and Issues of Concern

- *Difficult to initiate new business in MI*
- *Incentives lacking for wood use, carbon footprints*
- *Lack of coordination among forest/trade advocacy groups*

Measures of Success-Action Items

- *Improve the regulatory environment*
- *Incentivize*
- *Utilize existing programs*
- *Policies for biomass, nontraditional biomaterials*
- *Statewide, strategic plan for Initiative*

Steering Committee Gap Analysis

**Life Cycle Assessment Category
(Primary choice)**

	Stakeholder Category					
	Academics	Community & Economic Development Leaders	Industry	Private landowners	Legislators	Natural Resources & Related Agencies
Ecosystem Dynamics	9					4
Extraction & Procurement	5		12			3
Processing & Manufacturing	14		3			2
Marketing, Sales, & Distribution	1	1	1			1
Post-consumer Processing & Recycling						
Community & Economic Development	2	5	1	1	3	

Steering Committee Gap Analysis

Life Cycle Assessment Category
(Primary choice)

	<u>Stakeholder Category</u>					
	Academics	Community & Economic Development Leaders	Industry	Private landowners	Legislators	Natural Resources & Related Agencies
Ecosystem Dynamics	9					4
Extraction & Procurement	5		12			3
Processing & Manufacturing	14		3			2
Marketing, Sales, & Distribution	1	1	1			1
Post-consumer Processing & Recycling						
Community & Economic Development	2	5	1	1	3	

Expertise Gap Analysis

Life Cycle Assessment Category (Primary choice)	Stakeholder Category					
	Academicians	Community & Economic Development Leaders	Industry	Private landowners	Legislators	Natural Resources & Related Agencies
Ecosystem Dynamics	T.Bal T.Sharik A. Storer Bill Cook J.Wagenbren	M.Jurgensen G.Meadows R.Kobe HairongWei				S.Beyer D. Birdsall M.Vanimen S.Shine
Extraction & Procurement	R. Froese J.Lorensen BillPerkis	P.Nzokou R.Miller	R.Janowiak S.Hagan M.Korkko G.Longhini J.Hayrenen J.R.Richardson	M.Rintamaki R.Edwards Tony Fox J. Fosgitt J.Penegor W.Suchovsky		B. Hubbard B.O'Neill
Processing & Manufacturing	M.Gretz P.Laks E. Bar-Ziv B.Dale P.Heiden C.Saffron K.Zhang	L.Drzal D.Shonnard J.Meldrum S.Pueppke S.Albukari R.Alger		B.Kriepke Tim Neff PatTheut		B.Ross N.Stark
Marketing, Sales, & Distribution	K.Potter-Wit	B.Woodry	D.DeYou			D.Lacourt
Post-consumer Processing & Recycling						
Community & Economic Development	H.Abbots D.Rowe	C.Cook KenNye C.Knudson	D.Stypula	M. Davis	Bill Botti	K. Everett Elise Matz D.Nyberg

Who is missing from this meeting?

		Stakeholder Category					
		Academicians	Community & Economic Development Leaders	Industry	Private landowners	Legislators	Natural Resources & Related Agencies
Life Cycle Assessment Category (Primary choice)	Ecosystem Dynamics	T.Bal T.Sharik A. Storer Bill Cook J.Wagenbren	M.Jurgensen G.Meadows R.Kobe HairongWei				S.Beyer D. Birdsall M.Vanimen S.Shine
	Extraction & Procurement	R. Froese J.Lorensen BillPerkis	P.Nzokou R.Miller	R.Janowiak S.Hagan M.Korkko G.Longhini J.Hayrenen J.R.Richardson	M.Rintamaki R.Edwards Tony Fox J. Fosgitt J.Penegor W.Suchovsky		B. Hubbard B.O'Neill
	Processing & Manufacturing	M.Gretz P.Laks E. Bar-Ziv B.Dale P.Heiden C.Saffron K.Zhang	L.Drzal D.Shonnard J.Meldrum S.Pueppke S.Albukari R.Alger	B.Kriepke Tim Neff PatTheut			B.Ross N.Stark
	Marketing, Sales, & Distribution	K.Potter-Wit	B.Woody	D.DeYou			D.Lacourt
	Post-consumer Processing & Recycling						
	Community & Economic Development	H.Abbots D.Rowe	C.Cook KenNye C.Knudson	D.Stypula	M. Davis	Bill Botti	K. Everett Elise Matz D.Nyberg

Green is a private landowner, **Bold** indicates present today

Moving Forward

- Identify who is missing and bring them to the table
- Draft mission and vision
- Draft strategic plan around the 5 topical areas
 - Bring in an outside facilitator?
- Michigan Tech hire of a 'professor of practice'
- Meet again in ~6 months

New Hire at Michigan Tech: Professor of Practice in Biomaterials

- Hire a “Professor of Practice” in a 12-month position to direct the Biomaterials Initiative at Michigan Tech in the areas of teaching/curriculum, research, and outreach.
- Coordinate involvement at the state level and beyond
- Five-year self-sustaining plan.
- Emphasis on generating research funds more so for others than for one’s self.
- Strong connection to industry.
- Strong interpersonal/collaborative skills.

Regarding the integral role state government has played in forestry for nearly a century...

“.....Michigan doesn't have any Forest Products/Marketing positions in the DNR; WIDNR now has six, plus two UW-Extension Forest Products positions. The WIDNR has over 60 full-time equivalent positions dedicated to private forestry while the MIDNR has only two.

I spent 17 years in the WIDNR (the last five as a marketing specialist) and have worked very closely with the WIDNR since leaving 18 years ago; 90% of the projects I work on in Wisconsin involve some type of partnership/interaction with the WIDNR. In Wisconsin, there is truly a public-private partnership in forestry that is missing in Michigan. This is not to say that everything is perfect in Wisconsin; there are constant discussions and arguments over how to best move forward with forestry, which is a constantly evolving process.”

-Don Peterson

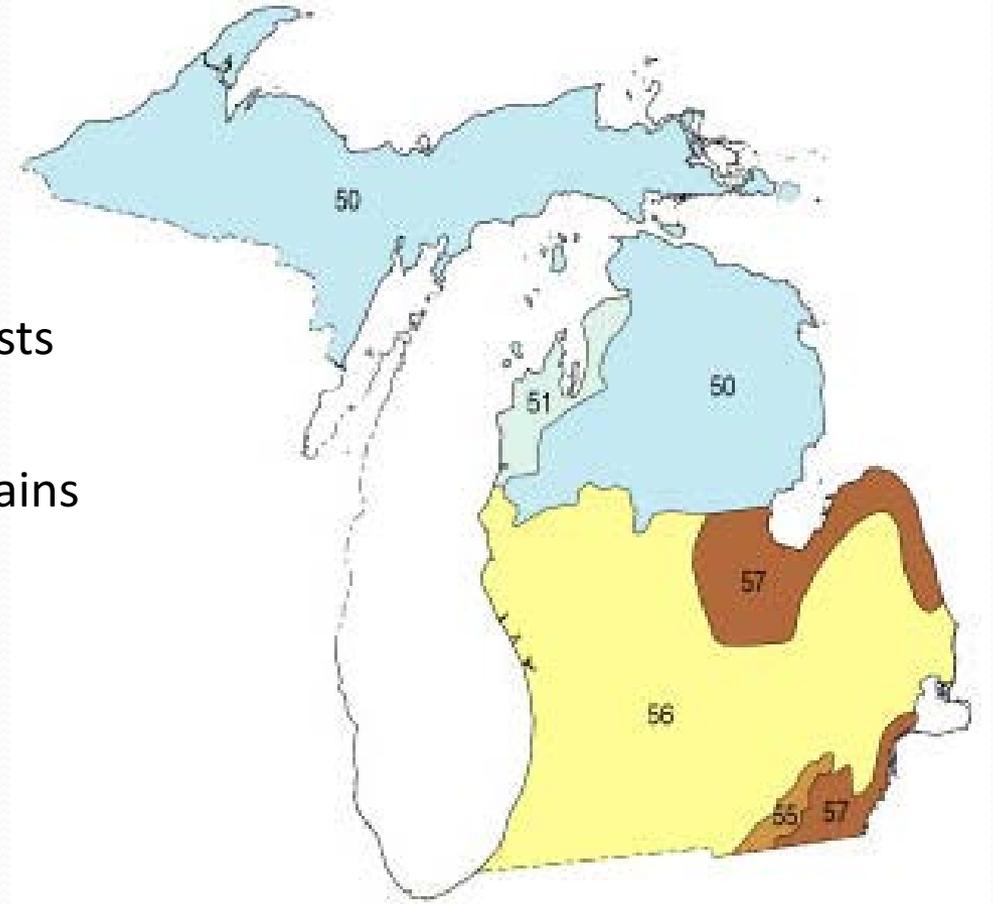
Renewable Resource Solutions, LLC, Crystal Falls, MI

(Bio)Regional Planning Key

- The influence of culture and settlement on the biophysical environment and the reciprocal of this.

Level III Ecoregions of Michigan

- 50. Northern Lakes and Forests
- 51. North Central Hardwood Forests
- 55. Eastern Corn Belt Plains
- 56. S. Michigan/N. Indiana Drift Plains
- 57. Huron/Erie Lakes Plains



Albert et al., 1986
Albert, 1995

Regional Economic Collaborative Development Regions

Economic Development Collaboratives



REGIONS

- 1** *Upper Peninsula region*
Lake Superior Community Partnership
- 2** *Northwest region*
NWMCOG
- 3** *Northeast region*
NEMCOG
- 4** *West Michigan region*
The Right Place
- 5** *East Central Michigan region*
Saginaw Future
- 6** *East Michigan region*
Flint and Genesee Chamber of Commerce
- 7** *South Central region*
LEAP
- 8** *Southwest region*
Southwest Michigan First
- 9** *Southeast Michigan region*
Ann Arbor SPARK
- 10** *Detroit Metro region*
Detroit Economic Growth Corp
Oakland County PCD
Macomb County PED
Wayne County EDGE

These collaboratives begin with the alignment of service providers, creating teams to serve each region. Regional teams are comprised of representatives from the following:

- MEDC Business Development Managers (BDMs)
- MEDC Community Assistance Team (CATeam)
- MEDC Development Finance Managers (DFMs)
- MEDC International Trade Managers (ITMs)
- Michigan Department of Agriculture and Rural Development (MDARD)
- Michigan Department of Environmental Quality (MDEQ)
- Michigan Department of Natural Resources (MDNR)
- Michigan Department of Transportation (MDOT)
- Michigan Manufacturing Technology Center (MMTC)
- Michigan Small Business Technology Development Centers (MI-SBTDCs)
- Michigan State Housing Development Authority (MSHDA)
- Procurement Technical Assistance Centers (PTACs)
- Talent and workforce organizations
- Other state and federal agencies

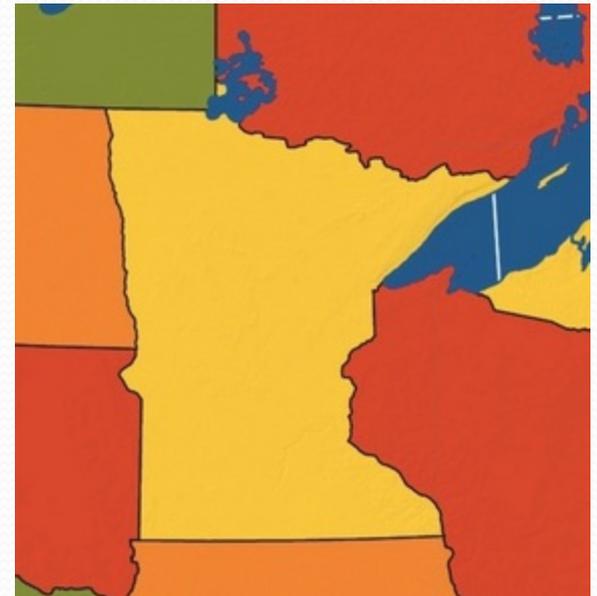


Minnesota bills to incentivize biofuel, biochemicals, and biomass

www.biomassmagazine.com

March 12, 2014

- Creates a capital equipment loan program for qualified facilities that source raw materials from Minnesota
- Agricultural or Forestry sources of organic content
- Payments to advanced biofuel, biomass, biochemical producers if annual production exceeds certain levels



Wood Technology Center of Excellence



Antigo, WI

NorthCentral Technical College, Wausau, WI

- *Wisconsin is the top state in the nation for wood-related jobs, employing over 61,000 workers.*
- *The Langlade County region, where the Wood Technology Center of Excellence is located, is one of the worldwide leaders in forest products manufacturing.*
- *The Wood Technology Technical Diploma ladders directly into the Wood Processes Associate Degree without losing a single credit.*
- Started wood technology program in 2011.
 - Wood Processes Associate Degree
 - Wood Manufacturing Technical Diploma
 - Basic Wood Manufacturing Certificate



PROGRAMS &
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by starting at NTC and transferring to

Michigan Tech

Michigan Technological University

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- Apply Now
- Job Placement
- Learning Center
- Paying for College
- Student Life
- Take a Single Class
- Transcripts
- Transfer to a 4 year

- Beginning Fall, 2014
- Associate degree transfer to Michigan Tech with junior standing.
- Additional agreement offers scholarships saving up to \$100,280
- Currently in 4 areas:
 - Electromechanical Technology > Electrical Engineering
 - Architectural Design & Technology > Construction Management
 - IT-Network Specialist > Computer Network & System Admin.
 - Mechanical Design Engineering Technology > MET

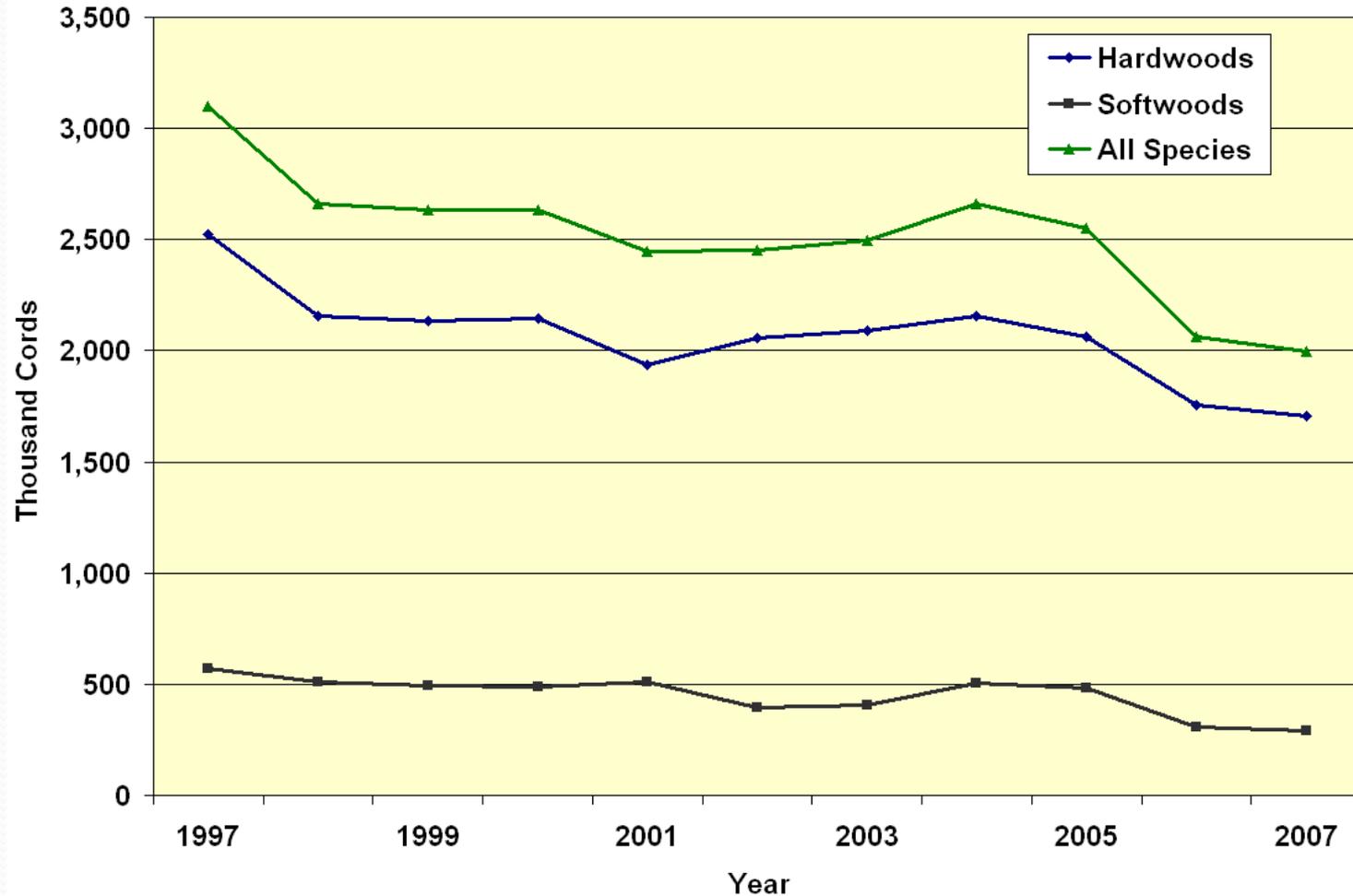
Forest Products Industry Downturn in Michigan Began in the Early 2000's

- Pulp & paper sector began significant decline with global competition;
- The cost lower in many developing countries;
- Environmental regulations were either less onerous or non-existent around world;
- Many of the same countries are also the major developing markets for paper;
- Pulp & paper mills began popping up in SA, SE Asia, China.
- In NA, initially the older pulp mills closed as costs mounted.
- Soon many older paper mills with older, smaller, slower paper machines began to succumb.

In late 2000's, Collapse of Housing and General Economic Downturn Kills Building Products Sector of Forest Industry

- Housing starts began to drop off in 2006-07;
- The “Great Recession” developed in 2008;
- Building products mills began to take down-time;
- Eventually shutdown completely;
- Many never to re-open again

Wood fiber demand and timber harvests dropped dramatically



Pulpwood Production in Michigan in thousands of cords - 1977 to 2007

Understanding TIMO's and REIT's

Timberland Investment Management Organization (TIMO)

- Focus is maxing the growth in value of timberland assets
- Owners want return and capital appreciation
- May be able to wait for better market conditions

Real Estate Investment Trust (REIT)

- Focus is to distribute profits as dividends annually, more regular cash flow
- Companies own and operate income-producing real estate
- Can be public or private company

Examples of TIMO's and REIT's

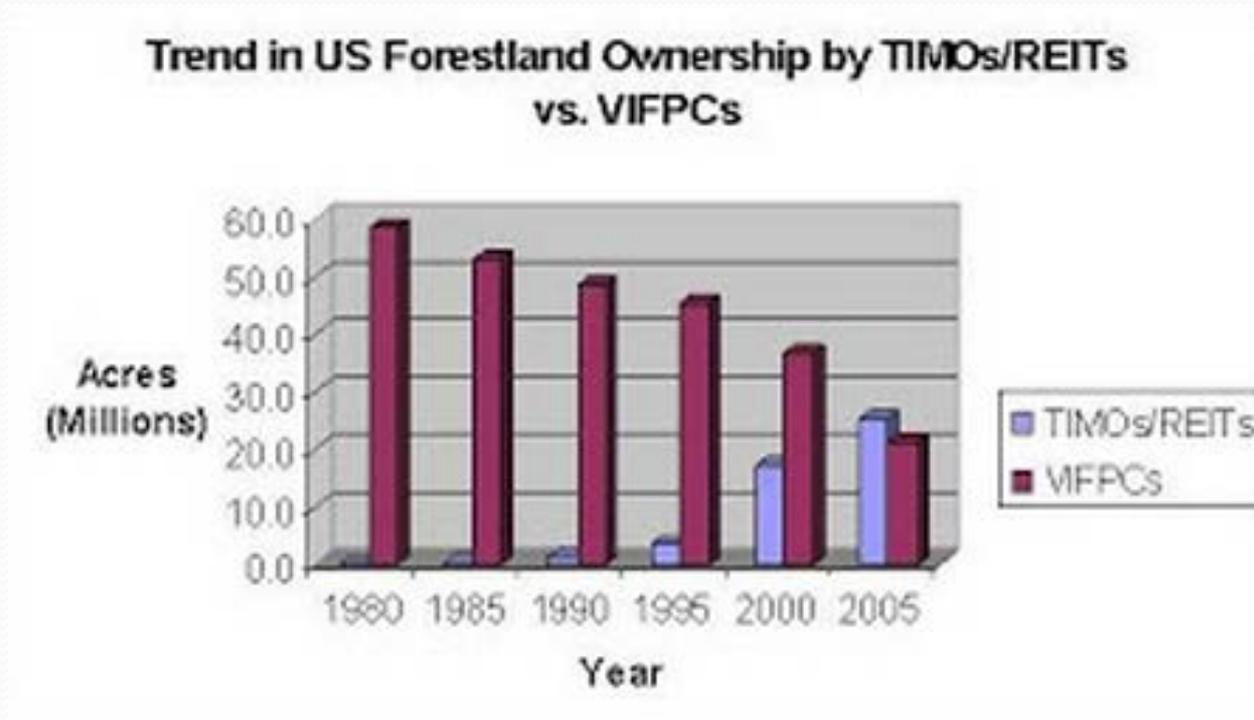
Timberland Investment Management Organization (TIMO)

- Global Forest Partners
- GMO Renewable Resources
- Hancock Timber Resources Group
- Molpus Woodlands Group
- The Forestland Group
- TimberVest
- The Campbell Group

Real Estate Investment Trust (REIT)

- Plum Creek
- Potlatch Corp.
- Rayonier Inc.
- Longview Fiber
- Many others invest in shopping malls, office buildings, industrial parks, residential areas, etc...

Increasing Ownership by TIMOs/REITs



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