Michigan Biomaterials Conference

The Role of Education, Research, and Technology in a Michigan Biomaterials Initiative

Hosted by Michigan Society of American Foresters
October 3-4, 2013, Traverse City, MI

Introduction by Terry L. Sharik, Dean
School of Forest Resources & Environmental Science, Michigan Tech

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The Michigan Association of Timbermen "Our Renewable Resource"

Michigan Forest Association

Grand Valley State University Biology Department

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Other Collaborators

FOREST SERVICE
US
DEPARTMENT OF AGRICULTURE

OAKLAND COMMUNITY COLLEGE
Renewable Energies and Sustainable Living

Holli Forest Products, Inc

Detroit Area
Green Sector Skills Alliance
(GSSA)

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.

Overall Goal of the Conference

- Position institutions of higher learning in the state of Michigan to **work with other sectors** around biomaterials

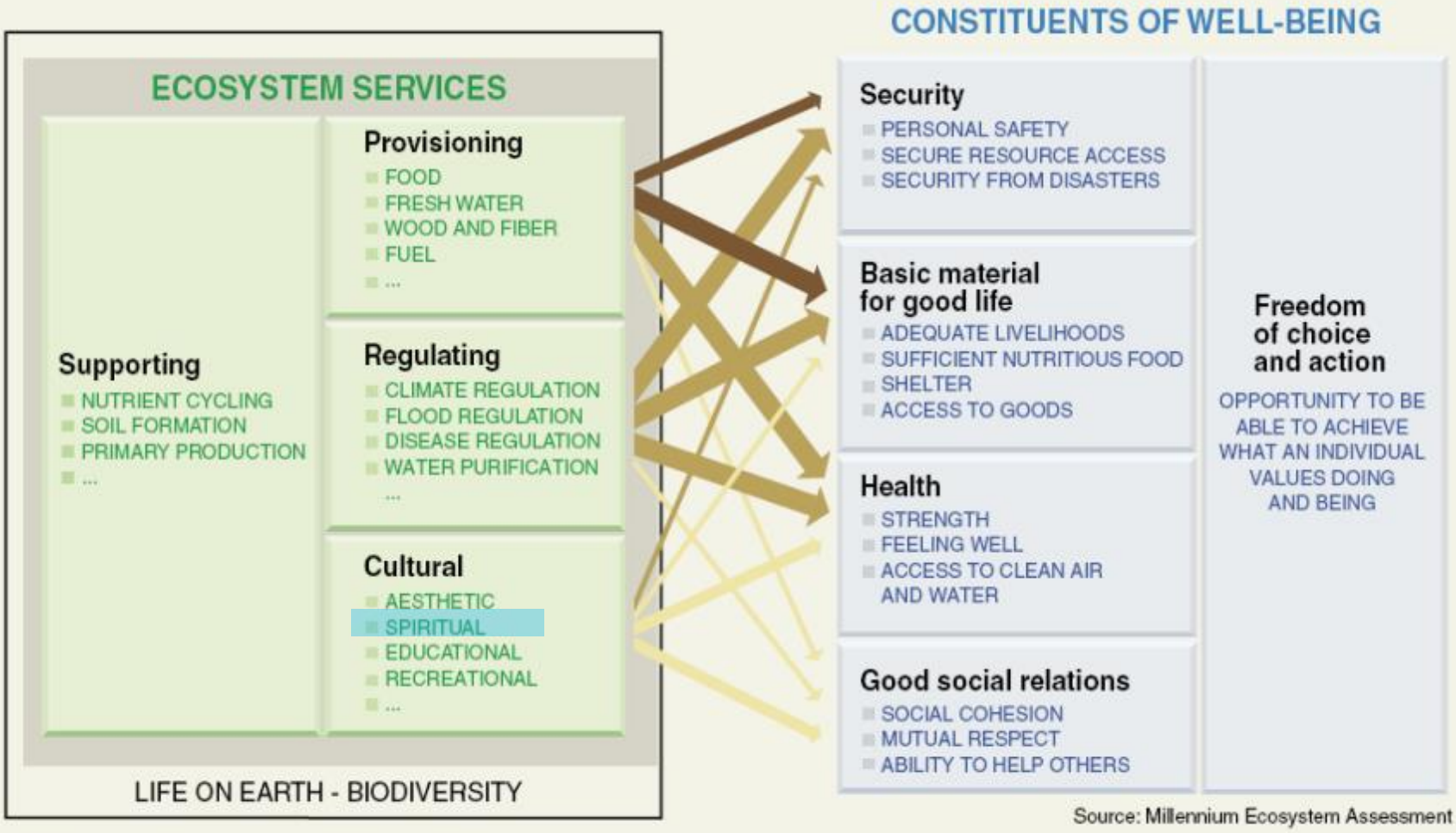
- In turn, increase the **economic well-being** and **overall quality of life** for all Michigan citizens while maintaining the **health of the ecosystems** upon which they depend

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


Ecosystem Dynamics
Extraction & Procurement
Processing & Manufacturing
Marketing, Sales, & Distribution
Post-Consumer Processing & Recycling
MICHIGAN BIOMATERIALS INITIATIVE
Natural Capital
QUALITY OF LIFE
Human Capital

Ecosystem Services

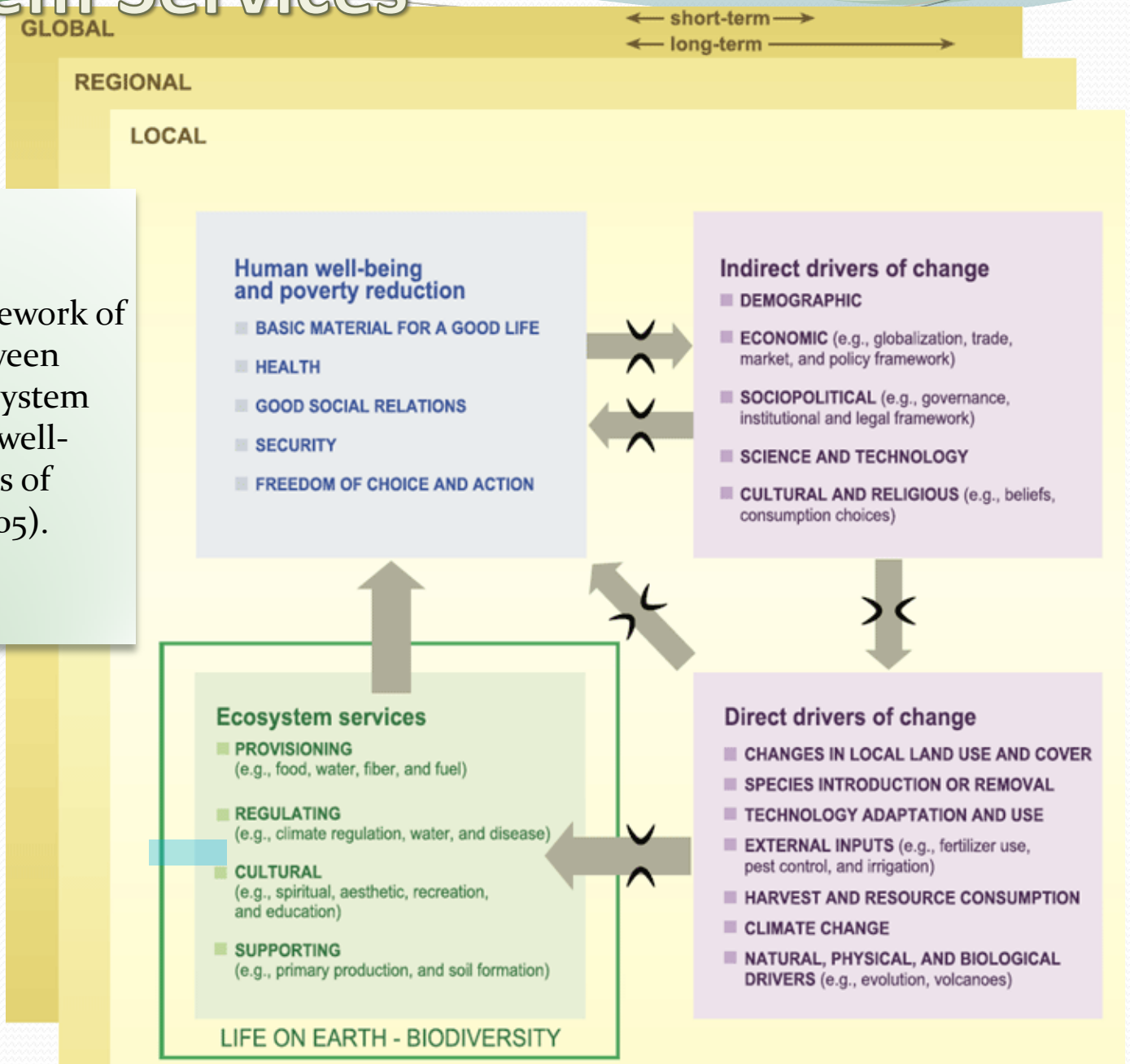


Source: Millennium Ecosystem Assessment

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

Ecosystem Services

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



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

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

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

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

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

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 interlinked. (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.

Michigan's Forests

Existing Forest Cover

MI Counties with Commercial Forest

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).

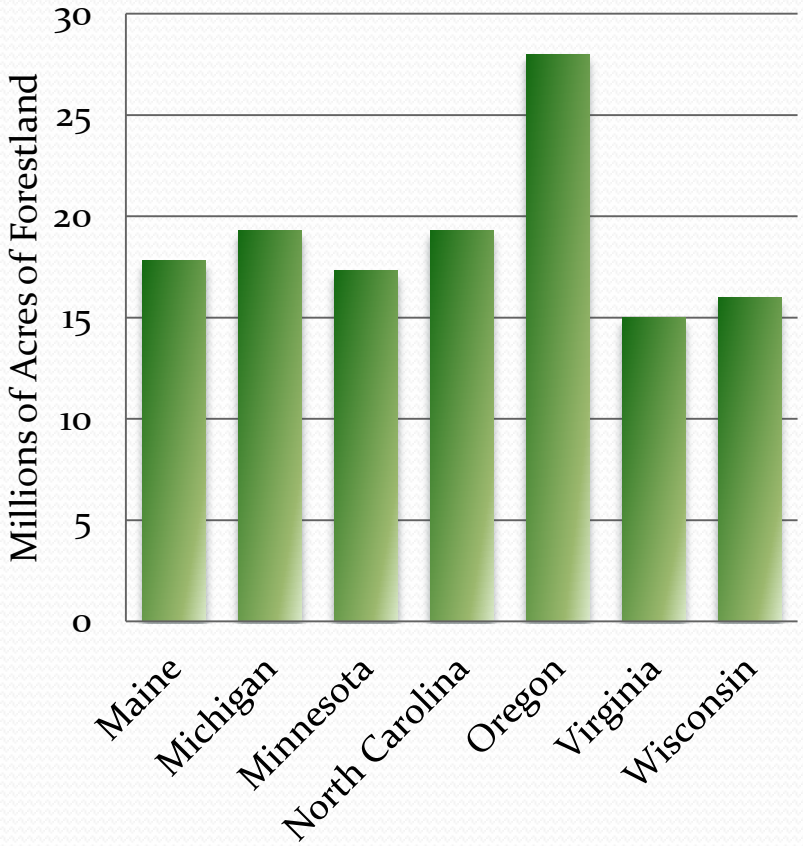
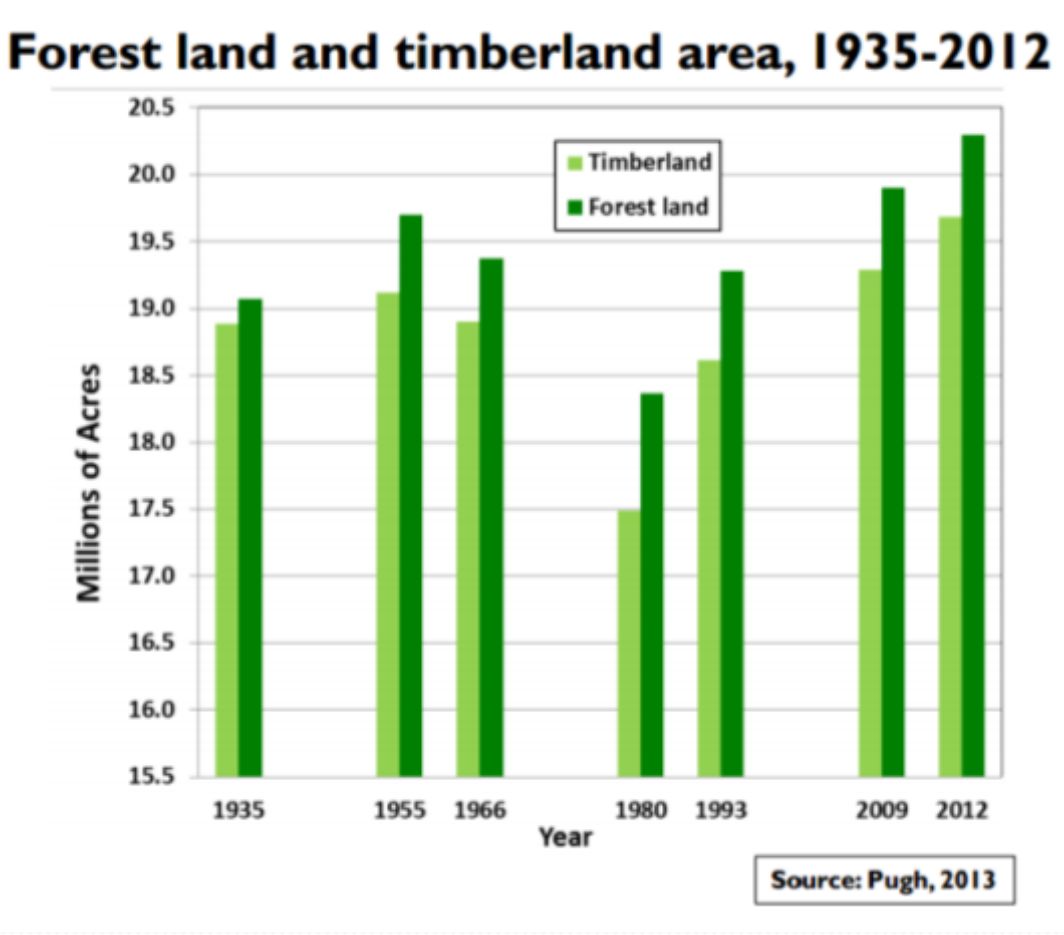


Figure by Tara Bal

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



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."

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)

“If you are not at the table, you are on the menu”

Steve Walsh, Traxys Power Group, stressing the importance of forest industry and government cooperation at the MI Forest Products Summit, April, 2013

Resources for this Conference

- Proceedings of the Governor's Forest Products Summit, April 2013 (available on-line and here in hard copy)
- White papers from Michigan Timber Advisory Council (under review)
- Introductory and keynote presentations in this conference
- Delegations from four leading states in the biomaterials industry presenting at this conference

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. Aligning 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

Sectors with a vested interest

- Academicians
- Community and Economic Development Leaders
- Industry
- Landowners
- Legislators
- Natural Resource and Related Agencies
- Citizens of Michigan

Alternative names for “Biomaterials”

- Ecosystem Materials
- Ecomaterials
- Sustainable Biomaterials
- Forest Biomaterials
- Ecosystem Products
- Bio-based Products
- Bioproducts
- Sustainable Natural Products
- Forest Products
- Ecosystem Provisioning Services
- Sustainable Natural Resources
- Others?....

Fragmentation

Fragmentation of Effort

Fragmentation of Thought (Systems Thinking)

Unknowns

Known Unknowns	Unknown unknowns

"Real knowledge is to know the extent of one's ignorance (Confucius)."

Agenda

October 3

11:30 a.m.-1:00 p.m.: Lunch, welcome, and conference overview

Presented by conference co-chairs: Bernie Hubbard and Terry Sharik

1:00-3:00 p.m.: Presentations by delegations from Maine and Oregon

3:00-3:30 p.m.: Break

3:30-5:30 p.m.: Presentations by delegations from North Carolina and Virginia

6:00-7:00 p.m.: Social

7:00-9:00 p.m.: Dinner

Keynote Presentation by David Shonnard

October 4

7:00-8:00 a.m.: Breakfast

8:00-10:00 a.m.: Breakout sessions around education, research, and technology

10:00-10:30 a.m.: Break

10:30-noon: Reporting on breakouts

Noon-1:00 p.m.: Lunch

1:00-3:00 p.m.: Strategies and assignments for moving forward

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Michigan Biomaterials, MI SAF Conference Worksheet, October 3-4, 2013

Educational Process*

Learning Objectives/ Outcomes	2-yr	4-yr	Graduate	Continuing
Knowledge				
Skills/Abilities				
Behaviors				

*rate the importance of each objective/outcome by level of education on a scale of 1-5, where 1 is of lowest importance

Research

Technology

Alternatives to the name "Biomaterials":

Ecosystem Materials
Ecomaterials
Sustainable Biomaterials
Forest Biomaterials
Ecosystem Products
Bio-based Products
Bioproducts
Sustainable Natural Products
Forest Products
Ecosystem Provisioning Services
Sustainable Natural Resources
Others?....

Soft Skills Clusters

Communication Skills:

- Listen effectively
- Communicate accurately and concisely
- Effective oral communication
- Communicate pleasantly and professionally
- Effective written communications
- Ask good questions
- Communicate appropriately and professionally using social media

Decision Making/Problem Solving:

- Identify and analyze problems
- Take effective and appropriate action
- Realize the effect of decisions
- Creative and innovative solutions
- Transfer knowledge from one situation to another
- Engage in life-long learning
- Think abstractly about problems

Self-Management Skills:

- Efficient and effective work habits
- Self-starting
- Well-developed ethic, integrity and loyalty
- Sense of urgency to address and complete tasks
- Work well under pressure
- Adapt and apply appropriate technology
- Dedication to continued professional development

Teamwork Skills:

- Productive as a team member
- Positive and encouraging attitude
- Punctual and meets deadlines
- Maintains accountability to the team
- Work with multiple approaches
- Aware and sensitive to diversity
- Share ideas to multiple audiences

Professionalism Skills:

- Effective relationships with customers, businesses and te public
- Accept and apply critique and direction in the work place
- Trustworthy with sensitive information
- Understand their role and realistic career expectations
- Deal effectively with ambiguity
- Maintain appropriate décor and demeanor
- Select appropriate mentor and acceptance of advice

Experiences:

- Related work or internship experiences
- Teamwork experiences
- Leadership experiences
- Project management experiences
- Cross disciplinary experiences
- Community engagement experiences
- International experiences

Leadership Skills:

- See the “big picture” and think strategically
- Recognize when to lead and when to follow
- Respect and acknowledge contributions from others
- Recognize and deal constructively with conflict
- Build professional relationships
- Motivate and lead others
- Recognize change is needed and lead the change effort

Contact Information

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