WHAT IS THE FOREST BIOECONOMY?

What is a Bioeconomy?

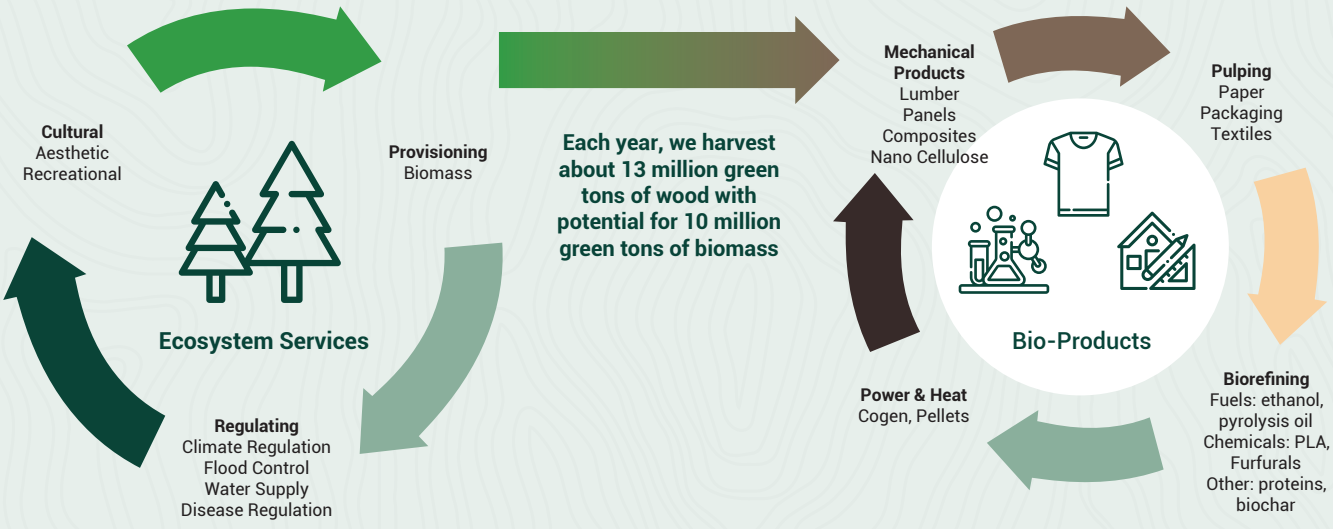
The bioeconomy uses renewable biological resources from land and sea—such as fish, forests, and micro-organisms—to produce energy, food, and value-added materials.

A **forest bioeconomy** encompasses traditional sectors such as forestry, paper and wood products, as well as new emerging industries such as textiles, chemicals, new packaging and building products, biopharma, and services related to these products—and forest services spanning recreation, hunting, tourism, carbon storage, biodiversity. A circular bioeconomy maintains the value of products, materials, and resources as long as possible, and minimizes generation of waste—while sustainably managing forests.

In the last decade, the bioeconomy has taken on a much larger role, with strategies and policies designed around the world to support its development. At the beginning of 2018, a quarter of the world's countries (49) were pursuing bioeconomy development in their policy strategies. The most significant emerging wood-based product markets are in construction, textile, chemical, and biofuel industries, and a number of small upstream niche markets such as cosmetics, food additives, and pharmaceuticals. Industry boundaries are flexible, as chemical, energy, and forest industries use some of the same feedstocks and develop products for the same markets.

Hetemäki, L. and Hurmekowski, E. (2020). Forest bioeconomy development: markets and industry structures. In The Wicked Problem of Forest Policy (edited by William Nikolakis and John Innes), Cambridge University Press (forthcoming).

Maine's Forest Bioeconomy



Maine's Transition to a Forest Bioeconomy

Maine is 90% covered by one of the most advanced, productive, and sustainable resource imaginable: the forest—the highest percentage of any state.

Maine's forests grow naturally, sequestering carbon, and provide habitat for wildlife, and recreation for residents and tourists. Forests provide a critical anchor for the state's economy. Forest outputs can be made into a staggering array of advanced and eco-friendly products. In a world that is seeking renewable resources to replace petroleum-based products, Maine has an abundance of forests, and the technology to convert them into environmentally responsible alternatives.

Today, technology, globalization, and shifting consumer demands are bringing change and new opportunities to Maine's traditional forest economy. While some markets have declined, the forest products sector remains a critical component of Maine's economy. But, like all manufacturing businesses, production has shifted to higher-demand products, and even newer products are on the horizon. A changing climate, and the need for new, more efficient technologies offers tremendous opportunities for Maine's wood products sector.

In response, we are building the next generation of the great Maine forest bioeconomy. To nurture this bioeconomy, we celebrate the many values of forests and sustainably manage them for the future. We are finding value in every part of the tree, reducing waste and reliance on fossil fuels, and contributing to climate and environmental protection. Woody biomass from forest residuals are the most abundant and promising raw material for biobased manufacturing right now.[1]

From cross-laminated timber, a substitute for carbon-intensive steel, to bio-fuels to wood-based insulation products, Maine is poised to be a leader in innovative forest products spanning construction, biochemicals and biofuels, and biomaterials, in addition to updated applications in paper and packaging. Maine has the opportunity to meet the significant consumer demand on the eastern seaboard, all within a day's drive of our state.

Maine forests have the attributes that businesses and investors seek in renewable forest endeavors:

- **Largest contiguous privately-owned working forest in the US: 16.3 million acres**
- **More than 50% certified sustainable**
- **Strong supply of moderately priced softwood raw material**
- **Well-established forest industry infrastructure that can sustainably produce 13 million tons of wood per year**
- **Leading world-class forestry school and forest products R&D facilities: University of Maine**
- **Highly experienced workforce trained in pulp and paper industry and advanced manufacturing transferable to biobased manufacturing**
- **Proximity to the largest consumer market in the world: US eastern seaboard**
- **Deepwater ports offer direct shipping to Europe and around the world**
- **Thriving tourism, hospitality, and outdoor recreation sectors**

[1] Biobased Maine and Environmental Health Strategy Center (2020). Plants to Products: Renewable Materials Manufacturing—A Maine Pathway to Prosperity.

CURRENT & EMERGING WOOD PRODUCTS

SAWN TIMBER

Sawn Timber will continue to be a critical component of Maine's forest economy. Demand in the US is largely driven by the number of housing starts, which is expected to continue to strengthen. Lumber is the foundation of forest land ownership and the final product of long-term forest management.

PULP AND PAPER MANUFACTURING

Pulp and Paper Manufacturing continues to be the leader in contributing to Maine's forest economy. Maine's paper mills are shifting production away from print media and into tissue, labeling and packaging grades of paper.

ORIENTATED STRAND BOARD (OSB)

Orientated Strand Board (OSB) is an alternative to plywood. It is used extensively as a structural panel in construction. This technology is produced by two major facilities in Maine.

LAMINATED VENEER LUMBER (LVL)

Laminated Veneer Lumber (LVL) is an engineered wood product used in residential construction that uses layers of dried wood veneer. No manufacturing currently exists in Maine.

MEDIUM DENSITY FIBERBOARD (MDF)

Medium Density Fiberboard (MDF) is a reconstituted wood-based panel product, manufactured from pulpwood and sawmill residues. Over the past 20 years, laminate flooring and modern furniture has become a major end use for MDF. No manufacturing capacity exists in Maine.

Current Wood Products

CROSS-LAMINATED TIMBER

Cross-laminated Timber is an engineered wood product that is especially well-suited for buildings between 6-18 stories tall. It is very early in the growth curve in North America and rapid growth is expected. Two CLT facilities have announced they will be opening in Maine.

CELLULOSIC SUGARS

Cellulosic sugars are a platform chemical for bioplastics such as Polylactic acid, Lactic acids which can be used as a preservative in food and beverages, and Succinic acid which is used in resins and coatings.Cellulosicsugars are a platform chemical for bioplastics such as Polylactic acid, Lactic acids which can be used as a preservative in food and beverages, and Succinic acid which is used in resins and coatings.

NANOCELLULOSE

Nanocellulose consists of incredibly light and strong fibers that can be used in a variety of applications, from coatings for packaging papers to high performance textiles and medical products. The University of Maine is a global leader in the R&D of nanocellulose applications.

PYROLYSIS OIL

Pyrolysis oil is a liquid fuel produced from wood, that can be used in heat and power production to substitute for fossil-based-oil.

DISSOLVING PULP

Dissolving Pulp can be made into textiles (Viscose) and competes with cotton and synthetics (nylon and acrylic). There are no facilities with this capability currently in Maine.

INSULATING WOOD FIBER

Insulating wood fiber composites is an alternative wood based insulating product for homes.

Emerging Wood Products

PRODUCTS WITH WOOD INPUTS

RECREATION

CONSTRUCTION

TEXTILES

INDUSTRIAL

FOOD SUPPLY

TRANSPORTATION

HEALTH & HYGENE

COMMUNICATIONS

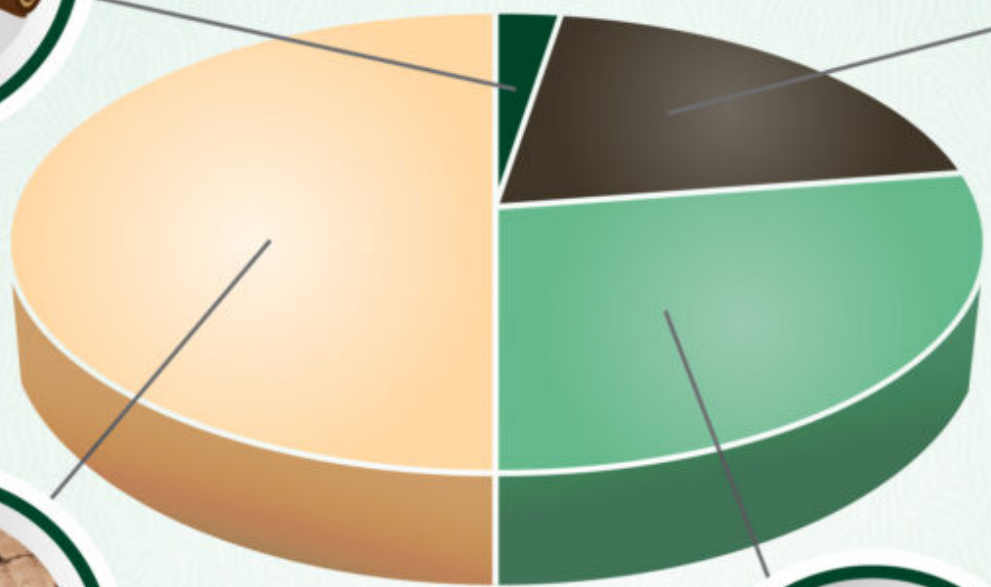
HOUSEHOLD CARE

1. **TREE TRUNKS**: Saw Logs
2. **WOOD CHIPS**: Pulp & Paper
3. **BIOMASS, BARK AND OTHER WOOD RESIDUES**: Wood Derived Chemicals

HARVESTED WOOD PRODUCTS (13M TONS/YEAR)

FIREWOOD/PELLETS

2.5%



BIOMASS

20%

PULPWOOD

50%

SAWLOGS

27.5%

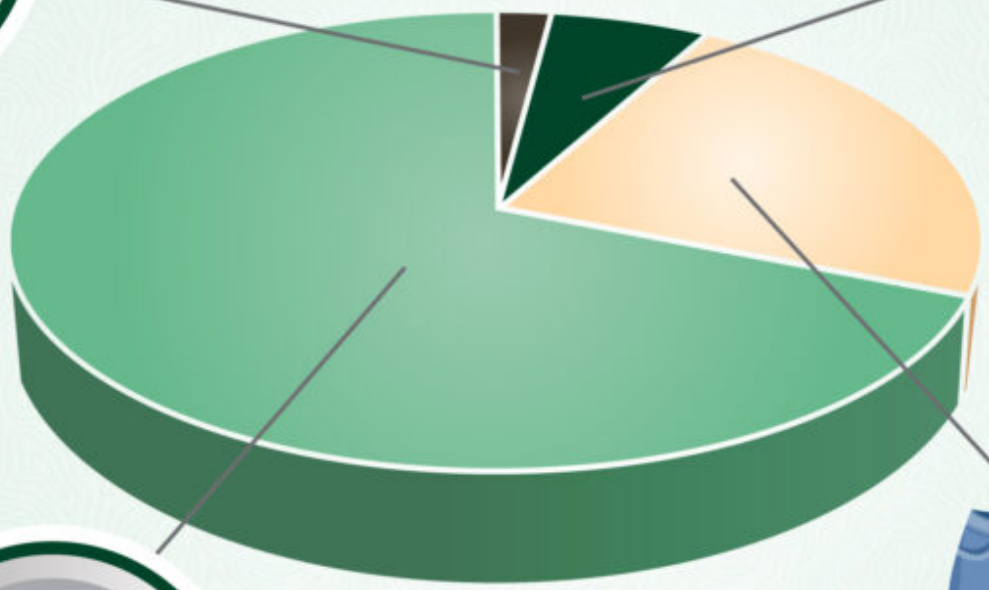
WOOD PRODUCTS REVENUE ($8.5B PER YEAR)

BIOMASS

2%

HARVESTING

6%



PULP & PAPER PRODUCTS

69%

SAWMILLS & WOOD PRODUCTS

23%