



FOREST BIOPRODUCTS: TOWARD A DIVERSIFIED CANADIAN FOREST BIOECONOMY

What is a bioeconomy?

A bioeconomy is based on the use of renewable biological resources and bioprocesses for more sustainable and eco-efficient manufacturing of goods. These goods are often referred to as bioproducts. The contribution of novel bioproducts and bioprocesses to the bioeconomy is being seriously explored as a source of commercial diversification in Canada.

It is believed that the forest bioeconomy will one day be as important as the conventional forest economy in Canada, which consists of conventional forest products such as lumber, fibreboard, particleboard, and pulp and paper. Canada's trade balance in 2005 was \$55 billion for the conventional forest sector.

Multiple benefits of the forest

Forest ecosystems provide an array of goods and services. In addition to the conventional forest products, up to 500 forest bioproducts are in commercial use today. The importance of the forest bioproduct industry is difficult to evaluate because Statistics Canada does not specifically track these products. It is estimated that forest bioproducts contribute close to \$1 billion to Canada's economy. These bioproducts represent a marginal forest industry but provide income for many forest-dependent and remote communities. Gathering reliable bioproducts data would allow the industry to evaluate whether the resource is being used sustainably, develop appropriate guidelines for sustainable harvesting and biodiversity conservation, and evaluate the success of measures used to stimulate this sector of the economy.

As Canada's greatest source of renewable biomass, forests could become one of the pillars of the bioeconomy, along with the agricultural sector.

Forest bioproducts include non-timber forest products (NTFPs). NTFPs are defined as any items from biological sources in the forest other than timber that usually do not require much processing. NTFPs include an array of products, such as medicinal herbs, edible mushrooms, berries, maple products, nuts, essential oils, cones and bark.

Forest bioproducts may be sourced from dedicated purpose-grown biomass, woodland collecting on a renewable basis or waste produced by the conventional forest sector. Bioproducts manufactured from dedicated species include textile, fibres, polymers, adhesives, bio-insecticides, antibiotics, plant-derived pharmaceuticals, nutraceuticals, biochemicals and industrial microbial enzymes. Forest wastes, such as sawdust, pulping liquors, paper mill sludge, forest harvesting and processing residues, can be converted into alternative fuels and value-added products, such as ethanol, artificial flavours, fertilizers and methane gas. The use of forestry products and/or waste to increase the amount of energy, biofuels and industrial products lessens our dependence on fossil fuels and reduces net emissions of greenhouse gases and persistent toxic substances, thereby improving environmental and human health.

Forest bioproducts and bioprocesses at the Canadian Forest Service

Natural Resources Canada's Canadian Forest Service (CFS) is active in the development of forest bioproducts and bioprocesses. The CFS has the mandate to promote the sustainable development of Canada's forests and the competitiveness of the Canadian forest sector. The CFS is facilitating this transformation to the bioeconomy by:

- Increasing public awareness of bioproducts
- Carrying out research
- Fostering multi-stakeholder networks to promote bioproducts and bioprocesses
- Increasing the profile of Canada's forest sector internationally
- Ensuring that Government of Canada policies work to ensure productive, sustainable and healthy forests together with the development of a productive industry





Through research and development of innovative practices and technologies, the CFS plays a central role in the sustainable development and multiple uses of our forests. Its scientists generate knowledge on forest bioproducts and bioprocesses and support development of the sector through in-house research and partnerships with universities, provinces, territories, the forestry sector, non-governmental organizations and other research organizations. Together with its partners, the CFS is involved in the following activities:

Inventory and assessment of forest resources

- Selection and management of yew cultivars for optimal production of taxanes, which are anti-cancer biochemicals
- Development of basic knowledge of the genetics, ecology, physiology, pathology, productivity and management of key NTFP species
- Identification of habitat requirements for key species
- Evaluation of the potential of woody species for
 - biomass production on contaminated and/or marginal sites
 - short-rotation intensively-cultured plantations
- Assessment of the suitability and availability of woody waste for the production of biofuels, value-added biochemicals and fertilizers

Sustainable management practices

- Development of compatible management options to increase productivity of both timber and non-timber resources
- Development of criteria and indicators to assess environmental impacts of increased biomass removal from forest sites
- Development of propagation methods for commercially important North, Central and South American timber and non-timber species

New bioproducts and bioprocesses

- Development of bioproducts
 - Environmentally acceptable forest pest control products
 - Biochemicals for nutrition, natural health care and drug discovery
 - Essential oils
- Development of bioprocesses
 - Methods to increase *in vivo* production of phytochemicals
 - Thermal extraction technology to isolate phytochemicals from bark, branches and foliage

Public outreach

- Publication of *Bioproducts From Canada's Forests: New Partnerships in the Bioeconomy*, S. Wetzel et al. 2006, Springer, Dordrecht
- Formation of the Canada Yew Association
- Development of the Non-Timber Forest Products Network of Canada (ntfpnetwork.ca)
- Development of an interactive tool for the identification of forest mushrooms

For more information about the Canadian Forest Service activities regarding forest bioproducts, please visit cfs.nrcan.gc.ca.

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