

Wood-based materials in circular economy

Examples from Finland

July 12, 2019

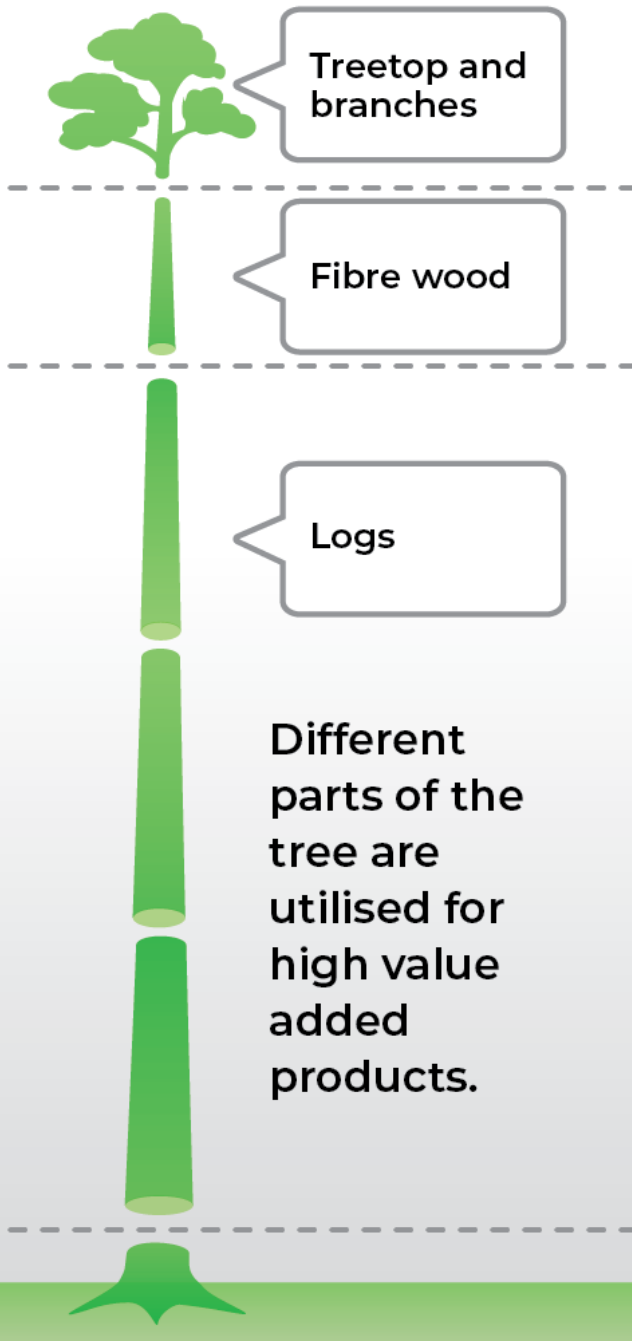


Effective and resource-wise use of raw materials & side streams



- Circular economy is an economic system aimed at minimizing waste and making the most of resources.
- In the circular economy, raw materials are kept as long as possible in various value chains and products.
- Wood retains its value best in long-lasting wood products. Paper and packaging materials replacing plastic also remain long in the value chain thanks to recycling.
- In Finland the well-functioning wood market steer different parts of trees to various uses.
- The development of spatial data and digital services promote the effective and resource-wise use of raw materials and side streams.





Effective and resource-wise use of raw materials & side streams

- In Finland target is to ensure that subsidies and other incentives do not distort the functioning of the wood market.
 - The objective is to utilise the different parts of wood in high added value products.
 - In Finland subsidies and other incentives are not used to channel wood or parts of wood suitable for processing into energy production through subsidies. The parts of wood that cannot be cost-effectively processed into other products are channelled into energy production.
- In addition to customary products, wood and by-products of wood processing provide components for numerous products:
 - Wood and by-products of wood processing are utilised in the production of chemicals, cosmetics, transportation fuels, medicines, smart packaging, coatings, adhesives, plastics, composites, animal feeds and functional foods and in fabric fibres.

Efficient use of side streams and residues of pulp and paper industry

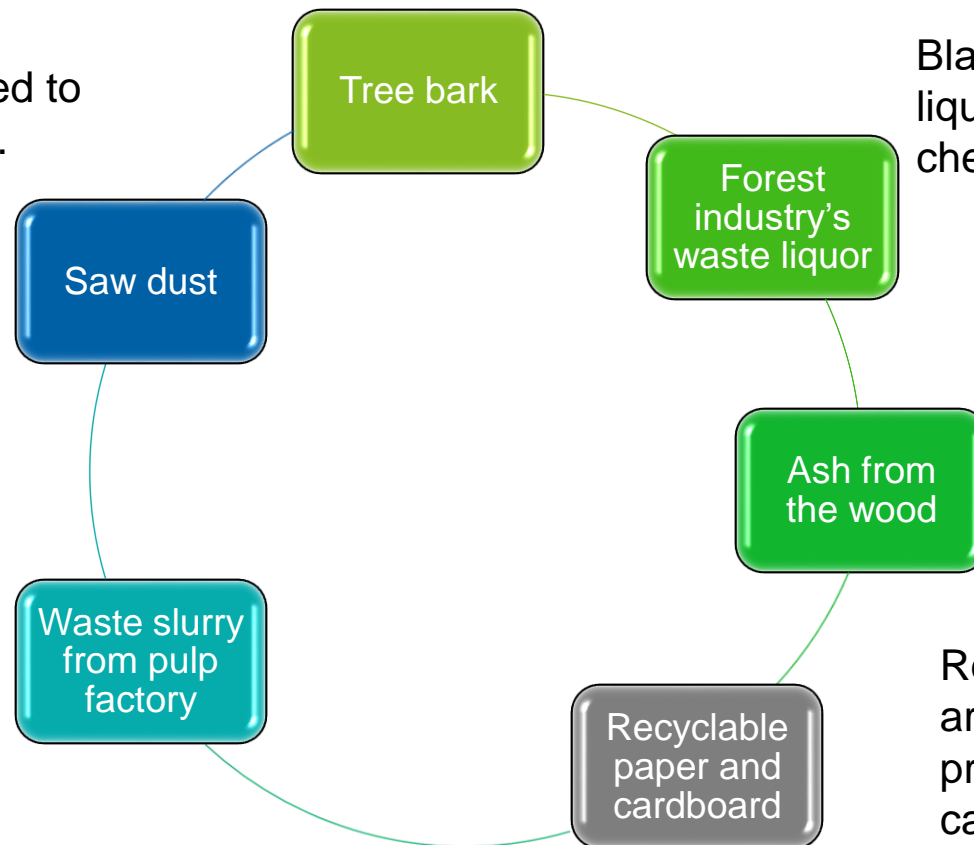


Tree bark can be used as an alternative for poisonous phenolic compounds used, for example, in glues.

Saw dust can be used to produce composites.

Saw dust, bark and the waste liquors from the pulp industry can be used to produce electricity and heat or to process transportation biofuels or saw dust into pellets.

Waste slurry from pulp and paper factories can be used to produce soil improvers and fertilisers.



Black liquor and the forest industry's waste liquor can be utilised in the preparation of chemicals and biofuels for transportation.

The ash from the wood fuel created during energy production can be utilised as fertiliser and in earthworks.

Recyclable paper and cardboard are recycled and utilised in the production of new paper and cardboard.

By-products of wood processing as raw materials



Photo: Stora Enso

- Efficient utilisation of wood raw material is a vital element of the strategy of the Finnish forest industry.
- Several by-products and residues are produced in connection with pulp and paper production.
- Examples of utilising various waste liquors and sludges in the forest industry:
 - Electricity and heat are produced from black liquor.
 - Waste sludges from pulp production can be used as soil improvers.
 - Soda sediment and ash from pulp mills can be used to replace cement in concrete.
- The utilisation of lignin, that is, the binding agent of wood fibres, is expanding.
 - Lignin is usually burnt with black liquor into energy in the pulp mill.
 - New technologies are expected to open doors to lignin use in the production of carbon fibre composites, for example. They can be used in the automobile and aircraft industries.
 - In the future, lignin can perhaps be processed into a liquid fuel, technical coal, active coal or bioplastic.



Photo: Erkki Oksanen



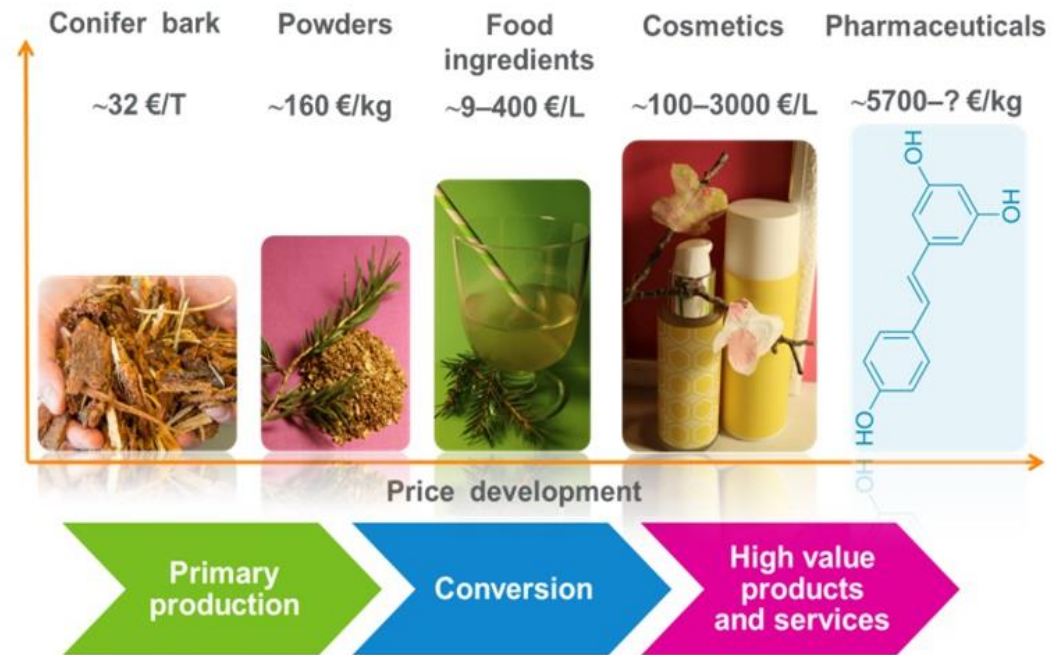
Photo: Stora Enso

By-products of wood processing as raw materials

- Raw materials can be derived from **wood bark** for the pharmaceutical, cosmetic and food industries.
- Around 10 per cent of the wood is bark. About three million tonnes of bark from coniferous wood are derived yearly as by-products of the forest industry in Finland. So far, the most typical use is burning into energy.
- Chipboards and composites are produced from sawdust. **Sawdust** is also utilised in pulp production.
- Sawdust is also a raw material for energy production; it is used to produce pellets, briquettes and transport biofuels or burnt directly in electricity and heat production.



Coniferous wood bark is a storehouse of useful substances



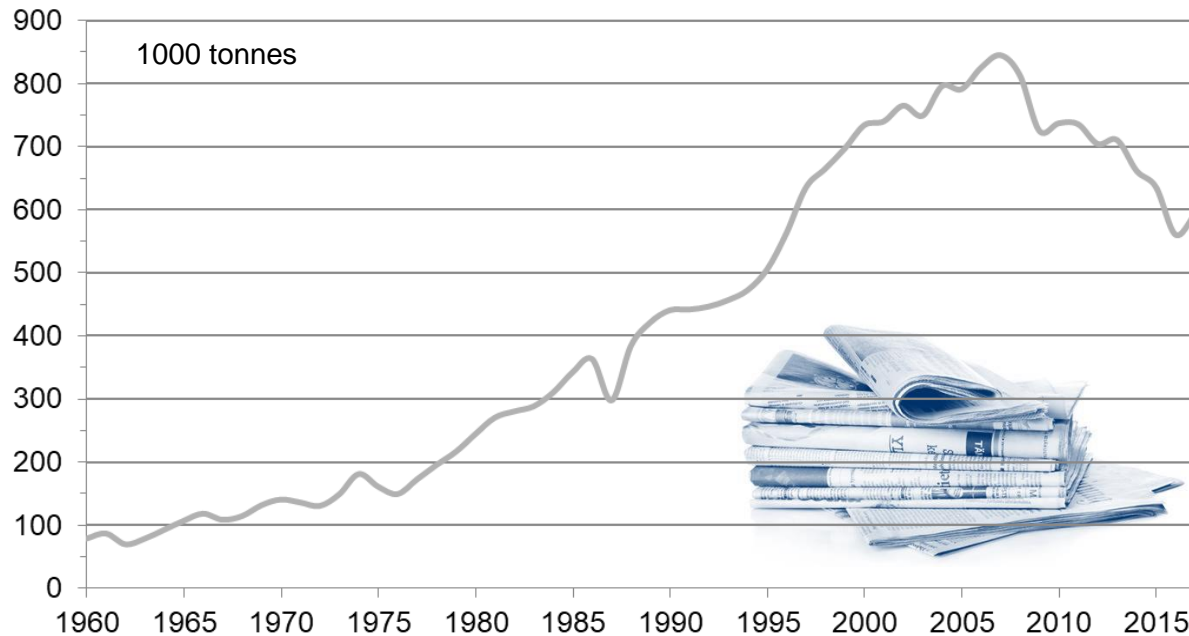
- Coniferous wood bark contains antimicrobial and antioxidative compounds that improve storage life.
- Source materials for pharmaceuticals and compounds that improve the taste of foodstuffs can be extracted from bark.
- Antioxidants are especially plentiful in the barks of trees grown under extreme conditions in Northern Finland.
- <https://www.luke.fi/en/tree-bark-a-treasure-chest-of-useful-materials/>

Recycling is an important part of bioeconomy and circular economy



- Recycling of the end products of the wood processing industry is efficient in Finland.
- The EU sets recycling objectives in the Waste Framework and Packaging Waste Directives:
 - The primary objective of the waste hierarchy is to prevent waste generation, after that to prepare for waste reuse and recycling.
 - The EU's Waste Framework Directive sets recycling targets for the years 2020, 2025 and 2030. They concern municipal waste and packaging waste (plastic, wood, glass, paper/cardboard, aluminium, ferrous metal)
- Applications of recycled wood-based products:
 - Cardboard and paperboard end up as raw materials for core board, for example.
 - Recovered paper is used as a raw material in the manufacturing of newsprint and soft tissue papers.
 - Waste wood, such as buildings' wood waste and broken pallets are mainly utilised as energy.
- The EU's Waste Framework Directive tightened the recycling targets of pallets
 - According to the EU's Waste Framework Directive, 25 per cent of wood packaging must be recycled in 2025 and 30 per cent in 2030. The present recycling rate in Finland is 15 per cent.
 - Wood packaging refers to such as wooden pallets. Repairs of pallets can be counted in the recycling target.

Most of paper and cardboard is recycled in Finland



Development of collecting reclaimed paper 1960-2017,
1000 tonnes

Source: Metsäeollisuus ry

- Recovered paper is an important raw material for papermaking. Wood fibre can be recycled from five to seven times. After that, the fibre quality, such as its firmness weakens.
- Eighty-five per cent of paper and cardboard consumed in Finland are recovered.
- Around 600,000 tonnes of recovered paper are generated annually in Finland, which covers about five per cent of the raw material need of the paper industry.
- Not all paper types can be recycled. Such papers are cigarette paper, wallpapers, books and hygiene papers. These papers are estimated to make up about one-fifth of paper consumption.



New paperboard, cardboard and core board from recovered cardboard

New life for corrugated cardboard

LAMINATED PAPERS



RAW MATERIALS FOR
CORRUGATED CARDBOARD



VARIOUS TYPES
OF CORES



BIOBASED BAGS



Aaltopahvi

- Applications of recovered cardboard include raw materials for corrugated cardboard, packaging board, envelopes, laminated papers and core board.
- Cores used in paper and fabric rolls are produced from core board.



Photo: Kotkamills



Photo: DS Smith



Photo: VTT

Wood-based materials can replace plastic

- Wood-based materials can be utilised to replace plastics made from fossil fuels.
 - Bio-based and biodegradable plastics are made from cellulose or side streams of forest industry.
- Wood-based packaging material, like cardboard, to replace plastic packages.
- EU Plastics Strategy aims to decrease the negative environmental effects of plastics.



Textiles are manufactured from wood and recycled materials



Photo: Juhani Kandell/Office of the President of the Republic of Finland



Photo: Saku Ruusila

- By-products of the forest industry and recovered paper can also be utilised in the manufacturing of textiles.
- In the last few years, several innovations have been made in Finland for textiles produced from wood fibres.
- Textiles based on wood fibres can replace cotton.



Photo: Erkki Oksanen



Photo: Metsähallitus

Electricity and heat from side streams and residues



- Various wood processing residues, such as bark, sawdust, industrial wood residue chips and black liquor from pulp manufacturing are utilised as energy.
- Treetops, branches, stems and stumps collected in connection with forest management work and felling can be chipped and used as energy sources.
- Over one quarter of Finland's energy production is based on wood fuels.
 - The most important wood fuels in Finland are black liquor, bark and sawdust.
 - In Finland, it is a key policy principle that wood suitable for processing is not channelled with subsidies and other incentives into energy production.



Wood-based biofuels for transport



Photo: Tiina Somerpuro

- Forest industry residues and various by-products can be used to manufacture biofuels for transport.
- Several production technologies are in use and under development in Finland.
- Transport biofuels produced from forest biomass or based on wood raw material are included in advanced biofuels because they do not compete with food production.
 - The EU directive on renewable energy sources (RED II) sets a sub-objective for advanced transport biofuels.
- All transport liquid fuels distributed in Finland contain bio-components.
 - The national target set in Finland is to raise the share of transport biofuels to 30 per cent by 2030.



Wood ash is used as fertiliser

- In Finland, more than 1.3 million tonnes of ash are generated in energy production yearly:
 - Over 200,000 tonnes of wood ash is produced per year. Mixed ash of peat and wood amounts to more than 100,000 tonnes per year.
- So far, over 15 per cent of so-called bio ashes from burning of wood and peat have been used in fertilisation annually.
- In forest fertilisation, wood ash has been utilised particularly in peatlands. Wood ash could also be potentially used as a fertiliser on mineral soils:
 - Using ash on mineral soils requires addition of nitrogen.
 - With modern technologies, it is also possible to granulate ash so it can be spread from the air as well. Loose ash hardens by itself so it is possible to spread it with earth spreading equipment.
 - As the use of other fertilisers, in Finland the fertiliser use of ash is regulated with the Decree on Fertiliser Products.



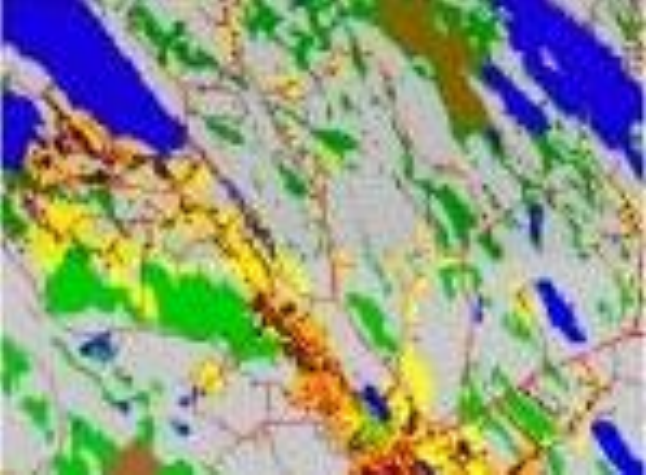


Wood ash can be used in road construction



Photos: Samuli Joensuu

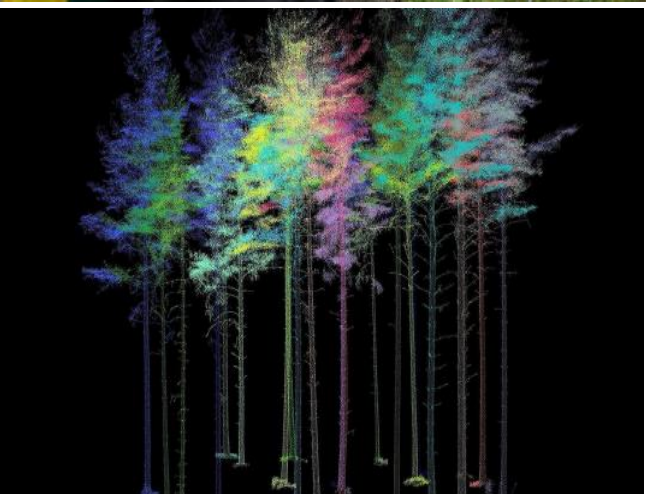
- Ash can be utilised in road construction, field structures, embankments and foundation structures of industrial and warehouse buildings.
- The utilisation of ash in constructing forest and private roads was made easier at the beginning of 2018.
- From the beginning of 2018, the Government Decree on the Recovery of Certain Wastes in Earth Construction included the possibility to utilise ash in forest and private roads without an environmental permit.
- To advance the use of wood ash it is vital to develop further the sorting of different ash fractions for various purposes at a very early stage at source.



Development of spatial data and digital services also advances bioeconomy and circular economy



- The location-specific knowledge base enables sustainable utilisation of renewable natural resources, side streams of production and recycled materials.
- Digital services are built around spatial data. New services boost the activity of markets and channelling of raw materials into the needs of the circular economy.
- In Finland the volume of growing stock and state of forests have been monitored in Finland since the 1920s.
 - National forest inventory is a monitoring system that produces information concerning national and regional forest resources - volume, growth and quality of growing stock. It also provides information e.g. on forest health, biodiversity of forests and forest carbon stocks and their changes





Ministry of Agriculture and Forestry of Finland