



Circular Bioeconomy in Washington State

Vancouver
December, 2021

Agenda

A Executive Summary and industry snapshot

B Opportunities

B1 Thinning equipment

B2 Wood construction

B3 Sawmill technology

B4 Biofuels

B5 Refined wood-based materials

C Appendices

A Executive summary

Key takeaways from the study of Circular Bioeconomy in Washington state

1 The forestry industry is in the transition
Washington state has set goals to become more sustainable and reduce carbon emissions. The state has set several policies to support the transition, and many of them are related to the better utilization of wood-based biomass.

- The forestry industry in WA has experienced many challenges, such as wildfires and increasing pressure to protect old-growth forests. Currently, the forests grow faster than they are harvested. The sub-optimal way of managing the forests and limited suitable end-uses for wood biomass have been limiting factors for higher harvesting volumes.
- The state has set new regulations and allowed taller mass-timber construction projects to become greener. The mass-timber construction is going to support many parts of the wood product value chain, including but not limited to: selective harvesting, small diameter tree sawmilling, CLT, and glulam production.
- Also, the plastic bag ban is supporting the R&D and commercialization of forestry feedstock-based bioplastics.

2 Solutions and collaboration opportunities
As the mass-timber industry develops, harvesting and sawmilling technology will be in demand. WA has lots of R&D activities, e.g., in biofuels, bioplastics, wood construction which provide opportunities for different types of collaboration

- The forestry industry needs to invest in new equipment, machines, software, and training to conduct commercial thinning and fuel treatment economically and ecologically.
- Finland has a strong offering in advanced sawmilling equipment, great for small-diameter trees. The sawmilling industry will be cutting more small diameter trees due to the increasing volume of mass-timber construction.
- Washington has a strong mass-timber community driving the digitalization of wood construction. Having an active role in the community could open doors to various opportunities in the mass-timber construction industry in the U.S.
- Washington State University and Center for Bioplastics and Biocomposites have strong research which could create opportunities for collaboration

3 Methodology of the research
Industry experts validated the finding of this market research study.

- This market research study was done by using publicly available sources. The project group formed hypotheses based on the findings during the market research phase. The formed hypotheses were validated by experts from (Washington State University)

4 Recommendations
In this study, five business opportunities were identified.

- Finnish companies have lots of solutions to be offered to Washington state. Many industry players in the Forestry Industry are aware of the Scandinavian and Finnish solutions. Still, establishing a solid foothold requires persistent marketing and relationship building.
- Finnish organizations also have many opportunities to learn from Washington state. Various types of collaboration opportunities shouldn't be underestimated. The most promising collaboration opportunities should be mapped out together with Finnish organizations.
- The recommended next steps are to formalize offering relating to the identified opportunities and prepare delegations to start the conversations to feel out interest for collaboration.

Industry snapshot (1/2)

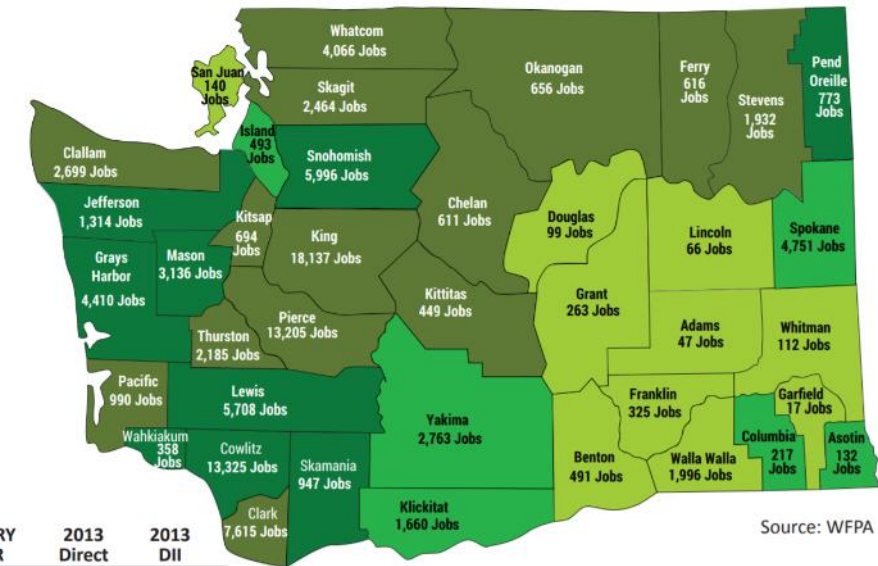
Description

Forestry

- The Pacific Northwest is one of the world's major timber producing regions in the world
- The Forest Products Industry consists of three primary forest sectors: wood manufacturing, paper manufacturing, forestry, logging and port activity.
- More than 70% of the economic activity generated by the Forest Products Industry comes from private working forests.
- About 50% of the state is forested, with 23 million acres of forestland, and 47% is working forests, and the remaining 53% of the forests are reserved for recreation.
- Federal lands dominate the state, with 44% ownership and produce just 3% of the overall statewide timber harvest
- The total volume of trees is growing 2.2 times faster than harvest, but 26% of the annual wood growth in Washington is lost each year due to mortality of trees dying because of insects, diseases, and fire.
- Washington is the 2nd largest producer of softwood lumber in the nation

PERCENTAGE OF COUNTY THAT IS FORESTLAND

<25% 25-50% 51-75% >75%



INDUSTRY SECTOR	2013 Direct	2013 DII				
Forestry & Logging	5,681	8,762	Direct, Indirect & Induced Wages	Direct	Indirect	Induced
Sawmills	13,608	38,021				
Pulp & Paper Mills	10,072	30,201	\$4,879,645,181	41,466	36,186	27,334
Furniture	4,519	8,556				
Wholesaling	5,927	13,938				
Ports	1,659	5,508				
TOTAL	41,466	104,986				

FOREST PRODUCTS SECTOR
WASHINGTON STATE DEPARTMENT OF COMMERCE

Industry snapshot (2/2)

Description

Companies

- Washington has more than 1,700 firms in: Forestry and logging, Wood products manufacturing, Paper products manufacturing, Furniture and cabinet manufacturing, Wood and paper wholesalers, Deep sea freight transportation.
- Total gross business income for the forest products industry was \$28bn in 2018, and the timber industry employed 105,000 workers garnering over \$5bn in wages.

Energy

- 73% of energy production comes from renewable sources
 - A quarter of all U.S. hydroelectric power comes from Washington state
 - The state produces twice as much energy as it consumes
- The state is working towards a 100% non-carbon emitting energy portfolio by 2045.
- Wind turbines are the second largest contributor to the state's growing renewable portfolio
- The state's Clean Energy Fund has allocated more than \$150 million in grants to organizations and researchers exploring new energy concepts and technologies.

Policies

- Washington State Dept of Natural Resources DNR Strategic Plan (2018-2021) aims to enhance economic development through forest restoration and management strategies that maintain and attract private sector investments. One of their strategic initiatives is to support innovation and investments in the forest products industry by increasing utilization of and adding value to forest health treatment by-products, such as small-diameter wood, CLT, mass-timber, biochar, biofuels, and associated products.

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B Opportunities

B1 Thinning equipment

B2 Wood construction

B3 Sawmill technology

B4 Biofuels

B5 Refined wood-based materials

C Appendices

Summary of Opportunities

Topic	Description
B1 Thinning equipment	<ul style="list-style-type: none">• The current way of managing forest (mainly clear cutting) is sub-optimal causing over-abundance of the fuels in many Washington forests, heightens wildfire risks and poses a significant threat to forest health• Pressure to protect old-growth forest increases the demand for selective harvesting• Adoption of a new type of harvesting equipment is easier to achieve because:<ul style="list-style-type: none">• Already many logging companies claim to do selective harvesting even though with sub-optimal equipment (e.g., excavators)• Most of the harvested forests are privately owned, allowing quicker adoption of smarter forest management
B2 Wood construction	<ul style="list-style-type: none">• Glulam and cross-laminated-timber construction is growing and going to replace more concrete and steel as a construction material due to its several benefits; small carbon footprint and fast construction process• Mass-timber construction is rapidly growing and providing several business opportunities along the value chain
B3 Sawmill technology	<ul style="list-style-type: none">• Washington state is the second-largest softwood lumber producer in the U.S.• More efficient sawmill technology is going to be in demand, and the growth of wood construction supports the demand for European sawmill technology optimized for small-diameter trees
B4 Biofuels	<ul style="list-style-type: none">• Washington passed a bill to reduce carbon used for transportation by 20% by 2035. The bill was passed in April 2021 at it demands the state to implement Clean Fuel Standard in 2023.• The biofuel industry is growing, and a \$600M investment is in the planning phase• Washington has the second-largest biodiesel production plant in the U.S. and two biodiesel production plants in operation
B5 Refined wood-based materials	<ul style="list-style-type: none">• WA's R&D activities in bioplastics and biocomposites are world-leading, providing fruitful opportunities for collaboration and commercialization• The single-use plastic bag ban is accelerating bioplastic R&D activities and demand for new packaging solutions• Center for Bioplastics and Biocomposites is the leading research organization in bioplastics in the U.S.• Washington State University has lots of interesting research focused on developing refined wood-based materials

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B1 Selective harvesting is going to become more common and increasing demand for advanced harvesting technology and equipment

Opportunity

- The over-abundance of the fuels in many Washington forests heightens wildfire risks and poses a significant threat to forest health
- In WA, annual logging volume is small compared to Finland, and forests are growing 2.2 times faster than they are harvested
- 80% of all harvested wood is softwood, and most of it comes from a privately owned forest located near wood processing facilities
- Many logging companies provide selective harvesting/thinning services, but the equipment they are using is not optimal
- Growth of mass-timber construction is going to support the cutting of dead or infested trees, which are typically cut by using selective harvesting method

Solutions

- Selective harvesting equipment:
 - Harvesting heads
 - Harvesting machines
 - Trailers
 - Fire suppression trailers
 - Fire suppression chemicals

B1 The over-abundance of the fuels in many Washington forests heightens wildfire risks and poses a significant threat to forest health

Topic	Description
Trends	<ul style="list-style-type: none"> Washington's forests face the challenges of a changing climate, the risk of forest fires, and the prevalence of forest pests and diseases increase. The risks are magnified because forest management and fire suppression practices of the past have drastically altered historical fire patterns and forest growth, allowing large volumes of standing and down wood to build in WA's forests. The over-abundance of the fuels in many Washington forests heightens wildfire risks and poses a significant threat to forest health.
Forest ownership	<ul style="list-style-type: none"> Washington's total land area is 42.5 million acres, and 52% is forested. Nearly 36% of the forest land is privately owned, and the government owns 64%. <ul style="list-style-type: none"> 21% of private forestland is owned by private industrial landowners¹ and 15% by non-industrial private landowners 4 million acres of forestland are privately owned and the member companies of the Washington Forest Protection Association (WFPA). These private forests are described as "working forests" because they produce a continuous supply of trees for the many wood, paper, and pulp-based products. About 60% (4.6 million acres) of WA's private forestland can be classified as being managed by "industrial private forest landowners." About 40% (3.2 million acres) consists of small family tree farmers and private individuals owning less than 10,000 acres per owner. Nearly 70% of the timber harvest in Washington state comes from privately owned forests. Washington is the second-largest lumber producer in the nation, supporting more than 101,000 jobs in WA.

GOAL	C4	A reduction in the risk of wildfire to lives, communities, property, ecosystems, and working forests.
STRATEGIES	C 4.1	Communicate relevant and timely information about wildfire risk to landowners, policy makers and the public, and assist communities in planning for future wildland fire events.
	C 4.2	Support Fire-Adapted Communities and landowner assistance programs that provide resources to coordinate risk reduction activities including defensible space near homes and structures.
	C 4.3	Conduct fuels reduction treatments, including mechanical and prescribed fire treatments, in the Wildland Urban Interface (WUI) to increase firefighter and public safety and protect communities.
	C 4.4	Adopt and utilize risk-based tools to inform wildland fire management decisions in order to reduce the risk to life, property, and landscapes.
	C 4.5	Work with local governments to engage and educate the public on the risks of living in the Wildland Urban Interface (WUI).

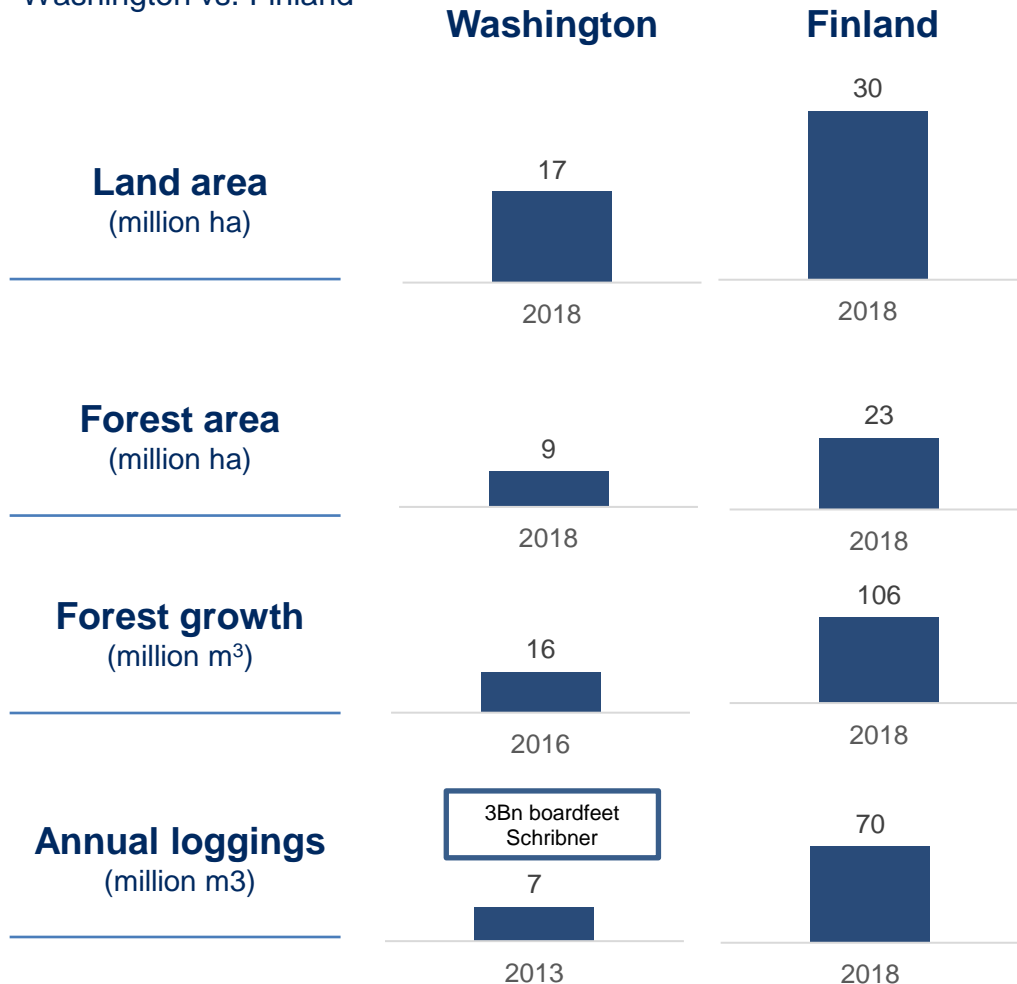
Strategic Plan 2018-2021 of Washington State
Dept. of Natural Resources

¹ Industrial private landowners include private land, which has a primary purpose of producing timber products for profit and per owner is 10,000 acres or more of forestland.

B1 In WA annual logging volume is small compared to Finland and forests are growing 2.2 times faster than they are harvested

Forestry industry comparison

Washington vs. Finland



Key insights

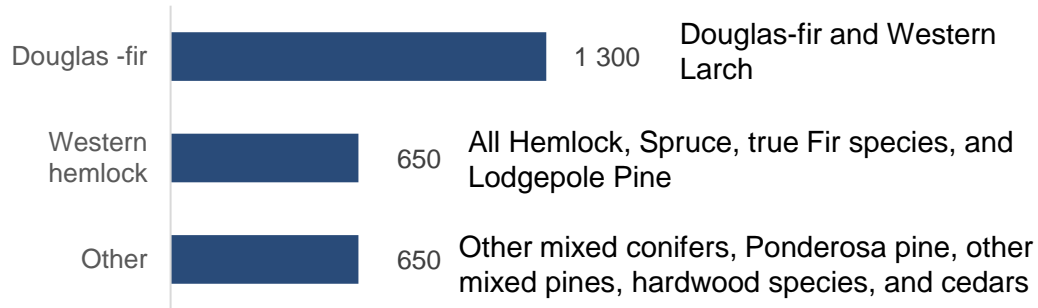
- Forest are growing 2.2 faster than the current harvesting volume
- The major species were Douglas-fir (60 percent) and hemlock (25 percent). Other species include conifers (spruce, true firs, Ponderosa pine, and lodgepole pine) and hardwoods (red alder).

B1 80% of all harvested wood is softwood and most of it comes from privately owned forest located near wood processing facilities

Timber harvest by wood species in Washington State

Million board feet, 2016

- Most timber harvested in the state belongs to two species: Douglas-fir and Western hemlock.
- More than 80 percent of all harvested wood is softwood



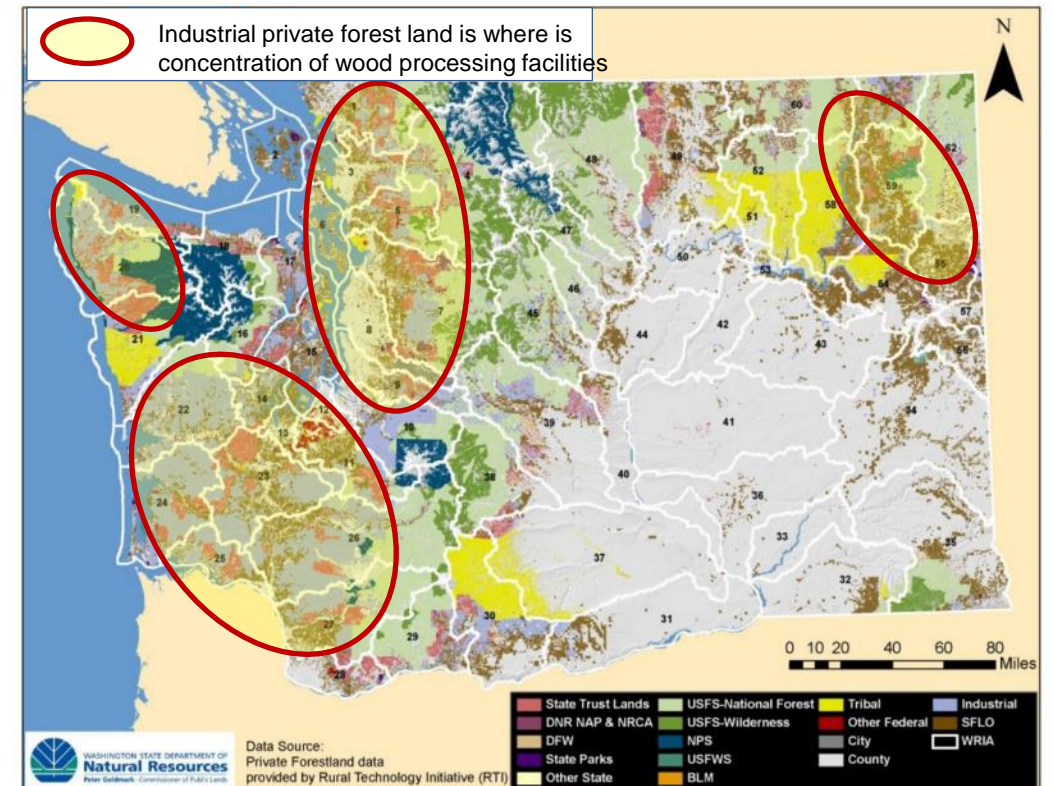
7 common wood species in WA









Source: <https://www.wfpa.org/sustainable-forestry/tree-species/>
https://www.dnr.wa.gov/publications/psl_ts_sep21_logprices.pdf

Map of timber harvest land in Washington State




- Western Washington's 19 counties contributed 2.3 billion board feet, around 85% of the total timber harvested in the state.
- Most of the mills are located where the industrial private forest landowners manage the forests.
- Nearly 70% of the timber harvest in Washington state comes from privately owned forests.



B1 Many logging companies provide selective harvesting/thinning services (1/2)

	Company name	HQ location	Services	Thinning	Employees	Website
	B&M Logging Inc	<ul style="list-style-type: none"> Chehalis, WA 	<ul style="list-style-type: none"> Cut, process, and haul 	<ul style="list-style-type: none"> N.a. 	<ul style="list-style-type: none"> 70+ 	<ul style="list-style-type: none"> bmlog.org
	C & C Logging	<ul style="list-style-type: none"> Kelso, WA 	<ul style="list-style-type: none"> Contract logging, cut to length, cable logging, cutting, heavy transport 	<ul style="list-style-type: none"> N.a. 	<ul style="list-style-type: none"> 100+ 	<ul style="list-style-type: none"> candclogging.com
	Carlson & Sons Logging Inc.	<ul style="list-style-type: none"> Cathlamet, WA 	<ul style="list-style-type: none"> Clear cutting, thinning, logging 	<ul style="list-style-type: none"> YES 	<ul style="list-style-type: none"> N.a. 	<ul style="list-style-type: none"> clearcuttinginlongviewwa.com
Gamble Bay Timber & Contruction, Inc.	Gamble Bay Timber & Contruction, Inc.	<ul style="list-style-type: none"> Port Gamble, WA 	<ul style="list-style-type: none"> Thinning, selective harvesting, regeneration harvest, tree planting, road building 	<ul style="list-style-type: none"> YES 	<ul style="list-style-type: none"> N.a. 	<ul style="list-style-type: none"> gamblebaytimber.com
	Gibson & Son Road Building Inc.	<ul style="list-style-type: none"> Ellensburg, WA 	<ul style="list-style-type: none"> Logging, thinning, harvesting, land clearing and road construction 	<ul style="list-style-type: none"> YES 	<ul style="list-style-type: none"> N.a. 	<ul style="list-style-type: none"> gibsonandson.net
Nielsen Brothers Incorporated	Nielsen Brothers	<ul style="list-style-type: none"> Bellingham, WA 	<ul style="list-style-type: none"> Timber harvesting, selective thinning, small parcel tree removal, reforestation 	<ul style="list-style-type: none"> YES 	<ul style="list-style-type: none"> N.a. 	<ul style="list-style-type: none"> nielsenbrothers.net
	Levanen Inc.	<ul style="list-style-type: none"> Battle Ground, WA 	<ul style="list-style-type: none"> Thinning and clear cut harvest 	<ul style="list-style-type: none"> YES 	<ul style="list-style-type: none"> 10 	<ul style="list-style-type: none"> levaneninc.com
	American Forest Lands	<ul style="list-style-type: none"> Maple Valley, WA 	<ul style="list-style-type: none"> Thinning, clear cutting, reforestation, log hauling, timber consulting 	<ul style="list-style-type: none"> YES 	<ul style="list-style-type: none"> N.a. 	<ul style="list-style-type: none"> americanforestlands.com

B1 Many logging companies provide selective harvesting/thinning services (1/2)

	Company name	HQ location	Services	Thinning	Employees	Website
	Janicki Logging and Construction	<ul style="list-style-type: none"> Sedro-Woolley, WA 	<ul style="list-style-type: none"> Clear cutting, thinning, forest management 	<ul style="list-style-type: none"> YES 	<ul style="list-style-type: none"> N.a. 	<ul style="list-style-type: none"> janickilogging.com
	Northwest Logging Company	<ul style="list-style-type: none"> Tacoma, WA 	<ul style="list-style-type: none"> Logging, thinning, land acquisition, timber purchases 	<ul style="list-style-type: none"> YES 	<ul style="list-style-type: none"> N.a. 	<ul style="list-style-type: none"> logginginwashington.com
	Northern Columbia Reforestation	<ul style="list-style-type: none"> Colville, WA 	<ul style="list-style-type: none"> Logging, fuel reduction, fire suppression, forest management planning, thinning & chipping 	<ul style="list-style-type: none"> YES 	<ul style="list-style-type: none"> xx 	<ul style="list-style-type: none"> ncrforest.com

B1 Currently sub-optimal clear-cutting harvesting equipment is used for thinning/selective harvesting operations

- Many logging companies providing thinning/selective harvesting services are using equipment that is optimal for clear-cutting
- Logging companies in Washington State use feller bunchers, skidders and excavators with processing heads for thinning operations. Very few harvester forwarders combinations are currently used.



Gibson & Son Road Building INC



Gamble Bay Timber & Construction, Inc.



Nielsen Brothers Incorporated











Carlson and Sons Logging Inc



Levanen Incorporated

B1 Forestry companies in WA

	Company name	HQ location	Services	Forest area (acres)	Employees	Website
	BTG Pactual Timberland Investment Group (TIG)	• Seattle, WA	• Timberland investing	• 3,000,000 (across the U.S.)	• 100	• timberlandinvestm entgroup.com
	Fruit Growers Supply company	• Valencia, CA	• Timberland management, Packaging, pallets, timber	• 317,000 CA (87%), OR (5%), WA (7%)	• N.a.	• fruitgrowers.com
	SDS Lumber Company	• Bingen, WA	• Lumber production, marine services, biomass energy, plywood	• 90,000	• 350	• sdslumber.com
	Green Crow	• Port Angeles, WA	• Timberland management	• 16,000	• ~100	• greencrow.com
	Green Diamond Management company	• Seattle, WA	• Owning and management of working forest land	• 1,300,000	• 200+	• gdmco.com
	Greenwood Resources	• Portland, OR	• Investing, Forestry management	• N.a.	• 100	• greenwoodresourc es.com
	Hampton Lumber	• Portland, OR	• Forest management, lumber production, lumber wholesale	• 250,000 acres in WA and OR. Manages 300,000 in BC	• 1,600	• hamptonlumber.com
	Hancock Timber Resource Group	• Boston, MA	• Forest and investment management	• 1,200,000 (Pacific N.W.)	• 600	• htrg.com

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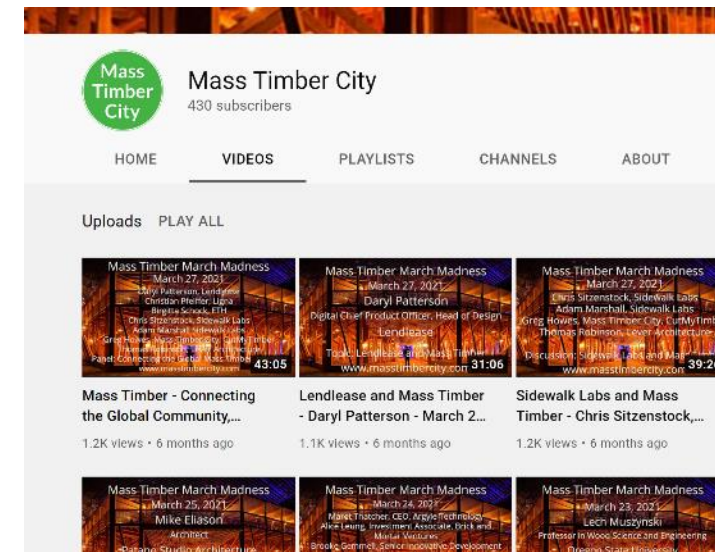
B2 Mass-timber construction rapidly growing and providing several business opportunities along the value chain

Opportunity

- Mass timber (CLT and Glulam) construction is growing rapidly due to its several benefits; small carbon footprint and fast construction process
- Green architecture and construction services are one of the fastest-growing industries in WA. Currently, the industry doesn't have enough mass-timber architects and engineers. The manufacturers are taking a more active role.
- Washington State has a strategic goal to grow and diversify Washington's forest product sector with a strong business climate.
 - One of the strategic initiatives is related to wood construction: "Promotion of the manufacturing of and construction with Cross Laminated Timber in Washington State."
 - At a tactical level harvesting procedures and building codes will be reviewed to strengthen the business climate.
- Washington and Oregon are both in the top 3 states in mass-timber construction
- Construction Digitization: Washington State has a very active community called "Mass Timber City" which is engaged in various aspects of mass-timber construction. One of the focus areas is digitization. The community provides opportunities for knowledge exchange and collaboration.

Solutions

- Wood construction engineering and architecture and engineering services/know-how
- Mass timber R&D collaboration opportunities with, e.g., Washington State's Composite Materials & Engineering Center
- Lumber production technology for smaller diameter trees which are used in mass-timber production
- Software development services for companies driving mass-timber digitization



youtube.com/c/masstimbercity

B2 Mass timber (CLT and Glulam) construction is growing rapidly due to its several benefits; small carbon footprint and fast construction process

Topic	Description
CLT and Glulam	<ul style="list-style-type: none">Mass timber consists of engineered wood products (e.g., CLT, Glulam, structural composite lumber, wood-concrete composites) typically made of large, solid wood panels, columns or beams often manufactured off-site for load-bearing wall, floor, and roof construction.CLT (cross-laminated-timber) was first developed in the 1990s, consists of three to nine layers of solid-sawn lumber, laid at right angles to each adjacent layer, then compressed and bonded together.Glulam (glued laminated timber) is a structurally engineered wood product constituted by layers of dimensional lumber bonded with durable, moisture-resistant structural adhesives.
Benefits of CLT and Glulam	<ul style="list-style-type: none">CLT<ul style="list-style-type: none">The most significant advantages of CLT are a much smaller carbon footprint than conventional construction, and very fast construction process on-site, and much less labor is needed.CLT is sustainable, especially since it can utilize smaller or even dead or diseased trees. It also carries a much smaller carbon footprint since trees store carbon while growing, and the production of CLT panels is much cleaner than steel and concrete.Washington Governor Jay Inslee has said that expanded use of CLT could revitalize parts of Washington's timber industry. "Demand for Washington's timber industry has been in decline for decades, impacting many rural communities. The manufacturing of CLT can strengthen local economies and grow jobs. For the economy, it is much better to produce CLT than shipping logs to China. (2018)The trees used to build CLT were passed over by the timber industry because they had not been economical to harvest, including trees as small as 4 inches in diameter and diseased and dead trees. Removing them is helpful in another way, too, as those small and diseased trees can fuel wildfires and pest outbreaks, according to the state Department of Natural Resources.Glulam<ul style="list-style-type: none">Glulam can be constructed from various smaller trees harvested from second-growth forests and plantations. Production of steel takes two to three times more energy than the manufacturing of glulam beams. Glulam has superior earthquake resilience and greater resistance to fire than any other structural construction material.




Fig. 1. Schematic of CLT layer configuration

B2 WA has a goal to grow the forest product sector and one of the initiatives is the promotion of construction with CLT

Topic	Description
Strategy	<ul style="list-style-type: none">Washington State has a strategic goal (208-2021) to grow and diversify Washington's forest product sector with a strong business climate.One of the strategic initiatives relates to wood construction: "Promotion of the manufacturing of and construction with Cross Laminated Timber in Washington State."At a tactical level, harvesting procedures and building codes will be reviewed to strengthen the business climate.
Regulation	<ul style="list-style-type: none">Washington was the first state to allow tall mass-timber buildings into its building code.<ul style="list-style-type: none">The Washington State building code allowances for tall wood buildings went into effect in July 2019. The following are code allowances for new construction types allowing mass-timber:Type IV-A allows 18-stories with full encapsulation of the mass-timber with gypsum-type products and no mass-timber exposure.Type IV-B allows 12-stories with partial exposure of the mass-timber, and several buildings are pursuing this construction type.Type IV-C allows 8-stories with full exposure of mass-timberThe Washington State Legislature is also working toward enacting State Bill 5379, a measure that would require all public buildings in the state rising 12 stories or less to be built using CLT. The move is called "natural one" for Washington, which has a thriving timber industry and has some catching up in terms of mass-timber adoption compared to neighboring Oregon.

https://issuu.com/wadnr/docs/em_strategic_plan_2018/1?ff
<https://www.thenewstribune.com/news/local/article224933605.html>


20

 **NATURAL RESOURCES**

STRATEGIC PLAN
2018–2021

ENHANCE FOREST HEALTH AND
WILDFIRE MANAGEMENT

Cross laminated timber (CLT) is a prefabricated, solid engineered wood panel. CLT can use trees produced from forest restoration projects.



GOAL	C2	Enhanced economic development through forest restoration and management strategies that maintain and attract private sector investments.
STRATEGIES	C 2.1	Support efforts to secure a reliable timber supply in order to increase forest products industry infrastructure to levels required to meet forest health goals.
	C 2.2	Support innovation and investments in the forest products industry by increasing utilization of, and adding value to, forest health treatment by-products, such as small diameter wood, cross-laminated timber (CLT), mass timber, biochar, and biofuels and associated products.

Strategic Plan 2018-2021 of Washington State
Dept. of Natural Resources

B2 Green architecture and construction services are one of the fastest-growing industries in WA

Topic	Description
Trends	<ul style="list-style-type: none">Green Architecture & Construction Services is the 10th fastest growing industry in Washington State with a pace of 21.6% per yearWashington's clean technology sector covers many processes, services, and products, from public and mass transit programs to sustainable forestry products and green architecture and construction.The largest mass-timber manufacturers in the region are Smartlam (MT), Structurlam (BC), StructureCraft (BC), Mercer (prev. Katerra), and Vaagen Timbers (WA).A lack of mass-timber architects and engineers is forcing mass-timber manufacturers to take a more active role in the projects

Mass-timber production



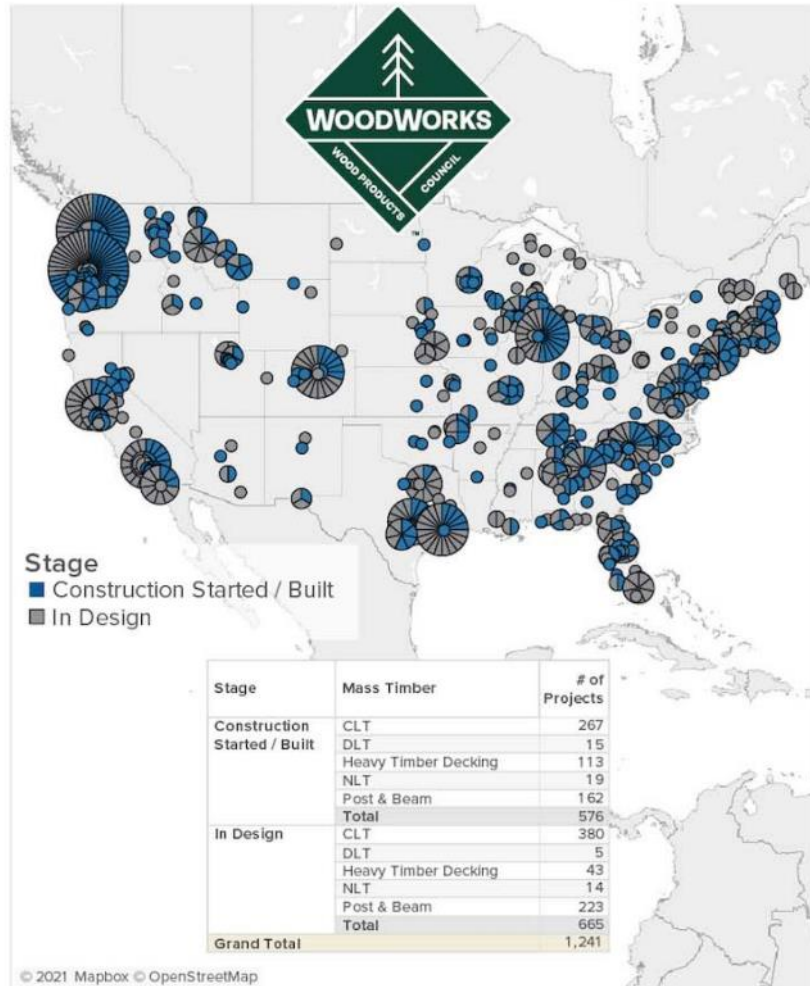
A Changing Dynamic



Not enough mass-timber architects and engineers and that's why manufacturers are taking more active role.

B2 Washington and Oregon are both in top 3 states in mass-timber construction

Mass Timber Projects In Design and Constructed in the US (September 2021)



State	Stage		State	Stage	
AK	In Design	2	MS	Construction Started / Built	1
AL	Construction Started / Built	8		In Design	2
	In Design	10	MT	Construction Started / Built	13
AR	Construction Started / Built	6		In Design	10
	In Design	8	NC	Construction Started / Built	27
AZ	Construction Started / Built	2		In Design	31
	In Design	3	ND	In Design	1
CA	Construction Started / Built	75	NE	Construction Started / Built	3
	In Design	113		In Design	10
CO	Construction Started / Built	19	NH	Construction Started / Built	1
	In Design	21		In Design	3
CT	Construction Started / Built	7	NJ	Construction Started / Built	3
	In Design	8		In Design	8
DC	Construction Started / Built	5	NM	Construction Started / Built	1
	In Design	9		In Design	1
DE	Construction Started / Built	1	NV	In Design	2
FL	Construction Started / Built	22	NY	Construction Started / Built	14
	In Design	38		In Design	37
GA	Construction Started / Built	13	OH	Construction Started / Built	9
	In Design	17		In Design	12
HI	Construction Started / Built	2	OK	Construction Started / Built	3
	In Design	1		In Design	2
IA	Construction Started / Built	3	OR	Construction Started / Built	66
	In Design	6		In Design	26
ID	Construction Started / Built	7	PA	Construction Started / Built	7
	In Design	5		In Design	9
IL	Construction Started / Built	15	RI	Construction Started / Built	3
	In Design	18		In Design	2
IN	Construction Started / Built	3	SC	Construction Started / Built	18
	In Design	1		In Design	5
KS	Construction Started / Built	2	SD	Construction Started / Built	1
	In Design	2		In Design	1
KY	Construction Started / Built	5	TN	Construction Started / Built	8
	In Design	2		In Design	4
LA	Construction Started / Built	1	TX	Construction Started / Built	32
	In Design	3		In Design	56
MA	Construction Started / Built	25	UT	Construction Started / Built	8
	In Design	36		In Design	8
MD	Construction Started / Built	4	VA	Construction Started / Built	9
	In Design	10		In Design	10
ME	Construction Started / Built	5	VT	Construction Started / Built	2
	In Design	9		In Design	10
MI	Construction Started / Built	2	WA	Construction Started / Built	71
	In Design	16		In Design	50
MN	Construction Started / Built	11	WI	Construction Started / Built	21
	In Design	2		In Design	18
MO	Construction Started / Built	8	WV	Construction Started / Built	2
	In Design	6	WY	Construction Started / Built	2
				In Design	1

Considering mass timber for a project?

Ask us anything.

For free project support, contact:






help@woodworks.org

woodworks.org/project-assistance

Insights

- As of September 2021, WA has 71 mass-timber projects completed/built and 50 in the design phase.

B2 Engineered wood manufacturers in WA

	Company name	HQ location	Products	Capacity	Employees	Website
	Vaagen Timbers	<ul style="list-style-type: none"> Colville, WA 	<ul style="list-style-type: none"> Cross Laminated Timber (CLT), Glulam Beams, and Glue Laminated Timber Panels (GLT) 	<ul style="list-style-type: none"> 50MMBF 	<ul style="list-style-type: none"> <50 	<ul style="list-style-type: none"> vaagentimbers.com
	Calvert Company Inc.	<ul style="list-style-type: none"> Vancouver, WA 	<ul style="list-style-type: none"> Glulam (custom-size, long-span, standard) 	<ul style="list-style-type: none"> N.a. (two plants in WA) 	<ul style="list-style-type: none"> 60 	<ul style="list-style-type: none"> calvertglulam.com
	Pacific Woodtech	<ul style="list-style-type: none"> Burlington, WA 	<ul style="list-style-type: none"> Joists (floors, roofs), LVL (laminated veneer lumber) 	<ul style="list-style-type: none"> 1 plant in WA 	<ul style="list-style-type: none"> 200 	<ul style="list-style-type: none"> pacificwoodtech.com
	Murphy Company	<ul style="list-style-type: none"> Eugene, OR 	<ul style="list-style-type: none"> Hardwood and softwood plywood, engineered wood/laminated veneer lumber, and softwood veneer 	<ul style="list-style-type: none"> 6 plants in total (1 x veneer plant in WA) 	<ul style="list-style-type: none"> 900 	<ul style="list-style-type: none"> murphyplywood.com
	Mercer	<ul style="list-style-type: none"> Vancouver, BC 	<ul style="list-style-type: none"> Pulp, timber, CLT 	<ul style="list-style-type: none"> 270,000-square-foot CLT plant (150 employees) in WA 	<ul style="list-style-type: none"> 2,375 	<ul style="list-style-type: none"> mercerint.com

B2 Mass timber construction project examples in WA

CLT projects in Tacoma

- Tacoma's Brewery Blocks is a development south of the University of Washington Tacoma. The developer is Horizon Partners Northwest. The development has 49 luxury apartments where the developer has used CLT and preserved and reused materials from the former structures. At the time, the Brewery Blocks was the tallest building to utilize CLT in WA. The CLT was in the form of prefabricated panels that serve as the floor and ceiling for each additional story. The CLT panels were prefabricated in Montana.
- Greywolf Elementary School in Sequim and Jefferson Elementary School in the Mount Vernon and are two of five schools in the state where CLT was used to build new classrooms, part of a pilot project included in Washington's 2016 capital budget. All four schools had four classrooms built. The CLT for the project came from Oregon.
- 10,000-square-foot warehouse in the Nalley Valley was built using CLT for its walls. The product was manufactured by Structurlam Mass Timber Corp., British Columbia. (2019)



Tacoma's Brewery Block development



Greywolf Elementary School in Sequim (one of the schools selected for a pilot project)

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B3 Sawmill technology

B4 Biofuels

B5 Refined wood-based materials

C Appendices

B3 Next-Gen Sawmill technology has potential in Washington which is the second-largest state producing softwood lumber

Opportunity

- In WA, there are 37 sawmills in total, which are the largest end-users of logs
- Washington is the second-largest softwood lumber producer in the U.S.
- Five very large lumber producers have mills or a head office in WA
- Small wood sawing will increase due to the increase of mass-timber construction. The small diameter wood production is going to create demand for new sawmill technology/equipment

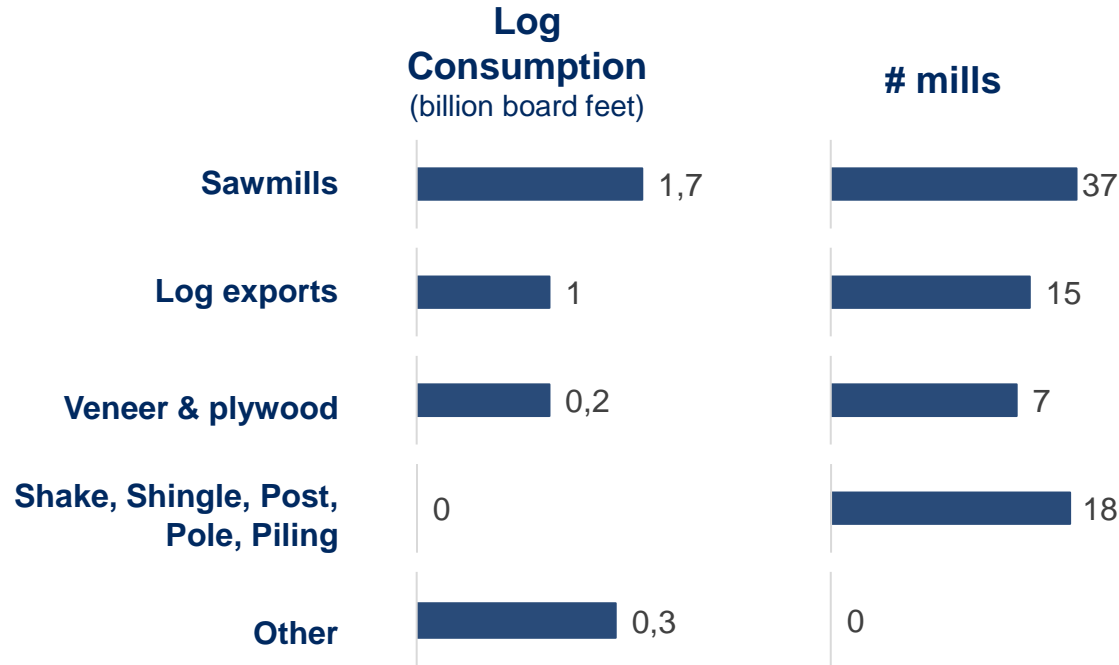
Solutions

- Next-generation sawmill technology:
 - Sawlines
 - Debarkers
 - Bark processing
 - Production control systems
 - Log scanners
 - Material handling systems

B3 In WA there are 37 sawmills in total which are the largest end-users of logs

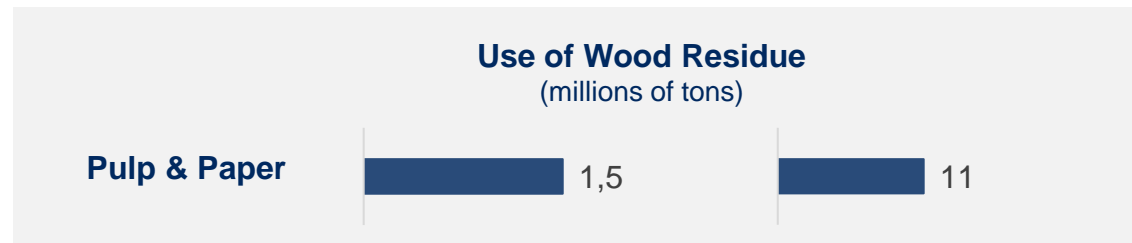
Wood product industry

Washington - 2016



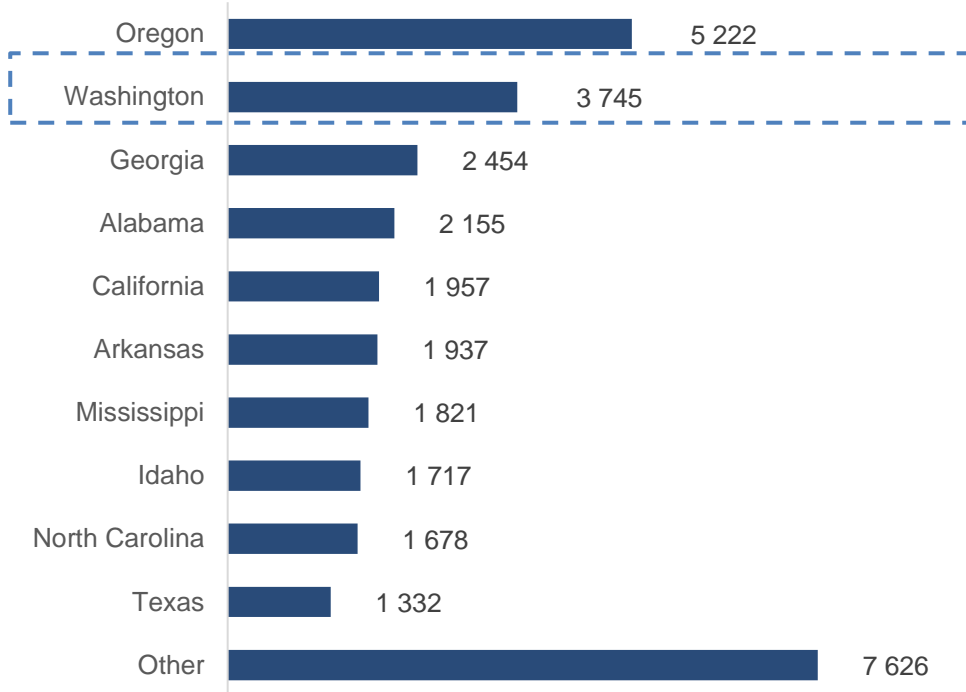
Insights

- Sawmills are the biggest user of logs in WA
- 75% of wood residue comes from sawmills and 25% from veneer & plywood mills
- The overall volume of residue has been in steep decline (4.6 million tons in 2006, 2.1 mtons in 2016)
- The wood residue is also used for board, fuel, and other uses



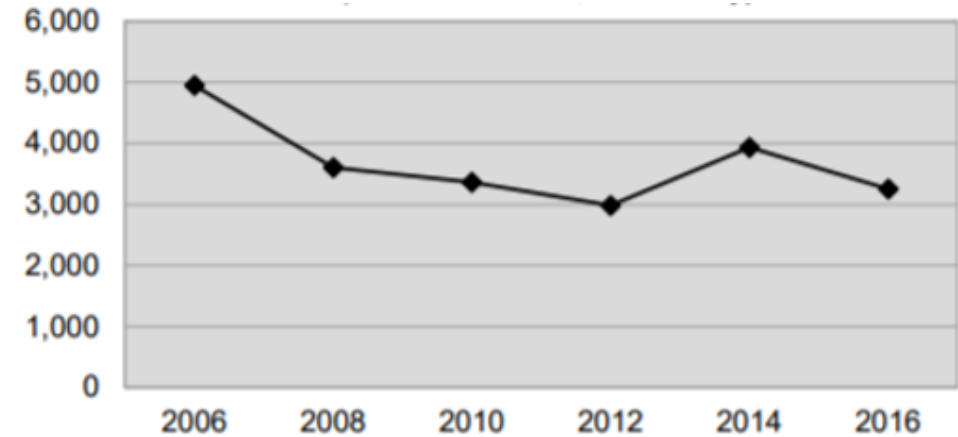
B3 Washington is the second largest softwood lumber producer in the U.S.

Top 10 states and U.S. total softwood lumber production
2015, million board feet



- Washington was the second largest state producing softwood lumber in the U.S. in 2015

Softwood lumber production in WA
2006-2016, million board feet



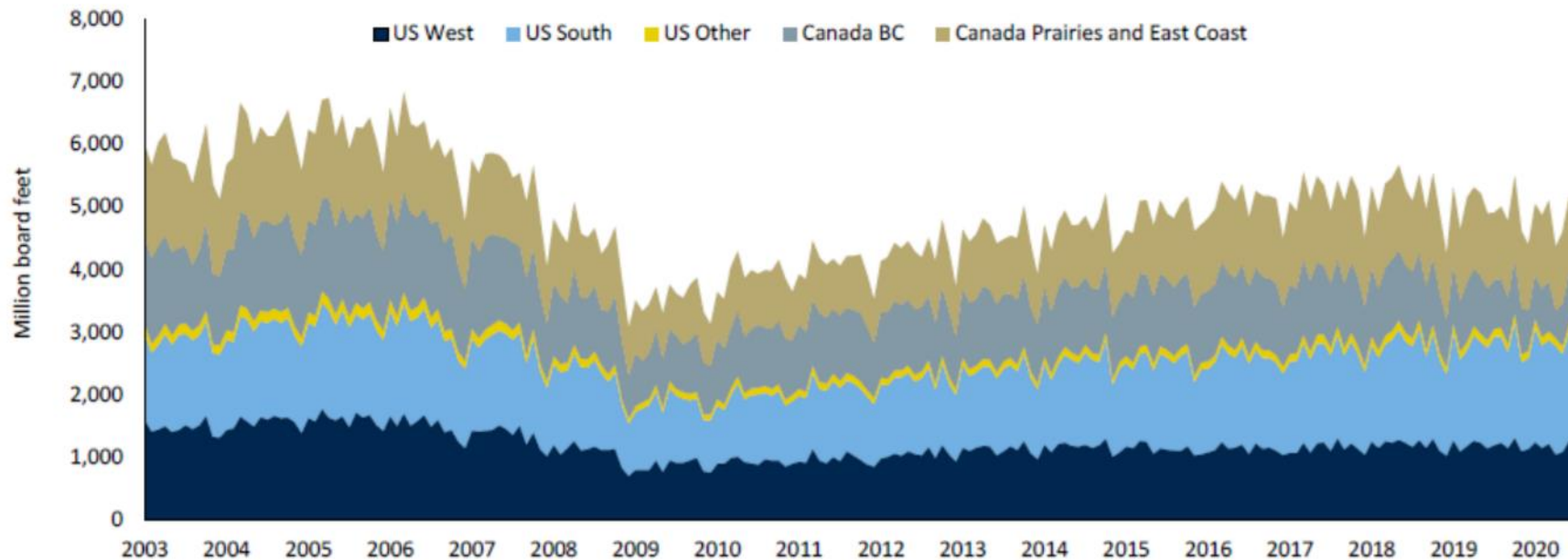
- Softwood lumber production has declined from the 2016 level

B3 Western U.S. is the second largest lumber producing region in N.America

Lumber production development 2003 - 2020

Washington - 2016

North American Lumber Production by Region (Monthly)



Insights

- The softwood lumber production has been stable in the US West in 2012-2020
- Softwood lumber production is growing strong in the US South.

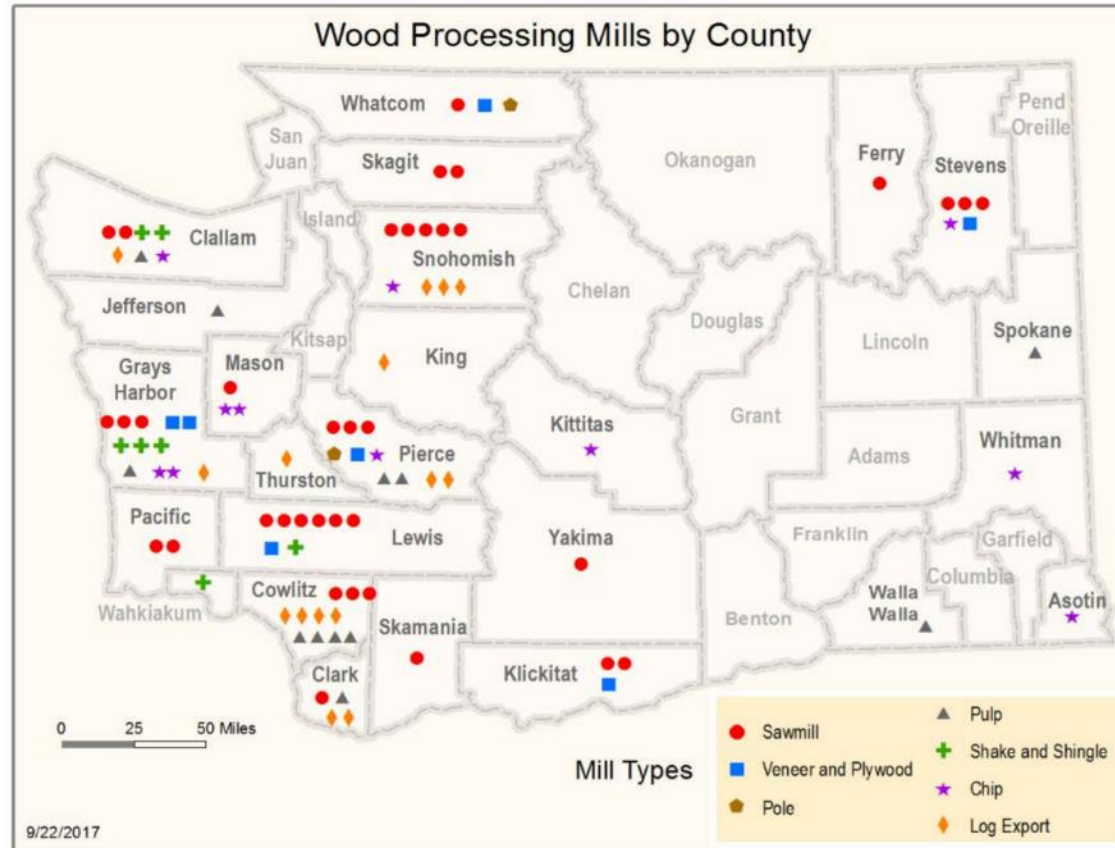
B3 WA has more than 80 primary wood product mills and they are mainly located in western side of the state

Mills by County

2016 Washington Mill Survey

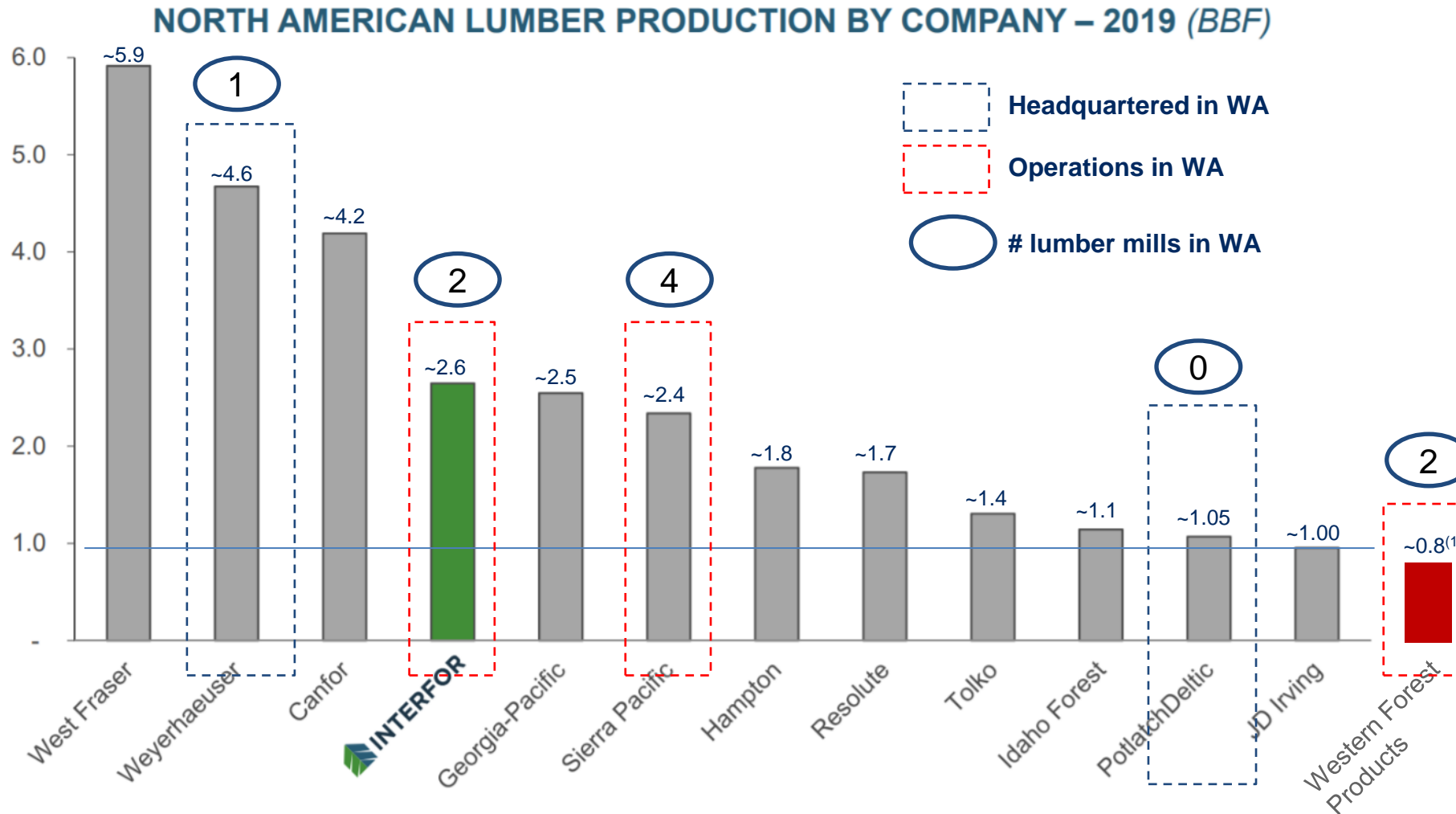
Insights

- Washington State had 88 primary wood product mills in 2016
- A few mills have been closed since



This map shows the counties where Washington's 88 primary wood product mills operated in 2016. The symbols only indicate in which county each mill was located, not the specific location.
DNR GIS map / Patrick Caton, Cartographer, 2017

B3 Five very large lumber producers have mills or a head office in WA



Insights

- Weyerhaeuser and PotlatchDeltic are the only large lumber company headquartered in Washington State
- Their combined softwood production was 3.45BBF in 2019.
- Weyerhaeuser has one lumber mill in Washington and PotlatchDeltic none.

¹⁾Estim. Based on WFP annual report

B3 Largest lumber companies present in WA

	Company name	HQ location	Main products	Corporate Revenue	Investments (total) ¹	Locations (WA/Global)	Locations producing (Lumber/Board)
	Weyerhaeuser	<ul style="list-style-type: none"> Seattle, WA 	<ul style="list-style-type: none"> Lumber, OSB, panels, engineered lumber 	<ul style="list-style-type: none"> \$7.5B 	<ul style="list-style-type: none"> \$225M 	<ul style="list-style-type: none"> 2/26 	<ul style="list-style-type: none"> Global: 20/26 WA: 2 / 0
	Boise Cascade	<ul style="list-style-type: none"> Boise, ID 	<ul style="list-style-type: none"> Engineered wood products, plywood, distribution of building materials 	<ul style="list-style-type: none"> \$5.5B 	<ul style="list-style-type: none"> \$83M 	<ul style="list-style-type: none"> 3/15 	<ul style="list-style-type: none"> Global: 2/8 WA: 2 / 0
	Mercer	<ul style="list-style-type: none"> Vancouver, BC 	<ul style="list-style-type: none"> Pulp, timber, CLT 	<ul style="list-style-type: none"> \$1.6B 	<ul style="list-style-type: none"> \$ 131M 	<ul style="list-style-type: none"> 1/6 	<ul style="list-style-type: none"> Global: 1/0 WA: 0 (1xCLT)
	Interfor	<ul style="list-style-type: none"> Vancouver, BC 	<ul style="list-style-type: none"> Lumber 	<ul style="list-style-type: none"> \$1.4B 	<ul style="list-style-type: none"> \$ 95.7M 	<ul style="list-style-type: none"> 3/23 	<ul style="list-style-type: none"> Global: 21 / 0 WA: 2 / 0
	Sierra Pacific	<ul style="list-style-type: none"> Anderson, CA 	<ul style="list-style-type: none"> Timberland, Lumber, remanufacturing, millwork, energy 	<ul style="list-style-type: none"> \$1.3B 	<ul style="list-style-type: none"> \$N/A 	<ul style="list-style-type: none"> 4/19 	<ul style="list-style-type: none"> Global: 10/0 WA: 4 / 0
	WFP (Western Forest Products)	<ul style="list-style-type: none"> Vancouver, BC 	<ul style="list-style-type: none"> Lumber 	<ul style="list-style-type: none"> \$0.8B 	<ul style="list-style-type: none"> \$9.8M 	<ul style="list-style-type: none"> 1/8 	<ul style="list-style-type: none"> Global: 8 / 0 WA: 1 / 0
	Hampton Lumber	<ul style="list-style-type: none"> Portland, OR 	<ul style="list-style-type: none"> Lumber 	<ul style="list-style-type: none"> N/A 	<ul style="list-style-type: none"> \$N/A 	<ul style="list-style-type: none"> 3/10 	<ul style="list-style-type: none"> Global: 10/0 WA: 3 / 0
	Alta Forest Products	<ul style="list-style-type: none"> Chehalis, WA 	<ul style="list-style-type: none"> Wood fence boards 	<ul style="list-style-type: none"> \$0.2B 	<ul style="list-style-type: none"> \$N/A 	<ul style="list-style-type: none"> 4/0 	<ul style="list-style-type: none"> Global: 4/0 WA: 4/0

Insights of investments in the following slide

Activities

Trends and near term strategy

- Weyerhaeuser (Weyer) follows a “disciplined capital expenditure” strategy which is allocated to “value-enhancing growth opportunities”.
- Weyer has been more conservative in their CAPEX and \$900M in 2020 went into gross debt reduction. This is a necessary action due to their weak credit rating [since Dec 2020: BBB, earlier BBB- (one grade above junk bonds)]
- In 2020, Weyer’s lumber business was very profitable and the year was the best in the last 10 years creating \$799M EBITDA. The second best year was 2018 with \$459M EBITDA.

Favorability



Insights

- Weyer’s CAPEX budget seems to be very disciplined indicating that they plan their investments for a long-time ahead making sales the process long.
- Their financial position is not the greatest but the situation is improving due to significant improvement in their profitability

Capital Investments (past & future)

- 2021, CAPEX budget is \$420M in total, and \$300M will go to wood products. The budget will be used on maintenance and projects to improve costs and reliability. They will resume high return discretionary projects and beginning Holden Sawmill modernization.
- Weyer’s capital expenditures across the company have been in decline between 2017-2020. In 2017, the total budget was \$419M, and in 2020 \$281M. In 2020, \$80M worth of discretionary projects were deferred.
- In 2020, Weyer going to spend \$16.1M for equipment upgrades to modernize its LVL sawmill in Natchitoches (Louisiana). The work is expected to begin in 2021 and continue for three more years. The upgrades will include presses and machinery.
- In 2019 Weyer made \$257M worth of capital expenditures in their wood product division and 2018 \$306M.
- In 2018, Weyer opened an upgraded SYP mill in Arkansas. The upgrade was \$190M in total because they upgraded the facility and replaced their former mill. The new mill can produce about 380 MBF per year.
- In 2017, Weyer’s Princeton sawmill was in the midst of a major multi-year upgrade that included the front end of the mill and primary breakdown equipment. The mill has a capacity of 300 MBF per year. They added a new Optimil balanced cut horizontal double arbor saw box. They have also worked closely with Comact.
- In 2016, Weyer announced a major upgrade on Millport (Alabama) softwood lumber mill. The investments were done over the next several years. The upgrades are done to cutting the cost and improving its long-term viability.



- CAPEX budget has been in a decline the last couple of years but in 2021 on average they invest ~US\$15M per sawmill per year.
- Their capital investments focus on improving their cost structure
- Weyer prefers to make big upgrade / rebuilt projects which are done over several year periods.
- In some projects, they have used state-of-the-art equipment making them a good prospect for customer

Capacity

- Weyer’s structural lumber capacity was 5.2BBF in 2019. It has grown from 2015 when the capacity was 4.2BBF. 41% of their revenue comes from structural lumber, 14% from OSB, 11% from softwood plywood



- Their capacity has increased over the years significantly
- Weyer’s capacity has increased only due to upgrades in their existing mills.

Acquisitions

- No sawmill acquisitions in recent years. All their acquisitions have been acquisitions of timber land.



- They are not expected to acquire new sawmills so the growth is expected to come from their existing mills

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B4 Washington state and several global companies are pushing forward biofuel support programs

Opportunity

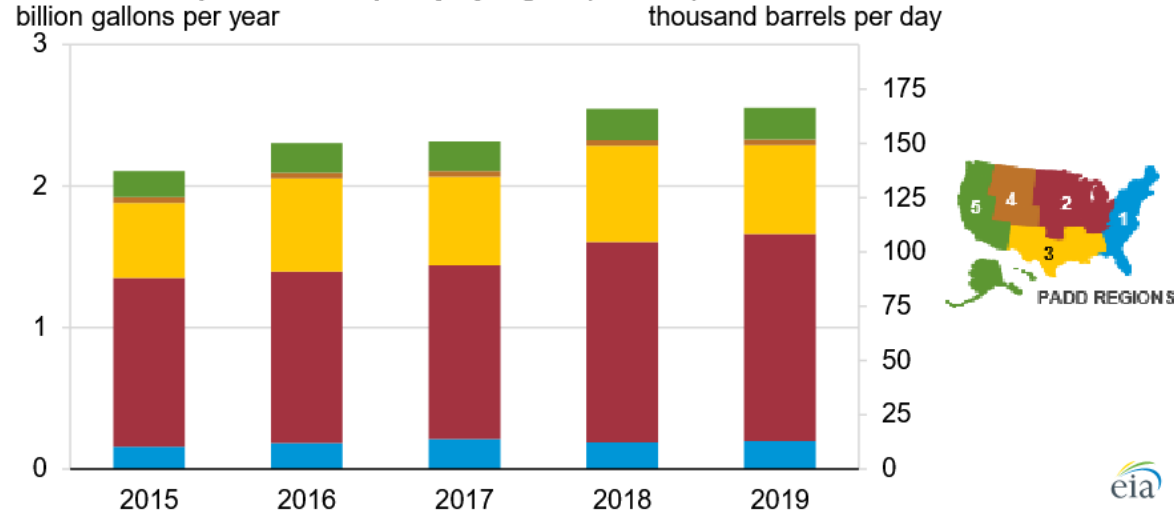
- Washington passed a bill to reduce carbon used for transportation by 20% by 2035. The bill was passed in April 2021 at it demands the state to implement Clean Fuel Standard in 2023.
- The Port of Seattle Commission has set aggressive goals for reducing the carbon emissions associated with its operations and facilities. Central to those goals is our pursuit of having SAF (Sustainable Aviation Fuel) comprise 10% of the fuel used at Sea-Tac Airport by 2028.
- Leading Washington businesses like Amazon, Microsoft, Boeing, and Alaska Air have set their own climate goals and shown support for the adoption of a clean fuel program
- In WA, two biofuel plants are in operation, and a third is in the planning phase. Northwest Advanced Bio-Fuels is planning to invest \$600 million for the largest announced Sustainable Aviation Fuel (SAF)/renewable biofuels project using cellulosic feedstock in the world.
- Neste has operations in WA through its acquisition of Mahoney Environmental who acquired the biodiesel plant of General Biodiesel in 2020.
- Biodiesel research is considered strong in Pacific Northwest, including Washington. The research is funded by state and national grants and conducted by National Laboratories, universities, and private industry partners.

Solutions

- Finland has several companies having experience in building and operating Biofuel plants.
- Finnish Biofuel R&D and Plant Engineering resources might be in demand if the \$600M Biofuel investment takes place
 - Åbo Akademi University
 - Chempolis
 - Finnish Forest Research Institute
 - Green Fuel Nordic Oy
 - Indufor
 - Neste Oil
 - Pöyry Finland Oy
 - St1
 - Technical Research Center of Finland (VTT)
 - UPM-Kymmene Corporation
 - Valmet
 - Vapo Oy

B4 Washington has the second largest biodiesel production plant in the U.S.

U.S. biodiesel production capacity by region (2015-19)



Insights

- The U.S. West is the third-largest region in the U.S., producing biodiesel.
- The U.S. West produces ~8% of all biodiesel produced in the U.S.

	Washington
Biodiesel production capacity ¹	114 MGY
Biodiesel consumed through general diesel fuel sales ²	2.7 MGY (0.4% biodiesel)
State biodiesel purchased	1.2 MGY ³
Biodiesel incentives	Few currently
Canola—acres harvested in 2017	54,000 acres

Notes: Biodiesel is blended with petrodiesel and sold as a blend in many different ratios. f petrodiesel.

¹ In July 2020.

² In 2015.

³ In 2016.

Insights

- 88% of all WA's production capacity is at Grays Harbor Biodiesel Plant (110 MMGY), the second largest plant in the U.S.

B4 Washington has two biodiesel production plants in operation

Activities

Biodiesel production in WA

- Grays Harbor Biodiesel Plant is the second largest biodiesel production facility in the USA, with a 100 MMgy capacity
 - Renewable Energy Group acquired the facility in 2015
 - The biorefinery uses low free fatty acid feedstocks, primarily canola oil. Most feedstock comes from western Canada, but Grays Harbor also receives oil from canola grown in-state. REG has expressed interest in further development of in-state canola production, as well as diversifying to include used oil and tallow
- Mahoney Environmental acquired a biodiesel plant of General Biodiesel in 2020. The raw material is cooking oil from restaurants, hotels, stadiums, and other venues with commercial kitchens
 - In 2020 Neste acquired Mahoney Environmental and more than doubled its network of renewable diesel fueling stations during that year
 - Mahoney Environmental is rapidly growing, has operations in 30 states, and is pursuing to spread in more states
 - Nearly 51 million pounds of UCO are generated in Washington each year—enough to create more than 5 million gallons of renewable diesel or sustainable aviation fuel (SAF)
 - In 2018 full capacity of 10 million gallons per year (MMgy) was achieved in Seattle's facility. However, the production rate returned to 5 MMgy next year.

Planned investments

- Northwest Advanced Bio-Fuels is planning to invest \$600 million for the largest announced Sustainable Aviation Fuel (SAF)/renewable biofuels project using cellulosic feedstock in the world.
 - The project is financed by an independent investment firm Stonepeak Infrastructure Partners

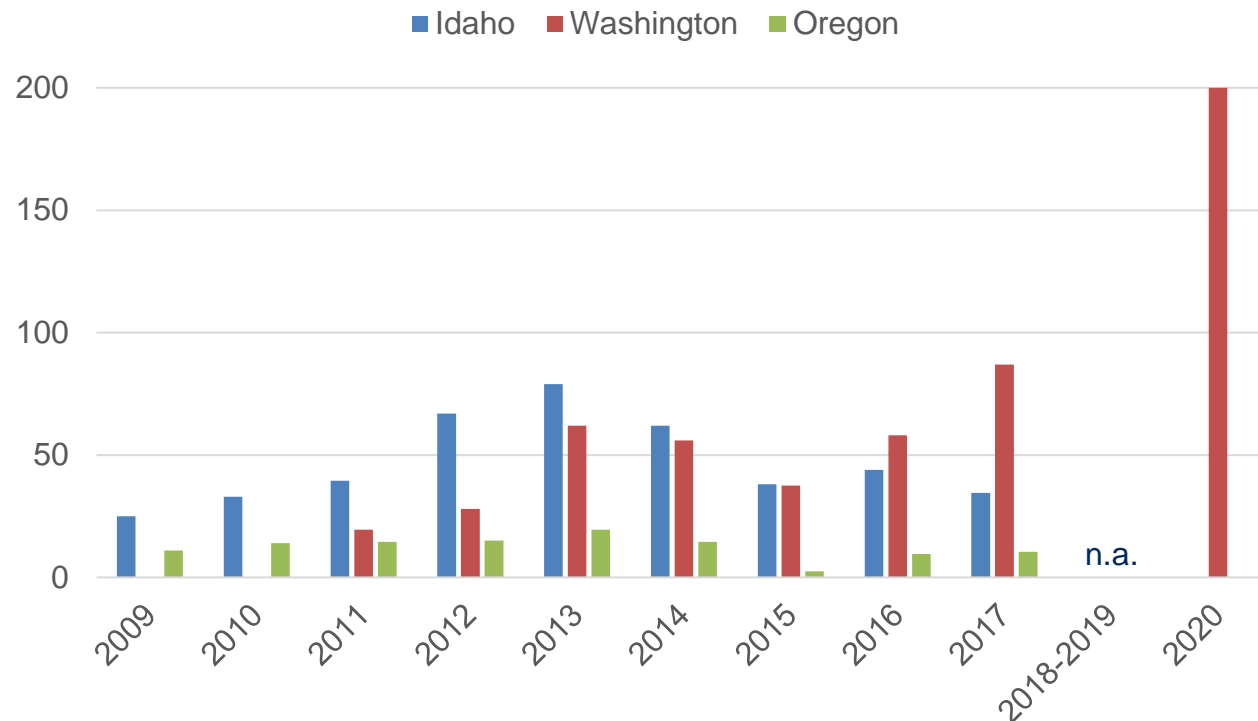
Recent failed opportunities

- Several biodiesel projects have failed in the past because of uncertain policies and low petroleum prices. The newest one was the plan of Phillips 66 and Renewable Energy Group to build a 250 MMgy production facility in Ferndale, which was discontinued in early 2020.
- Advanced Hardwood Biofuels Northwest (AHB) is researching and developing ways to grow and convert hybrid poplars into bio-based chemicals and liquid biofuels.
 - *As of April 2020, its official website is no longer actively updated*
 - *No interesting news of AHB is found after April 2020*

B4 Canola production is increasing fast benefiting Grays Harbor biodiesel plant

Canola production

2009 – 2021, millions of pounds



Canola production over time by state in the PNW. No data is available for WA in 2009 and 2010, 2018-2019. No data available for Idaho and Oregon 2018-2021. Data source: USDA National Agricultural Statistics Service Crop Production Annual Summaries.

Insights

- Washington, Oregon, and Idaho make up over a third of the states growing canola in the United States.
- Most canola production in the United States takes place in the northwestern states adjacent to Canada. According to the 2020 UDSA AG Census, North Dakota was the leading canola-producing state, with 2.82 billion lbs. North Dakota was then followed by Montana with 241 million lbs. and Washington with 200 million lbs in 2020.

B4 Bioproducts Sciences and Engineering (BSE) Laboratory is developing Sustainable Aviation Fuel

- Bioproducts Sciences and Engineering Laboratory locates at the Tri-State campus of Washington State University. They have done interesting biofuel research:
 - Biojet fuel from hydrocarbon molecules made from lignin waste
 - Lignin to biofuel conversion
 - Enzyme manufactured nanocrystalline cellulose catalyst that will lower the cost and increase the efficiency in producing bio-based jet fuels
 - BSE associate professor Bin Yang is part of a \$3.7 million, U.S. Department of Energy-funded project led by researchers at the University of North Dakota. The team will design, build, and test a lignin-based pilot reactor for the first time studying the commercial viability of the process.
- The university cooperates with United States Department of Energy national laboratories forming Pacific Northwest National Laboratory, which researches biotechnology such as utilizing fish residue as a biofuel raw material.
- Recent U.S. News ranks BSE 12th Best Graduate School for Agricultural and Biological Systems Engineering
 - On average, nearly 1,180 citations with an average h-factor of 46 (2019)
 - In 2020 the department worked on 118 active research projects with a global expenditure of \$4.9 million



tricitie.wsu.edu/research/bsel/

B4 Advanced Hardwood Biofuels Northwest program



Advanced **Hardwood Biofuels** Northwest

Topic	Description
Overview	<ul style="list-style-type: none">Advanced Hardwood Biofuels Northwest (AHB) was a program funded by the USDA National Institute of Food and Agriculture. AHB integrated research, education, and extension to develop the framework for a poplar-based biofuel and bio-based chemical industry in the Pacific Northwest. The project ran from 2011 to 2019.AHB was focused on laying the foundation for renewable biofuels and the bio-based chemical industry. High-value chemicals, such as acetic acid, ethyl acetate, ethylene, and cellulosic ethanol, produced during the first stages of the biofuel production process, can be used to make bioproducts, including paints and plastics.The longer-term goal was to develop poplar-based biofuels including jet fuel, diesel, and gasoline, to supplement fossil fuels. These biofuels will be certified to run conventional cars, truck, and aircraft engines and be 100% compatible with existing infrastructure.
Challenges	<ul style="list-style-type: none">Today, the process used to convert poplar trees to liquid fuels is not economically feasible. Before biofuels can play a significant role in the Pacific Northwest's transportation fuel supply, many barriers must be overcome. AHB was working to ensure that the Pacific Northwest is prepared for biofuels when market conditions are more favorable. The current challenges are:<ul style="list-style-type: none">Low Oil Prices: Since the project began, the oil price has dropped to a point where it will be tough to make a biofuels industry work in the Pacific Northwest.Biorefinery Construction Costs: biorefineries are extremely expensive to build at \$700 million or more. Investment is risky due to policy instability, feedstock supply issues, and other issues.Absence of Feedstock: A biorefinery would require a large, readily-available supply of local biomass to sell fuel at a competitive price.Delayed Investment Returns: It takes at least 5 years to achieve yields of poplar that are sufficient to sell at a good price. Growing poplar is likely impractical without additional support (e.g., contracts with a biorefinery or government subsidies).

Project partners



<https://hardwoodbiofuels.org/about/>

<https://hardwoodbiofuels.org/resources/additional-projects/>

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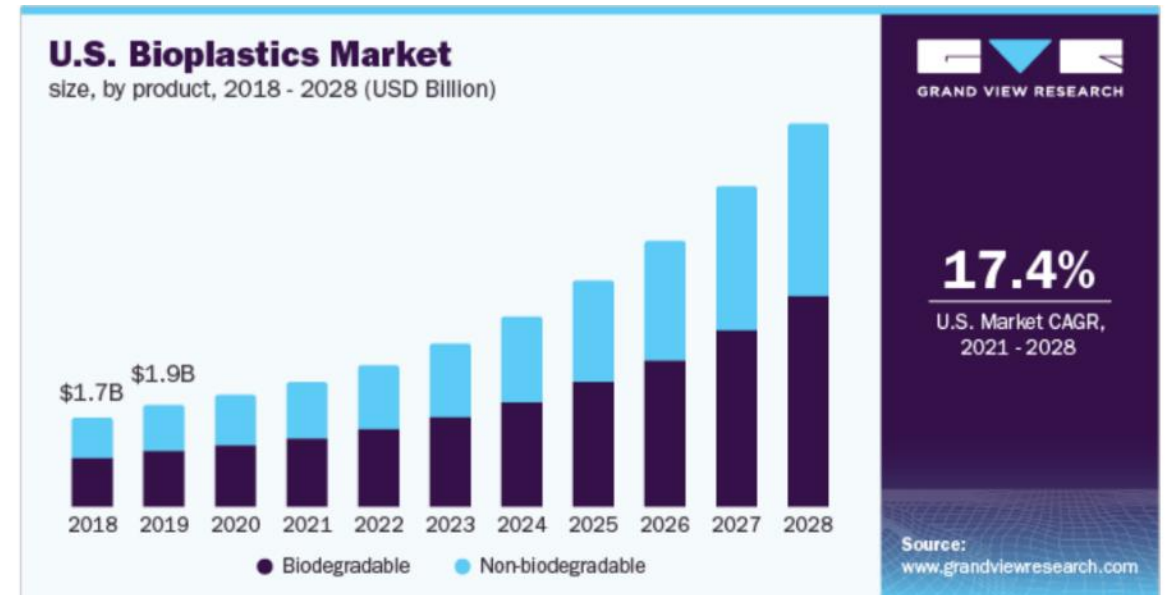
B5 WA's R&D activities in bioplastics and biocomposites are providing opportunities for collaboration and commercialization

Opportunity

- The Center for Bioplastics and Biocomposites develops bio-based composite materials for infrastructure applications
 - The new funding for Phase II of a study of \$1.95 million is shared by four universities, including Washington State University (2021)
 - The study has more than 30 industry partners including Ford, Amazon, 3M, John Deere, Sherwin-Williams, Kimberly-Clark, AkzoNobel, ADM, Hyundai, and BASF, define and mentor research projects at the four CB2 sites
 - The goals for the study are:
 - Expand the science for recycling and end-of-life treatment of sustainable materials, particularly as they are mixed with petrochemical plastics.
 - Engage other companies that have expressed a need for recycling and end-of-life treatment.
 - Develop fundamental knowledge of sustainable materials.
 - Prepare students to join the workforce.
- Danimer Scientific, a leading developer and manufacturer of biodegradable materials, received nearly \$5.7 million from the U.S. Department of Energy in support to conduct research and development projects within the biomanufacturing industry. (2020)
 - One of the cooperating research teams of Danimer is from Pacific Northwest National Laboratory in Richland, Washington
- Currently, there are neither bio-plastics plants in Washington nor published plans to build one

Solutions

- Finland has innovative biodegradable packaging solutions that might have demand in the new greener business environment
- Finnish R&D and other bioplastics know-how could be interesting from Washington's perspective
- Currently no bio-plastics plant investment has been made in WA, allowing growth oriented manufacturers an opportunity to be the first and leading player in the field of bioplastics



B5 Center for Bioplastics and Biocomposites is a cooperative research center that focuses on developing high-value biobased products

- The Center for Bioplastics and Biocomposites (CB²) (cb2center.org) is a National Science Foundation Industry & University Cooperative Research Center (I/UCRC) that focuses on developing high-value biobased products (e.g., including plastics, coatings, adhesives, and composites) from agricultural and forestry feedstocks.
- CB2 is a collaborative effort by the Coatings and Polymeric Materials and IME teams at North Dakota State University (NDSU), Biopolymers & Biocomposites Research Team at Iowa State University (ISU), the Composite Materials and Engineering Center at Washington State University (WSU), the New Materials Institute at the University of Georgia (UGA) and industry members to conduct commercially relevant research.
- Washington State University has a 25% stake at the Center for Bioplastics and Biocomposites
- NDSU, ISU, WSU, and UGA are uniquely positioned to develop and operate a bioplastics center successfully. NDSU is a land grant university with one of the nation's few programs that specialize in coating technology. ISU is an established leader in the area of biobased products. WSU has strong history of research and inventions in natural fiber polymer composites. UGA has a strong and historied expertise in biopolymers and biodegradable materials. By bringing together their expertise, the center will be able to successfully transfer their ideas, results, and technology to the U.S. plastics industry.

Oregon has BioSphere Plastic, a global market leader and innovator with its world-class biodegradable plastic additive. Cooperation with BioSphere Plastic might offer business opportunities in Washington.

The screenshot shows the homepage of the Center for Bioplastics and Biocomposites (CB²). The header features the center's logo, a tagline "A National Science Foundation I/UCRC: Phase II", and navigation links for "Directions" and "Contact Us". Below the header is a main navigation bar with links for "Home", "About", "Members", "Research", "Capabilities", "Education", "Newsroom", and "Intranet". The main content area includes a large banner with the text "Welcome to CB²" and "Working to develop new processes and biobased products", accompanied by images of laboratory equipment and a scientist. Below the banner are three columns of information: "For Industry" (encouraging companies to join), "For Faculty" (encouraging faculty participation), and "Save the Date" (announcing a 2022 Spring Meeting). Further down is a section titled "DRIVE INNOVATION Become a Member" with a video player showing a student's perspective. The footer contains the center's contact information and logos for its partner institutions: NDSU, WSU, ISU, and UGA.

Center for Bioplastics and Biocomposites
A National Science Foundation I/UCRC: Phase II

Home About Members Research Capabilities Education Newsroom Intranet

Welcome to CB²
Working to develop new processes and biobased products
[More Info](#)

For Industry
Companies, commodity boards, and other organizations are encouraged to join and provide direction to the center's goals.
[Become a member »](#)

For Faculty
Faculty members interested in biobased products can participate in the center's research activities.
[Learn how »](#)

Save the Date
The 2022 Spring Meeting will be in person. The dates are scheduled to be May 17-18, 2022. Location will be announced in the spring.

DRIVE INNOVATION
Become a Member
The Center for Bioplastics and Biocomposites is bringing together university researchers and industry members to push the boundaries of renewable resources and establish new revenue coating processes and products. The center will focus on developing high-value biobased products from agricultural feedstocks.

CB² REU 2017 - Hear What Our Students Say
Watch this three-minute video of what our CB² REU students say about their summer research experience at Iowa State University and at Washington State University.

CENTER FOR BIOPLASTICS AND BIOCOMPOSITES
Engineering Building, Room 106
1315 Centennial Blvd, Fargo, ND 58102
(701) 231-5395 | ndsu.cb2@ndsu.edu

NDSU NORTH DAKOTA STATE UNIVERSITY
WASHINGTON STATE UNIVERSITY
IOWA STATE UNIVERSITY
UNIVERSITY OF GEORGIA

B5 Single-use plastic bag ban is accelerating demand for new packaging solutions

States with Enacted Plastic Bag Legislation



Insights

- Washington is banning single use plastic bags in favor of paper bags, reusable carryout bags, and compostable bags. A similar ban is introduced in several states in the USA.

Washington's single-use plastic bag ban

Gov. Jay Inslee ends delay. Bag ban effective Oct. 1, 2021

Plastic bags are a major contaminant in Washington's recycling facilities, waterways, roadways, and environment. Washington's Plastic Bag Ban will reduce pollution by prohibiting single-use plastic carryout bags and charging a fee for acceptable bags in businesses beginning in October 2021.

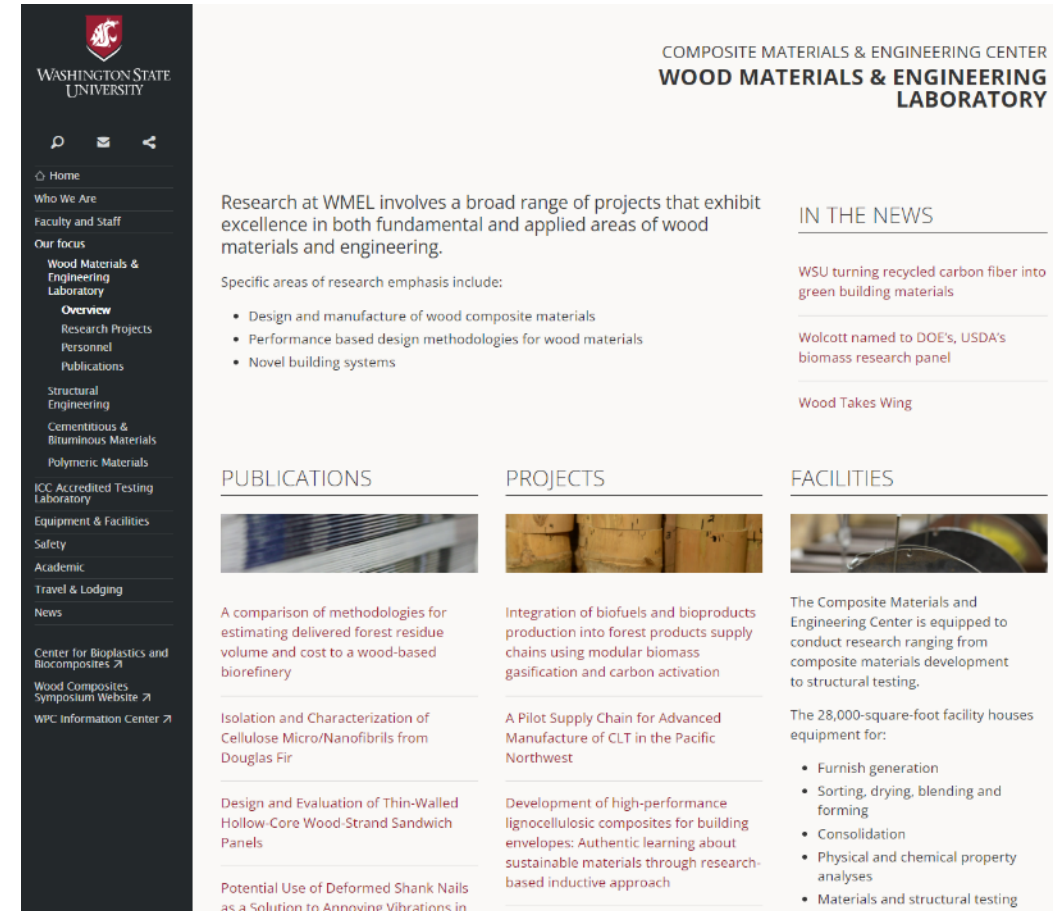


I want to...

- Download an accessible toolkit in one of 17 languages
- Learn about banned and allowed bags
- Join our email list for bag ban updates

B5 Washington State University has lots of interesting research focused on developing refined wood-based materials

- Washington State University's Research at Wood Materials & Engineering Laboratory (WMEL) involves a broad range of projects that exhibit excellence in fundamental and applied wood materials and engineering areas.
 - Specific areas of research emphasis include:
 - Design and manufacture of wood composite materials
 - Performance-based design methodologies for wood materials
 - Novel building systems
- Examples of current projects:
 - A pilot supply chain for advanced manufacture of CLT in the Pacific Northwest
 - Alternative jet fuel supply chain analysis
 - Developing innovative wall systems that Improve the hygrothermal performance of residential buildings
 - Development of high-performance lignocellulosic composites for building envelopes: authentic; earning about sustainable materials through a research-based inductive approach
 - Inland-Northwest forest products research consortium
 - Integration of biofuels and bioproducts production into forest products supply chains using modular biomass gasification and carbon activation
 - Northwest Advanced Renewables Alliance (NARA): A new vista for green fuels, chemicals, and environmentally preferred products (EPPs)
- Washington State University researchers work with a Port Angeles nonprofit organization to develop new housing materials from heat-treated wood and recycled carbon fiber used in Boeing airplanes.



The screenshot shows the website for the Composite Materials & Engineering Center Wood Materials & Engineering Laboratory at Washington State University. The page features a dark sidebar with navigation links, a main content area with a welcome message and research emphasis, and three columns for news, publications, and facilities.

WASHINGTON STATE UNIVERSITY

**COMPOSITE MATERIALS & ENGINEERING CENTER
WOOD MATERIALS & ENGINEERING LABORATORY**

Research at WMEL involves a broad range of projects that exhibit excellence in both fundamental and applied areas of wood materials and engineering.

Specific areas of research emphasis include:

- Design and manufacture of wood composite materials
- Performance based design methodologies for wood materials
- Novel building systems

IN THE NEWS

- WSU turning recycled carbon fiber into green building materials
- Wolcott named to DOE's, USDA's biomass research panel
- Wood Takes Wing

PUBLICATIONS

- A comparison of methodologies for estimating delivered forest residue volume and cost to a wood-based biorefinery
- Isolation and Characterization of Cellulose Micro/Nanofibrils from Douglas Fir
- Design and Evaluation of Thin-Walled Hollow-Core Wood-Strand Sandwich Panels
- Potential Use of Deformed Shank Nails as a Solution to Annoying Vibrations in

PROJECTS

- Integration of biofuels and bioproducts production into forest products supply chains using modular biomass gasification and carbon activation
- A Pilot Supply Chain for Advanced Manufacture of CLT in the Pacific Northwest
- Development of high-performance lignocellulosic composites for building envelopes: Authentic learning about sustainable materials through research-based inductive approach

FACILITIES

The Composite Materials and Engineering Center is equipped to conduct research ranging from composite materials development to structural testing.

The 28,000-square-foot facility houses equipment for:

- Furnish generation
- Sorting, drying, blending and forming
- Consolidation
- Physical and chemical property analyses
- Materials and structural testing

Agenda

A Executive Summary

B Opportunities

B1 Thinning equipment

B2 Wood construction

B3 Sawmill technology

B4 Biofuels

B5 Refined wood-based materials

C Appendices

© Appendix 1. Paneltech / PaperStone

- **HQ:** Hoquiam, WA
- **Products:** paper based overlay systems and paper-based heavy-duty composites

- **Revenue:** \$n.a.
- **EBITDA:** \$n.a.

- **Total number of employees:** 38
- **Ownership (private & public):** Private
- **Website:** www.paneltechintl.com

Activities

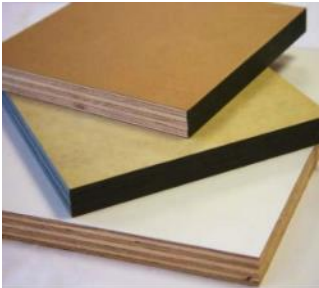
Description

- Paneltech is a company manufacturing medium and high density panel/overlay systems. It is a sister company of PaperStone.
 - PaperStone has distributors across the US, Canada, and Europe.



Products

- Medium Density Overlays (MDO) are heavy kraft paper-based products that are first saturated and cured, then coated with our own PetroFree™ phenolic glue resin for application directly to hardwood or softwood plywood in a hot press. Originally developed for sign painting and concrete formwork industries, MDO is also used as a paintable surface for other applications. Paint finishes on MDO are up to three times more durable than the same finish applied to ordinary plywood.
- High-Density Overlays (HDO) and films are Highly saturated papers that are self-bonding to the substrate without a glue coating. Their higher resin content produces a somewhat glossier surface texture than MDO, resulting in an “architectural finish” on concrete surfaces. The higher resin gives the HDO and films superior barrier properties and increased resistance to abrasion and alkalinity. HDO can extend panel life up to 20 times over non-overlaid plywood.
- PaperStone® products are heavy-duty composites made of post-consumer recycled paper and old containerboard paper. The products are manufactured in WA and are FSC certified. The products are Layers of this paper are pressed into “stone” using resin made from industrial by-products that would otherwise go into the waste stream and have been specially designed to produce a hardwood-like, highly workable, non-brittle composite panel.
- Typical applications for PaperStone: table and countertops, restroom vanities & partitions, interior decorative wall paneling, desktops, furniture, signage, etc.



High and Medium Density Overlay



PaperStone heavy duty composite

© Appendix 2. International Paper Global Cellulose Fibers

• **HQ:** Federal Way, WA
• **Products:** Absorbent, papergrade and specialty pulp

• **Revenue:** \$20.6B
• **Net income:** \$482M

• **Total number of employees:** 50,000+ (IP in total)
• **Ownership (private & public):** Public
• **Website:** ipgcf.com

Activities

Description

- International Paper Innovation Center is a fully functional research and development center including research labs and complete mill process pilot plant capability.
- The center was built as state-of-the-art research and new product development center.
- Innovation and Research and Development Centers include full in-house testing laboratories. They are staffed with engineers and scientists who have extensive knowledge in product development, fiber chemistry, pulp production, and conversion and physics.
- International Paper Global Cellulose Fibers division produces fluff, paper grade, and specialty pulp.

Products

- Elegance fluff pulp for baby diapers is engineered to provide excellent absorbency, improved wicking, and higher pad integrity. The pulp is made using 100% renewable, responsibly sourced natural fibers. The benefits are: reduced packaging, improved densification, low static, comfort, protection (higher absorption), healthy skin.
- SuperSoft ® Odor Control Fluff Pulp for baby diapers, incontinence products, bed pads, and pet pads.
- Bliss™ Fluff Pulp has dual protection odor control and pH modulation to deliver comfortable and discreet feminine care products.
- In 2021, International Paper Global Cellulose Fibers introduces new brands for specialty products, FloraCel™ and Matrix®. The portfolio has grades for the textiles and cellulose derivative segments. Their brand names will be updated with the name FloraCel™. Their Matrix® portfolio delivers solutions for fiber reinforced concrete and cement to the construction industrv.



Textiles



Cellulose Derivatives



Fiber Cement & Concrete



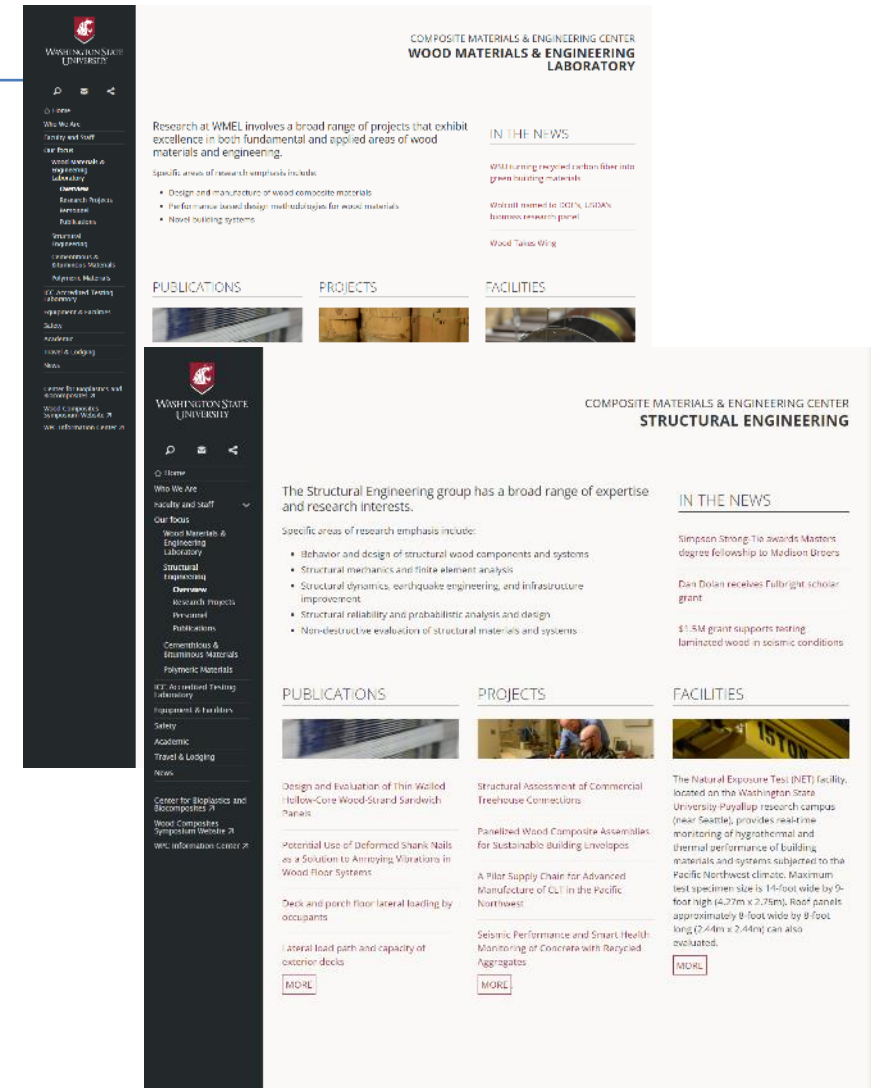
© Appendix 3. Associations and research organizations

Topic

Description

Organizations

- Washington Forest Protection Association www.wfpa.org
- Washington Contract Loggers Association www.loggers.com
- Northwest Pulp & Paper Association www.nwpulpanpaper.org
- American Forest Resource Council www.amforest.org
- Washington Farm Forestry Association www.wafarmforestry.com
- Washington State Department of Natural Resources
- Washington Friends of Farms & Forests www.wafriends.org
- WSAC Timber Counties Program www.wacounties.org/timber_counties.php
- Society of American Foresters www.safnet.org
- American Wood Council www.awc.org
- American Forest & Paper Association www.afandpa.org
- National Alliance of Forest Owners www.nafoalliance.org
- Washington Hardwoods Commission www.wahardwoodscomm.com
- Washington Tree Farm Program www.watreefarm.org
- Washington State University's Composite Materials & Engineering Center:
 - Wood Materials & Engineering Laboratory
 - Structural Engineering
- International Paper Global Cellulose Fibers Innovation Center



© Appendix 4. Contact details

If you have any questions regarding this study, feel free to reach out to for more details.



Nordic Trading House is a Vancouver-based company helping Nordic companies to access the North American market. We can sell, market, and distribute your products on behalf of you or we can help you to conduct market research before deciding to expand to North America.

We have combined experience of 20+ years in business development, sales, and marketing. We are passionate about selling and marketing innovative products, increasing productivity, reducing the total cost of ownership, or making lives better. Our Nordic background helps to understand cultural differences and to avoid potential pitfalls due to a lack of cultural and local understanding and knowledge.

We have a wide network of industry connections, investors, and export organizations who might be able to give additional support to you in your journey to North America. We believe that there are great opportunities to be captured in North America and we are sure they are worth exploring further together.

**SALES AND MARKETING OF NORDIC PRODUCTS
IN CANADA AND THE U.S.**

Flags of Denmark, Norway, Finland, Sweden, and Iceland.

Distribution	Partner Search	Representation	Market Studies
All inclusive package including market research, import, legal checks, warehousing, marketing and sales.	We will help you to identify and find business partners meeting your needs.	Sales and marketing of your products on a commission basis.	Sales and marketing of your products on a commission basis.

Jukka Matikainen, Managing Director
E: jukka.matikainen@nordictradinghouse.com
T: +1 236 412 6172
W: www.nordictradinghouse.com