Hemp for Victory

A Case Study for the possibility of building
a Washington Hemp industry

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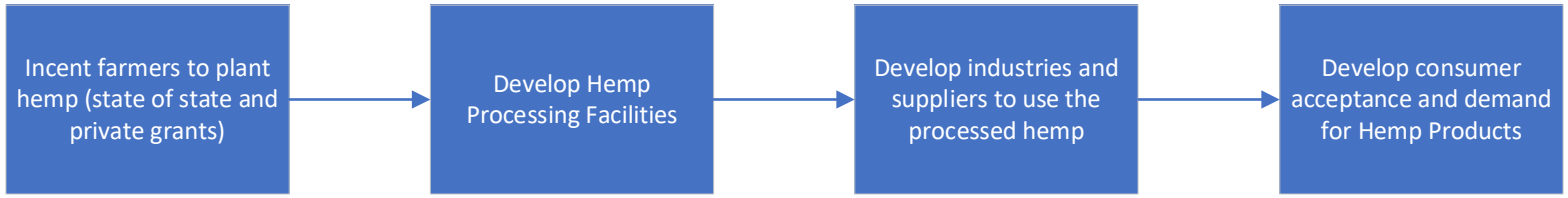
Hemp Discussion Overview

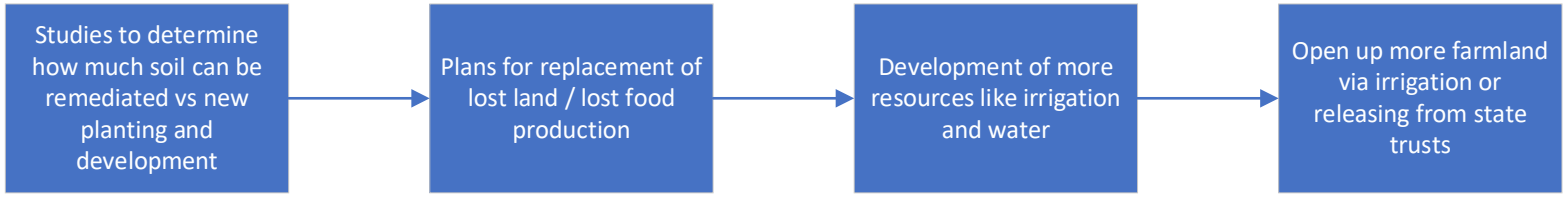
- The following slides contain some collected thoughts on remediating our soil and developing a Hemp industry on Washington based on our discussions

Rough outline of how to build Hemp industry on Washington

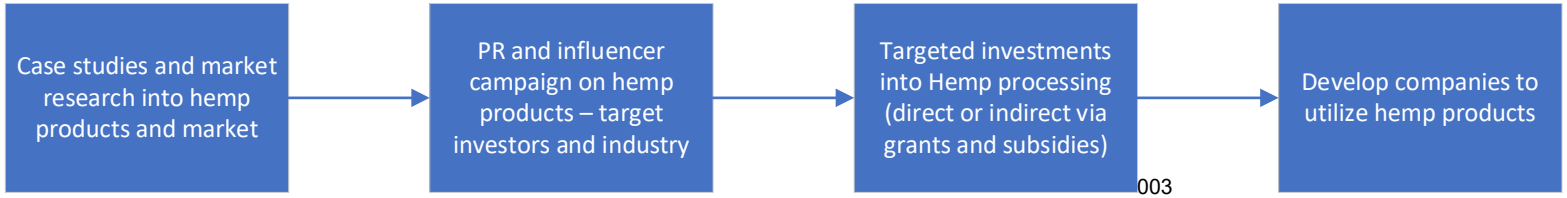
Overall Process



Workstream 1: Grow hemp and remediate soil



Workstream 2: Build Industry to process and create hemp products



Hemp Industry Development

- There are several workstreams to the creation of a hemp industry and the chart is neither thorough nor exhaustive, but a start at how it could be built
- Much of the workstreams can be worked in parallel. You can perform studies and develop factories while incenting farmers to plant as an example
- Washington has many existing corporations and resources it could utilize to more quickly build a Hemp industry ecosytem. Shoes and textiles were one example we discussed:
  - Shoes and footwear: Brooks (running shoes), Nick's Boots, White's Boots, etc
  - Fabric and apparel: Eddie Bauer, Filson, etc
  - The list gets much larger if you expand to other states in the pacific northwest such as Oregon which boasts Nike, Pendleton and Patagonia to name a few

Additional services and industries

- Assuming hemp as a cover crop is a viable option, we may want to incentivize additional industries or incent the repurposing of existing equipment
- Row crop farms typically have different equipment set-ups than hay farms. You won't see a tedder on most row crop farms. Rather than have the row crop farmer invest in expensive new equipment, can we help create the means to incent their neighbors who do have the proper equipment to work with them and both profit?
- You can also look at shared services, in the Midwest for instance, very few farms purchase a combine anymore, instead they have a service that runs the combines come through at harvest

Hemp & Soil Remediation

Strategy	Description of Strategy	Strengths	Weaknesses	Notes
Rip & Replace	Rip out and replant existing crop with hemp	Potentially assures optimal soil	More expensive investment. Need lots of new land. Lose existing investments (planting, irrigation)	Worst short term option
Cover crop	Where possible, use hemp as a cover crop in existing row crop setups	Remediate existing soil and can use existing farms	Slower to fully clean food. Food gets cleaner year over year	May require additional investment. A drip irrigation set-up would require additional irrigation to support hemp as a simple example. Won't work with all row crops
Crop rotation	Where possible, introduce hemp as a rotational crop, like soybeans are used with corn	Relatively easy to implement	Slower to fully clean food. Food gets cleaner year over year	Best hemp quality and monetary value. Hemp can fully mature before being harvested.

This not an exhaustive list. There may be other additional or better strategies

Open Questions / Unknowns

- Can existing crops and lands be remediated? For example, are the poisons so embedded in the plant, that it can only grow tainted fruit? Or can better soil yield a cleaner fruit or harvest?
- If you use hemp as a cover crop, what is its best economic value? For most row crops, allowing the hemp to fully develop means that the hemp would grow too tall and hurt the quality and yield of the current row crop. Hemp cover crop harvested more like hay (2-3 cuttings in a season), may not have significant fiber value, and would also have little or no seed /oil value.
  - If using cut hemp from our row crop example as an animal feed, does hemp clean the poison or absorb it such that we are just putting the poisoned hemp into livestock and we consume the poison via that method?
- If it is tainted, is there another, higher, best use of the tainted hemp? Like hempcrete or biofuel?

Addendum – Hempwood Pros AI discussion

- HempWood:
  https://www.youtube.com/watch?v=Uua964Y6BbA

  HempWood is an innovative and sustainable construction material with several pros and cons:
  Pros:
  - Eco-Friendly: HempWood is made from rapidly renewable hemp plants, making it a sustainable alternative to traditional hardwood.
  - Carbon Sequestration: Hemp plants absorb significant amounts of carbon dioxide, contributing to a lower carbon footprint.
  - Non-Toxic: HempWood is free from harmful chemicals and is safe for indoor use.
  - Durable: It is resistant to scratches and damage, making it a practical choice for flooring and furniture.
  - Pest and Fire Resistant: HempWood has natural pest and fire-resistant properties.Insulating: HempWood provides excellent insulation, which can improve energy efficiency in buildings.

Addendum – Hempwood Cons AI discussion

- HempWood:
  https://www.youtube.com/watch?v=Uua964Y6BbA

  Cons:
  - Expensive: HempWood can be more costly compared to traditional wood materials.Availability: It is not widely available and can be difficult to find.
  - Structural Integrity: HempWood is not suitable for heavy-load structures like walls and roofs.
  - Maintenance: HempWood requires more maintenance compared to other wood materials.
  - Square Footage: Using HempWood can reduce the square footage of living space due to its thickness

Addendum – MettleWood & Hemp

- MettleWood:
  https://youtu.be/96Dz-rQtGxI?si=Cv5htzGDfytv8Asg

  Notes on hemp – AI discussion:
  - Yes, hemp fiber does contain lignin. The lignin content in hemp fiber is typically around 2-4%. Lignin is a complex organic polymer that helps bind the cellulose fibers together, providing strength and rigidity to the plant.
  - The lignin content in hemp fiber is around 2-4%, while in yellow pine, it is significantly higher, typically around 25-27%. This difference highlights the structural variations between plant fibers and wood, with wood generally having a much higher lignin content to provide additional strength and rigidity.
  - The lignan content in ash (Fraxinus species) is relatively low, typically around 0.1-0.2%. On the other hand, poplar (Populus species) has a higher lignan content, generally ranging from 1-3%.

Additional Views

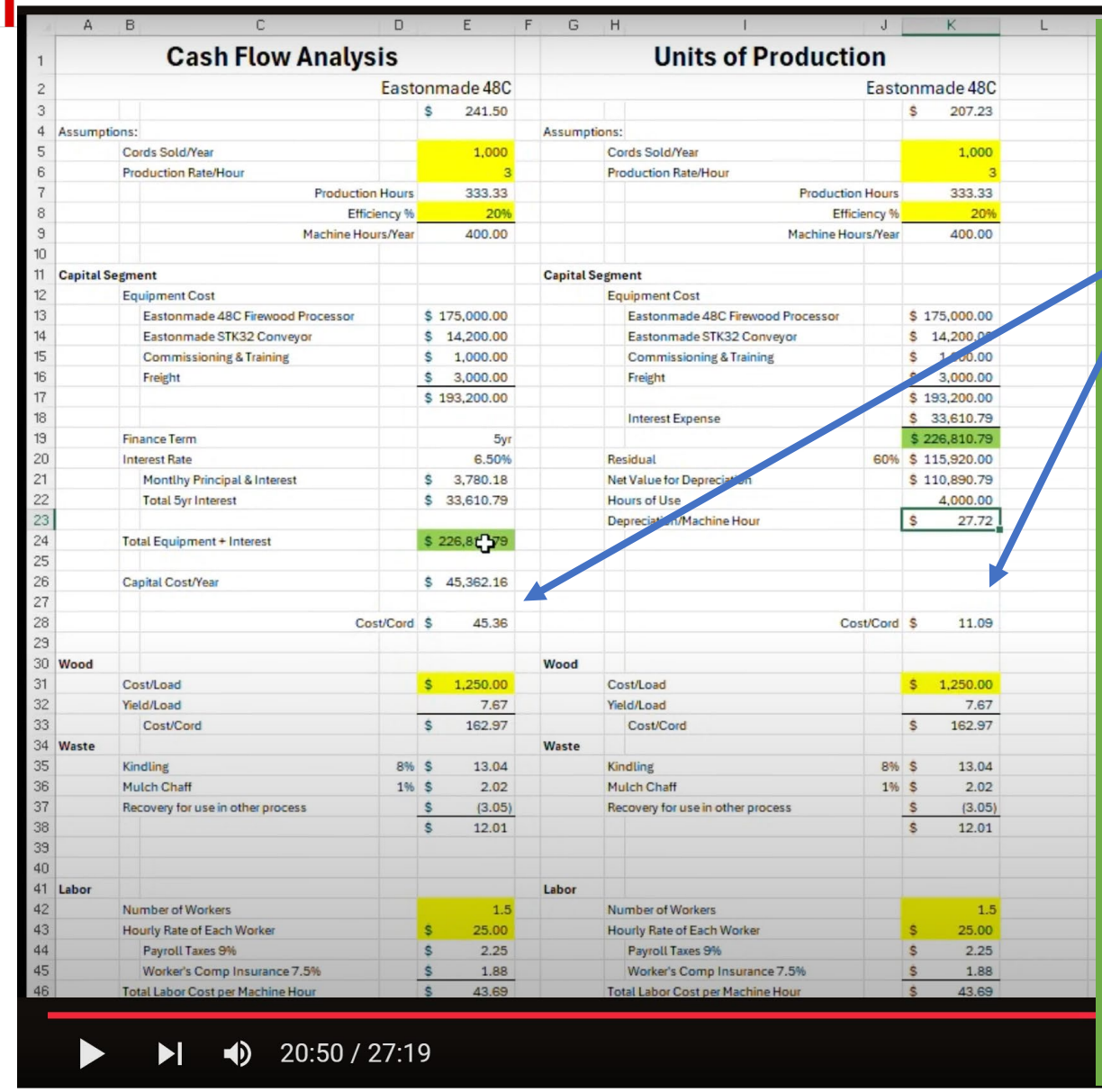
- Hardened Super Wood! - Can It Rival Steel?
- Wood Densification Experiment
- Hempitecture Aims to Make the 'Most Sustainable Building Material on the Planet'
- Home – Hempitecture
- Mill26 is Making 100% Hemp Paper in Upstate New York
- Hemp Fiber | An Eco-Friendly, Textile Powerhouse
- Best Selection of Hemp & Natural Fabrics and Hemp Products
- Avant wood densification explained at Ligna

Repurposing Forestry

- We discussed how forestry jobs might change with the implementation of Hemp
  - Reduced demand for certain wood products
- There is a market for firewood
  - US and I believe state has had incentives for moving to wood stoves and furnaces
  - This creates a natural market for firewood
  - Also creates a natural market where Forestry experts can supply that firewood

Repurposing Forestry continued

- Fairly easy to fund multiple small firewood and sawmill operators
  - Return wood processing back to towns and cities instead of overly centralized as today
  - Historically, small firewood operations are usually labor intensive
    - One or two people with chainsaws and log splitters
    - Can only earn based on labor (time) and physical capacity
    - More dangerous – Forestry work one of the most hazardous professions in the US
- Additional product line / revenue source for hemp processing plant
  - Can process firewood after hemp has been processed seasonally
- Firewood processing systems as found in this video:
  - How Accountants Buy Equipment



Cash Flow Analysis

	Eastonmade 48C
	$ 241.50
Assumptions:	
Cords Sold/Year	1,000
Production Rate/Hour	3
Production Hours	333.33
Efficiency %	20%
Machine Hours/Year	400.00
Capital Segment	
Equipment Cost	
Eastonmade 48C Firewood Processor	$ 175,000.00
Eastonmade STK32 Conveyor	$ 14,200.00
Commissioning & Training	$ 1,000.00
Freight	$ 3,000.00
	$ 193,200.00
Finance Term	5yr
Interest Rate	6.50%
Monthly Principal & Interest	$ 3,780.18
Total 5yr Interest	$ 33,610.79
Total Equipment + Interest	$ 226,8[illegible]79
Capital Cost/Year	$ 45,362.16
Cost/Cord	$ 45.36
Wood	
Cost/Load	$ 1,250.00
Yield/Load	7.67
Cost/Cord	$ 162.97
Waste	
Kindling	8% $ 13.04
Mulch Chaff	1% $ 2.02
Recovery for use in other process	$ (3.05)
	$ 12.01
Labor	
Number of Workers	1.5
Hourly Rate of Each Worker	$ 25.00
Payroll Taxes 9%	$ 2.25
Worker's Comp Insurance 7.5%	$ 1.88
Total Labor Cost per Machine Hour	$ 43.69

Units of Production

	Eastonmade 48C
	$ 207.23
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Freight	$ 3,000.00
	$ 193,200.00
Interest Expense	$ 33,610.79
	$ 226,810.79
Residual	60% $ 115,920.00
Net Value for Depreciation	$ 110,890.79
Hours of Use	4,000.00
Depreciation/Machine Hour	$ 27.72
Cost/Cord	$ 11.09
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- Spreadsheet shows you the difference in cost when you have to deal with the equipment cash flow issues - $45/cord vs $11/cord
- If you help fund the firewood processing equipment, you remove cost throughout the system
  - Firewood processor can make a fair wage more safely
  - Homeowners can heat their homes more cheaply, keeping more of their money
  - Sustainable heating and removes need for oil
  - Jobs for forest industry professionals impacted by Hemp

Wood consumption by household per AI

- For an average-sized home (around 2,000 square feet) in Washington state, you'll typically need 4 to 6 cords of wood to get through the winter. This can vary depending on factors like insulation, the efficiency of your wood-burning appliance, and how cold the winter is.
- In Wisconsin, which has a colder climate, you might need a bit more—around 6 to 8 cords of wood for the same size home.

- Again, this can vary based on similar factors.

Households by population

- To estimate the number of households in a given population, you can use the average household size, which is the number of people per household. This figure varies by region and can be found through census data or other demographic sources.
- In the United States, the average household size is around **2.5 people per household**. So, if you have the population of an area, you can divide that number by 2.5 to get an estimate of the number of households.
- For example:
- **Washington State**: With a population of approximately 7.7 million, you would divide 7,700,000 by 2.5, which gives you around **3.08 million households**.
- **Wisconsin**: With a population of approximately 5.9 million, you would divide 5,900,000 by 2.5, which gives you around **2.36 million households**.

Forestry continued

- At a local level, a town of 20k, with all wood heat, would be approximately 8,000 households.
  - On Washington, consuming 4-6 cords of wood, or about 32,000 – 48,000 cords per year.
    - If you look at Washington as having ~20% of homes with wood heat, you would be 8k-12k cords of wood if those households went exclusively to wood heat
  - On Wisconsin, consuming 6-8 cords of wood, or about 48,000 – 64,000 cords of wood
    - Wisconsin has about 30% of homes with a fireplace, so 12k-32k cords of wood if those households went exclusively to wood heat

Forestry Continued

- The Easton 48C as featured in the video, processes just over 3 cords per hour
  - 24 cords a day with one shift, 48 with two
  - Per their sales rep
    - The machine can double that output per hour with better logs, and better handling of the wood – cleaner loading of the logs into the machine and managing the volume of output
    - The machine has high uptime and is more than capable of running 2-3 shifts per day if you follow the recommended service schedule (approx. every 500 and 1k hours)
- Pezzolato has a similar but larger machine that will process ~5cords per hour

Forestry continued

When you talk city or residential, firewood transport and storage becomes a larger issue

IBC Tote frames can be repurposed to store firewood

Used totes can be had for less then $50/each and hold ~1/3 cord of wood

Easy organization, handling and storage of split firewood

There are also products that will stack firewood on a pallet with a bag

Forestry Continued

- For roughly $1.5M, you can put in a firewood processor in almost any town
  - Easton or pezzzalato systems will run $500k-$1M+ depending on configuration
  - Add wheel loader ($150k),
  - 22’ flatbed truck ($80k)
  - Burro forklift ($30k)
  - Used totes ($40k -- 1k $40/each)
  - Or palletizing machine ($400k)
- These are new/list prices, you can get some of this equipment used
- If you invest in an existing operation, they may already have some of this equipment

Pezzolato

- 480 3-phase power
- Kiln drying is future
- Kiln direct for kilns
- Up to 33 inch diameter –tla22
- Can split up to 47 inch
- Pezzolato can bundle cut – tb model
- X wedge
- Cooking / solo stove wood –pezzolato
- 850-900k for full system
- American packing machinery.com – shrinkwrapping machinery
- Krevitz
- Duraflame runs full pezzalato line
- About 10% waste / scrap
- Performance corp out of seymour

Kiln Direct

- Gas kiln – most common
- Biomass kiln
  - Chamber temp is 260-275F
  - Gassification of wood is 450
  - Biggest (performance) kiln is 12-cord kiln, about 10k cords annually -22-28 hours
    - $165-200k (x3 for unit cost of straight biomass kiln)
    - All biomass is about double the drying time (8-12 yards of mulch per day)
  - 6-cord kilns (basic) around 1k – 36-48 hour cycle times
  - 6-cord kiln (performance) 22-28 hours
    - $85k unit/gas
  - Hot and cold spots with larger kilns (like you think of the big warehouses for lumber). Better to run more small kilns, which is why they stop at a 12-cord model.
  - Bottom up airflow since heat rises
  - Kiln and two sets of baskets
    - Mini wheel loader is more efficient than a skid steer, can move two baskets at a time
    - Hydraulic rotator is ideal
    - C&C Denver is a large operator of kiln direct kilns
    - Large operator in Mobile, AL
  - 30 gallons of propane per cord if doing gas and not biomass
  - 200k btu per cord
  - Sanitation of logs means you need to hit 165 degrees internal temp. For places like Minnesota or interstate and you have to prove via reporting
  - Seymour Wisconsin Performance another large operator

Donkey's Incorporated!

- Last mile delivery systems for palleted wood such as those from Donkey forklift

VPM – 8

- Verbruggen Palletizing Solutions – Pasco, WA is US sales HQ
- https://youtu.be/EBJZq7ZeLgU
- Approximately $400k ish delivered and installed
- Allows for small bundles of firewood (like you would find at a supermarket for campers)
- Higher price premium if in bundles – retail vs bulk
- More markets / distribution
- V-pack out of Colorado for bag media
- VPM-8 about 19 bags / minute – this corresponds well with 5 cords an hour
- VPM-10 about 30 bags / minute
- VPM-14 about 40 bags / minute

Coffee and Sawdust blocks

- Additional usage for the hydraulic press in hemp wood manufacture or wood densification.

- Compressed Sawdust Blocks vs. Real Firewood
- You can also do coffee briquettes and even combined sawdust and coffee
- Great use of press in offseason. Blocks/bricks can be easily stored and stacked

Power Consumption by sector

- Here's a breakdown of the average electricity consumption by sector in the United States:
- **Residential**: 38.4%
- **Commercial**: 35.4%
- **Industrial**: 26.0%
- **Transportation**: 0.2%

Power generation by source

- **Washington State**
- **Hydroelectric**: 67.6%
- **Natural Gas**: 12.5%
- **Nuclear**: 8.4%
- **Wind**: 6.9%
- **Coal**: 3.1%
- **Biomass**: 1.1%
- **Solar**: 0.1%
- **Other**: 0.3%

- **Wisconsin**
- **Natural Gas**: 37.0%
- **Coal**: 35.8%
- **Nuclear**: 16.5%
- **Hydroelectric**: 4.0%
- **Wind**: 2.9%
- **Biomass**: 2.0%
- **Solar**: 1.4%
- **Petroleum**: 0.5%

Home Heat by energy Source

- **Washington State**
- **Electricity**: 58.3%
- **Natural Gas**: 41.7%

- In Washington state, approximately **19.9%** of homes have wood-burning stoves or fireplaces

- **Wisconsin**
- **Natural Gas**: 64.4%
- **Electricity**: 17.7%

- Approximately **30%** of homes in Wisconsin have a fireplace