INDUSTRIAL HEMP – CREATING AN ENVIRONMENTALLY SUSTAINABLE, SOCIALLY CONSCIOUS ECONOMY THAT UNDERPINS BIDEN ADMINISTRATION GOALS

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Executive Summary (Part 1)

- We are seeking **$535M to fund a 5-year program** to accelerate the infrastructure build for a US industrial hemp industry
- The development of a 'proper' hemp industry directly supports this Administration's goals to:
    1. Be the **leader in global climate change** by carbon reduction and water management
    2. Create a **new major US manufacturing** industry underpinned by diversity and equality
    3. Deliver a new large **scale commodity crop** to US farmers
- This opportunity exists as a result of the combination of the 1937 Marihuana Tax Act and 2018 Farm Bill
    - The intent of the 1937 Act was to curb the use of hemp to protect specific (less sustainable) industries
    - The 2018 Farm Bill provides an opportunity to remedy damage to our environment and the social injustices resulting from the Act
- The climate change opportunity comes from preventing the causes of climate change. For example, if 10% of cotton transitioned to a 90/10 cotton / hemp blend, on an annual basis:
    - We would save **~2 billion gallons of fresh water**
    - Sequester an additional **~18.5 billion pounds of carbon**
    - Prevent **~3.5 million pounds of pesticides and herbicides** from entering our soil and water systems

Executive Summary (Part 2)

- Challenges to expedite the building of a proper hemp industry are addressable. Manufacturing industry commitment to sustainability and government support to accelerate a new commodity crop are required.
- We look to establish a coherent program to synchronize the hemp supply chain. Manufacturers clearly set input and sustainability requirements for processors, growers and genetics providers. Specifically:
    - Input classifications so manufacturers can commit to the use of hemp and growers / processors can deliver to a standard
    - Sustainability classification system to ensure climate change is delivered and prevent 'greenwashing'
    - Genetics and agronomy improvements so hemp is economically viable
- Several significant US manufacturers are committed to using hemp as a sustainable input material. However supply chain certainty is required. We look to develop a program so the US can target a meaningful transition to using hemp by 2027.
- Today we seek **$3.5m to fund foundational items** that accelerate the growth of a US hemp industry:
    - Develop classification system for the use of hemp in the textile and building industry.
    - Develop classification system for hemp that rewards sustainability outcomes (carbon capture, water use, soil preservation) driven by better farming, manufacturing and supply chain practices.
    - Accelerate R&D for genetics and agronomy in order to support c.13,000 ton of planting seed by 2027 which translates to 600,000 acres of US hemp production.

Industrial hemp delivers on a multiplicity of Administration goals.

US Leadership in Climate Change

- "Input-led program" – Prevents as opposed to treats symptoms climate change
- An additional 18 billion lbs. of carbon sequestered (~4.6 million acres of trees)*
- ~2 million megaliters less water used p.a. (~1 billion gallons)*

*based on a 10% transition from cotton to hemp

US Socially-led Industrial Platform

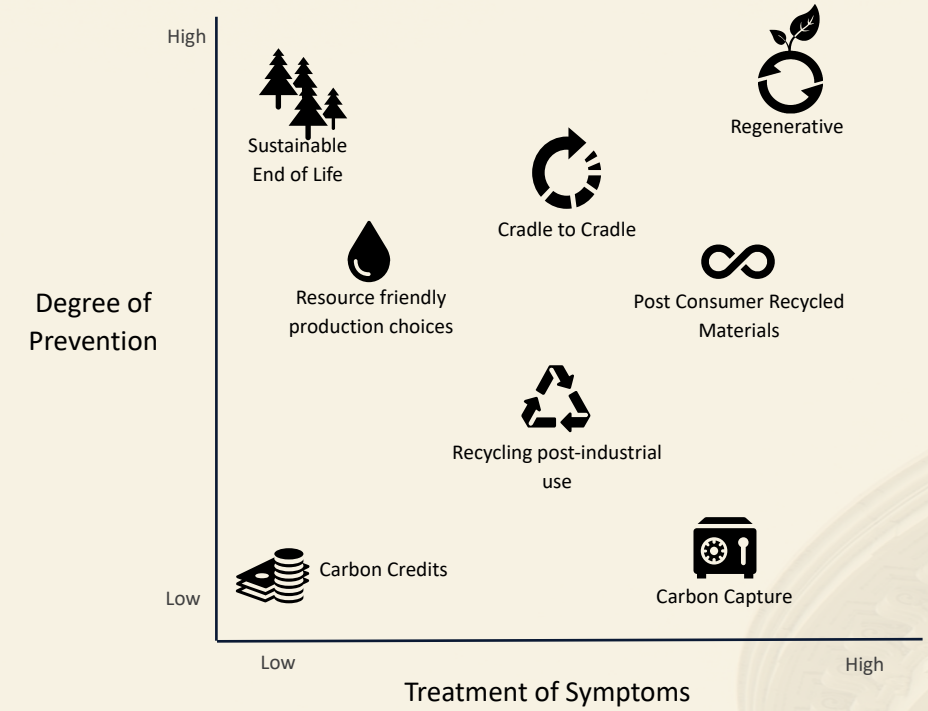
- Create a significant manufacturing industry with social equality at its core
  - Job creation
  - New infrastructure investment
  - Education and training across the value chain
- New industry provides lower barriers to entry with support of this administration

US Agricultural Commodity Crop

- Highly attractive agricultural crop for farmers:
  - Ideal rotational crop with 16 week grow cycle
  - Improves soil
  - Low relative water usage

The 1937 Marihuana Tax Act prevented the US from realizing the benefits of this high-quality, versatile commodity crop.

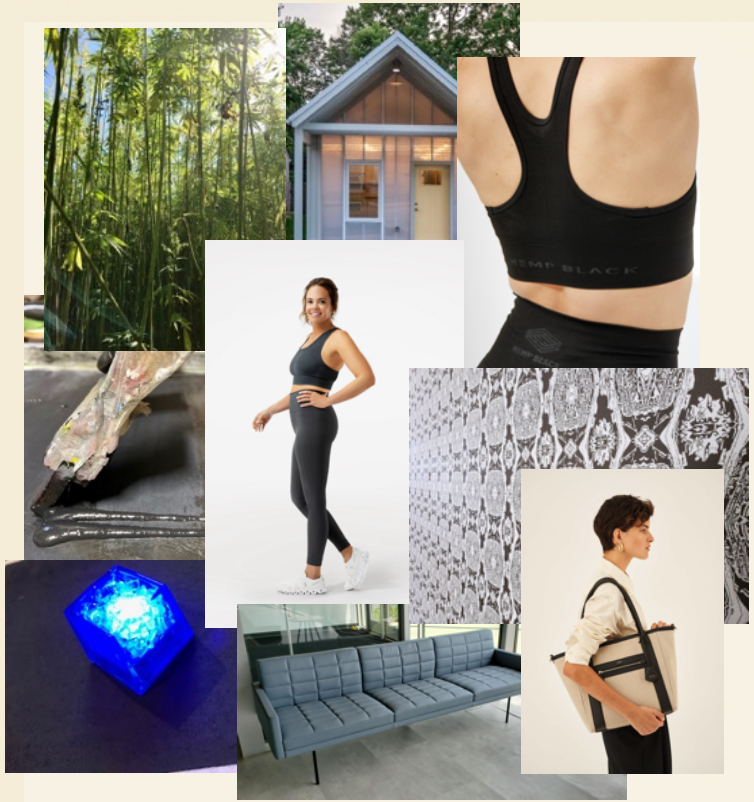
Context: Environmental sustainability comes in many forms.



- Effective sustainability initiatives and goals are preventative, treat the symptoms, move towards a healthy environment
- Stimulation of the private sector is the most cost-effective and long-term solution
- TRUST-90% of consumers are demanding sustainability in the products they buy. Conversely, 88% don't believe the sustainability value in the products they are buying-Change needs to happen!

Sources: Sourcing Journal

Industrial hemp is one of the most sustainable and versatile inputs.



Hemp Technology Properties

- Durable, high tensile strength (3X stronger > cotton)
- Abrasion resistant
- UV resistant
- Mold and mildew resistant
- Accepts dyes easily
- Breathable and washable
- High surface area

Platforms that Hemp underpins

- Infrastructure and building
- High performance textiles
- Anti-microbial and self-cleaning
- Conductive materials
- Sustainable Carbon Black
- Wearables
- Military

Future of Hemp

Sources: Hempblack, Ontario Ministry of Agriculture, Food and Rural Affairs, University of Twente Global Water Footprint of Industrial Hemp Project (2015)

The entire Hemp plant needs to be used as a sustainable input in a variety of supply chains.

Hemp Stalk

1

25% of volume is Fiber

2

75% of volume is Hurd (wood)

Applications

- Textiles
- Furniture
- Anti-bacterial
- Anti-Microbial

- Insulation
- Hemp-Crete
- Paper-making
- Absorbents

Fiber - Science supports the opportunity for a substantial shift in climate change via the reintroduction of industrial hemp.

	Hemp	Cotton	Forest
Water usage / acre (MGL)	1.2	3	N/A
CO_2 Sequestered / Acre	16,000lbs	400lbs	3,909lbs[1]
Fibre yield / acre	1000lbs	500lbs	-
Pesticide (P) & Herbicide (H)/acre	-	0.8lbs (P), 2.1lbs (H)	-
Maturation	<120 days	<175 days	<80 years

For example….if 10% of cotton was replaced by Hemp[2]…

2.2 million megaliters of water returned to the system (2 billion gallons)

18.5 billion lbs. more of carbon would be sequestered (~4.6m acres of trees[1])

3.5 million lbs. of herbicides and pesticides prevented from entering the soil & water system

Sources: Boeing, Bureau of Meteorology

1. Per annum based on a 120 year old forest assuming 700 trees per acre (Forestry Research & Engineering: International Journal (2018))
2. Assumes 2020 cotton production of 12m acres in the United States. Replacement assumes 600,000 acres of cotton swapped for Hemp

The science behind hemp as a carbon sink.

One hectare of industrial hemp can absorb 22 tonnes of CO2 per hectare. It is possible to grow to 2 crops per year so absorption is doubled. Hemp's rapid growth (grows to 4 metres in 100 days) makes it one of the fastest CO2-to-biomass conversion tools available, more efficient than agro-forestry.

Biomass is produced by the photosynthetic conversion of atmospheric carbon. The carbon uptake of hemp can be accurately validated annually by calculations derived from dry weight yield. This yield is checked at the weighbridge for commercial reasons prior to processing. Highly accurate figures for total biomass yield and carbon uptake can then be made, giving a level of certainty not available through any other natural carbon absorption process.

The following carbon uptake estimates are calculated by the examining the carbon content of the molecules that make up the fibres of the hemp stem. Industrial hemp stem consists primarily of Cellulose, Hemicellulose and Lignin, whose chemical structure, carbon content, (and therefore absorbed CO2).

- Cellulose is 70% of stem dry weight. Cellulose is a homogeneous linear polymer constructed of repeating glucose units. The carbon content of cellulose accounts for 45% of its molecular mass.
- Hemicellulose is 22% of stem dry weight. Hemicellulose provides a linkage between cellulose & lignin. It has a branched structure consisting of various pentose sugars.
- Lignin is 6% of stem dry weight. Lignin is a strengthening material usually located between the cellulose microfibrils. The lignin molecule has a complex structure that is probably always is variable.

To summarize the above, one tonne of harvested stem contains:

- 0.7 tonnes of cellulose (45% Carbon)
- 0.22 tonnes of hemicellulose (48% Carbon)
- 0.06 tonnes of lignin (40% Carbon)

Source: The Role of Industrial Hemp in Carbon Farming. James Vosper. 13/04/2011.

Industrial hemp fiber: A sustainable and economical alternative to cotton.

Conclusion

The textile industry, one of the highest polluting industries in the world, needs a more sustainable way to produce garments. This study asked if hemp fiber can be produced in an economically competitive manner, specifically in terms of its agricultural activities, and have a lower ecological footprint than cotton fiber. We researched the main agricultural activities to produce hemp fiber and cotton with two main variables for fiber production: *(i)* cost and *(ii)* yield. We considered four main cost inputs within the agricultural activities. First, fertilization costs were considered for field preparations. Secondly, we assessed the seed costs associated with cultivation. Third, we assessed the cost of irrigation (i.e., water consumption) and fourth, pest control cost for field operations. Further, the aggregated cost was associated with the final fiber extracted from a hectare of land, yield, for both hemp and cotton fiber. All the data extracted was further validated with people in the field to support our results and conclusion.

Our results show that with hemp fiber, the current garment industry's demand can be satisfied by using only **1/3 of the land cotton uses** to produce the same amount of fiber. For the lowest estimate of water required to grow both plants, **cotton requires 2.5 times the water than hemp per hectare** of land cultivated. Additionally, the production of **cotton accounts is one of the plants with the highest usage of pesticides and insecticides in the world**. In contrast, hemp, due to its resilient and fast-growing qualities, currently does not use any pesticides or insecticides.

Source: Industrial hemp fiber: A sustainable and economical alternative to cotton. Journal of Cleaner Production. May 2020.

Hurd - the building industry in the US is worth $1.3T and would benefit from potentially lower-cost, more sustainable inputs.

There is significant building material demand in the United States….

The United States build 1.3m+ homes annually

The average 2,500 sqft home will lock up 6,250lbs of CO_2

The average 2,500 sqft home would continue to sequester an additional 6,250lbs of CO_2 over its life

Hempcrete is a highly sustainable and effective insulator…

Highly Effective

- ✓ Regulation of humidity by absorption and desorption of moisture
- ✓ Thermal mass qualities to maintain warmth
- ✓ Highly insulative
- ✓ Fireproof
- ✓ Non-toxic

Highly Sustainable

- ✓ Zero-waste
- ✓ Carbon-negative in growth and in lifetime use

If **1%** of all new homes in 2022 were built with Hemp, **6.5 billion lbs of carbon** would be sequestered

Sources: Innovation Network – Sustainability Planet (2020), National Association of Home Builders (2019), Associated General Contractors (2020)

There is significant fragmentation in the hemp supply chain.

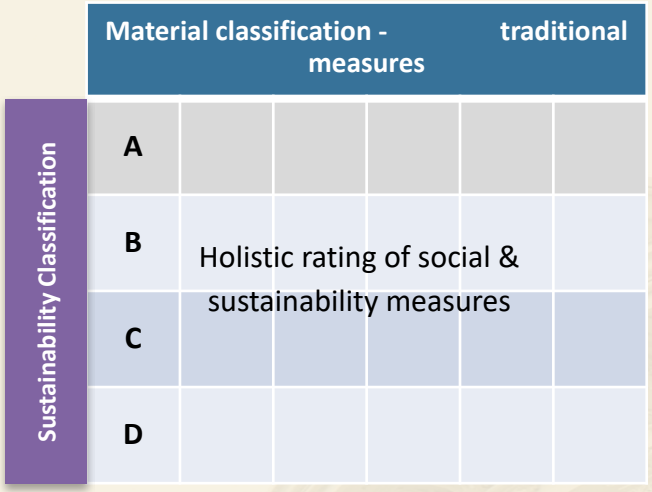
	Genetics	Farmer	Processor	Manufacturer	Brand & Customer
Current State	• Lack of quality genetics • Limited alignment to manufacturer requirements	• Poor genetics received from sources • Limited expertise from genetics providers	• Processing of hemp is on a case-by-case basis • Poor decision-making results in poor outputs and higher costs	• Lack of quality and consistency in inputs • Unreliable supply chain to support commitments to use of hemp	• Misconceptions regarding Hemp as a product • Inability to access Hemp as an input material
Pain points	• Bad genetics derails the entire supply chain from the beginning	• No support to grow a new commodity crop • No understanding of supply chain needs as they are disconnected from the system	• Disconnect between what is provided by farmers and what is required by manufacturers	• No classification system to standardize requests and develop longer-term planning	

Sources: Hemp Black

A material classification system brings cohesion to the hemp supply chain. A sustainability classification system delivers climate change and social equality.

Material Classification

- Staple fiber length
- Tensile strength
- Micronnaire
- Color grade
- Leaf Grade
- Extraneous matter
- Module averaging



Sustainability Classification

- Water used
- Carbon sequestered
- Distance travelled
- Pesticide / herbicide
- Child / slave labor
- Business owner type

Sources: Cotton Classification Cotton Inc. (2018)

To accelerate a socially conscious, sustainable industry $535M is required to drive 5% hemp in products by 2027 across multiple industries.

Stakeholder	Program Description	$m
Genetics	• Hemp genetic research and development incentives expansion at farmer and operational levels • Funding for universities and private enterprise to conduct R&D to provide genetic resource to farmers that meets manufacturer requirements and is competitive with existing commodity crops	• $85M • R&D grants
Farmers	• Agronomy, harvesting and handling research • Development of a regulated and informed advisory body to support farmers • Education programs to support growers • Grower risk-based incentives (carbon credits, crop insurance)	• $120M • Carbon credits • R&D / education grants • Crop insurance • Minority farmer grants
Processors	• Development of mechanical classification standards • R&D for private and public institutions to establish processing requirements • Support investment for processing infrastructure • Training and education	• $200M • Business loans (including minority owned) • R&D / education grants
Manufacturers	• Private sector incentives to move towards sustainable manufacturing inputs • Support capital requirements to accelerated development of hemp industry	• $80M • Climate change tax incentives • Tax credits
Consumers and Brands	• Development of sustainability classification standards with industry for compliance • Consumer education on sustainability classifications to drive consumer-led climate change	• $50M • R&D grants • Consumer marketing