



BRAED

BATTLE RIVER ALLIANCE
FOR ECONOMIC DEVELOPMENT

BATTLE RIVER ALLIANCE FOR ECONOMIC DEVELOPMENT BUSINESS OPPORTUNITY:

HEMP BASED BIOCOMPOSITES

Biocomposites are materials formed by blending natural fibres with other natural or synthetic materials. The use of hemp as a feedstock, which has good growth potential in the BRAED region, is an exciting opportunity. Hemp has been grown for industrial purposes for many decades. The hemp based food and supplement markets are maturing and somewhat competitive, with established manufacturers in both the US and Canada. There are also possible emerging hemp fibre and hemp hurd opportunities in automotive parts and building products respectively, ramping up manufacturing in Alberta. The BRAED region can grow all varieties of hemp and has sufficient infrastructure to export intermediate or finished products.

FEEDSTOCK

Industrial hemp is grown primarily for its seeds and fibres, or in some cases both. Straw from the hemp crop, which was largely considered as a waste product in the past, is currently used to produce hemp fibres, which is processed further and can be used in a variety of industries such as textile, bioplastics, and pulp and paper. It should be noted that the hemp straw consists of 15% to 30% fibre, 55% to 60% hurd (the woody core of the stem), and 15% to 25% is dust, which can potentially be pelletized and used as biofuel. The leaves contain 23% protein, among other valuable compounds.

“Location Advantage”

Northern Alberta is more suitable for growing hemp for industrial uses (fibre, etc.), due to longer sunlight hours in the summer months. Southern Alberta hemp grows shorter stalks, making it more suitable for seed harvest.

The BRAED region is situated between these two areas.

But specially equipped combines can harvest the entire crop so it is conceivable that both food and fibre could be grown in the same field to enhance producer netbacks, given an appropriate hemp variety. Hemp straw after combining from high yielding varieties can provide 1.2 to 2.4 tonnes/acre or 2.4 to 4.8 tonnes/hectare.

Hemp is currently grown in eastern Alberta and the growing conditions are favourable for straw intensive varieties. There are several hemp varieties, some with a significant biomass proportion growing 2 to 3 metres in height. Shorter varieties are easier to harvest for producers who only want seed.

In circumstances where producers harvest both grain and straw (there are maturation timing issues to consider) it is useful to also understand grain yields. These are highly variable. For dryland areas, a conservative average is 800 lbs./acre or 850 kg/hectare, with yields significantly higher for irrigated crops.

MARKET

Growing Market:

According to a new market report*, the future of the natural fibre composites (NFCs) market looks attractive with opportunities in the automotive and building and construction industries. The global natural fibre composites market is forecast to grow at a CAGR of 8.2% from 2015 to 2020. The major driver for the growth of this market is the rise in demand for lightweight and environmentally sustainable composite materials in various applications, such as automotive, building and construction, and others.

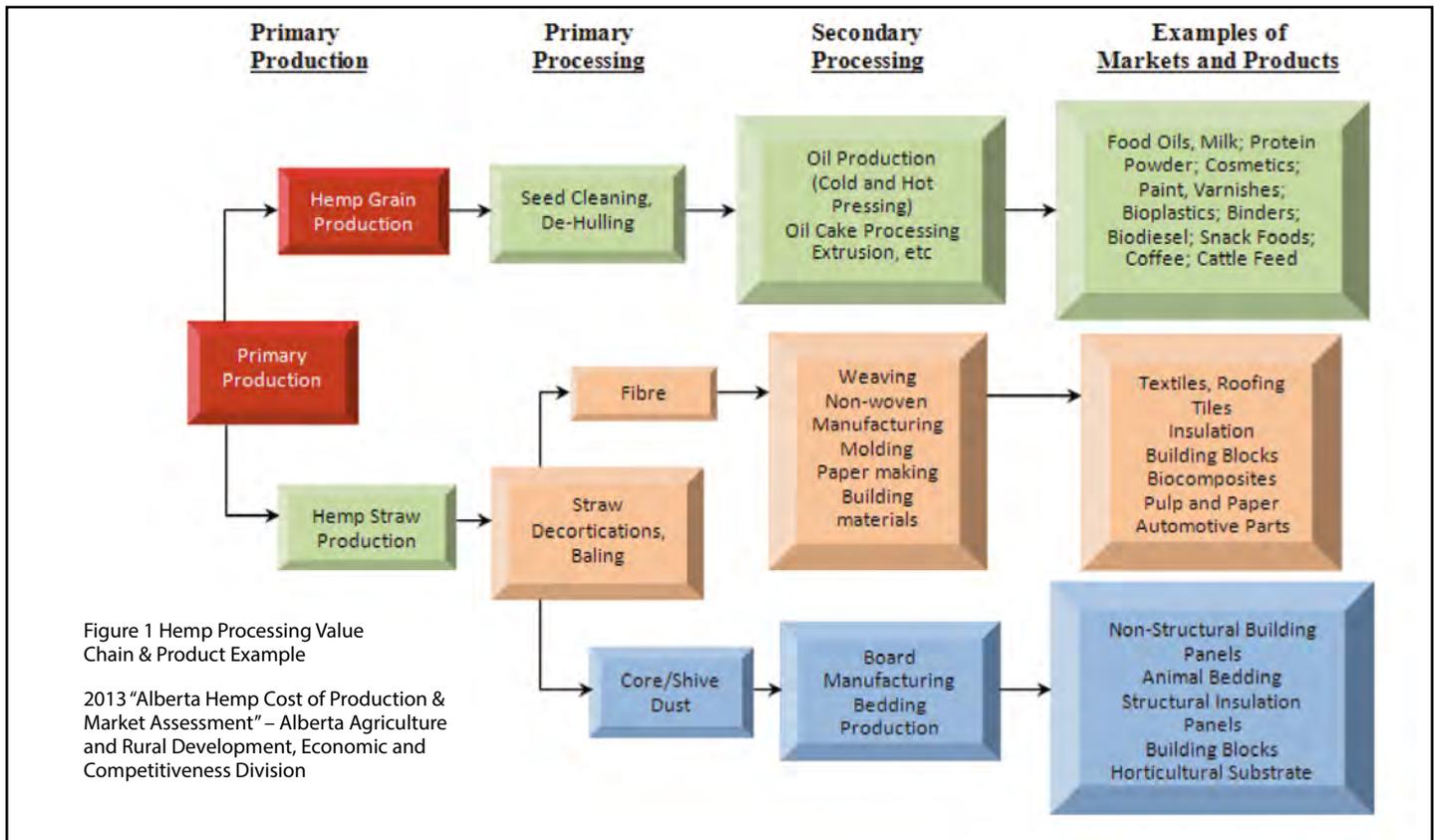
So Many Uses:

Hemp offers super absorbency. This quality is desirable for oil and gas cleanup, livestock bedding and personal hygiene markets. Hemp's very high tensile strength, strength-to-weight ratio, flexural strength and ability to rebound are desired benefits in bio-composites for automotive parts, aerospace and packaging. The textile, paper and building markets have interest in some specialty applications due to hemp's durability, anti-microbial, acoustic and aesthetic properties. There is growing demand in food markets for certified organic hemp production. Some 80% to 85% of Canadian grain production is exported, mainly to the United States.**

And Strong:

While pre-commercial, just Biofibre Structural Solutions Corp. of Calgary has patented a hempcrete building block, which is lower cost on an installed basis, stronger and has better acoustic and insulating properties than cement blocks. Just Biofibre uses the hemp hurd (the woody core of the stalk surrounded by the bast fibre) so is an excellent complement to Biocomposites Group's demand for hemp fibre. Biocomposites Group is a manufacturer of high performance bio-fibre products. Its blocks provide an insulating value of between R27 and R42 for the same price or lower as conventional concrete blocks. The BRAED region has good transportation access for movement of hemp fibre and hurd by road and for finished hempcrete blocks by rail.





New Opportunities:

The Controlled Drugs & Substances Act regulation currently forces farmers to discard the leaves in the field, due to their low 0.3% THC content. This level is deemed to be above the limit wherein narcotic effects occur. The announcement updating this regulation to permit harvesting of leaves is expected soon. This would open a significant new co-product revenue source for higher value foods, medicinal products, nutraceuticals, and animal feed. Last year, the US Industrial Hemp Farming Act of 2015 was introduced into the Senate, which would change the material's designation as a controlled substance and permit farmers in the US to produce industrial hemp.

* Lucintel - Global Natural Fiber Composite Market 2015-2020: Trends, Forecast, and Opportunity Analysis, December 2015
 ** "Industrial Hemp Enterprise"; Published by Alberta Agriculture and Forestry, November 2015

VALUE CHAIN & PRODUCTS

Figure 1 illustrates the numerous steps in the processing value chain and the resulting products. This value chain excludes leaves, which could also serve as feedstock for health, food, and animal feed products.

Active projects in Alberta include fibre mats for automotive interior panels and hempcrete construction blocks. Internationally, hemp is becoming a mainstream fibre in many domains. For example, Nike uses hemp fibres in its running shoes. There are several Canadian companies—including Hemp Oil Canada Inc., Hempola Valley Farms, Fresh Hemp Foods Ltd., Ruths



Hemp growing and retting hemp side by side

Hemp Foods, Cool Hemp, and Natures Path, etc.— who are working to develop and market hemp seed products. These companies are all involved in the hemp seed market and are producing a wide range of products like snack foods, hemp meal and flour, edible oil, shampoo and conditioners, moisturizers, commercial oil paints, beer, aromatherapy, and cosmetic products.

Electricity is vital to hemp processing. There is a Capital Power wind farm with 83 turbines and a capacity of 100 to 150MW in the County of Paintearth. The transmission infrastructure within the BRAED region is well established with a high capacity (greater than 230kV) line available from the Forestburg coal plant. There are other, smaller capacity lines available within the region as well.



TYPICAL CAPITAL & OPERATING COSTS

With ready access to feedstock and a cluster to reduce capital and operating costs, this opportunity could likely be competitive in nature if supported by both fibre mat and hempcrete customers:

- A standalone dry decortication unit with a straw processing capacity of 4 to 7 MT/h, would cost approximately \$8M to \$10M. The outputs of this plant would be bast fibres, clean hurd, and dust in bulk.
- The prices of processed fibre and hurd is approximately \$1,000/tonne and \$370/tonne, respectively, to the manufacturer.
- It is estimated that a 3 MT/h plant, the operating costs were \$5.5M, of which one half was feedstock.
- Given yields of 30% fibre and 55% hurd, the maximum annual fibre production from a 3 tonnes/h decortication plant running 24 hours per day for 350 days/year would be about 6,300 tonnes of fibre and 13,800 tonnes of hurd.
- It is estimated that the demand for hemp fibre for automotive interior manufacturing in Alberta will be between 2,000 and 6,000 tonnes/annum (Biocomposites Group). at an average price of \$1,000/tonne for processed fibre, the total fibre revenue for a decorticator selling into an automotive panel manufacturer in Alberta would be \$2M to \$6M.
- A full scale hempcrete building block plan would consume 16,000 tonnes of hurd annually. Thus, at a price of \$370/tonne, a decorticator could earn an additional \$5.9M.

March 2012 – “Alberta Hemp Cost of Production & Market Assessment”: Alberta Agriculture and Rural Development

HEMP PROCESSING OPPORTUNITY IN THE BRAED REGION

Just outside the northern edge of the BRAED region, InnoTech Alberta (formerly AITF) Vegreville decortication has made it possible for an Alberta company to conduct successful pilot programs with automotive parts manufacturers for hemp reinforced automotive interior panels. Each panel within a single car model would generate approximately \$2 million in sales.

Given the large reduction in mass of fibre versus the entire hemp plant, it is advantageous to have decortication facilities close to the field. There may be an opportunity for up to 4 new decortication facilities in East Alberta, should this market opportunity fully emerge.

TRANSPORTATION CAPACITY IN BRAED REGION

The BRAED region has an excellent transportation system for moving agricultural products, connected by a series of high load highways. The high load corridors along Highway 41 and 36 run north-south to U.S. and Mexican markets. The Queen Elizabeth II Highway corridor, the province's major north-south route, is only 40 minutes west of the City of Camrose. Well-maintained principal highways in the region include Highways 13 and 14, which bisect the region from west to east, and north-south. A series of other secondary highways connect the region, along with CN and CP rail lines, and a number of regional airports. In addition, Edmonton International Airport is just east of the BRAED region.



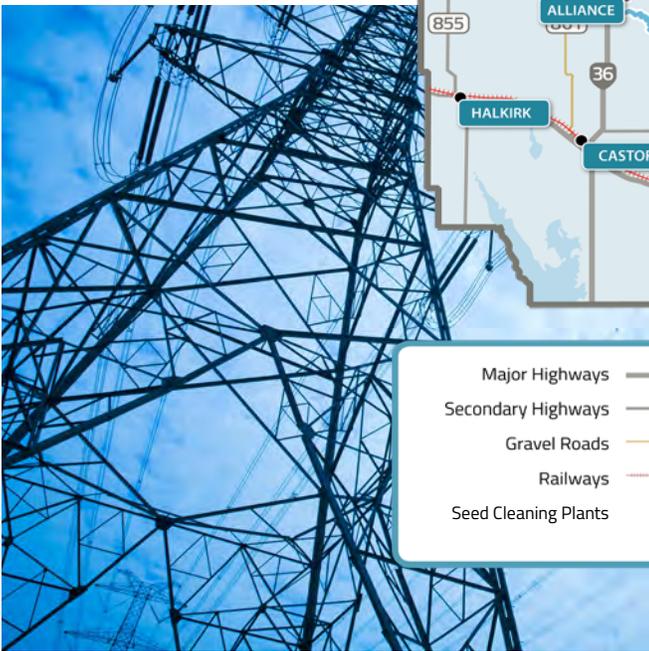
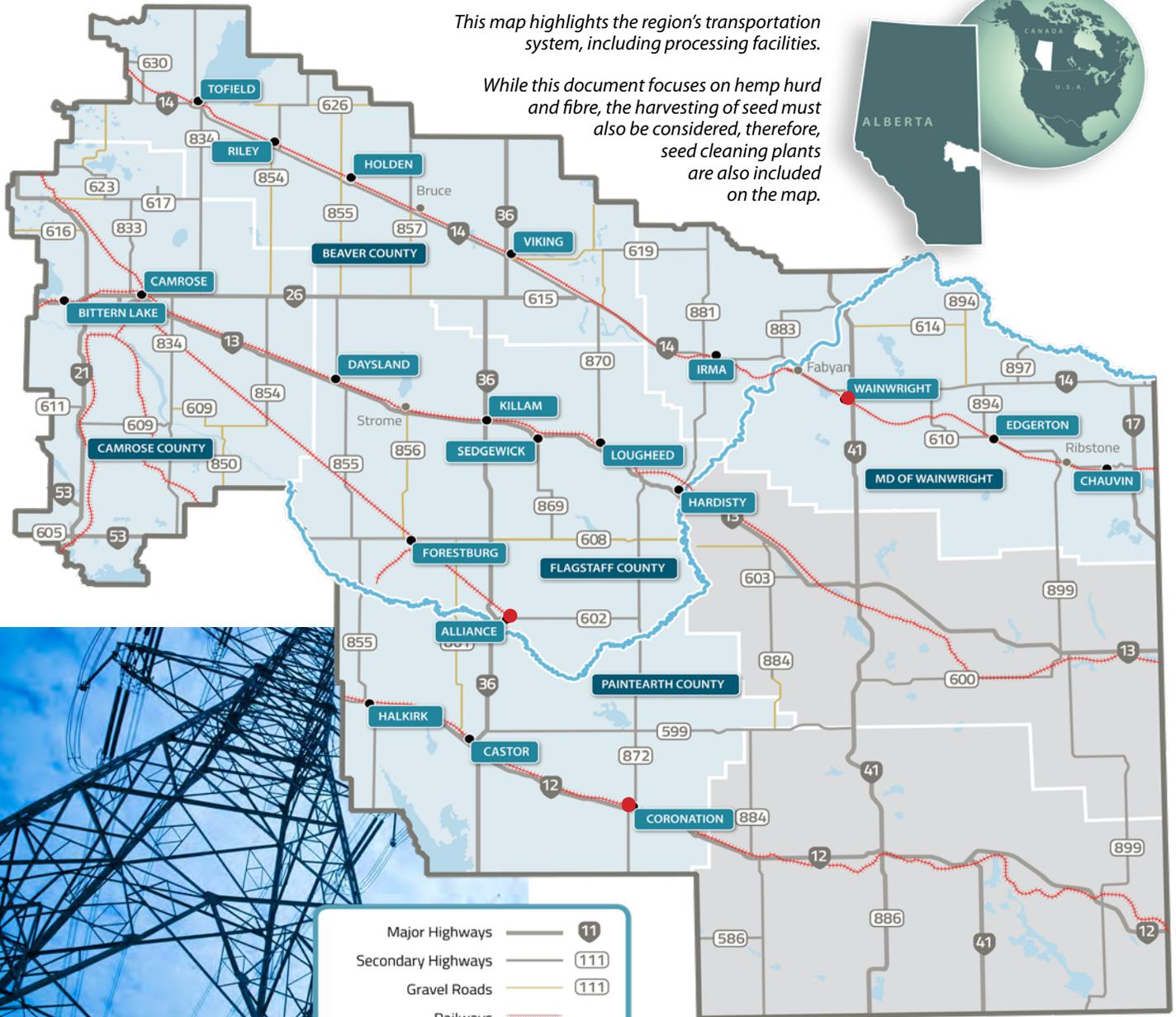
The BRAED region's central location within Eastern Alberta positions businesses well for easy access to local, national and international markets, opening up product export and import opportunities. The BRAED region's partnership with the Ports to Plains Alliance further expands market access down into the United States and Mexico.





This map highlights the region's transportation system, including processing facilities.

While this document focuses on hemp hurd and fibre, the harvesting of seed must also be considered, therefore, seed cleaning plants are also included on the map.



Sample Site Locations in the BRAED Region for Hemp Processing

Location	Rail	Rail Terminal	Labour	Water	Transmission
Camrose	CN/CP	Yes	18,000	Battle River / Dried Meat Lake (may be limited)	115 – 229 kV line
Wainwright	CN	Yes – (operated by Altex Energy)	5,900	Battle River / Betty Lake (may be limited)	Forestburg 115 – 229 kV line

Battle River Alliance for Economic Development (BRAED) strives to provide current and accurate information, however, numbers are approximate and information is subject to change. This information has been sourced from communities, Government of Alberta departments and other organizations. Please contact BRAED should you require additional information or visit www.braedalberta.ca.

KEY REGIONAL ADVANTAGE

Both Canadian Pacific and Canadian National Railway provide daily freight service, and interchange is available at many points throughout the region. CN runs a line connecting Camrose to the Alliance region with a 268,000lb line and CP runs a main line east of Camrose through Hardisty.

