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The Future for Hemp

An Environmental Perspective - What Can Hemp Offer?

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What Can Hemp Offer?

Hemp is emerging as one of the most rapidly growing agricultural and industrial markets that has emerged for decades

Major environmental benefits
carbon sequestration, enhanced biodiversity, phytoremediation and environmentally responsible industrial and consumer products

10,000+ applications including
Construction materials, high protein foods and beverages, food supplements, composites, textiles, paper products, biofuel, graphene substitutes

Profitable cash crop for farmers when permitted to utilise the whole plant
plus multi billion pound downstream markets

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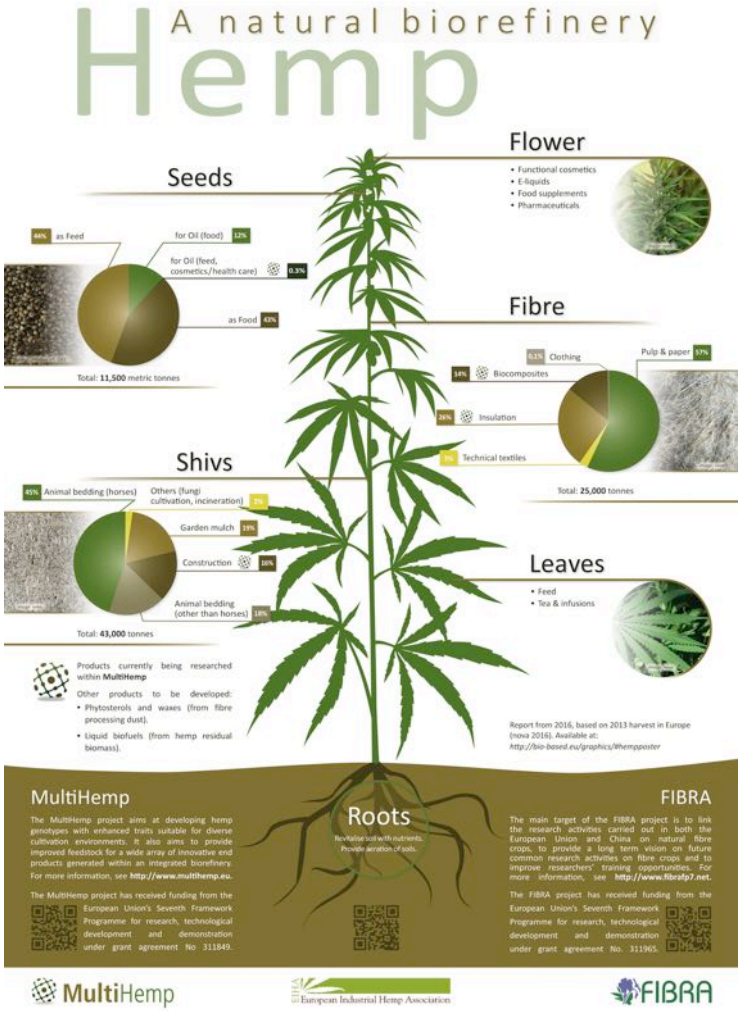
Hemp Renaissance in the 21th Century

Advance in science has enabled us to quantify environmental and health benefits of growing, eating and using hemp for industrial applications.

The production of Hemp is ***carbon negative***, which means it absorbs more carbon from the atmosphere during its growth than is emitted by the equipment used to harvest, process and transport it.

We can use the whole plant.

Hemp is an important raw material.



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Target 2015 Paris Agreement

- Global warming to be kept to a maximum of 1.5C to pre-industrial levels.
- To keep warming below 2C, countries must triple their current efforts. **For the more ambitious target of 1.5C, countries must raise ambitions by five times.**
- "It's a line in the sand and what it says to our species is that this is the moment and we must act now," *Debra Roberts, a co-chair of the working group on impacts*

Source: Report by the UN Intergovernmental Panel on Climate Change (IPCC)

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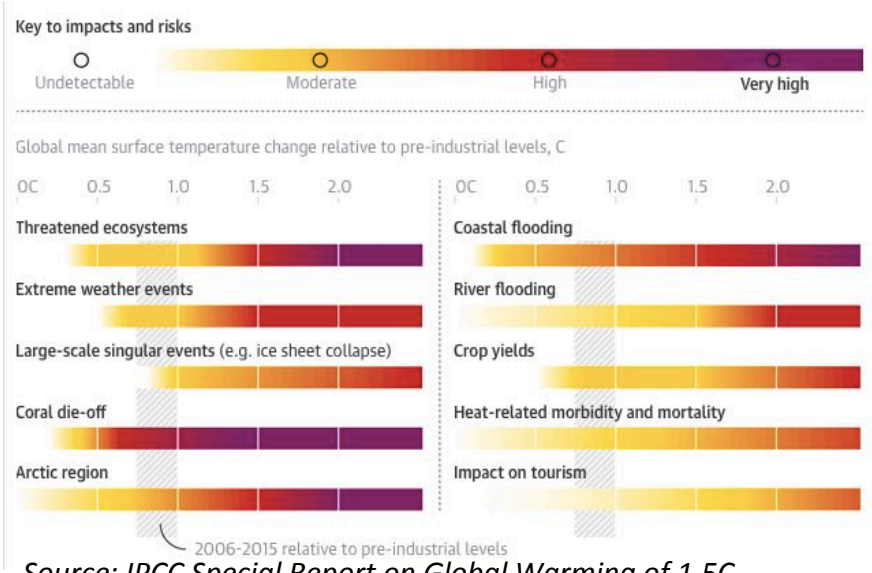
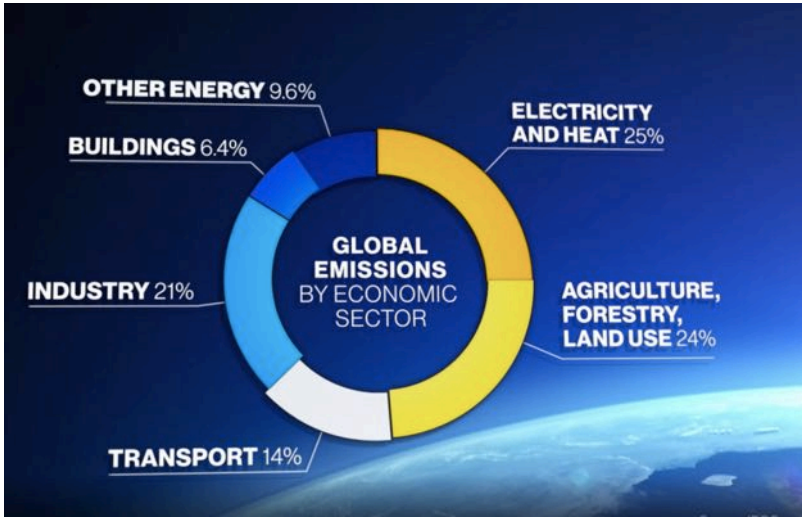
Core Issues

- Pollution and contamination of land, sea and air
- Adverse effects on human health
- Mass extinction of species



Source: IPCC Special Report on Global Warming of 1.5C



Source: BBC

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Key environmental benefits of hemp – Agriculture & Land Use

- According to Defra, UK Farming emits a total CO2e of 57 million tonnes in green house gases (GHG's). UK agricultural land use is 18.5 million hectares. This amounts to an average of around 3.1 tonnes of CO2 per hectare total embodied emissions (CO2e).

- In comparison, **one hectare of industrial hemp can sequester potentially 10.5 tonnes of CO2** per hectare per annum, returning carbon to soil.

- In addition, hemp rapidly absorbs Co2 from atmosphere using the carbon to create the woody cellulose stem which support this tall, slim plant during the rapid growth cycle (4-5 months).

- **Restores soil health**: Hemp is a valuable preceding crop in rotations. After cultivation the soil is left in better condition.

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How does hemp sequester carbon

Hemp (along with many others) is a mycorrhizal plant which means it can establish a symbiotic relationship with **Arbuscular Mycorrhizal fungi (AMF)**. **AMF** is important as **it's the only known source of glomalin**.

Glomalin aids in forming soil aggregates that then form a protective barrier around the soil pore spaces that protects nutrients from being leached away by rain water; effectively 'locking in' Soil Organic Carbon (SOC) which is exuded by the hemp roots.

Hemp has an advantage as its roots can grow to a length of 2 metres; providing considerable surface area for the development of the AMF ecosystem.

It will take about 30 years of no-till farming to raise the carbon content from roughly 2% to roughly 4% (top soil currently between 1.5% - 2% carbon).

No till hemp farming enables potentially **10.5 tonnes per year per hectare of carbon sequestration and contributes to soil health restoration**

Note: using traditional plowing and tilling techniques the AMF in the soil will be killed. If hemp farmer uses modern no-till planting techniques a healthy AMF population can be established.

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Key environmental benefits of hemp – Agriculture & Land Use

- **Protects the environment and enhances biodiversity**: Hemp can be grown with less or no use of herbicides, pesticides or fungicides. It is in the top 5 out of 23 crops for biodiversity friendliness.

Most striking is the sound of birdsong around hemp fields. The tall plant provides a dense cover providing lots of food for farmland birds (when no insecticide has been used).

Hemp offers a late season pollen source for stressed bees.
(Source: Science News)

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Construction Sector

- Globally the construction industry is responsible for approx. **one third of all carbon emissions**. The buildings sector consumed nearly 30% of total final energy use, plus 6% for construction and manufacturing of building materials. *UN Environment Report*

- Making one tonne of steel emits 1.46 tonnes of CO2 and 198kg of CO2 is emitted to make one tonne of reinforced concrete. **One square metre** of timber framed, **hemp-lime wall** (weighing 120kg), after allowing for the energy cost of transporting and assembling the materials actually **stores 35.5kg of CO2**.

- "The Science Museum's three-storey building is constructed using a hemp-lime envelope and was so effective that **they switched off all heating, cooling, and humidity control for over a year**, maintaining steadier conditions than in their traditionally equipped stores, reducing emissions while **saving a huge amount of energy**. " *Dr Mike Lawrence is Director of the University of Bath's new research facility, the Building Research Park*

FIGURE 6 Share of global final energy consumption by sector, 2015

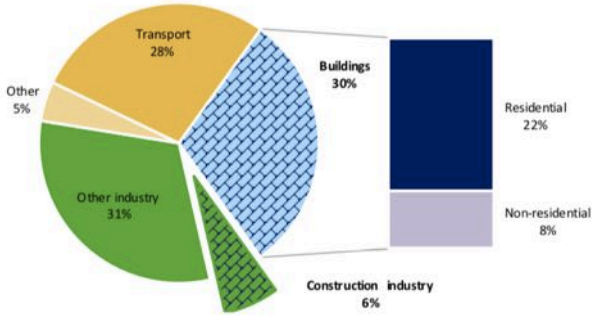
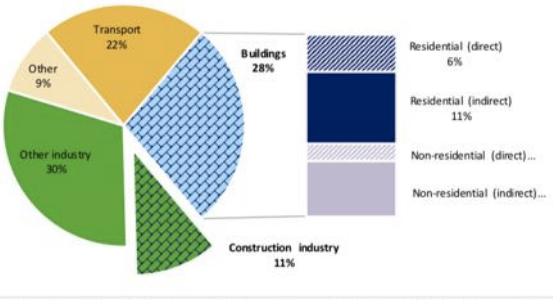


FIGURE 7 Share of global energy-related CO2 emissions by sector, 2015



Note: The "construction industry" is an estimate of the portion of the overall industry sector that applies to the manufacturing of materials for building construction, such as steel, cement and glass.
Source: derived with IEA (2017), World Energy Statistics and Balances, IEA/OECD, Paris, www.iea.org/statistics

Construction – zero carbon building materials

- Insulation
- Shuttering filled with Hempcrete
- Panels
- Hempcrete Blocks

Composites & Plastic Alternatives

- Global annual plastics production reached 322 mio tonnes in 2015, expected to double by 2050.
- Globally, 5 -13 million tonnes of plastic end up in the world's oceans every year. 150k – 500k t/ pa from the EU.
- 150+ mio/t of plastic are estimated to be present in the oceans;
- Cited UN study: ”if nothing is done, there will be more plastic than fish in the oceans by 2050.”

Source: A European Strategy for Plastics in a circular economy (EP, 9/2018)

- EU waste plastic mountain of approx. 25.8 million tonnes per annum (2017).
- This equates to 1.6 million trailers, or 4.5k trailers a day/fully loaded 16t each.
- Parked up = 25,000 kms.
- **Or 6 lanes wide solid line from Lisbon to Tallinn or Athens to Scotland, annually!**

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Composites & Plastic Alternatives

- Many possibilities for hemp plastics, resins and bio-composites. **Virtually any shape and purpose can be fulfilled by bio-composite plastics.**

- It has been calculated that the serial implementation of the lightweight biomaterials on the high-volume vehicles will deliver a reduction of 40,000 tons of CO2 emissions and the ability to drive an additional 325 million kilometres with the same quantity of fuel.
  Source: Autocar Pro Newsdesk 3/2018

"Porsche's smoking hot new race car, the 718 Cayman GT4 Clubsport features composite doors that use an organic fibre mix from hemp and flax. Porsche says the organic ingredients used are agricultural by-products, making it more environmentally friendly."
Source: FoxNews

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Composites & Plastic Alternatives

- Hemp composites may not be necessarily bio-degradable, but utilising a carbon negative/neutral raw material is an improvement.

- Depending on the final application products can potentially be recycled. Plastic alternatives which are becoming available now are suitable for the vast majority of manufacturing processes, eg injection moulding, storage containers, food packaging…

Can hemp produce? HempPropylene, HempEthylene, HempPLA, HempABS

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Textiles

Hemp may help make the overall textile chain more environmentally friendly.

Hemp **uses significantly less water and chemicals than cotton**.
1kg cotton = 17,000 litres water vs 1kg hemp = 700 litre. **Hemp is 24x more water efficient**.

- Scientists shed light on the benefits of hemp fibres:
  - they have a complex three-dimensional structure
  - very good moisture absorption characteristics
  - an anti-bacterial effect
  - they provide good UV protection and allow textiles to dry fast.

- Nowadays, very fine hemp fabrics of an unprecedented quality are introduced to the market by Chinese “hemp alliance” companies. A bulk purchaser is the Chinese army, which buys hemp uniforms and socks for their soldiers.

- Levi's head of global product said: "It's great that it's resonating with the consumer, but it's more important that it's helping to future-proof our supply chain.”
- *Source: Forbes*


Universal Images Group/Getty Images

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Paper Products

- Pulp and paper industry, one of the largest industrial sectors is the world, has an enormous influence on global forests. This sector uses over 40 percent of all industrial wood traded globally.
- Hemp contains around 65-70% cellulose (wood contains around 40%, flax 65-75%, and cotton up to 90%)
- Hemp is currently used for speciality paper, hemp fibre alone appears at this point to be too expensive for volume paper and packaging products.
- However, in the medium/long term, the cost of raw material may become sufficiently competitive, cross financed by a thriving cultivation and presence of large scale processing facilities.

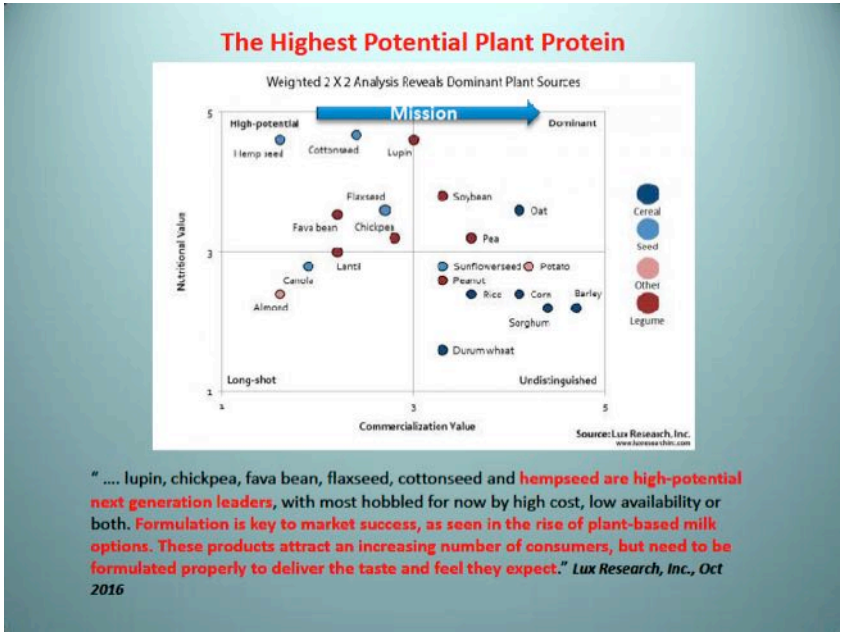

Hemp Content Paper - 8.5 x 11 | 110#

Seeds: High Potential Plant Protein (>25%)

- ”Global food production threatens climate stability and ecosystem resilience and constitutes the single largest driver of environmental degradation and transgression of planetary boundaries…**Food is the single strongest lever to optimize human health and environmental sustainability on Earth.**" *Source: EAT Lancet Report*

- “Hemp seeds possess an extremely high nutritional value due to a high content of unsaturated fatty acids (about 80% of fatty acids) and proteins (about 25%). **It is not to be ruled out that other minor components, such as terpenes and cannabinoids, could contribute to the surprising beneficial effects of hemp seeds.”**

WHO Expert Committee on Drug Dependence Pre-Review, Extracts and tinctures of cannabis, Section 1: Chemistry, WHO, 2018 page 21



Source: Lux Research, Inc, October 2016

- It is predicted that over 2.66 million Britain alone are set to move from meat & dairy to a plant based diet in 2019. Hemp can provide the ideal protein to satisfy this growing demand

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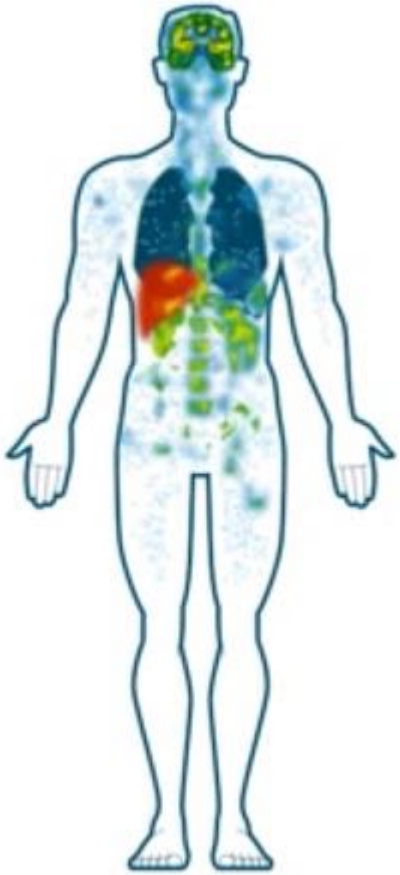
Flowers/Leaves: Foods, drinks and supplements

- We have an entire physiological system, the **endocannabinoid system**, which regulates many physiological processes and helps maintain balance in mind and body.

- Our body produces endocannabinoids throughout our lives, but these are not necessarily sufficient. It is evident that we benefit from including health promoting phyto-cannabinoids in our food, drinks, snacks and food supplements.

- Hemp foods, naturally rich in cannabinoids/CBD, have been part of our diet for millennia. Due to it's nutritional profile, hemp is a 'superfood' or 'functional food'.

- Hemp flowers are the most profitable part of the hemp plant.



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European Targets

EU leaders have committed to transforming Europe into a highly energy-efficient, low carbon economy.

- For 2020, the EU has committed to cutting its emissions to 20 % below 1990 levels (Europe 2020 growth strategy). This is being achieved via the Emissions Trading System (ETS). Companies receive or buy **emission allowances** which they can trade with one another as needed.

- Climate and energy policy framework for **2030** , EU target of reducing emissions to 40% below 1990 levels.

- For 2050, EU leaders endorsed the objective to reduce by 80 % compared to 1990 levels. That is only 30 years!!!

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Blockages to growth and achieving international competitiveness

- Myths and misconceptions about hemp
  - **Education of all stakeholders**

- Complex licensing procedures
  - **The need to designate hemp as an agricultural crop**

- Uncompetitive THC levels for hemp seeds which are permitted to be grown in EU
  - **Raise THC levels to 0.3% in line with international standards**

- Restrictions on the use of the green parts
  - **Secure whole plant utilisation**

- Resolve above blockages to facilitate grants and attract investment in R&D and market development funding

The hemp industry has a real opportunity to play a leading role in the development and expansion of a unique industry; bringing a new 'cash-crop' to agriculture, creating jobs across the entire supply chain and establishing a 'hemp innovation' hub for Europe.

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Removing Barriers to Growth

Now is the time to make it a priority to permit and support the hemp industry to contribute to large-scale and innovative solutions to **decrease total environmental impact of products.**

Europe's farmers and the hemp industry are well regulated. To attract investment into R&D and processing facilities **we need a hemp positive legislative framework** for low-THC cannabis **permitting the use of the Whole Plant**.

There is an urgent need for these changes to ensure that Europe is not left behind and can therefore benefit from what is forecast to rapidly becoming a multi billion € industry whilst **reducing carbon emissions and supporting the health of our nations**.

When asking an industry colleague why he is still in hemp considering the difficulties we encounter, he answered "when we start to understand hemp we become morally obligated."

It becomes our individual and collective responsibility to work together to make this happen

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Thank you

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