



The Environmental Benefits of Industrial Hemp

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Introduction

The environmental benefits of industrial hemp are frequently cited by its advocates. The facts are in. From climate change mitigation to biofuel to air quality to toxic remediation to agricultural and biological resources and more, industrial hemp offers demonstrated benefits to the environment. This brief outlines and provides evidentiary support for just some of these promising benefits in an age of critical environmental challenges both in the U.S. and globally.

I. Climate Change

Of all the environmental challenges faced by modern civilization, perhaps the most daunting is the necessity of addressing climate change. Industrial hemp offers significant benefits in the struggle to meet the challenge of climate change in a great many ways, highlighting the urgent need for further study of the potential for hemp cultivation and production in this area.

1. Carbon sequestration

A. Thermoplastics

Thermoplastics are a type of plastic made from polymer resins. Common types include polyurethane, polypropylene, polycarbonate, and acrylic. Common products made from thermoplastics include sports equipment, Lego blocks, automobile parts, compact disks, drinking bottles, food storage containers, eyeglass lenses, shampoo bottles, grocery bags, and bulletproof vests.¹ Hemp has been found to perform carbon sequestration when introduced as a new component of thermoplastics.

“A comparative life cycle analysis focused on nonrenewable energy consumption of natural and glass fiber composites shows that a net saving of 50 000 MJ ($\frac{1}{3}$ ton CO₂ emissions)

¹ “What is Thermoplastic?” <http://www.wisegEEK.com/what-is-thermoplastic.htm>

per ton of thermoplastic can be achieved by replacing 30% glass fiber reinforcement with 65% hemp fiber.”²

“It is further estimated that 3.07 million ton CO₂ emissions (4.3% of total USA industrial emissions) and 1.19 million m³ crude oil (1.0% of total Canadian oil consumption) can be saved by substituting 50% fiber glass plastics with natural fiber composites in North American auto applications.”³

“The results in this study show that use of natural fibers in thermoplastics have great potential to act as sustainable ‘sink’ for atmospheric carbon dioxide and at the same time saving non-renewable resources.”⁴

“Besides thermal, mechanical, and acoustical properties, the use of natural fibers has a very high carbon storage potential, as demonstrated by Pervaiz and Sain who estimated a value of 325 kg of carbon stored per metric ton of hemp-based polypropylene composite. In addition, the net carbon sequestration by industrial hemp crop is estimated as 0.67 ton/ha (hectar)/year. [citation]”⁵

B. Building Materials: Hempcrete and Cannabric

Hemp-based building materials can significantly sequester carbon well after construction. Many variables in the production of hemp-based building products and construction processes result in a wide range of possible net carbon outcomes. Estimates for sequestering potential range as high as 180 kg/cubic meter.⁶ (Further study is needed in this area to measure the precise comparative benefits of hemp-based building materials, taking into consideration the many variables involved in the manufacturing and building processes.) Furthermore, the superior insulation and anti-mold properties of hemp-based building materials have demonstrated conclusively that significant energy savings and efficiency, as well as improved indoor air quality, result from the use of hemp-based materials in building construction.

“Hempcrete insulation locks up around 110kg of CO₂ per m³ of wall and provides one of the best value materials for low impact, sustainable and commercially viable construction.”⁷

² Pervaiz & Sain, “Carbon storage potential in natural fiber composites,” 2002, p. 325, accessed at https://www.researchgate.net/publication/248231800_Carbon_storage_potential_in_natural_fiber_composites

³ *Id.*

⁴ *Id.*, p. 338

⁵ Zampori, Dotelli and Vernelli, “Life Cycle Assessment of Hemp Cultivation and Use of Hemp-Based Thermal Insulator Materials in Buildings,” 2013, accessed at https://www.researchgate.net/publication/237092725_Life_Cycle_Assessment_of_Hemp_Cultivation_and_Use_of_Hemp-Based_Thermal_Insulator_Materials_in_Buildings

⁶ “Building with Hemp and Lime,” p. 11, accessed at http://gse.cat.org.uk/public_downloads/research/hemp/building_with_hemp_and_lime.pdf

⁷ “Cannabis: The greatest sequestration agent of them all,” <http://www.carbonplanet.com/blog/2008/02/16/cannabis-the-greatest-sequestration-agent-of-them-all/>

“Like other plant products, the hemp crop absorbs carbon dioxide gas as it grows, retaining the carbon and releasing the oxygen. 165 kg of carbon can be theoretically absorbed and locked up by 1 m³ of hempcrete wall during manufacture. [citation]”⁸

“Cannabric has a GWP (Global Warming Potential) of -0.624 kg CO₂eq/kg, that means **negative**. It is a material that retains CO₂. In its manufacturing processes (materials, transport, used energy) it does not contribute to global warming.”⁹

“[Hemp] reduces energy consumption because of its excellent insulation and airtightness. There is little heating or cooling losses from the building which means constant energy output to keep the building cool or warm is not required. Because hempcrete has low effusivity and high thermal inertia, it does not take as long to heat a house but once heated, it will slowly release heat back in when the temperature drops ... so the heater doesn’t need to stay on all night.”¹⁰

“Because Hempcrete is super insulating the need for additional mechanical heating/cooling is reduced. For example a typical home will have 1 ton HVAC per 500 square feet. Using Hemp/Lime for insulation will reduce that requirement to 1 ton per 1500 square feet (60%).”¹¹

America’s first house made of hempcrete was completed in Asheville, North Carolina in 2010. Its construction company described the benefits of hemp as follows: “We recognized almost immediately that hemp was, in every way but in cost, seemingly the most effective and sustainable material available worldwide. The qualities it offers are beyond anything we get from typical materials, combining energy efficiency found in mass-based construction with the carbon sequestration, rapid renewability, strength, several hundred year wall lifespan, and the breathability and indoor air quality that is unsurpassed. It is an incredible combination, and a list of positive attributes we have never seen in any other material.”¹²

C. Carbon Biosequestration

If these benefits aren’t enough, hemp can provide a method of sequestering carbon back into the soil through the process known as “biosequestration.” (This property is in addition to the well-known efficiency of hemp as a carbon sink while the plant itself is growing, given its growth rate and superior height of between 9 and 12 feet.¹³)

⁸ <https://en.wikipedia.org/wiki/Hempcrete>

⁹ “9 Ways Industrial Hemp Can Save the World,” <http://www.kinemagazine.com/9-ways-industrial-hemp-can-save-the-world/>

¹⁰ http://www.hempcrete.com.au/index.php?option=com_content&view=article&id=24&Itemid=25

¹¹ “Frequently Asked Questions,” Hemp Technologies Collective, <http://www.hemp-technologies.com/page79/page79.html>

¹² “The house made of hemp,” November 30, 2010, <http://www.gizmag.com/first-us-hemp-house/17115/>

¹³ Nikolas Kosloff, “Fighting Climate Change and Creating ‘Green Jobs’: Is Hemp the Silver Bullet?” http://www.huffingtonpost.com/nikolas-kozloff/fighting-climate-change_b_2982614.html

“Through [carbon biosequestration](#), a process of capturing carbon emissions from the atmosphere through plants, we can trap or, “sequester,” carbon from the air into plants. Once the plants are harvested we can then create a substance called [biochar](#), not through burning the plants, but slow-smoldering them to create a form of charcoal, which we then mix with nutrients and bury back into the soil. The ancient tribes of the Amazon had this process figured out a long time ago. There’s a particular type of soil made from this active human interaction called [terra preta](#), and it’s spectacular stuff. Compared with the surrounding soil, [terra preta can contain three times as much phosphorus and nitrogen](#). ... But what does hemp have to do with this? Hemp is one of the highest yielding biomass crops on the planet, and it takes far less water and fertilizer to grow than other high-yielding biomass plants. ‘Seen as a carbon sequester, the hemp might give as much as up to 13 tonnes of charcoal per hectare annually, which would outdo the Salix plantations (a popular biomass crop) about three times.’
– “[Carbon sequestration for everybody: decrease atmospheric carbon dioxide, earn money and improve the soil](#)” – Folke Günther, Holon Ecosystem Consultants¹⁴

D. Carbon Sequestration from Hemp Cultivation

Various figures have been cited for the carbon sequestration from hemp cultivation itself. Conservatively, hemp cultivation yields an approximate sequestration ratio of 1.5 units of sequestration for every unit produced.

“Every metric tonne (MT) of cellulose grown and used removes 1.5 tonnes of carbon dioxide from the atmosphere. For example, if 200,000 hectares of hemp were grown (averaging a yield of 12 tonnes [of dried stem matter] per hectare), 3.6 million tonnes of carbon dioxide would be offset. At \$8 per tonne on the carbon trading market, that is an extra \$29 million in revenue for growers.”¹⁵

“Hemp is cooling the globe in innumerable ways—not just from its applications in textiles, food, building materials and bioplastics—but from the actual cultivation of the crop worldwide. ... Consider this: for every ton of hemp we harvest, it sequesters 1.62 tons of CO₂ from the atmosphere.”¹⁶

E. Forest Conservation

As discussed below, hemp as a substitute for tree-based paper will result in the preservation of forestlands, including old-growth forests, thus enhancing the carbon sequestering property of forests. (See below, p. 8 and footnote 27.)

¹⁴ “9 Ways Industrial Hemp Can Save the World,” <http://www.kinemagazine.com/9-ways-industrial-hemp-can-save-the-world/>

¹⁵ “Oil Seed Crops: Food and Energy, Hemp,” February 9, 2016, <http://www.oilseedcrops.org/hemp/>

¹⁶ “HEMP COOLS-How Hemp Cools the Globe,” January 4, 2016, <http://hempnationmagazine.com/hemp-cools/>

2. Hemp Biofuel

Americans have long known that transitioning away from fossil fuels is essential. While biofuels have long been an attractive alternative, numerous problems with attempts such as ethanol and biodiesel have emerged. One problem is the need to avoid converting farms away from food products because of limited land resources; another is the failure of ethanol to deliver and its consequential problems associated with monocrop corn plantations and pollution. Industrial hemp has the potential to avoid these problems and serve as a feasible and critical part of our transition out of the fossil fuel economy.

There are two basic ways to create hemp biofuel: hemp ethanol/methanol, and hemp biodiesel.¹⁷

“At a time when petroleum reserves are running out around the world and many countries are forced to buy fuel from others, some biomass researchers believe that it is necessary to look for reusable fuel sources that may be generated locally—something like an independent source of energy that is also capable of contributing to environmental quality. This source of energy may be drawn from hemp, specifically from the oil obtained from it. ... Some experts even state that hemp could supply carbon biofuels without an environmental or human impact, unlike ethanol from corn or the combustion of coal or oil that, when burned, produce carbon dioxide, carbon monoxide, solid particles, and sulphur dioxide, among other harmful substances.”¹⁸

The process of creating biofuel from hemp “can produce charcoal, gasoline, ethanol, non-condensable gases, acetic acid, acetone, methane and methanol. Jeremy Briggs, who has studied hemp as a possible fuel, explains that pyrolysis facilities could also create jobs, as at least three shifts a day are required to keep them in operation. These infrastructures could use the same technology that is currently being used to process oil from fossil fuels and coal—so it would not be necessary to use new technologies or replace those that already exist. This would help put an end to acid rain and reverse the greenhouse effect.”¹⁹

Thus, clearly the production of hemp for biofuel brings economic and environmental benefits. However, some claims regarding hemp as biofuel have been found to lack foundation. For example, “...[a] widely published claim is that hemp cultivated on just 6 percent in the United States could supply all of our oil and gas needs. The reference for this estimate was a 1984 textbook which stated: ‘Meeting US demands for oil and gas would require that about 6% of the land area of the coterminous 48 states be cultivated intensively for energy production.’ Hemp was not specifically evaluated for this statement and, clearly, even if the claim were true, 6 percent of U.S. continental landmass (the equivalent of approximately 27 percent of the nation’s agricultural land) is an unrealistically large amount of land to dedicate to any single energy crop.”²⁰

¹⁷ “Hemp Fuel,” <http://www.hemp.com/hemp-education/uses-of-hemp/hemp-fuel/>

¹⁸ “Running Out of Petrol? No Problem ... We Have Hemp Bio-Oil,” <https://www.dinafem.org/en/blog/hemp-bio-oil/>

¹⁹ *Id.*

²⁰ Skaidra Smith-Heisters, “Illegally Green: the Environmental Costs of Hemp Prohibition,” March 2008, <http://reason.org/files/1030ae0323a3140ecf531bd473632b57.pdf>

Nevertheless, hemp biomass conversion appears to provide a promising improvement in efficiency and environmental benefit as compared with corn- and switchgrass-derived ethanol:

“What’s really a game-changer is hemp can be used to make gasoline. The good stuff. Real, unleaded gasoline, identical to the stuff we currently put into our combustion engine vehicles, but derived completely from cellulose. ‘Making it from cellulose sources such as Switchgrass or poplar trees grown as energy crops, or forest or agricultural residues such as wood chips or corn stover, solves the lifecycle greenhouse gas problem that has recently surfaced with corn ethanol and soy biodiesel.’

– John Regalbuto, Director of the Catalysis and Biocatalysis Program at The National Science Foundation.

“But, that’s ‘wood’ and ‘corn,’” you say, “what does this have to do with *hemp*”? Well, it turns out that hemp is the best plant in the world to produce biomass for cellulosic gasoline. Hemp is the world’s most versatile plant. It can yield 10 tons per acre in four months. Hemp contains 80% cellulose; wood produces 60% cellulose. Hemp is drought resistant making it an ideal crop in the dry western regions of the country. – “Energy Farming in America“, Lynn Osburn. ‘Once this technology has evolved sufficiently to be cost effective at large scales, we conclude that Cannabis sativa and its related species is a superior cultivar for bio-fuel production. Hemp exhibits far superior ethanol yields per unit biomass compared to *Zea mays* (Corn) or *Panicum virgatum* (Switchgrass), which are currently the two most supported biofuel cultivars by the United States government.’ ”

– “Does the use of Cannabis species for the production of biodiesel and ethanol result in higher yields of ethanol than competing cellulosic crops, including Zea mays?“, University of Washington Dept. of Biology 2008 – Kimball Christensen & Andrew Smith.

Once we get the production of cellulosic gasoline (hopefully supplied by hemp) ramped up to the point that we can start fueling most of our vehicles with it, simply using cellulosic gasoline will reduce our greenhouse gas emissions (GHG) by 85% compared to today’s reformulated petrol/ethanol-gasolines.”²¹

In addition to the aforementioned benefits of hemp biomass conversion to biofuel, hemp biodiesel (made from hemp seed oil) provides these environmental benefits:

- Biodiesel is the only alternative fuel that runs in any conventional, unmodified diesel engine.
- It can be stored anywhere that petroleum diesel fuel is stored. Biodiesel is safe to handle and transport because it is as biodegradable as sugar, 10 times less toxic than table salt,

²¹ “9 Ways Industrial Hemp Can Save the World,” <http://www.kinemagazine.com/9-ways-industrial-hemp-can-save-the-world/>

and has a high flashpoint of about 300 F compared to petroleum diesel fuel, which has a flash point of 125 F.

- Biodiesel can be made from domestically produced, renewable oilseed crops such as hemp.
- Biodiesel is a proven fuel with over 30 million successful US road miles, and over 20 years of use in Europe.
- When burned in a diesel engine, biodiesel replaces the exhaust odor of petroleum diesel with the pleasant smell of hemp, popcorn or french fries.
- Biodiesel is the only alternative fuel in the US to complete EPA Tier I Health Effects Testing under section 211(b) of the Clean Air Act, which provide the most thorough inventory of environmental and human health effects attributes that current technology will allow.
- Biodiesel is 11% oxygen by weight and contains no sulfur.
- The use of biodiesel can extend the life of diesel engines because it is more lubricating than petroleum diesel fuel, while fuel consumption, auto ignition, power output, and engine torque are relatively unaffected by biodiesel.
- The Congressional Budget Office, Department of Defense, US Department of Agriculture, and others have determined that biodiesel is the low cost alternative fuel option for fleets to meet requirements of the Energy Policy Act.²²

IV. Deforestation, Species Protection and Toxic Pollution

Hemp has long been known as a potential substitute resource for paper sourced from trees. According to studies, substituting hemp for trees results in longer lasting paper products produced with significantly less environmental impact.

“Using hemp in place of timber as a source of paper could radically reduce deforestation. One acre of hemp produces four times as much pulp as an acre of timber. [citation] Hemp also grows on almost any land and in any region, so it could be grown throughout the US, unlike the trees which are used for paper and which have a fairly limited habitat. Hemp can also be grown on unproductive land and between seasons and can even be used to enrich soil which has become leached of minerals. [citation] Hemp can also be grown without the pesticides that are necessary for cultivation of other textiles and paper products, such as cotton which requires large amounts of pesticides and today is the most polluting of all agricultural industries. [citation] Cotton production, in fact, accounts for half the pesticide use in the US, and that product is one of the major products for which hemp could be substituted. [citation]”²³

“Producing Hemp for copy paper, boxes, toilet paper, and books, can have a positive impact on deforestation. Forests hold thousands of species of animals and plants that are becoming endangered due to deforestation. On top of that, trees act as Mother Nature’s ‘lungs’.

²² “Hemp Fuel,” <http://www.hemp.com/hemp-education/uses-of-hemp/hemp-fuel/>

²³ “TED Case Studies: Hemp Case,” <http://www1.american.edu/ted/hemp.htm>

- On average, one acre of Hemp can produce two to four times more paper than one tree.
- Hemp matures 90-120 days. For trees, it takes 20 years to mature.
- Paper produced from Hemp can be recycled a little over two times more than timber paper.
- Paper manufacturing needs many harmful chemicals for bleaching. Hemp can be simply whitened with hydrogen peroxide.
- Trees remove emissions out of the air—just like Hemp. Let's leave the trees standing and grow fields of Hemp like never before!
- Hemp paper is superior to timber not only because of sustainability, but also because it is much more durable and lasts many decades longer.”²⁴

Another source reports: “there are 4 characteristics of hemp which make it particularly appealing for making paper:

- Hemp fibers are long (makes for stronger paper which [can be recycled more times than wood paper](#))
- Hemp contains high levels of cellulose ([57-77%](#) – more cellulose makes for more pulp)
- Hemp has low (3%) lignin content (this is what makes [wood-pulp paper turn yellow](#) over time).
- [One acre of hemp can produce as much usable fiber as four acres of trees](#). Hemp can be harvested every 100 days. Trees take decades to harvest.”²⁵

“Every tract of 10,000 acres which is devoted to hemp cultivation is equivalent to a sustained pulp-producing capacity of 40,500 acres of average pulp-wood lands, a 4.5 fold increase in efficiency.”²⁶

Hemp production can therefore benefit rare, threatened and endangered species that rely on forest habitat. Furthermore, old-growth forests are valuable carbon sinks.²⁷ Thus, substituting hemp for tree-based paper will have consequential benefits with respect to climate change mitigation.

V. Agricultural Restoration and Sustainability

1. Phytoremediation

Hemp is already used to treat and restore contaminated soil.

“Interestingly enough, by shifting to large-scale hemp production the U.S. might not only spur the growth of new industries but also help to clean up contaminated landfill. Recently, the

²⁴ “Hemp Paper,” 2016, <http://www.hemphelps.org/pages/hemp-paper-facts>

²⁵ “9 Ways Industrial Hemp Can Save the World,” <http://www.kinemagazine.com/9-ways-industrial-hemp-can-save-the-world/>

²⁶ “Oil Seed Crops: Food and Energy, Hemp,” February 9, 2016, <http://www.oilseedcrops.org/hemp/>

²⁷ “Old Growth Forests are Valuable Carbon Sinks,” September 14, 2008, <http://www.sciencedaily.com/releases/2008/09/080910133934.htm>

Colorado State legislature [passed a bill](#) to study hemp's potential to bring about so-called "phyto-remediation," a process by which plants actually filter and clean polluted soil. If Colorado plants hemp on contaminated sites, the state would [follow in the steps of Ukraine](#), which planted industrial hemp near Chernobyl in the late 1990s in an effort to remove harmful contaminants from the ill-fated nuclear site.²⁸

2. Agricultural Innovation and Soil Productivity

The many agricultural benefits of growing hemp are well established. "Hemp cultivation requires very limited amounts of pesticide. Few insect pests are known to exist in hemp crops and fungal diseases are rare. Since hemp plants shade the ground quickly after sowing, they can outgrow weeds, a trait especially helpful for organic farmers. ... Hemp has a broad climate range and has been cultivated successfully from as far north as Iceland to warmer, more tropical regions. Being an annual crop, hemp functions very well in crop rotations."²⁹ And as noted above, hemp is a drought-resistant crop which will augment climate change adaptation.³⁰

"The environmental impacts of increased hemp production over cotton would be tremendously positive. Cotton simply takes more water, more fertilizer, more herbicides and more pesticides to grow."³¹

Postscript: Hemp for National Security

Former CIA Director and Ambassador to the Negotiation on Conventional Armed Forces in Europe James Woolsey has long been an advocate for industrial hemp legalization.³² Ambassador Woolsey has identified industrial hemp as a national security tool to achieve energy independence. Woolsey has also pointed out that industrial hemp will help rural communities in America achieve energy self-sufficiency and a safe haven from regional electric grid failures.³³ Moreover, "in 1994, President Clinton issued Executive Order 12919, entitled "National Defense Industrial Resources Preparedness," which was intended to strengthen the U.S. industrial and technology base for meeting national defense requirements. The order included hemp among the essential agricultural products that should be stocked for defense preparedness purposes."³⁴ As a substitute for imported fossil fuels and a bulwark of electrical grid reliance, industrial hemp is a crop whose legal commercial production would significantly enhance both national and regional security in the United States.

²⁸ Nikolas Kosloff, "Fighting Climate Change and Creating 'Green Jobs': Is Hemp the Silver Bullet?"

http://www.huffingtonpost.com/nikolas-kosloff/fighting-climate-change_b_2982614.html

²⁹ Thomas Prade, "Is Industrial Hemp The Ultimate Energy Crop?" January 13, 2014,

<http://www.wakingtimes.com/2014/01/13/industrial-hemp-ultimate-energy-crop/>

³⁰ "9 Ways Industrial Hemp Can Save the World," <http://www.kinemagazine.com/9-ways-industrial-hemp-can-save-the-world/>

³¹ *Id.*

³² Andrea Miller, "Legalizing Weed: Industrial Hemp's Most Unlikely Champions," November 12, 2015,

<http://www.newsmax.com/FastFeatures/legalizing-weed-hemp-champions/2015/11/13/id/701904/>

³³ Woolsey to Johnston, *Pers. Comm.*, February 2, 2016

³⁴ Congressional Research Service, "Hemp as an Agricultural Commodity," February 2, 2015, <https://www.fas.org/sgp/crs/misc/RL32725.pdf>, p. 20.

Conclusion

Human civilization has benefitted from the production of hemp for thousands of years. Indeed, some anthropologists believe hemp may have been the first agricultural crop domesticated by humans some twelve thousand years ago.^{35,36} This theory is evidenced, further, by the "...[u]se of hemp cord in pottery identified at [an] ancient village site dating back over 10,000 years, located in the area of modern day Taiwan. Finding hemp use and cultivation in this date range puts it as one of the first and oldest known human agriculture crops."³⁷

"The Columbia History of the World (1996) states that weaving of hemp fiber began over 10,000 years ago! Carbon tests have suggested that the use of wild hemp dates as far back as 8000 B.C. In Great Britain, hemp cultivation dates back to 800AD. In the 16th Century, Henry VIII encouraged farmers to plant the crop extensively to provide materials for the British Naval fleet. A steady supply of hemp was needed for the construction of battleships and their components. Riggings, pendants, pennants, sails, and oakum were all made from hemp fiber and oil. Hemp paper was used for maps, logs, and even for the Bibles that sailors may have brought on board."³⁸

It is frequently stated that there are over 25,000 uses for hemp.³⁹ Early English colonists in America were required to grow it – perhaps because of its necessity in the construction of the rope and canvas sails of English vessels. "In 1619 Jamestown Colony, Virginia enacted laws ordering farmers to grow hemp. Similar laws were enacted in Massachusetts in 1631, Connecticut in 1632 and the Chesapeake Colonies in the mid-1700's."⁴⁰ In fact, "...[f]or over 200 years in colonial America, hemp was currency that one could use to pay their taxes with! (Don't try that today, kids!)"⁴¹

Given this rich heritage, and given the manifold benefits of growing and producing hemp in the modern world, the current state of prohibition of hemp production in the US is likely to be seen by future historians as an aberration and ultimately a costly mistake. Aside from the economic promise of industrial hemp, at a time when environmental crises increase in number and intensity by the day, it would be wise for U.S. lawmakers to bring hemp back to its rightful place as a useful and common commodity grown in the United States. Whether as climate change mitigation, toxic pollution abatement, natural resource protection, endangered species preservation, air quality enhancement, agricultural sustainability, or all these and more, the time for hemp in America has come.

³⁵ April Holloway, "First hemp-weaved fabric in the World found wrapped around baby in 9,000-year-old house," February 6, 2014, <http://www.ancient-origins.net/news-history-archaeology/first-hemp-weaved-fabric-world-found-wrapped-around-baby-9000-year-old>

³⁶ "What is Hemp" <http://www.hemp.com/what-is-hemp/>

³⁷ "10,000-year History of Marijuana use in the World," <http://www.advancedholistichealth.org/history.html>

³⁸ "History of Hemp," <http://www.hemp.com/history-of-hemp/>

³⁹ "Hemp Education," <http://www.hemp.com/hemp-education/>

⁴⁰ "Hemp Facts," <http://www.hempuniversity.com/hemp-university/quick-facts/>

⁴¹ "History of Hemp," <http://www.hemp.com/history-of-hemp/>