

Footsteps of Our Forefathers:
From Hempen Fields to 3D Printers—Paradoxical Ethics

Ryan Barron

University of Maryland Baltimore County

Abstract

Industrial hemp (*Cannabis sativa* L.) offers a multitude of sustainable applications. Unlike its psychoactive cousin, the entire lifecycle of hemp contains negligible amounts of THC. This distinction mirrors poppy seeds, which lack the opiate properties of mature poppy plants. Hemp boasts a rich history of industrial use, valued by the Founding Fathers for paper and clothing. Legislative efforts are underway to revitalize this promising industry, overcoming existing limitations. Advancements in 3D printing technology unlock a new frontier for hemp, enabling the creation of sustainable bioplastics, paper products, and even construction materials. This resurgence promises not only economic advantages through cost-effective and eco-friendly options but also significant environmental benefits by promoting the use of renewable resources.

Footsteps of Our Forefathers:

From Hempen Fields to 3D Printers—Paradoxical Ethics

“If a lie is only printed often enough, it becomes a quasi-truth, and if such a truth is repeated often enough, it becomes an article of belief, a dogma, and men will die for it.” (Blagden, 1869, p. 155). As society progresses, we sometimes mistake changes for ultimatums of human achievement. Still, as Blagden wrote a hundred years ago, some changes are made in error, guided by *mens rea*—a guilty mind. Cannabis has been a popular topic throughout history, with decades of misinformation. Some seemingly corrupted the cannabis plant by breeding strains with excessive mind-altering crystals that grow on the plant, while others made use of the industrious fiber sprouting as stalks. However, there are major differences between marijuana and hemp. Far back in the history of the world, civilizations utilized hemp for many uses. Early America used the plant extensively, even to make the hangman’s noose. As recently as the mid-20th century, America has used hemp fiber to outfit warships and other materials. Today, we can use hemp for many industrial applications, but the most comprehensive technological application is 3D printing. While the environment and sectors of the economy, such as farmers and consumers, stand to gain from implementing 3D-printing hemp, others stand to be challenged, such as the petroleum, cotton, and tree-harvesting industries. Society’s most ethical step is to stop lumping all cannabis together to fight against THC quantities that may or may not be present. We must go on to look again at the industrial applications of a specific genetic derivative, to that of hemp, as the founders of our nation have done, and allow new 3D-printed creations in hemp building, hemp plastic, hemp paper, and hemp food to boost our quality of life.

What is and isn't Hemp?

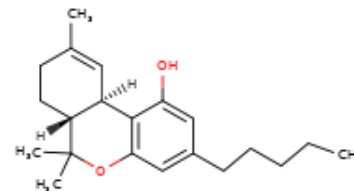
Hemp is a plant that is a member of the *Cannabis sativa* species that contains less than 0.3% delta9-tetrahydrocannabinol, also known as THC (*Industrial Hemp Program FAQs*, 2019). Hemp, with such low quantities of mind-altering chemicals, cannot get people high. Most content is “around 65-70% cellulose (Aiau, 2019). Although hemp and marijuana are both from the same species, *Cannabis sativa*, hemp is not marijuana. According to the Middlebury Institute of International Studies, marijuana contains 5% to 25% THC (*Think Hempy Thoughts*, n.d.). When comparing different products of the same species, Innvista uses a hemp analogy to *Coriandrum sativum*, where:

Either the seeds or the leaves are used. The resulting products from the same plant are entirely different from each other. If the seeds are used, it is called Coriander, but if the leaves are used, it becomes Cilantro. (*Hemp Biology*, 2016)

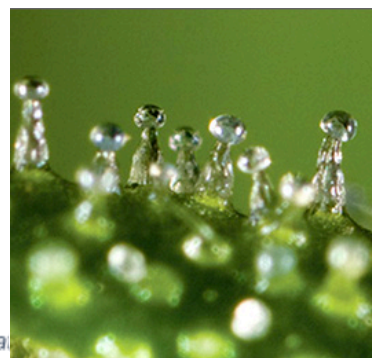
An analogical extension is a poppy plant, where its seeds make opium or beagles; we don't outlaw all kinds of poppy.

Industrial v Recreational v Medicinal

There are four types of cannabis use. The first is no usage, by making everything about the plant illegal. Another is the medical usage, in which implements of the plant cure targeted diseases and other ills. Medicinal cannabis may or may not utilize THC. The third type of usage is the recreational smoking of cannabis to induce an altered state of mind, similar to alcohol consumption. Recreational usage is



Delta 9-Tetrahydrocannabinol
Retrieved from
<https://toxnet.nlm.nih.gov/cgi-bin/sis/search/a?dbs+hsdb:@term+@DOCNO+6471>



What is the difference between
Medical Tetrahydrocannabinol
from Wilcox, 2016, Herb, from
<https://herb.co/learn/what-is-thc-sts/ask-a-nempster/what-does-nemp-biomass-actually-mean-cannabis>

focused solely on THC metabolization. The fourth and final type of cannabis use is the industrial application, which makes no use of THC. The industrial type of usage takes hemp's fibers, nutrients, and other qualities to add value to society. The application of industrial hemp for technological usages, such as 3D printing complies with the AMC code of ethics point 1.1 to contribute to society and human well-being.

Falling from Grace- An Unwarranted Exile

In the 1930s, there was a large push against the use of cannabis. The term 'marihuana' was used in place of cannabis to attribute to Mexican immigrants. Stories and movies were also generated to create an evil perception of cannabis. One particular movie, *Reefer Madness*, published in 1936, said, "Marijuana destroyed the human spirit. It made fools and whores of young women. The evil weed turned men into monsters of the occult" (Sorene, 2015).

The first law in the United States that restricted cannabis sales was the Marihuana Tax Act of 1937. This law still permitted the sale of the plant, all strains but required that some money be paid to the government. From the law itself:

To impose an occupational exise tax upon certain dealers in marijuana,'marijuana' means all parts of the cannabis sativa L., whether growing or not; the seeds thereof; the resin extracted from any part of such plant; and every compound, manufacture, salt, derivative, mixture, or preparation of such plant, its seeds, or resin; but shall not include the mature stalks of such plant, fiber produced from such stalks, oil or cake made from the seeds of such plant, any other compound, manufacture, salt, derivative, mixture, or preparation of such mature stalks (except the resin extracted therefrom), fiber, oil, or cake, or the sterilized seed of such plant which is incapable of germination.

(Congress, 2019)

The law did not intend to regulate the fiber of the stalks, which is the most abundant material of the plant used for industrial applications.

The Marihuana Tax Act of 1937 was pushed by Harry J. Anslinger, the first Federal Bureau of Narcotics Commissioner, to the 75th Congress (U.S. Customs and Border Protection, 2019). There are concerns that Anslinger was deeply racist and pushed the early forms of the drug war as a result. Concerned members of the 115th Congress introduced House Resolution 933, named ‘To acknowledge that the War on Drugs has been a failed policy in achieving the goal of reducing drug use, and for the House of Representatives to apologize to the individuals and communities that were victimized by this policy’. The contents state:

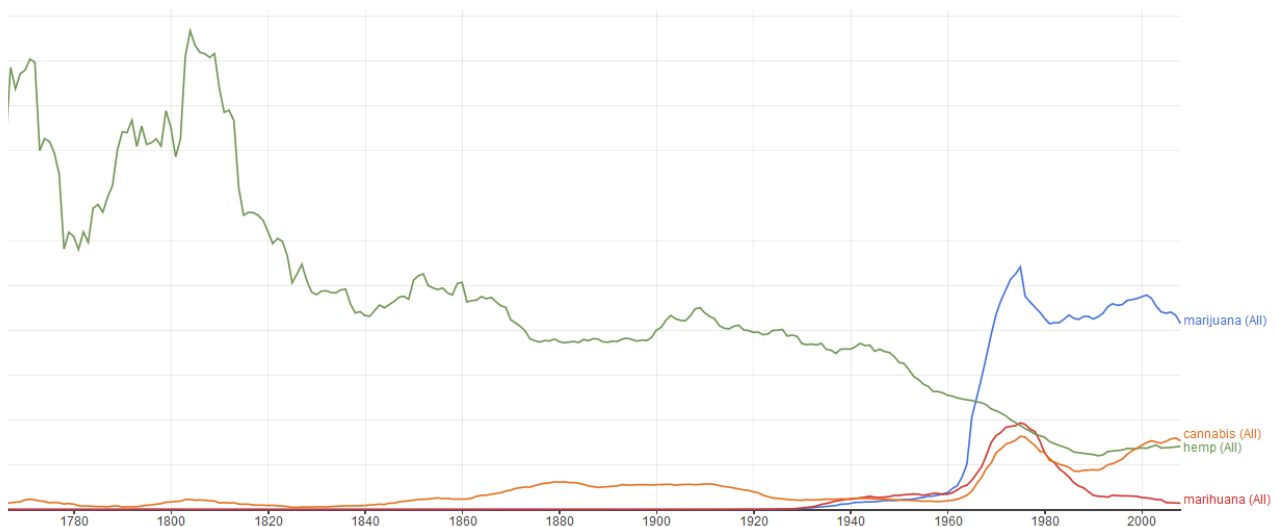
Whereas, in the 1930s, the first Commissioner of the Federal Bureau of Narcotics, Harry J. Anslinger, who was a strong opponent of marijuana, pushed a heavy propaganda campaign to demonize marijuana use, stating that it caused people to be violent and criminals;

Whereas much of this propaganda was racially charged against the Mexican-American community, for example, Commissioner Anslinger testified to the 75th Congress in 1937 that, ‘I wish I could show you what a small marijuana cigarette can do to one of our degenerate Spanish speaking residents. That’s why our problem is so great; the greatest percentage of our population is composed of Spanish-speaking persons, most of whom are low mentally because of social and racial conditions’;

Whereas in 1937, the 75th Congress passed the Marijuana Tax Act, which criminalized marijuana, and laws passed during the following years were introduced to institute mandatory minimum sentences for those who bought, sold, and used the drug;
(Coleman, 2018)

The resolution's co-sponsors acknowledged that making cannabis illegal violated the Association for Computing Machinery (ACM) 's points 1.3 to 1.2, Which Are to Be honest and trustworthy and Avoid harm to others.

Similarly, David E. Anslinger's propaganda has also been attributed to the common usage of the term marijuana instead of cannabis or hemp. Figure 4 shows Google's Ngram Viewer searched for hemp, marijuana, marihuana, and cannabis, which shows how often the terms appeared in books from 1770 to 2008 (*Ngram Viewer*, 2019). The first rise in the terms marijuana and marihuana began in the 1930s and spiked in the 1960s, while hemp has been on a steady decline since the 1800s.



A Doctor of Education from Harvard, Newton, in *Marijuana A Reference Handbook*, attributes the following quote to Anslinger, "Reefer makes darkies think they're as good as white men" (Newton, 2017, p. 183). Holding such a belief is absolutely unethical, especially for someone that has who has the power of a public office. Anslinger's mindset completely violates the ACM point 1.4 to be fair and take action not to discriminate, believing "degenerates" use cannabis. The conclusion of Anslinger's damaging thought pattern was to subvert the law to target minorities via cannabis. However, his damaging effects don't end at the start of the drug

war's spirit since the Drug Enforcement Administration Museum says Anslinger retired in 1962, giving him 32 years in his post (*Harry Jacob Anslinger 1892-1975*, n.d.). Therefore, one of the reasons for modern-day hemp prohibition is Anslinger's racism.

Further, in the spirit of the drug war, 1970 saw the passage of the Controlled Substances Act. As stated by Cornell Law School, the law for Schedule 1 drugs has the following stipulations:

- (A) The drug or other substance has a high potential for abuse.
- (B) The drug or other substance has no currently accepted medical use in treatment in the United States.
- (C) There is a lack of accepted safety for the use of the drug or other substance under medical supervision.

(21 U.S. Code § 812, 2019)

As mentioned, hemp is less than 0.3% THC, which cannot produce an altered state of mind. So, hemp doesn't qualify for any of the Schedule 1 conditions. However, part d of schedule 1 additionally includes "any quantity of cannabimimetic agents...The term 'cannabimimetic agents' means any substance that is a cannabinoid receptor type 1 (CB1 receptor) agonist as demonstrated by binding studies" (21 U.S. Code § 812, 2019). By this definition, even though hemp has less than 0.3% THC and cannot produce a high, it's still scheduled since 0.3% is greater than zero. Part d is why hemp is schedule 1, despite meeting no other conditions for such categorization.

Petrol Dollar

Additionally, hemp can be made into biodiesel or ethanol, which competes with petroleum. Hemp "can extend the life of diesel engines because it is more lubricating than

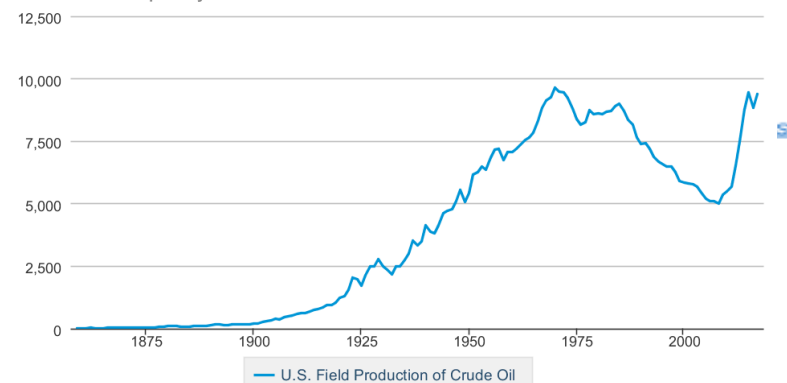
petroleum diesel fuel, while fuel consumption, auto ignition, power output, and engine torque are relatively unaffected” (*Making Environmentally Friendly Fuel From Industrial Hemp*, 2016). If cars begin to run on hemp fuels, there will be less need for fossil fuels. Hemp stocks and products will compete with oil market shares.

Competitive hemp. Cannopy Corporation, created in 2015 as a response to the repeal of hemp prohibition, calls itself a biotechnology company focusing on industrial hemp and its resulting products. The corporation states, “Henry Ford built a sedan powered by 100% hemp Ethanol... Ford’s plan was frustrated...by the heavy hand of federal prohibition, which banned all cannabis cultivation the very same year he built his first prototype”. (*Hemp Information*, 2016). Cannopy Corporation goes on to say the cost per gallon of corn ethanol is 55 to 93 cents per gallon, while hemp costs 24 to 27 cents per gallon, and total energy output is a net gain of 38% for corn ethanol, while hemp ethanol has a net gain of 168%, measured in joules (*Hemp Information*, 2016). Hemp is much more powerful than corn as far as energy returns and is a good energy source.

Oil power. America and Saudi Arabia have been world leaders in oil production, which means financial dependence on oil. The previous chart from the Energy Information Administration shows America's oil production since 1850 (2019). The following line graph, from the Organisation for Economic Co-operation and Development depicts Saudi Arabia and the US oil production since

U.S. Field Production of Crude Oil

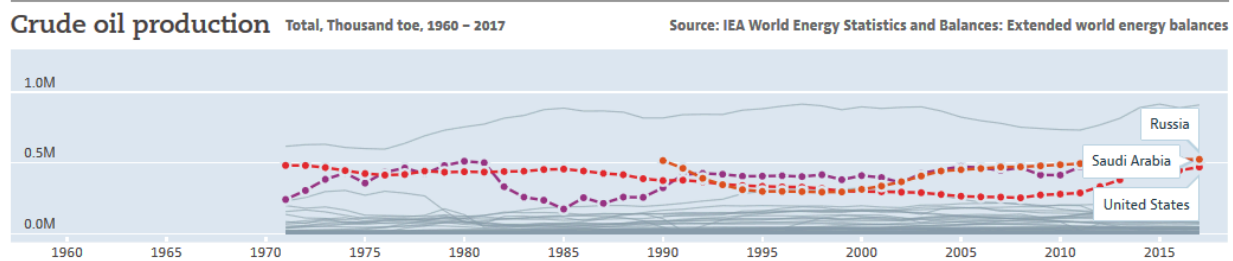
Thousand Barrels per Day



Source: U.S. Energy Information Administration

Energy - Crude oil production - OECD Data. (2018) Organisation for Economic Co-operation and Development. Retrieved from <https://data.oecd.org/energy/crude-oil-production.htm>

the 1970s, with the United States in red, Saudi Arabia in purple, and Russia in Orange (2018). Organisation for Economic Co-operation and Development (OECD) is the highest line in the chart, which is 36 nation's total output (OECD, 2018). The charts show how America and Saudi Arabia have been world leaders in oil production. Corporate interests have long had a say in



congressional regulations. Therefore, it follows that oil companies lobby to keep hemp heavily regulated to protect profit margins. In 1931, the “United States and Saudi Arabia established full diplomatic relations” (United States Department of State, 2018).

Similarly, “U.S. businesses have been involved in Saudi Arabia’s oil industry since 1933 when the Standard Oil Company of California (now Chevron) won a sixty-year concession to explore eastern Saudi Arabia. It discovered its first oil there in 1938” (CFR, 2018). The first oil company's relationship with Saudi Arabia was when the Marihuana Tax Act of 1937 was passed.

In 1945, the relationship between Saudi Arabia and America was strengthened. The White House states, “President Roosevelt requested the meeting with King ibn Saud because he recognized the strategic importance of Saudi Arabia to the region's future and the global economy ” (*A Look Back at the U.S.-Saudi Friendship*, 2017). The relationship has continued due to economic ties and interests. Today, the Middle Eastern country maintains its oil dominance:

Saudi Arabia has the second-largest proven oil reserves in the world (about 266 billion barrels). The Kingdom possesses approximately 18 percent of the world's proven petroleum reserves and ranks as the largest exporter of petroleum. Its oil and gas sector accounts for about 50 percent of gross domestic product and about 70 percent of export earnings (Source: OPEC). (*Saudi Arabia - Oil and Gas*, 2018)

Saudi Arabia has a lot of economic power due to its oil volume. Along with economic power comes political power. By extension, Saudi Arabia has a powerful lobby in America:

The former Saudi ambassador to the United States, Prince Bandar, who was so close to the President George H.W. Bush that he referred to himself as 'Bandar Bush,' acknowledged the relationship between how a government official behaves while in office and how well he will be rewarded when he leaves office. 'If the reputation then builds that the Saudis take care of friends when they leave office, you'd be surprised how much better friends you have when they are just coming into office.'

Bard concludes from this well-known quid pro quo that: 'given the potential of these post-retirement opportunities, it would not be surprising if officials adopted positions while in government to make themselves marketable to the Arab lobby.'

(Dershowitz, 2010)

Since hemp is a competitor to oil, and most of Saudi Arabia's wealth is due to oil, hemp easily becomes an object of Saudi distaste, which their lobby seeks to influence in American politics. This prevents technological breakthroughs related to hemp in 3D printing and is therefore unethical according to the AMC code of ethics, point 1.3, to be honest, and trustworthy, as well as point 1.1, to contribute to society and human well-being.

Hemp History

Although the hemp plant is out of reach for many today, it was not always the case. In fact, hemp has been crucial for many lives over the millennia.

World History

The first use of hemp is documented by the Brazilian Scientific Electronic Library, describing how industrial hemp was utilized:

Cannabis Sativa (cannabis) is among the earliest plants cultivated by man. The first evidence of the use of cannabis was found in China, where archeological and historical findings indicate that that plant was cultivated for fibers since 4000 B.C. With the fibers obtained from the cannabis stems, the Chinese manufactured strings, ropes, textiles, and even paper.

(Zuardi, 2005)

As one of the earliest cultivated plants, hemp should receive more consideration for its applications. It is not a plant for abuse but rather for industrial innovation.

Early law (values)

In early America, hemp use was ethical. The Colonial Williamsburg Foundation writes, “Homespun clothing, including that made out of hemp, became a hallmark of the American cause. The Virginia Gazette in April 1767 printed front-page instructions for growing hemp” (Swenson, 2015). Young America not only believed it was ethical to use hemp, but they also encouraged hemp farming. According to the collection of all the laws of Virginia, from the first session of the legislature, in the year 1619, published by Hening, in October 1783, Virginia permitted taxes to be paid with hemp. It instructed, “the courts of the counties... [are] required, to provide good and sufficient ware-houses for the storage of hemp, flour, or deer-skins”

(Hening, 1823, p. 303). It's clear the utility of hemp was important enough to be collected for official state uses through taxes.

Founding fathers. George Washington wrote six pages on the hemp plant in his 1765 diary. He wrote about the many aspects of growing the plant, such as the best conditions, times of the year to plant, and other hemp-growing techniques (Washington, 1765).

Similarly, Benjamin Franklin “owned a mill that produced hemp paper” (*History of Hemp*, 2017). Much of the early American ideas had to be written and transported by a carrier messenger to other colonies. For instance, Ben Franklin wrote the Silence Dogood letters as a teenager (*Benjamin Franklin, the Writer*, 2019). His papers contained political ideas, which would have been easier to share later in life with hemp paper.

A third founding father, Thomas Jefferson, the second vice president (1797-1801) and third president of the United States (1801-1809), wrote before his presidency that:

A Fact well established in the System of Agriculture is that the best Hemp and the best Tobacco grow on the same Kind of Soil. The former Article is of first Necessity to the Commerce and Marine in other Words to the Wealth and Protection of the Country.

(Jefferson, 1791)

The writing shows that Jefferson thought the country was unsafe without hemp since protection produces safety. Similarly, Jefferson wrote to Willson Peale, after his presidency, to say, “I had adapted a hemp break to my sawmill, which did good work. I have since fixed one to my threshing machine in Bedford, which breaks & beats about 80.℔ a day” (Jefferson, 1816). Jefferson not only believed hemp was necessary for the economy and safety of the country, but he grew and used hemp in industrial applications himself. Jefferson doesn't stop there, as Monticello cites 39 instances of Jefferson and Hemp together in writings (*Hemp*, n.d.). Believing

in hemp for the good of the country and himself, Jefferson also shared hemp ideas to help his friends.

Civil War.

Georgetown University has an image from 1861, with “Hemp for Traitors, north or south” as a death threat to maintain loyalty in the Civil War (*Noose Manufacturing Process*, 1861). Hemp nooses show the fiber can bear a lot of tension—ideal for industrial use.

World War Two – Hemp for Victory

The US Department of Agriculture released a film in 1942 titled *Hemp for Victory*, which explained that ships, such as old Ironside, took over 60 tons of hemp for rigging and that all the ships prior to 1850 sailing the western seas had hemp rope and sails. The video then teaches how to grow hemp for the World War Two war efforts, claiming 14,000 acres of hemp were harvested, with a goal of 300,000 acres the following year. America had to domestically supplement hemp supplies considering previous sources became occupied territories, such as the Philippines and East India. (Evans, 1942). If hemp production was necessary to win a world war, the application of fiber is valuable enough to permit continued domestic growth in today’s economy.

First Ford Car

Henry Ford is known for innovations regarding cars. When he was continuing the spark of his creativity, the College of Horticulture at Purdue University published, “Henry Ford recognized the utility of hemp in early times. In advance of today’s automobile manufacturers, he constructed a car with certain components made of resin stiffened with hemp fiber” (Small and Marcus, 2002). Despite the years since Ford, a man named Bruce Dietzen invested \$200,000 his own money to make a sports car made from hemp, where he and Jay Leno both pound on the

hood in a video by CNBC to support the claim that the hemp composite is stronger than steel and lighter than carbon fiber (*This Car Made From Hemp Cannabis Is Stronger Than Steel*, 2017). If cars become lighter through hemp, they will consume less fuel.

Climbing Up the Down Escalator – Legislation

The founding fathers wrote extensively on their uses of Industrial hemp, so it's evident that the laws went backward for a while. Despite the backwardness of the hemp laws, some members of the legislatures have taken steps to redeem America's hemp industry.

National

Kentucky has a history of farming hemp, as shown in the hemp for victory push of World War II (Evans, 1942). So the Senate majority leader, the senior senator from Kentucky, Mitch McConnell, pushed an initiative to allow the state to start the process again in the 2018 farm bill, as an extension to the 2014 farm bill that permitted institutes of higher education to partner with growers for research purposes (*Hemp Production Program*, 2019).

Maryland

Maryland introduced medicinal cannabis before hemp research. It is codified in Maryland law under Title 10, Subtitle 62, and is called the Natalie Laprade Medical Cannabis Commission. The regulations started on September 14, 2015 (*Compilation of Medical Cannabis Laws*, 2019).

Industrial Hemp research. Responding to 2018's national Farm Bill, Maryland passed House Bill 689 for Maryland's Industrial Hemp Research Pilot Program. The law allows licensed growers to partner with institutes of higher education. Maryland's Department of Agriculture began considering hemp projects on January 28, 2019 (*Industrial Hemp*, n.d.).

Experimenting states

As a nation of unionized states, American legislatures often look to companion legislatures of neighboring states for ethical comparisons. Regarding hemp, “At least 41 states have enacted legislation to establish industrial hemp cultivation and production programs “ (State Industrial Hemp Statutes, 2019). Most states realize now is the time to rediscover hemp as the nation's founders saw it.

Industrial 3D-Printing of Hemp

As innovation continues, society is finding increasingly more uses for 3D printing. The process is not exempt from hemp applications.

Building Material

In a free market, new creations and innovations flourish. For 3D printing, an Australian company named Mirreco “is creating a 3D printing procedure that utilizes hemp biomass as a material for the fabrication of building panels for houses“ (Ahmed, 2018). The company themselves call their panels Lumecast and say, “Hemp has 3 crops per annum... Sequestering up to 22 tonnes of carbon dioxide stored per hectare, during the 3-4 month growth cycle. Faster and more than any other tree or plant” (*Hemp - Versatile, Carbon-Capturing Miracle Plant*, 2019). Trees are considered good for the environment, but how much more is hemp?

Concrete. A university in the Netherlands called the Eindhoven University of Technology is 3d printing regular concrete for bridges and other architecture (*3D Concrete Printing*, 2019). This can be useful to hemp applications, as Hempstone and Hempcrete are two names known for hemp-derived concrete. The material is made in a combination of lime, and hemp, petrifying the cellulose over time (*What is Hempcrete?*, 2018). Further, hempcrete can be used to build houses (Sullivan, 2010). The hempcrete can be adapted to a 3D printer, one such as

Eindhoven University uses, to create more efficient, cheaper, and lighter houses than traditional concrete.

Plastics.

Hemp plastics are available for sale, even as a 3D printer's filament. A company named Kanesis produces:

3D-printer filament made entirely from the waste of hemp production.... Called HempBioPlastic (HBP), it has shown to be more efficient and more aesthetically pleasing than other bioplastics on the market. HBP has shown to be 20% lighter and 30% stronger than PLA – the most common plastic used in 3D-printing filaments. (Aiau, 2019)

Printed materials may become crucial for quickly produced parts, such as those used in military applications. Stronger parts mean more reliable parts.

Paper

In 1916, the U.S. Department of Agriculture examined hemp as a potential material for paper. One reason they justified the test was, "Without doubt, hemp will continue to be one of the staple crops of the United States." (Dewey and Merrill, 1916, p. 9). They cite wood as needing 5.4 acres to produce 1 ton of fiber in one year, whereas hemp only needs 1.33 acres for the same production. At the end of their tests, they found the paper made from hurds produced "very favorable comment from both investigators and from the trade" (Dewey and Merrill, 1916, p. 25). The oldest surviving paper in the world is hemp, and from China 2000 years ago. (Small, E., & Marcus). Similarly, paper is used to 3D print by a company called Mcor Technologies, and

their printer is called the ArkePro (*about*, 2018). The use of hemp paper is beneficial and ethical, as it can be printed on a 3D printer such as Mcor's since hemp is better for the environment.

Food

Foods are beginning to be 3D printed. For instance, a Japanese company named Open Meals is 3D printing sushi (*Mashable*, 2018). They not only 3D print food but plan to be able to teleport food through their 3D print system, which they link to space travel. Along with other industrial applications, the hemp plant can be made into a food source from the seed's nutrients. One product of hemp seeds is protein powder. The Food and Drug Administration analyzed Canadian hemp protein powder from Fresh Hemp Foods and found that it contained "protein content greater than 64.5%. Other major components of the protein powders include fiber (9-41%), carbohydrates (7-48.5%), fat (9-15%), and moisture (5-8%)" (FDA, 2018). The food derivatives of the hemp plant, such as protein powder, can be adapted to a 3D printer, like Open Meals is doing with sushi, or even how NASA 3D-printed pizza (*Futurism*, 2017).

Effects

Utilizing more of the hemp plant to 3D print will change parts of society and touch many people's lives. Some will benefit, and others will have to adjust.

People Affected

Some of the people who will benefit from 3d printing hemp will be Farmers, Consumers, and taxpayers. Farmers will benefit from the positive impact on the farmland and the plant's many uses. Consumers will benefit because products will be improved and cheaper. Taxpayers will benefit because many governmental processes require large quantities of materials that hemp will make cheaper and better.

OPEC, cotton growers, and lumberjacks will need to adjust to hemp. Oil producers will be challenged for their market shares in the production of plastics and fuel, and therefore, they will have to make their products very cheap or find alternatives in the market to increase income. Cotton growers produce cloth for clothing that hemp can grow as well, similarly challenging their market shares. Lumberjacks will be challenged because hemp production will reduce the need to cut trees down for paper and other derived products.

Consequences

Reimplementing an ancient plant's industrial applications with 3D printers will have several effects.

Energizing Economic Sectors. Printing hemp American reduces import costs. Similarly, farm costs will decrease with a healthier environment, including the soil, due to the growth of hemp. Many consumers support farmers in supporting the environment.

Tension with OPEC. The wide use of hemp to produce plastic and biodiesel will cause the OPEC economies to shrink. Of course, they will blame the countries for shifting away from their sources, so we will have diminished political relationships with them.

Environment. Hemp can replace paper, so we can reduce deforestation. The hemp biotechnology company mentioned, Cannopy, states, "cellulosic ethanol also produces 86% less GHG (greenhouse gas) emissions during production than gasoline, and it beats both corn and sugarcane as well" (2018). Similarly, Mirreco showed growing hemp can remove carbon dioxide from the air. (Mirreco, 2019). Therefore, climate threats will lessen as we utilize hemp 3D printing.

Alleviate World Hunger. Hemp grows fast and can be used as a food source, so hemp seeds can be transported to areas that are hurting for food. Once arrives, food can be 3D printed

to relieve afflicted people. “When cannabis hemp is grown for seed, half the weight of the mature, harvested female plant is seed” (Herer, 2010). Similarly, recovered people can learn to grow the crop to sustain themselves and help others recover.

Conclusion

The founding fathers left more than a few footsteps in their hemp fields. By reintroducing the use of industrial hemp for 3D printing, we can produce many outputs that have great effects for AMC point 1.1 to contribute to society and human well-being. Part of the process is getting over false information to target minorities and profit-specific markets that negatively affect the world. Many Legislatures are using hemp’s cousin, marijuana, as a stepping stone back to industrial hemp uses, as many first considered medical uses, and then some began recreational usage. Without the intermediaries, the research programs for industrial hemp may not have been given legislative attention. Industrial Hemp is Ethical.

Summary

Analysis. The Hemp plant has a long, productive history in America and the world. At our nation's founding, hemp’s industrious applications were common sense. Today, they are ethically challenged. Society must move beyond misconceptions and rediscover the economic and social power of the hemp plant. 3D printing industrial hemp is ethical.

Reasoning. Society can distinguish chemical abuse from industrial productivity; Clear differences exist between marijuana and hemp. Excessive regulation of hemp only cripples healthy professional industries. Not using hemp is unethical due to the many applications that benefit the economy, environment, and people in general.

APA Citation:

- 21 U.S. Code § 812 - Schedules of controlled substances. (2019). Cornell Law School. Retrieved from <https://www.law.cornell.edu/uscode/text/21/812>
- 3D Concrete Printing. (2019). Eindhoven University of Technology. Retrieved from <https://www.tue.nl/en/research/research-groups/structural-engineering-and-design/concrete-research-areas/3d-concrete-printing/>
- A Look Back at the U.S.-Saudi Friendship*. (2017, November 09) White House. Retrieved from <https://www.whitehouse.gov/articles/look-back-u-s-saudi-friendship/>
- About*. (2018). Mcor Technologies. Retrieved from <https://www.mcor technologies.com/about/>
- Ahmed, R. (2018, June 27). *Mirreco Prints Houses Using Hemp-Based Material*. 3DPrinting. Retrieved from <https://3dprinting.com/news/mirreco-prints-houses-using-hemp-based-material/>
- Aiau, C. (2019). *Hemp Plastic, Benefits, Uses & Characteristics*. Hempme. Retrieved from <https://www.hempme.com.au/hemp-plastic-benefits-uses-characteristics/>
- Benjamin Franklin, the Writer*. (n.d.) America's Library. Retrieved from http://www.americaslibrary.gov/aa/franklinb/aa_franklinb_writer_1.html
- Blagden, I. (1869). *The crown of a life* (Vol. 3). London: Hurst and Blackett. Retrieved from <https://books.google.com/books?id=EtoBAAAAQAAJ&printsec=frontcover&dq=the crown of life isa blagden&hl=en&sa=X&ved=0ahUKEwjAm-PmlaHjAhWUKs0KHaqdAGUQ6AEIKDA#v=onepage&q&f=false>
- Carell. (2018, September 8). *What Does Hemp Biomass Actually Mean?* Cannabis Tech. Retrieved from <https://www.cannabistech.com/webcasts/ask-a-hempster/what-does-hemp-biomass-actually-mean-cannabis>
- CFR.org Editors. (2018, December 7). *U.S.-Saudi Arabia Relations*. Council on Foreign Relations. Retrieved from <https://www.cfr.org/background/us-saudi-arabia-relations>
- Coleman, B. W. (2018, July 30). *Text - H.Res.933 - 115th Congress (2017-2018): To acknowledge that the War on Drugs has been a failed policy in achieving the goal of reducing drug use, and for the House of Representatives to apologize to the individuals and communities that were victimized by this policy*. U.S. Congress. Retrieved from <https://www.congress.gov/bill/115th-congress/house-resolution/933/text>
- Compilation of Medical Cannabis Laws*. (n.d.) Maryland. Retrieved from

<https://mmcc.maryland.gov/Pages/law.aspx>

Dershowitz, A. M. (2010, August 24). *The Arab Lobby in America and Influence over the U.S.*. Retrieved from <https://www.thedailybeast.com/the-arab-lobby-in-america-and-influence-over-the-us>

Dewy, L. H., & Merrill, J. L. (1916, October 14). *Hemp Hurds As Paper-making Material*. United States Department of Agriculture. Retrieved from <https://catalog.loc.gov/vwebv/search?searchCode=LCCN&searchArg=agr16001178&searchType=1&permalink=y>

Did You Know... Marijuana Was Once a Legal Cross-Border Import? (n.d.). U.S. Customs and Border Protection. Retrieved from <https://www.cbp.gov/about/history/did-you-know/marijuana>

Energy - Crude oil production - OECD Data. (2018) Organisation for Economic Co-operation and Development. Retrieved from <https://data.oecd.org/energy/crude-oil-production.htm>

Evans, R. (Director). (1942). *Hemp for Victory* [Video file]. US Department of Agriculture Retrieved from https://archive.org/details/Hemp_for_victory_1942

GCF. (2018, January 18). *Delta 9-Tetrahydrocannabinol*. National Library of Medicine Toxnet. Retrieved from <https://toxnet.nlm.nih.gov/cgi-bin/sis/search/a?dbs+hsdb:@term+@DOCNO+6471>

Gohd, C. (2017, March 07). *NASA Astronauts Can Now 3D-Print Pizzas in Space*. Retrieved from <https://futurism.com/nasa-astronauts-can-now-3d-print-pizzas-in-space>

Harry Jacob Anslinger 1892-1975. (n.d.). Drug Enforcement Administration Museum. Retrieved from <https://deamuseum.org/anslinger/introduction/>

Hemp. (n.d.) Monticello. Retrieved from <https://www.monticello.org/site/research-and-collections/hemp>

Hemp - Versatile, Carbon-Capturing Miracle Plant. (2019) Mirreco. Retrieved from <https://mirreco.com/hemp/>

Hemp Biology. (2016) Innvista. Retrieved from <http://innvista.com/health/foods/hemp/hemp-biology/>

Hemp Information. (2016). Cannopy Corporation. Retrieved from <http://www.cannopycorp.com/hemp-information.html>

Hemp Production Program. (2019, February 27). U.S. Department of Agriculture (USDA). Retrieved from <https://www.ams.usda.gov/content/hemp-production-program>

- Hening, W. W. (1823). *The Statutes at large; being a collection of all the laws of Virginia, from the first session of the legislature* (Vol. 1). Retrieved from <https://search.lib.virginia.edu/catalog/u1371096>
<http://vagenweb.org/hening/>
- Herer, J. (2010). Cannabis Hempseed as a Basic World Food. In *The Emperor Wears No Clothes* (12th ed.). Jack Herer. Retrieved from <https://jackherer.com/emperor-3/chapter-8/>
- History. (2018) Organisation for Economic Co-operation and Development. Retrieved from <http://www.oecd.org/about/history/>
- History of Hemp. (2017, May 22) World History. Retrieved from <https://worldhistory.us/american-history/history-of-hemp.php>
- Industrial Hemp. (n.d.) Maryland. Retrieved from <https://mda.maryland.gov/plants-pests/Pages/Industrial-Hemp.aspx>
- Industrial Hemp Program FAQs. (2019) Pennsylvania Department of Agriculture Retrieved from https://www.agriculture.pa.gov/Plants_Land_Water/industrial_hemp/Pages/Industrial-Hemp-Program-FAQs.aspx
- Jefferson, T. (1791). *Enclosure: Notes respecting Tobacco, 16 March 1791*. National Historical Publications and Records Commission (NHPRC). Retrieved from <https://founders.archives.gov/documents/Jefferson/01-19-02-0140>
- Thomas Jefferson to Charles Willson Peale, 8 May 1816. (n.d.). National Historical Publications and Records Commission (NHPRC). Retrieved from <https://founders.archives.gov/documents/Jefferson/03-10-02-0015>
- MacArthur, J. R. (2007, April 17). *The Vast Power of the Saudi Lobby*. Common Dreams Retrieved from <https://www.commondreams.org/views/2007/04/17/vast-power-saudi-lobby>
- Making Environmentally Friendly Fuel From Industrial Hemp. (2016, April 6) National Hemp Association (NHA). Retrieved from <https://nationalhempassociation.org/making-fuel-from-industrial-hemp/>
- Newton, D. E. (2017). *Marijuana* (2nd ed., Contemporary World Issues). Santa Barbara, CA: ABC-CLIO. Retrieved from https://saltonverde.com/wp-content/uploads/2017/09/22-Marijuana_Reference_Handbook.pdf
|
<https://catalog.loc.gov/vwebv/search?searchCode=LCCN&searchArg=2016042067&searchType=1&permalink=y>

- Ngram Viewer: Marijuana, marihuana, hemp, cannabis.* (2019) Retrieved from https://books.google.com/ngrams/graph?content=marijuana,marihuana,hemp,cannabis&case_insensitive=on&year_start=1760&year_end=2019&corpus=15&smoothing=5&share=&direct_url=t4::marijuana;c0;s0::marijuana;c0::Marijuana;c0;t4::marihuana;c0;s0::marihuana;c0::Marihuana;c0::MARIHUANA;c0;t4::hemp;c0;s0::hemp;c0::Hemp;c0::HEMP;c0;t4::cannabis;c0;s0::cannabis;c0::Cannabis;c0::CANNABIS;c0#t4::marijuana;c0;s0::marijuana;c0::Marijuana;c0;t4::marihuana;c0;s0::marihuana;c0::Marihuana;c0::MARIHUANA;c0;t4::hemp;c0;s0::hemp;c0::Hemp;c0::HEMP;c0;t4::cannabis;c0;s0::cannabis;c0::Cannabis;c0::CANNABIS;c0
- Noose Manufacturing Process. (1861, January 01). Georgetown University Library. Retrieved from <https://repository.library.georgetown.edu/handle/10822/550499>
- Re: *GRAS Notice*. (2018) U.S. Food and Drug Administration. Retrieved from <https://www.fda.gov/media/119426/download>
- Saudi Arabia - Oil and Gas*. (2018, November 5) Export. Retrieved from <https://www.export.gov/article?id=Saudi-Arabia-oil-and-gas>
- Small, E., & Marcus, D. (2002). *Hemp: A New Crop with New Uses for North America**. Retrieved July 8, 2019, from <https://www.hort.purdue.edu/newcrop/ncnu02/v5-284.html>
- Sorene, P. (2015, November 05). *Reefer Madness: Mid-Century Anti-Marijuana Propaganda In Movies And Books*. Retrieved from <https://flashbak.com/reefer-madness-mid-century-anti-marijuana-propaganda-in-movies-and-books-35558/>
- State Industrial Hemp Statutes*. (2019, February 1). Retrieved from <http://www.ncsl.org/research/agriculture-and-rural-development/state-industrial-hemp-statutes.aspx>
- Sushi Teleportation*. (n.d.) Open Meals. Retrieved from <http://open-meals.com/sushiteleportation/index.html>
- Sullivan, J. (2010, December 27). *The House That Hemp Built*. Builder Online. Retrieved from https://www.builderonline.com/design/the-house-that-hemp-built_o
- Swenson, B. (2015, Winter). *Hemp & Flax in Colonial America*. The Colonial Williamsburg Foundation. Retrieved from <https://www.history.org/foundation/journal/winter15/hemp.cfm>
- Think Hempy Thoughts*. (n.d.). Middlebury Institute of International Studies. Retrieved from <http://sites.mii.edu/thinkhempthoughts/hemp-vs-marijuana/>
- This Car Made From Hemp Cannabis Is Stronger Than Steel* [Video file]. (2017, July 18).

- CNBC. Retrieved from <https://www.cnn.com/video/2017/07/18/this-car-made-from-cannabis-is-stronger-than-steel.html>
- U.S. Congress. (2019). *Acts of the Seventy-First Congress of the United States*. 577. Retrieved from <http://www.loc.gov/law/help/statutes-at-large/75th-congress/c75s1.pdf>
- U.S. Field Production of Crude Oil. (2019) U.S. Energy Information Administration. Retrieved from <https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=MCRFPUS2&f=A>
- U.S. Relations With Saudi Arabia Bilateral Relations Fact Sheet. (2018, August 7) United States Department of State. Retrieved from <https://www.state.gov/u-s-relations-with-saudi-arabia/>
- Washington, G. (n.d.). *Image 38-43 of George Washington Papers, Series 1, Exercise Books, Diaries, and Surveys 1745-99, Subseries 1B, Diaries 1748-1799: Diary, January 1 - November 13, 1765*. Washington: Library of Congress. Retrieved from <https://www.loc.gov/resource/mgw1b.651/?perdst=gallery>
- What is Hempcrete? (2018). American Lime Technology. Retrieved from <http://www.americanlimetechnology.com/what-is-hempcrete/>
- Wilcox, A. (2016, July 25). *THC: Everything You Need To Know About Delta9-Tetrahydrocannabinol*. Herb. Retrieved from <https://herb.co/learn/what-is-thc>
- Zuardi, A. W. (2005, November 21). *History of cannabis as a medicine: A review*. Scientific Electronic Library Online (SciELO). Retrieved from <http://www.scielo.br/pdf/rbp/v28n2/29785.pdf>