



Revitalization of U.S. Hemp Cultivation

Leveraging Innovations in Agricultural Technology to Streamline
State Regulatory Oversight & Enforcement of a Budding Industry



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Prelude

This industry insight report is provided in the context of AgEagle’s ultimate intention to aid U.S. state and territorial departments of agriculture in removing unnecessary guesswork when determining how best to leverage proven technologies to efficiently optimize oversight and enforcement of the ‘new’ hemp cultivation industry fast emerging in the United States.

We believe that our Company is uniquely qualified to opine on expected challenges likely to confront hemp cultivation programs nationwide; and we are well positioned to present viable, cost-effective solutions to those challenges.

Our confidence is due in large measure to our proven technological expertise in advanced aerial imagery-based data collection and analytics, matched by the customer trust and fidelity we have earned through our global experience in developing leading agriculture technology innovations and applications. To date, our platform of advanced technology solutions has served to process more than 1.3 million acres of crops, analyzing data from over 50 countries and 53 different crop types. As a result, we have created nearly 11,000 comprehensive crop reports, providing actionable intelligence for commercial growers worldwide.

Technological innovation is at the heart of AgEagle Aerial Systems and we take great pride in being one of the industry’s leading pioneers.



Barrett Mooney, PhD
Chairman
AgEagle Aerial Systems Inc.



AgEagle Aerial Systems Inc. | Corporate Headquarters | 117 S. 4th Street, Neodesha, Kansas 66757

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History of U.S. Hemp Production

While it may be surprising news to some, hemp cultivation has played a much storied and revered role in the annals of U.S. history since first being introduced to American farming in 1606. For the next 330 years, it earned hard-won distinction as a vital, highly sustainable crop used to produce everything from paper to textiles and paint to rope. In fact, the *Declaration of Independence* was printed on high quality hemp paper, and the threads of the earliest American flags were strung from hemp's rugged fibers.

In 1938, *Popular Mechanics* published an article¹ describing hemp as the “new billion-dollar crop.” The article went on to state that there were “over 25,000 uses for the plant ranging from dynamite to cellophane” – and apparently biodegradable plastics and fuel.

After 12 years of research, in 1941 Henry Ford unveiled the “hemp car,” which was rumored to be composed of 70% cellulose fibers with ten times the impact resistance of steel and powered entirely by hemp-ethanol. Reporting on the groundbreaking invention, *Popular Mechanics* said, “The experimental model is pictured as a step toward materialization of Henry Ford’s belief that some day he would grow automobiles from the soil.”

Unfortunately, Ford’s automotive marvel and *Popular Mechanic’s* very bullish outlook for hemp would virtually vaporize overnight due largely to the passing of the Marijuana Tax Act of 1937, making it illegal to produce marijuana and any plant type in association with the cannabis family – including hemp. Hemp is a strain of the *Cannabis sativa* plant species.

The smoking of marijuana had come to the attention of the U.S. Federal Bureau of Narcotics and President Franklin D. Roosevelt and, despite opposition from the American Medical Association², the act was passed and an 80-year moratorium on hemp production began. Thirty-three years later when the Controlled Substances Act of 1970 was signed into law, marijuana was then classified as a Schedule I narcotic and regulatory constraints on hemp became even more rigid.

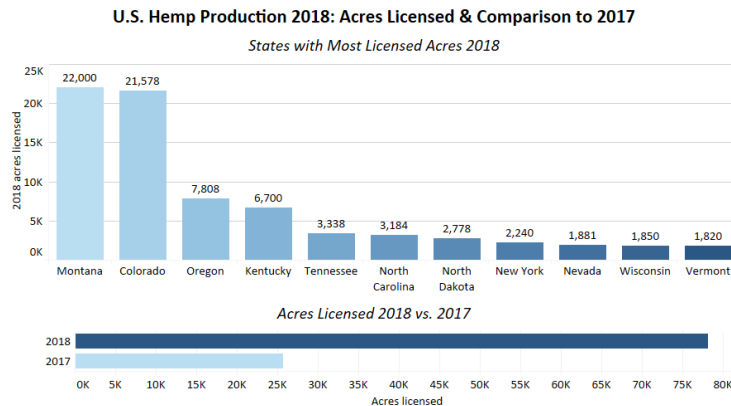
¹ Limer, E. (2018, April 20). Back When We Thought Hemp Would Be a Billion-Dollar Crop. Retrieved from <https://www.popularmechanics.com/science/environment/a19876318/popular-mechanics-billion-dollar-hemp/>

² Marihuana Tax Act of 1937. (2019, April 30). Retrieved from https://en.wikipedia.org/wiki/Marihuana_Tax_Act_of_1937

A New Day Dawns for Hemp

A glimmer of hope for revitalizing the hemp industry was ignited in 2014 when President Barack Obama signed the 2014 Farm Bill, which essentially allowed for hemp to be grown by permitted universities and state departments of agriculture in the name of federally funded research – rather than as a commercial crop.

With the 2014 Farm Bill allowing the production of hemp under specific research conditions, hemp cultivation in the United States began a sharp upward march. No official estimates of hemp production are available currently, but private estimates show that although the overall acreage is modest, the growth rate is very strong. Vote Hemp³, an organization that promotes hemp in the marketplace, estimates that in the last three years hemp acreage has increased from 9,800 in 2016, to 26,000 in 2017, to 78,000 acres in 2018.



Source: Vote Hemp
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Accordingly, Vote Hemp reports, “The U.S. hemp crop tripled in 2018 with acreage rising rapidly in the 24 states actively growing last year,” and that figure is expected to grow now that the 2018 Farm Bill (the Agriculture Improvement Act of 2018) has opened the door nationwide to hemp production.

Since 2014, pro-hemp legislation received increasingly favorable bipartisan support, culminating in December 2018 with the passing of the 2018 Farm Bill, which removed industrial hemp from its listing as a Schedule I drug and now recognizes hemp as an agricultural commodity, such as corn, wheat or soybeans. Consequently, 2019 marks the year that it is ‘game-on’ for farmers and regulators, alike, to collaborate on establishing an efficient oversight and enforcement foundation upon which the ‘new’ hemp cultivation industry in the U.S. can take flight, thus restoring hemp as one of America’s most prolific, highly sustainable, crop staples.

NEW BILLION-DOLLAR CROP

“...Hemp is the standard fiber of the world. It has great tensile strength and durability. It is used to produce more than 5,000 textile products, ranging from rope to fine laces, and the woody “hurds” remaining after the fiber has been removed contain more than seventy-seven per cent cellulose, and can be used to produce more than 25,000 products, ranging from dynamite to Cellophane.

“...As an industry it amounts to over \$1,000,000,000 a year, and of that, eighty per cent is imported. But hemp will produce every grade of paper and government figures estimate that 10,000 acres devoted to hemp will produce as much paper as 40,000 acres of average pulp land.

“...the connection of hemp as a crop and marijuana seems to be exaggerated. The drug is usually produced from wild hemp or locoweed, which can be found on vacant lots and along railroad tracks in every state. If federal regulations can be drawn to protect the public without preventing the legitimate culture of hemp, this new crop can add immeasurably to American agriculture and industry.”

³ Cowee, M., & Nichols, K. (2019, February 04). Chart: America's hemp acres hit almost 80,000 in 2018; MT the new leader. Retrieved from <https://hempindustrydaily.com/chart-americas-hemp-acres-80000-2018-montana-new-leader-among-states/>

Global Market Outlook

In part because of its legalization, United States hemp production has the potential to increase substantially, showing great promise to emerge as a major hemp producer on the global stage. According to research presented in the March 2019-released *Global State of Hemp: 2019 Industry Outlook* from New Frontier Data, industrial hemp is currently a \$3.7 billion global industry, with cultivations as large as 100,000 acres dating back to 1998 among European growers.



In its report, Frontier Data states, “But in the U.S., onerous regulations kept the domestic market from establishing much of a presence in the global hemp market. While pilot programs introduced over the past decade have encouraged a nascent market to develop, the U.S. hemp industry is set to change drastically with the recent allowances granted to growers in the 2018 Farm Bill.”

“Despite the relatively minor space U.S. growers hold in global hemp cultivation, the U.S. is actually the second largest market for the product in terms of sales, spending about \$1 billion throughout 2018. This is only slightly behind China, which purchased roughly 1.2 billion in hemp-based fibers or other products.”

Frontier Data further notes that 2018 sales were “driven by continued strength in Chinese textiles, European industrials, Canadian foods and the U.S. hemp-derived CBD market.” The report goes on to predict continued demand in the latter CBD market will be the main driving force behind the global hemp market’s continued growth, which it estimates will reach \$5.7 billion by 2020.





Proposed New Regulatory Framework

In accordance with the 2018 Farm Bill, the US Department of Agriculture (USDA) has been directed to develop a program by which it will review and approve plans submitted by each state, territory and Indian tribal agency outlining their production of hemp for commercial purposes.

More specifically, the 2018 Farm Bill authorizes state departments of agriculture, including agencies representing the District of Columbia, the Commonwealth of Puerto Rico and any other territory or possession of the United States, and Indian tribal governments, to submit plans to the USDA applying for primary regulatory authority over the production of hemp in their respective state or tribal territory. Each plan to be submitted to the USDA must describe:⁴

- 1) A practice to track and maintain relevant information regarding land on which hemp will be cultivated, including a legal land description and global positioning coordinates;
- 2) A procedure for maintaining records for at least three years and reporting to the USA;
- 3) A procedure for testing, using post-decarboxylation or other reliable methods, delta-tetrahydrocannabinol concentration to ensure levels are not more than 0.3% on a dry weight basis in hemp produced in the state or territory of the Indian tribe;
- 4) A procedure for the effective disposal of plants, whether growing or not, that are produced in violation of the law;
- 5) A procedure to conduct annual inspections and provide for violations, corrective actions and enforcement procedures and comply with all other federal requirements; and
- 6) Certification that the state or Indian tribe has the resources and personnel to carry out the practices and procedures described above.

While the USDA is currently accepting plans, it is important to note that no plan will be reviewed or approved until such time as the USDA finalizes and publishes in the Federal Register its formal guidelines and regulations relating to commercial hemp production. It is the USDA's intention to issue these guidelines and regulations in the Fall of 2019 to accommodate the 2020 planting season. Once the USDA publishes regulations for the production of hemp, a state or tribal nation may initially use the USDA plan and then, at some future date, submit their own plan to the USDA for approval to begin their own commercial hemp production oversight program.

⁴ Hemp Production. (n.d.). Retrieved from <https://www.ams.usda.gov/rules-regulations/farmbill-hemp>

The Root of the Problem: Looming Chaos for State Administrators and Farmers, Alike

To date, nearly 40 U.S. states or territories have enacted or introduced legislation favorable to hemp cultivation. Fueled by legalization of hemp at the federal level, farmers in regions of the country that are highly dependent upon a single crop, such as tobacco and wheat, as well as growers across the country seeking to capitalize on planting hemp for the purpose of addressing exploding demand for hemp-derived CBD products, have been inundating state Ag agencies with questions and requests for direction on how to proceed with transitioning to more profitable commodity production.

To comply with state and federal regulations for both commercial and research hemp cultivation programs, growers will need to be annually licensed, registered and permitted – thus beginning what could be an overwhelming paper trail, particularly when multiplied by any number of growers.

Proposed USDA and state/territory plan guidelines also indicate that monitoring, tracking, record keeping, testing, reporting and certifications may bury state and federal agencies in even more paperwork, contributing to the already complex and potentially gross inefficiencies of day-to-day administrative and enforcement activities related to sanctioned hemp programs. Add to this the problems of efficiently and timely communicating with growers individually, while also maintaining full, global transparency of hemp fields operating statewide on a real-time – or near real-time – basis. How will this be managed? Email? Snail mail? Personal visits or phone calls?



Will the funds generated from licensing and registration processes, coupled with allocated taxpayer dollars, be enough to offset the cost for expanding field and back-office staffing requirements and other mission critical infrastructure? How will a state or tribal nation confirm that growers are complying with reported planting and harvesting timelines? Will they require large forces of “feet on the ground” – and if so, how many will be necessary to ensure that hemp is not being planted near sensitive geographic regions or assets, such as schools or major roadways throughout the state? What processes will be necessary to confirm that the actual acres in production sync with the number of acres registered? How will oversight agencies prioritize inspections, testing and destruction of plants, when/if necessary? What happens if a grower inadvertently supplies inaccurate field location information to regulators? Quite frankly, how would regulators even know?

All things considered, overseeing and enforcing commercial hemp production will be a complex undertaking by any measure, and could ultimately prove entirely too chaotic for some state and territory departments of agriculture. Moreover, managing and complying with state and federal regulations could result in recurring nightmares for hemp farmers, potentially disrupting growth of what many expect holds great promise to be a new, highly lucrative industrial crop for American agriculture.

So, what is the solution to avoid the looming chaos? One word: **technology**.



The Solution: Proven, Advanced Aerial Imaging and Data Collection Technologies Designed Specifically for Agriculture

When viewed through a strategic lens, technology has delivered possibilities for game-changing efficiency gains for virtually every industry on the planet, including Agriculture. In fact, today's commercial farmers are among the most tech-savvy industrialists, continually seeking out leading edge advancements to assist them in acquiring high quality, actionable intelligence that results in higher equipment efficiency, reduced crop damage, improved yield, less time on foot in the field and increased profit.

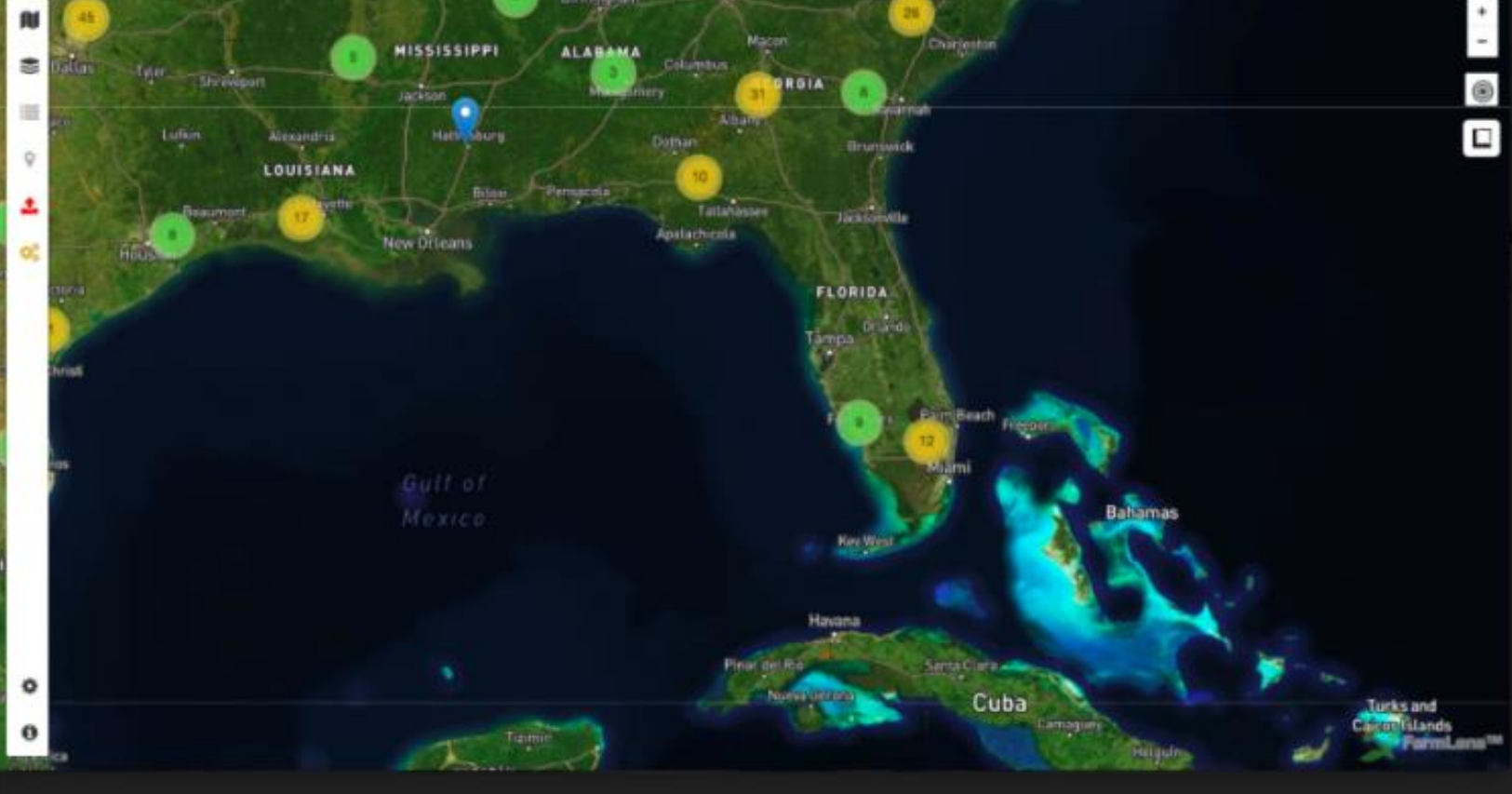
Consequently, it is presumably safe to assume that those U.S. farmers dedicating valuable acreage to hemp production will heartily embrace technology as a means to help ensure that their investments in producing quality hemp biomass for the global markets will not be compromised through unnecessary inefficiencies in what will be a highly regulated compliance and enforcement environment.

Federal, state and territorial departments of agriculture must be prepared to communicate and collaborate with growers in the most transparent manner possible to fully optimize the extraordinary growth potential of the budding U.S. hemp market and its important stakeholders. However, it is only through smart, proven technological applications that this is likely to be achieved with any modicum of organization and success.

With deployment and adoption of a simple, web-based interface with intuitive user-friendly features and proven, integrated applications, regulators and farmers, alike, can manage their respective supply chain responsibilities swiftly, economically and efficiently.

More specifically, AgEagle Aerial Systems has developed the *HempOverview* platform, powered by *AgEagle*, that elegantly blends the simplicity of a web-based data collection and management app with the power of the technology that underpins its industry proven *FarmLens™* solution.

As a standardized, yet customizable, user interface with mobile log-in capabilities, state and tribal nations can provide for individual hemp growers to effectively meet all registration, licensing, permitting and reporting requirements for their hemp cultivation operations using any mobile phone, tablet or PC – and provide for collection of fees in real-time through an integrated online payment processing solution, if desired.



In addition, *HempOverview* empowers regulators with:

- authenticated log-in controls and centralized reporting functions;
- access to both low- and high-resolution remote sensing solutions using satellite, aerial and drone technologies for viewing and monitoring of hemp field operations;
- direct connectivity allowing regulators to communicate with individual growers through integrated text messaging and emailing capabilities;
- the ability to push notifications to growers to remind them to amend planting or harvest times, if/when applicable, or schedule inspections and CBD/THC testing;
- automated algorithmic change detection, auto-alerting regulators of suspected problems and/or when fields change status, such as:
 - field is cut between overpasses
 - field loses sections
 - field boundaries do not coincide with details provided in registration and/or planting reports
 - planting and harvesting windows do not comply with reported planting and harvesting timelines;
- the ability to remotely confirm registered field details are consistent (or inconsistent) with state compliance requirements and the related data is directly tied to a state department of agriculture database, and/or other data collection resource through API connectivity – among other details, data collected would include:
 - GPS coordinates of fields, including field boundaries and
 - Proximity of fields to residential developments, schools or other geo-sensitive areas;
- the ability for growers to upload UAV imagery to the platform to support compliance with government inspection requirements;
- an in-app annotation feature for adding notes and uploading pictures taken during on-site inspections; and
- remote visibility into a single hemp field, visibility into multiple fields specifically selected for view, or global visibility of all hemp fields in operation with the state or territory.

AgEagle's technology-enabled *HempOverview* platform – on which regulators and growers connect, share, maintain proactive communications and collaborate on developing best practices for compliance and enforcement – will go a long way in promoting rapid revitalization of the U.S. hemp industry; and save valuable tax payers dollars every year through cost-effective monitoring and enforcement of industrial hemp cultivation.

For more information on AgEagle and our *HempOverview* solution for state and territorial departments of agriculture, please visit www.AgEagle.com.

Locations

Type to begin searching
Use the search box above or click a marker on the map to see data.

John Doe Acres: 30
Hemp Doe Farm Seed Registration Number
Field Name Name of Seed Planted
Variety Name
Plant Date: 06/21/2019 Approved/Certified Seed? Yes No
Seeded harvest Date: 10/15/2019 Number of pounds planted
Scout Markers: [Add] [Remove]
DOWNLOAD PRODUCTS
FarmLens Layers
Stitched image without georeferencing (0.3m)
Stitched field health map without georeferencing (0.3m)
Stitched, georeferenced, unaltered image (0.05m)

Status

Below are list of fields we have flagged for further inspection.
Inspection to flag fields has been done through aerial and satellite imagery. Key findings are changes to boundaries, miss drawn field locations, or early harvests, late planting.

Fields that require attention.

Show 10 entries Search:

Reference ID	Field	Farm	Farm Owner	Status	Registered	
14009	IR_ALBANIA Stitching Flight	Albida	Jimmy Underhill	OK	about 1 month ago	[Download] [Share] [Edit]
14015	Parcela 58 con 3...	Los Canelos	Fertica Panama	OK	23 days ago	[Download] [Share] [Edit]
14021	CETT Stitching Flight	CETT	Ernesto Vega	Field not planted	16 days ago	[Download] [Share] [Edit]
14087	banana test harry g Stitching Flight	vaughenieu	Jeff FIDELIN	Field boundary error	about 18 hours ago	[Download] [Share] [Edit]

Help



AgEagle was created to pioneer, innovate and advance aerial imaging data collection and analytics technologies capable of addressing the impending food and environmental sustainability crises that threaten our planet. Our daily efforts are focused on delivering the metrics, tools and strategies necessary to define and implement intelligent sustainability and precision farming solutions that solve important problems.

Since our founding in 2010, AgEagle has grown to become a trusted partner to major food manufacturers, precision farmers and government agencies seeking to adopt and support productive agricultural approaches to better farming practices which limit impact on our natural resources, reduce reliance on inputs and materially increase crop yields and profits.

While our business is powered by technologies that allow us to soar above the Earth's surface, our belief systems and core values are firmly rooted in making a positive difference in the lives of those we serve, partner and share the world.

AgEagle Aerial Systems Inc.
117 S. 4th Street
Neodesha, Kansas 66757
www.AgEagle.com