Volume 31 | Issue 1 Article 6

1-27-2020

High Time to Go Green: Environmental Impact of Marijuana Legalization

Kahn R. Wiedis

HIGH TIME TO GO GREEN: ENVIRONMENTAL IMPACT OF MARIJUANA LEGALIZATION

I. INTRODUCTION

Marijuana is the most valuable cash crop in the United States.[1] Despite the federal government's ban on marijuana, more than half the states have passed some form of legislation to legalize or decriminalize it.[2] As more states propose legislation to permit the use, possession, and growth of medical and recreational marijuana, overall demand has continued to increase, thereby creating a host of new policy issues for state regulators.[3] Due to the longstanding federal prohibition on marijuana use, a large portion of the industry has been forced underground to evade criminal prosecution.[4] Notwithstanding, the marijuana industry has continued to blossom, with black market cultivators and legal state-sanctioned growers regularly producing new marijuana products.[5] This has resulted in significant environmental harms, the extent of which is largely unknown.[6]

Over the last two decades, the marijuana policy debate in the United States has shifted "from whether to legalize marijuana to

1. Jon Gettman, *Marijuana Production in the United States (2006) – Comparison With Other Cash Crops*, DRUG SCIENCE (2006), https://www.drugscience.org/Archive/bcr2/MJCropReport_2006.pdf (recognizing marijuana as legitimate and most valuable agricultural crop in majority of states). A 2006 study estimated marijuana's value in comparison to the average production value of other cash crops to be the highest valued agricultural crop at 35.8 billion dollars. *Id.* (estimating marijuana to be more valuable than corn, soybeans, hay, and other cash crops). More recent figures support this claim and estimate marijuana to generate forty-eight million dollars per square kilometer. *See* Joseph Misulonas, *Is Cannabis the World's Biggest Cash Crop?*, CIVILIZED (Aug. 29, 2017), https://www.civilized.life/articles/cannabis-worlds-biggest-cash-crop/ (depicting marijuana as most valuable cash crop compared to other agricultural commodities).

2. Gina S. Warren, *Regulating Pot to Save the Polar Bear: Energy and Climate Impacts of the Marijuana Industry*, 40 COLUM. J. ENVTL. L. 385, 386 (2015) (addressing state-led legislation efforts to legalize and decriminalize marijuana).

3. Seth Feldman, *The Uncertain Environmental Impacts of Cannabis Cultivation*, GREEN HORIZONS (May 15, 2018), https://medium.com/green-horizons/the-uncertain-environmental-impacts-of-cannabis-cultivation-aae7fc4832ff (explaining need to address newfound issues from increased demand for marijuana).

4. *See* Warren, *supra* note 2, at 391 (recognizing illegal nature of black market marijuana production).

5. *Id.* (identifying growth in marijuana industry despite federal government's refusal to decriminalize marijuana).

6. *Id.* at 386 (discussing lack of environmental consideration in debate over marijuana legalization).

how to regulate a legal market."[7] While the discussion surrounding marijuana legalization is primarily centered on public health, economics, and criminal concerns, it often overlooks one notable issue: the environmental impact associated with a legal marijuana market.[8] Similar to other forms of agriculture, the widespread commercial growth of marijuana can have a significant and negative effect on natural resources.[9]

Implementing regulatory measures "designed to mitigate environmental harm" from widespread marijuana growth presents unique difficulties compared to regulating other forms of agricultural commodities.[10] The marijuana industry faces an unsettled legal status - while many states have legalized marijuana, the federal government still recognizes it as a controlled substance and prohibits its use in all forms.[11] Marijuana legalization is further complicated by the widespread black market cultivation of marijuana.[12] Given both marijuana's questionable legal status and the prevalence of an unregulated black market industry, the implementation of environmentally conscious regulations poses significant hurdles for lawmakers.[13] It is imperative that individual states consider and address the environmental impacts of commercial marijuana cultivation prior to enacting legislation that legalizes marijuana.[14] By doing so, states will be better equipped to alleviate significant environmental risk factors associated with large-scale marijuana cultiva-

---

7. Jon Gettman & Michael Kennedy, *Let it Grow – The Open Market Solution to Marijuana Control*, 11 HARM REDUCT. J. 1, 1 (2014) https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4247667/ (noting general shift in approach to discussing marijuana policy debate).

8. Jennifer K. Carah et al., *High Time for Conservation: Adding the Environment to the Debate on Marijuana Liberalization*, 65 BIOSCIENCE 822, 822 (June 19, 2015), https://academic.oup.com/bioscience/article/65/8/822/240374 (explaining lack of consideration for environmental harms of marijuana cultivation).

9. Michael O'Hare, *Environmental Risks and Opportunities in Cannabis Cultivation*, BOTEC ANALYSIS CORP. (June 28, 2013), https://lcb.wa.gov/publications/Marijuana/SEPA/BOTEC_Whitepaper_Final.pdf (noting environmental consequences of marijuana cultivation).

10. *See* Carah, *supra* note 8, at 822-23 (explaining marijuana's complex legal status in United States).

11. *Id.* (highlighting federal government's refusal to end prohibition on marijuana).

12. Ryan B. Stoa, *Marijuana Agriculture Law: Regulation at the Root of an Industry*, 69 FLA. L. REV. 297, 314 (2017) (recognizing complexity of regulating marijuana industry due to it being regarded as "black market agricultural cultural product for decades").

13. *Id.* (addressing difficulties of implementing environmental regulations).

14. *Id.* at 312 (establishing that most states are unprepared to mitigate environmental effects of marijuana legalization).

tion such as surface water diversion, land clearing, chemical pollution, and the destruction of natural habitats and ecosystems.[15]

This Comment explores the environmental impact of marijuana legalization in the United States in light of the recent trend towards state legalization of medicinal and recreational marijuana.[16] Part II examines the technical process of growing marijuana and the plant's historical roots in the United States.[17] Addressing the environmental implications of widespread marijuana cultivation, Part III focuses on the environmental impacts of outdoor, indoor, and black market cultivation.[18] Part IV highlights current state-specific marijuana regulations enacted in the United States, including well-established programs, newly emerging laws, and licensing frameworks.[19] Finally, Part V evaluates how states can approach regulatory uncertainties associated with marijuana legalization while also focusing on environmental concerns as marijuana use continues to rise in the United States.[20]

II. BACKGROUND

Marijuana, also known by its scientific name, Cannabis, "is one of the world's oldest cultivated plants."[21] The marijuana plant has been used for medicinal purposes for thousands of years with the earliest documented reports dating back to Chinese writings in the twenty-seventh century B.C.[22] Others estimate that its earliest roots

15. For a further discussion of the environmental impacts of marijuana cultivation, see *infra* notes 58-108 and accompanying text.

16. For a discussion of the state trend towards legalizing marijuana, see *infra* notes 109-193 and accompanying text.

17. For a discussion of the process of growing marijuana and its history in the United States, see *infra* notes 21-57 and accompanying text.

18. For a discussion of the environmental impacts associated with marijuana cultivation, see *infra* notes 58-108 and accompanying text.

19. For a discussion of current marijuana regulations and state specific legalization frameworks, see *infra* notes 109-193 and accompanying text.

20. For a discussion of recommendations for how states can better mitigate the environmental impact of marijuana cultivation, see *infra* notes 194-254 and accompanying text.

21. Robert Connell Clarke, *Marijuana Botany An Advanced Study: The Propagation and Breeding of Distinctive Cannabis*, CANNABIS RESEARCH A-Z (June 15, 1981), https://www.calgarycmmc.com/ebooks%20p%20q%20r%20s%20t%20u%20v%20w%20x%20y%20z%20/Robert%20C%20Clarke%20-%20Marijuana%20Botany%20-%20An%20Advanced%20Study.pdf (recognizing marijuana's ancient history).

22. Gerald J. McKenna, *The Current Status of Medical Marijuana in the United States*, 73 HAW. J. OF MED. & PUB. HEALTH 105, 106 (2014), https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3998227/pdf/hjmph7304_0105.pdf (identifying first written report of marijuana use). Marijuana has been cited throughout history for its ability to mitigate and control chronic pain symptoms. *Id.* (discussing marijuana's pain management function).

trace back to the Paleolithic period where "hunter-gatherers . . . appreciated its nutritious and psychoactive properties."[23] Along the Silk Road, Middle Easterners actively traded the plant and its seeds.[24] Eventually, marijuana was introduced to Europe and North America, where it began to flourish among Western societies.[25] Despite its pervasiveness throughout history, marijuana remains a significant topic of discussion and debate within social policy and the law.[26] To understand the marijuana industry's significance and the environmental need to regulate it, it is important to understand how the plant is commonly grown and how it took root in the United States.[27] This section will discuss the process by which marijuana is grown, its physical traits, and its historical background throughout the United States.[28]

A. Marijuana: From the Ground Up

The process of growing marijuana begins with planting female and male seeds in "light well-drained composted soil."[29] Seeds are generally planted in the spring season, where germination occurs quickly, and begin to sprout in approximately three to seven days.[30] During germination, seedlings form an embryonic stem that straightens upwards through the soil and past the surface of the ground.[31] Through direct sunlight, or by exposure to other artificial forms of light, marijuana seeds sprout seed leaves, known as cotyledons.[32] The leaves, which have a distinct pointed shape, are generally unequal in size and form in opposite directions from one another.[33] A fully grown plant can sprout up to eleven leaflets and will eventually form flowering buds located under each leaflet.[34]

---

23. *See* Stoa, *supra* note 12, at 305 (noting early appreciation in addition to use of marijuana in society).

24. *Id.* (discussing trade routes along Silk Road).

25. *Id.* (explaining marijuana's existence throughout history).

26. *Id.* (noting marijuana's contentious background).

27. For a discussion of marijuana's growing process, see *infra* notes 29-42 and accompanying text.

28. For a discussion of marijuana's history in the United States, see *infra* notes 22-57 and accompanying text.

29. *See* Clarke, *supra* note 21, at 3 (explaining early stages of marijuana growth).

30. *Id.* at 5 (identifying germination process where plant seed begins to take form into stemmed plant).

31. *Id.* at 3 (explaining early formation of marijuana plant stem).

32. *Id.* (identifying marijuana leaf formation).

33. *Id.* (elaborating on marijuana leaf formation process).

34. *See* Clarke, *supra* note 21, at 3 (identifying maximum leaflet formation per plant).

The budding process only occurs "when female marijuana plants have not been pollenated by male plants. . . ."[35] The budding process is a rare natural occurrence, and highlights the need for human intervention in cultivating marijuana fit for human consumption.[36]

"Cannibis is a dioecious plant, which means that the male and female flowers develop on separate plants . . . ."[37] Female plants, which are noticeably different from their male counterparts, are known and identified by their short height, leafier makeup towards the top of the plant, and the presence of more branches.[38] Female plants are generally preferred by marijuana cultivators due to their propensity to produce more flowering buds than male plants.[39] Under optimal growing conditions, the plant can grow up to seven centimeters per day.[40] Marijuana's primary outdoor growing season is during the summer months.[41] Growers most often seek nutrient-rich soil close to natural water sources, where the plant will receive the most sunlight per day.[42]

B. Marijuana Roots in the United States

Job-seeking Mexican immigrants traveling north first introduced the act of smoking marijuana to the United States in the 1920s.[43] As immigration from Mexico increased and the United States economy tumbled during the Great Depression, public sentiment turned against Mexican immigrants.[44] United States residents began to develop negative stereotypes about Mexican immigrants such as their propensity for violence correlated with smoking mari-

35. *See* Stoa, *supra* note 12, at 311 (recognizing need for human intervention in cultivating budded marijuana).

36. *Id.* (addressing regularly occurring pattern of fertilization in nature).

37. *See* Clarke, *supra* note 21, at 4 (defining dioecious plant).

38. *Id.* (contrasting female plants' physical traits with male plants' physical traits).

39. *See* Stoa, *supra* note 12, at 311 (noting female marijuana plant's budding tendency).

40. *See* Clarke, *supra* note 21, at 3 (discussing maximum growth per plant per day).

41. *See* Warren, *supra* note 2, at 406 (noting optimal outdoor growing season for marijuana plant to receive maximum sun exposure).

42. *Id.* (describing plant's daily sunlight requirement).

43. David F. Musto, *Opium, Cocaine and Marijuana in American History*, 265 SCI. AM. 40, 45 (July 1991), https://www.jstor.org/stable/10.2307/24936977 (describing early marijuana use in United States).

44. *Id.* at 46 (highlighting bleak economic outlook in United States during 1930s).

juana.[45] The United States government exploited these growing public concerns by "releas[ing] dramatic and exaggerated portrayals of marijuana's effects," depicting the drug as dangerous.[46] Thereafter, the practice of smoking marijuana was associated with a host of negative stereotypes and looked down upon by the majority of United States citizens.[47] After pressure mounted on states to control marijuana growth and usage, the federal government responded by issuing the Marihuana Tax Act of 1937.[48] The Act "established control over the transfer and sale of the plant" by requiring that individuals obtain a stamp to possess the plant.[49] Despite the limited use of marijuana at the time, the government did not issue any stamps or licenses, rendering all marijuana possession illegal.[50]

Views about marijuana shifted in the 1960s when its use became widespread among adolescents, beginning an era of drug tolerance in the United States.[51] In the 1970s, demand for marijuana continued to rise among American youth, and many urged the government to decriminalize possession for personal use.[52] Efforts to decriminalize marijuana use proved unsuccessful, and public sentiment again shifted in favor of stricter regulations and penalties for

45. *Id.* (linking act of smoking marijuana with Mexican immigrants and violent tendencies).

46. *Id.* (describing early publications United States government released depicting marijuana as dangerous).

47. *See id.* (portraying exaggerated effects of marijuana use). Reporters cited marijuana use as having dangerous effects on impulse and human motor functions. *Id.* (explaining reports were used to incite fear about marijuana use).

48. Musto, *supra* note 43, at 46 (introducing first form of government regulation on marijuana).

49. *Id.* (specifying Marihuana Tax Act's prohibition power over marijuana). The federal government utilized its taxing power to maintain complete control over marijuana. *Id.* (explaining federal government's drug enforcement power).

50. *See id.* (explaining federal government's refusal to issue stamps or licenses to private citizens).

51. *Id.* (identifying era of drug tolerance). Investigators were unable to link marijuana use to health problems. *Id.* (mentioning investigators' efforts). Large social gatherings such as Woodstock, framed marijuana as a safer alternative to alcohol. *Id.* (comparing marijuana use to alcohol use).

52. *See id.* (explaining Carter administration's attempt to decriminalize marijuana use). In 1980, a Gallup Poll revealed fifty-three percent of Americans favored legalization of up to one ounce of marijuana. *Id.* (discussing public sentiment on marijuana use). Favorable attitude towards marijuana use reached a peak in the late 1970s. *Id.* (noting shifting perception of marijuana). Later, public sentiment reversed and a majority of Americans rejected efforts to lower penalties for marijuana possession. *Id.* (explaining decline in public support for lenient marijuana regulations in United States).

marijuana users.[53] Marijuana, along with other mind-altering agents, was solidified as a Schedule I controlled substance under the Controlled Substance Act of 1970 (CSA).[54] A Schedule I classification "is defined as a drug (1) with a high potential for abuse; (2) with no currently accepted medical use; and (3) that is not safe to use under medical supervision."[55] Penalties for individuals caught possessing, growing, or distributing marijuana "range from one year to life in prison, with maximum fines from one thousand to eight million dollars," based on amount and circumstances surrounding conviction.[56] Due to the adoption of stricter drug laws and the lack of scientific data on the effects of marijuana use, legalization remains a central topic of heated political and ethical debate today.[57]

III. ENVIRONMENTAL IMPACTS OF MARIJUANA GROWTH

Marijuana, similar to other forms of land based agriculture, is a "water- and nutrient-intensive crop," which often leads to "land clearing, the diversion of surface water, agrochemical pollution," eradication of wildlife, and destruction of ecological habitats.[58] Current legalization efforts indicate legislators and consumers are inadequately informed on the environmental impacts of marijuana growth.[59] While more recent state-led efforts have begun to raise awareness of environmental factors, few states have recognized the environmental harm caused by widespread marijuana growth.[60] In addition, the majority of legalization legislation has overlooked

53. *See* Musto, *supra* note 43, at 46 (detailing shifts in public opinion on penalizing marijuana use).

54. McKenna, *supra* note 22, at 105 (noting addition of marijuana in Schedule I under CSA). The CSA also banned other agents such as Lysergic Acid Diethylamide (LSD), Gamma-Hydroxybutyrate (GHB), and mephedrones. *Id.* (listing other drugs prohibited by CSA).

55. Warren, *supra* note 2, at 391 (citing Controlled Substances Act, 21 U.S.C. § 812(b)(1)(2012)); *see also* Gonzales v. Raich, 545 U.S. 1, 14 (2004) (describing Congress's classification of marijuana as Schedule I drug).

56. Matthew Shechtman, *Joint Authority? The Case for State-Based Marijuana Regulation*, 8 TENN. J. L. & POL'Y 44, 48 (2012) (highlighting CSA as primary form of control over marijuana industry in United States).

57. *See* Musto, *supra* note 43, at 46-47 (highlighting reasons for shifting public opinion on marijuana use).

58. Carah, *supra* note 8, at 823 (identifying common environmental consequences of marijuana cultivation).

59. *See generally* Hope M. Babcock, *Illegal Marijuana Cultivation on Public Lands: Our Federalism on a Very Bad Trip*, 43 ECOLOGY L. Q. 723, 765 (2016) (discussing marijuana consumer behavior).

60. *See* Stoa, *supra* note 12, at 311-12 (recognizing limited environmental consciousness when states implement marijuana legalization laws).

these environmental aspects.[61] This section will discuss the environmental impacts of marijuana cultivation.[62]

A. Outdoor Marijuana Production

Outdoor marijuana germination poses multiple risks toward the environment and climate.[63] Marijuana is a nitrogen-hungry crop, absorbing its nutrients from the surrounding soil where it is planted.[64] Although a majority of the nutrients absorbed throughout the growing process are eventually returned to the soil, there lies potential for nutrient eradication from extended harvesting cycles and failing to rotate crops.[65] Outdoor cultivation also implicates environmental climate effects as each plant has a "small fossil energy input[ ]" and thus produces small fossil energy emissions.[66] Additionally, the use of generators and fertilizers in the cultivation process can produce diesel and nitrous oxide emissions, respectively.[67] Although the direct environmental impact of outdoor cultivation is relatively small, especially when compared to indoor or greenhouse grow methods, the indirect environmental impact "extend[s] far beyond the specific cultivation site."[68]

Marijuana heavily relies on water.[69] During the outdoor growth process, one plant can soak up an estimated twenty-two liters of water each day.[70] Considered in the context of the California north coast where there are roughly 130 thousand marijuana plants per square kilometer, one growing season uses about 430 million liters of water per square kilometer.[71] This water consump-

61. *See id.* (addressing lack of legislative remedies in addressing environmental factors of marijuana production).

62. For a further discussion of the importance of recognizing the environmental impacts of marijuana production see *infra* notes 218-253 and accompanying text.

63. *See* Carah, *supra* note 8, at 823 (identifying environmental harms posed by marijuana cultivation).

64. *See* O'Hare, *supra* note 9, at 8, 10 (comparing marijuana's nutrient absorption rate to hemp). Hemp is non-psychoactive component of marijuana used for industrial purposes and "foodstuff products." *Id.* at 11 (explaining common uses for hemp).

65. *Id.* at 12 (explaining nutrient draw from growing marijuana and hemp).

66. *Id.* at 8 (recognizing small energy emission inputs per unit of marijuana product).

67. *Id.* (addressing various sources of emissions in growing process).

68. *See* Carah, *supra* note 8, at 822-23 (addressing marijuana production operation's wide-ranging environmental implications).

69. *Id.* (recognizing marijuana's high water consumption rate).

70. *Id.* at 823 (estimating water absorption rate of one plant).

71. *Id.* (calculating water expenditure per plant during outdoor growing season).

tion rate is estimated to be double that of other major irrigated crops in California.[72]

Marijuana cultivation also poses significant risks to a region's natural biodiversity.[73] Grow sites are often "irrigated with summer and fall surface water diversions directly from headwater streams and springs."[74] These watersheds are home to a variety of aquatic life and particularly sensitive to water abstraction.[75] When surface water diversion occurs, it reduces a watershed's natural stream flow to dangerously low levels, which threatens the survival of many endangered species.[76] Environmental effects are multiplied in places like California where marijuana's primary outdoor grow season coincides with dry summer seasons that are already susceptible to drought.[77] As a result, even a small scale grow site "can have a disproportionately large impact on water resources and flow."[78]

Marijuana grow sites, especially black market sites, can have a significant detrimental impact on the environment by polluting natural water sources and endangering biodiversity.[79] Illegal growers utilize pesticides and rodenticides, which inevitably seep into the land and pollute natural food chains.[80] When pesticides are introduced into otherwise pristine natural habitats, they significantly alter these habitats and increase the risk of eradication to endangered species living within them.[81] Moreover, sophisticated

72. *Id.* (comparing marijuana's water application rate to wine grapes). Wine grapes in the region consume an estimated 271 million liters of water per square kilometer per growing season. *Id.* (discussing wine grapes water consumption rates compared to marijuana).

73. Carah, *supra* note 8, at 823 (explaining surface water diversion's negative effects on watershed biodiversity).

74. *Id.* (identifying common source of water for marijuana grow sites).

75. *See id.* (explaining need to mitigate negative effects of water diversion). "Water abstraction refers to the process of taking or extracting water from a natural resource." Brent Cooper, *The Abstraction of Water*, MEDIUM, (Feb. 18, 2018) (defining water abstraction).

76. Carah, *supra* note 8, at 823 (highlighting effects of surface water diversion on endangered species). Species impacted by surface water diversion include "rare and endangered salmonids, amphibians, and other animals." *Id.* (addressing threats posed to already threatened species by marijuana water diversion).

77. *Id.* (noting California's Mediterranean, arid summer season).

78. *Id.* at 824 (highlighting marijuana grow site's impact on water flow and availability).

79. *Id.* (identifying illegal marijuana grow site's impact on natural ecosystems).

80. *See id.* (revealing negative effects of introducing pesticides and rodenticides to natural habitats).

81. Carah, *supra* note 8, at 824 (identifying Pacific fishers as endangered species significantly affected by illegal grow sites). One study revealed that eighty percent of Pacific that were found dead near marijuana grow sites in northern California and Sierra Nevada were exposed to dangerous chemicals used to kill

and large scale grow sites are associated with land clearing, road construction and maintenance, and soil erosion, all of which lead to the degradation of natural habitats.[82]

Illegal grow sites are often inhabited by growers who tend to the plants and security personnel who patrol and guard the crop.[83] These individuals tend to camp near the grow sites for months at a time, bringing with them trash, petroleum fuels to run generators, and human excrement, which contaminate the ground and natural watersheds.[84] Illegal growers are also known to poach the area's wildlife without regard for a species's conservation status.[85]

B. Growing Marijuana "Where the Sun Don't Shine"

While a majority of marijuana is grown outdoors, especially in California, it can also be grown indoors in simulated conditions.[86] Many growers prefer outdoor production, compared to indoor cultivation, based on the potential for higher yields per plant.[87] A single outdoor plant, grown in ideal conditions, can yield approximately five hundred hundred grams (roughly seventeen ounces) of budded marijuana for retail sale.[88] Comparatively, indoor plant yield corresponds with light wattage in which experienced growers can expect to achieve a yield of one gram "per watt of an HPS light."[89] Despite this, black market growers often main-

wood rats that feed on the marijuana plant. *Id.* (examining findings of study that highlighted ecological harms from pesticides used in marijuana grow process). Pacific fishers are one example of a species that is near extinction and a prime candidate for listing under the Federal Endangered Species Act. *Id.* (discussing endangerment of Pacific fishers).

82. *See id.* (expounding on problems presented by illegal and semi-legal marijuana cultivation).

83. *Id.* at 824-25 (introducing environmental harm presented by humans tending to marijuana grow sites).

84. *Id.* at 824 (elaborating on illegal growers' pollution of areas near grow sites). Even after an illegal grow site is discovered and destroyed, environmental remedial measures are limited due to a lack of federal resources. *Id.* (discussing limited resources available to adequately combat illegal marijuana production operations).

85. *Id.* (noting illegal growers' propensity to poach wildlife near cultivation site).

86. *See* Carah, *supra* note 8, at 822-23 (identifying marijuana production in California and variability of grow sites available).

87. Alex Sekella, *Indoor vs Outdoor Cannabis Production: What's the Difference?*, INTERNATIONAL CANNABIS CORP., https://intlcannabiscorp.com/blog/indoor-vs-outdoor-grown-cannibis/ (last visited Oct. 10 2019) (explaining higher plant yield for marijauan grown outdoors).

88. *How Much Weed Can One Marijuana Plant Yield?*, BONZASEEDS, https://www.bonzaseeds.com/blog/marijuana-yield/#yield (last visited Oct. 11, 2019) (recognizing higher production from outdoor growth).

89. *Id.* (contrasting smaller plant yield from indoor cultivation).

tain indoor grow operations to evade law enforcement.[90] Legal producers also often utilize greenhouse or indoor growth methods to mitigate naturally occurring risk factors and produce what many consider to be a "high-grade product."[91] Indoor growers are free from seasonal constraints and thus can "achieve multiple harvests per year," leading to higher profits.[92] Moreover, because indoor germination allows for artificially controlled environmental conditions, growers are not inhibited by unpredictable weather patterns, typical predatory insects, and normal harvest cycles.[93] These benefits to the grower are arguably offset by the significant energy consumption required by indoor growth operations.[94]

Indoor growth presents the most significant environmental impacts of all growing methods due to the extensive energy required to replicate ideal outdoor growing conditions.[95] Similar to outdoor grow operations, indoor marijuana production requires limiting plants' exposure to "pests and fungal agents", as well as the use of pesticides and fertilizers.[96] The need to recreate outdoor conditions by providing adequate light, ventilation, and climate control is unique to indoor grow operations.[97] Indoor marijuana facilities utilize high-intensity lighting that is five hundred-times more powerful than the average light levels needed to adequately illuminate a room.[98] These specialized heat lights "contain[ ] a mixture of metal halide (MH) and high-pressure sodium (HPS) lamps," and need to be changed frequently between grow cycles.[99] A marijuana "grow house," often a "residential building converted to support

90. *See* Warren, *supra* note 2, at 402 (highlighting "clandestine" nature of indoor grow operations).

91. *See* O'Hare, *supra* note 9, at 5-6 (highlighting benefits to indoor grow methods).

92. *See id.* at 6 (explaining indoor cultivation's economic benefit to grower).

93. *See id.* (describing benefits of indoor cultivation).

94. *See id.* at 5 (recognizing energy consumption of indoor cultivation as having "most significant environmental effect").

95. *See id.* at 5, 7 (noting costly environmental implications of indoor grow sites).

96. *See* O'Hare, *supra* note 9, at 4-6 (discussing indoor marijuana cultivation process).

97. *See id.* at 5 (establishing necessity of optimal growing conditions for successful indoor cultivation).

98. *See id.* at 6 (expounding upon light requirements of indoor grown marijuana).

99. *Id.* (specifying chemical properties of lamps used in marijuana grow operations).

cannabis cultivation," can consume an enormous amount of energy from the lighting requirements alone.[100]

Grow houses also utilize Carbon Dioxide (CO_2) generators to increase indoor CO_2 levels to improve plant yield and overall productivity.[101] In full-scale, indoor production operations, CO_2 concentrations can be as high as four times the naturally occurring levels.[102] It is estimated that CO_2 generators make up "[two percent] of the overall carbon footprint of indoor cultivation."[103] Off-grid indoor production operations are estimated to produce even higher carbon greenhouse gas (GHG) emissions, sometimes being "[three to four] times greater" compared to the "relatively low-carbon electricity available" in populated, residential areas.[104]

While illegal production facilities are known to cause a strain on the energy grid, legal commercial and industrial indoor facilities would presumably require less energy and carbon intensities than their illegal counterparts.[105] Legal producers, incentivized to maximize profits by minimizing energy costs, would presumably operate more efficiently, thereby reducing their overall carbon footprint.[106] It is likely that rates of indoor growth will decline as more states move to legalize marijuana.[107] In addition, increased legalization, complimented by licensed grow operations and proper regulatory standards, should help further minimize some of the harmful effects on the environment.[108]

---

100. *See id.* (detailing energy output based just on lighting requirements in indoor grow operation). A standard grow house is estimated to have a power density output of 400 W/m^2. *Id.* (estimating power output of grow house).

101. *See* O'Hare, *supra* note 9, at 6 (explaining use of CO_2 generators in indoor cultivation). Generators are "fueled by natural gas or propane." *Id.* (specifying how generators are powered).

102. *Id.* (noting dramatic elevation in CO_2 levels from utilizing CO_2 generators).

103. *Id.* (summarizing generator's overall effect on carbon footprint of indoor grow operations).

104. *See id.* at 7 (describing off-grid and clandestine nature of many illegal indoor grow operations).

105. *See id.* (explaining environmental benefit to growers operating under legal frameworks).

106. *See* O'Hare, *supra* note 9, at 7 (noting grower's economic incentive to reducing energy costs).

107. *See id.* at 5 (explaining decreased energy consumption from reduced indoor grow operations).

108. *See id.* at 4 (identifying reduced environmental risk as states legalize marijuana).

IV. PRESENT STATE OF MARIJUANA REGULATIONS

A. Federal Constraints on the Marijuana Industry

Despite many states legalizing marijuana, it remains illegal under federal law due to its classification as a Schedule I drug.[109] The United States Supreme Court has expressly solidified Congress's power to regulate the marijuana industry through its precedent in case law.[110] In *Gonzales v. Raich*,[111] the Court upheld the CSA and affirmed the "constitutional authority of the federal government to prohibit the possession and distribution" of marijuana.[112] Federal marijuana policy enforcement, however, "is largely dependent on state cooperation."[113] While the federal Drug Enforcement Administration (DEA) is responsible for enforcing drug laws, the agency lacks the resources to regulate on a state-by-state basis.[114] Accordingly, the federal government must rely on state and local law enforcement to enforce federal drug policy because the federal government cannot force states to cooperate.[115]

Despite the CSA's broad grant of federal authority, many states have flatly rejected marijuana's Schedule I drug classification, instead legalizing or decriminalizing the drug within their territorial boundaries.[116] As state-level marijuana reform sweeps the nation,

109. *See* McKenna, *supra* note 22, at 106 (explaining current state of federal regulations on marijuana use). By listing marijuana as a Schedule I drug, the opportunity to conduct research on the drug is forbidden. *Id.*

110. *See* Jonathan H. Adler, *Marijuana, Federal Power and the States*, 65 CASE W. RES. L. REV. 505, 506 (2015) https://scholarlycommons.law.case.edu/cgi/viewcontent.cgi?article=1039&context=caselrev (explaining Supreme Court's affirmation of Congress' power to regulate marijuana).

111. *See generally* Gonzales v. Raich, 545 U.S. 1 (2005).

112. *See id.* at 28 (holding Congress may regulate marijuana industry based on constitutional authority to regulate intrastate commerce); *see also* Adler, *supra* note 110 (discussing constitutional authority to regulate marijuana).

113. *See* Adler, *supra* note 110, at 506-07 (highlighting importance of state cooperation to implement and enforce federal drug policy).

114. *Id.* at 507 (noting DEA's inability to police individual state's marijuana policy). "There are approximately four times as many state and local law enforcement officers within the states of Washington and Colorado as there are Drug Enforcement Administration agents across the globe." *Id.* (discussing federal government's reliance on state and local law enforcement to implement federal drug policy).

115. *Id.* (addressing federal government's reliance on state-level law enforcement to enforce marijuana drug laws). It is not feasible for the federal government to dedicate significant manpower to enforcing the CSA in each state. *Id.* (noting federal government's lack of agency resources); *see also* Printz v. United States, 521 U.S. 898, 914 (1997) (finding federal government cannot compel states to implement federal law); *see also* New York v. United States, 505 U.S. 145 (1992) (discussing federal government's limitiations in power over states).

116. *See* Warren, *supra* note 2, at 391 (highlighting certain states' rejection of federal drug classification on marijuana).

the federal government has opted for a less obstructionist role by allowing for state autonomy in adopting permissive marijuana laws.[117] The Department of Justice (DOJ) has taken a different approach to federal drug enforcement based on the varying objectives and priorities of presidential administrations.[118] This has often led to contradictory statements, policies, and an unclear understanding of marijuana's legal status.[119]

Despite its continually shifting status, the DOJ has attempted to explain its drug enforcement priorities in states with evolving marijuana policies.[120] In a 2009 memorandum, the Deputy Attorney General (AG), David Ogden, signaled the DOJ would maintain enforcement efforts on marijuana production and distribution to reduce trafficking, but would not devote significant agency resources to pursue individuals in compliance with state laws that permit marijuana use.[121] In a subsequent memorandum, then Deputy AG James Cole stated the drug remained strictly prohibited under federal law while the DOJ was in the process of refining its drug enforcement priorities.[122] In 2013, following the legalization of marijuana in both Colorado and Washington, the DOJ largely returned to AG Ogden's position.[123] By doing so, the DOJ highlighted a priority to curb interstate trafficking and to prevent youth access to marijuana while also respecting state-level initiatives to legalize marijuana.[124]

Most recently, the Trump Administration's DOJ, led by then AG Jeff Sessions, issued a memorandum rescinding all prior gui-

117. *See* Adler, *supra* note 110, at 507-08 (addressing federal government's lack of involvement in guiding individual state marijuana policy).

118. *See id.* (recognizing shifting priorities for enforcing marijuana laws under different presidential administrations).

119. *See id.* (noting lack of clarity in marijuana's legal status).

120. *Id.* at 507 (highlighting shifts in federal drug enforcement policy).

121. *See* Memorandum from David W. Ogden, Deputy Att'y Gen. on Investigations and Prosecutions in States Authorizing the Medical Use of Marijuana (Oct. 19, 2009), https://www.justice.gov/sites/default/files/opa/legacy/2009/10/19/medical-marijuana.pdf (stating Justice Department's deference to state regulatory programs that allow medical marijuana).

122. *See* Memorandum from James M. Cole, Deputy Att'y Gen. on Guidance Regarding the Ogden Memo in Jurisdictions Seeking to Authorize Marijuana for Medical Use (June 29, 2011), https://www.justice.gov/sites/default/files/oip/legacy/2014/07/23/dag-guidance-2011-for-medical-marijuana-use.pdf (reaffirming marijuana as illegal under federal law).

123. *See* Memorandum from James M. Cole, Deputy Att'y Gen. on Guidance Regarding Marijuana Enforcement (Aug. 29, 2013), https://www.justice.gov/iso/opa/resources/305201382913275685746 7.pdf (updating Justice Department's stance on marijuana drug enforcement policy in United States).

124. *Id.* (focusing on reasoning behind DOJ's return to previous policy).

dance on marijuana policy enforcement.[125] This guidance reiterated "Congress's determination that marijuana is a dangerous drug and that marijuana activity is a serious crime."[126] Despite the DOJ's recent posturing towards reinforcing federal marijuana policy, President Trump has signaled a less contradictory tone in which he appears to support state-led legalization efforts.[127] In a 2015 rally in Nevada, then-candidate Trump stated, "[i]n terms of marijuana legalization, I think it should be a state issue, state-by-state."[128]

B. State Specific Marijuana Legalization Frameworks

To date, thirty-three states, and the District of Columbia, have legalized medicinal use of marijuana.[129] California grows the majority of marijuana found in the United States.[130] There, marijuana is most often grown in "remote forested watersheds" on both private and public lands.[131] In contravention to the CSA, California

125. *See* Memorandum from Jefferson B. Sessions, Att'y Gen. on Marijuana Enforcement (Jan. 4, 2018), https://www.justice.gov/opa/press-release/file/1022196/download (rescinding all prior guidance on marijuana enforcement).

126. *See id.* (committing to uphold Congress's Schedule I classification of marijuana).

127. *See* Phil McCausland, *What Will a Trump Administration Do About Marijuana Legalization?*, NBC NEWS (Nov. 11, 2016), https://www.nbcnews.com/news/us-news/what-will-trump-administration-do-about-marijuana-legalization-n682261 (asserting Trump's support for marijuana legalization).

128. *See id.* (quoting Trump's campaign message on marijuana legalization).

129. *See* Jeremy Berke & Skye Gould, *New Jersey Lawmakers Postponed A Critical Vote to Legalize Marijuana – Here Are All The States Where Pot Is Legal*, BUSINESS INSIDER (Mar. 26, 2019), https://www.businessinsider.com/legal-marijuana-states-2018-1 (discussing states that have passed some form of legalization initiative); *see also* Carah, *supra* note 8, at 822 (explaining current state of marijuana legalization across United States). States such as Colorado, Washington, Oregon, and Alaska have legalized the recreational sale and possession of marijuana. Berke, *supra* note 129 (listing states that have legalized recreational marijuana). While several states have decriminalized marijuana use based on its medicinal benefits, the policy debate on recreational use remains a point of contention for many. Carah, *supra* note 8, at 822 (identifying continuing United States policy debate over marijuana legalization).

130. *See* Carah, *supra* note 8, at 822 (highlighting California's pristine growing conditions for marijuana). It is estimated that sixty to seventy percent of marijuana consumed in the United States is grown outdoors in California. *Id.* (providing statistics regarding amount of marijuana consumed in United States that was also grown in California). These figures represent both state authorized medical grow sites and illegal black market grow operations. *Id.* (describing source of California's marijuana).

131. *See id.* (identifying common growing locations in California). Illegal grow sites in California are often located in "sensitive watersheds with high biodiversity" which contain several protected animal species. *Id.* (quoting Mourad W. Gabriel et al., *Anticoagulant Rodenticides on Our Public and Community Lands: Spatial Distribution of Exposure and Poisoning of a Rare Forest Carnivore*, PLOSONE (July 13, 2012) (stating geographic locations of most common illegal grow sites in California).

was the first state to decriminalize marijuana for medicinal use.[132] Seriously ill individuals were deemed "qualifying patients" permitted to use and cultivate specified amounts of marijuana without repercussion from state law enforcement agencies.[133]

California's medical marijuana program expanded through its marijuana registry program.[134] The program enabled patients to voluntarily register with the state as medical marijuana users and to procure identification cards.[135] Valid card holders are legally permitted to use, possess, transport, and cultivate up to twelve immature plants for personal medicinal purposes.[136] Despite California's legislative attempts to regulate its marijuana market, the industry's most pressing issues remained legally ambiguous following the California Supreme Court's decision in *People v. Kelly*.[137]

In *Kelly*, the court ruled the rights established by the CSA could not be curbed by legislative action.[138] This holding created a lenient framework under which California established marijuana laws which have been left largely unchecked by state regulatory authority for nearly two decades.[139] Ultimately, the court's holding in *Kelly* helped pave the way for what is now a burgeoning marijuana

---

132. *See* California Compassionate Use Act of 1996, CAL. HEALTH & SAFETY § 11362.5 (West 2014) (decriminalizing medical marijuana use for qualifying patients).

133. *See id.* (listing qualifying patient illnesses for medical marijuana use). Qualifying illnesses included arthritis, cachexia, cancer, chronic pain, HIV or AIDS, epilepsy, migraine, multiple sclerosis and other illnesses of which medical use is "deemed appropriate and has been recommended by a physician." *Id.* (identifying qualifying illnesses).

134. *See* Warren, *supra* note 2, at 392 (discussing California's medical registry system).

135. *See* CAL. HEALTH & SAFETY CODE §§ 11362.7-11362.83 (West 2014) (establishing California's medical marijuana registry program).

136. *See id.* §§ 11362.71(e), 11362.78, 11362.77(a) (specifying parameters of registered medical marijuana patient's use). Qualified patients or primary caregivers were permitted to possess "no more than eight ounces of dried marijuana per qualified patient." *Id.* (iterating state-imposed restrictions on patients). Qualified patients or primary caregivers were also permitted to maintain "no more than six mature or twelve immature marijuana plants per patient." *Id.* (outlining amount and type of plants permitted per patient).

137. People v. Kelly, 222 P.3d 186, 209-10 (Cal. 2010) (limiting California's legislative authority to regulate local marijuana industry).

138. *See id.* (explaining California Supreme Court's holding in *Kelly*).

139. *See* Josh Harkinson, *New California Laws Are a Big Deal for People Who Care Where Their Pot Comes from*, MOTHER JONES (Sept. 16, 2015), https://www.motherjones.com/politics/2015/09/california-medical-marijuana-bill-pot-smokers-environment/ (addressing California's "hands-off approach" to marijuana production).

industry.[140] California now has "as many marijuana farms in Humboldt County, as there are wineries statewide."[141]

In 2016, California legislators introduced the Medical Marijuana Regulation and Safety Act (MMRSA) in response to environmental concerns surrounding the impacts of nearly twenty years of unrestrained marijuana agricultural development.[142] The MMRSA included comprehensive regulatory proposals and designated state regulatory authority to various state agencies in managing the marijuana agricultural industry.[143] Regulatory reform in marijuana production was long overdue, and the MMRSA required marijuana production be treated akin to other plant-based agricultural commodities whereby "[c]ultivators . . . have to comply with the same kinds of regulations that typical farmers do . . . ."[144] California's regulatory measures established by the MMRSA set a strong example for how a state can appropriately oversee the marijuana legalization in otherwise legally uncharted territory.[145]

Other states, however, have failed to implement adequate regulatory measures to address the disruptive environmental impacts

---

140. *See id.* (noting effects of California's permissive approach to marijuana legalization). California is regarded as the "Wild West" of marijuana reform where individual and commercial growers alike are permitted broad discretion in the production, sale, and distribution methods used in the marijuana industry. *Id.* (explaining California's unstructured approach to regulating marijuana industry).

141. *See* Stoa, *supra* note 12, at 300 (comparing number of marijuana farms and wineries in California); *see also* Alissa Walker, *How Growing More Weed Can Help California Fix Its Water Problems*, GIZMODO (Oct. 12, 2015), http://gizmodo.com/how-growing-more-weed-can-help- california-fix-its-water-1732169259 (comparing roughly four thousand wine farms in California to four thousand marijuana farms in Humboldt County).

142. *See* CAL. BUS. & PROF. CODE § 2220.05 (West 2016) (codified as amended in scattered sections of CAL. BUS. & PROF. CODE) (codifying agricultural regulation on marijuana industry in California).

143. *See id.* (designating state regulatory authority over marijuana industry); *see also* Stoa, *supra* note 12, at 301 (dividing regulatory responsibilities between various state agencies). State agencies responsible for overseeing the industry included the Department of Food and Agriculture, Department of Fish and Wildlife, Department of Public Health, and the State Water Resources Control Board. CAL. BUS. & PROF. CODE § 19332 (West 2016) *repealed by* STATS. 2017, C. 27 (S.B.94) § 2, EFF. JUNE 27, 2017 (designating labeling specific state agencies responsible for industry oversight).

144. *See* Stoa, *supra* note 12, at 301 (arguing marijuana should be treated similarly to other agricultural commodities); *see also Assemblymembers Urge Governor To Sign Historic Medical Marijuana Legislation*, KHTS NEWSROOM (Sept. 18, 2015), https://www.hometownstation.com/santa-clarita-news/politics/assemblymembers-urge-governor-to-sign-historic-medical-marijuana-legislation-160398 (noting MMRSA's author's view on Bill's reformative measures).

145. *See* Stoa, *supra* note 12, at 301 (explaining necessity of regulating marijuana cultivation similar to other forms of agriculture).

of marijuana legalization.[146] These states have focused regulatory efforts that prioritize the "distribution, sale, and consumption of marijuana."[147] Colorado, for example, became the first state in the nation to fully legalize adult recreational use of marijuana.[148] In 2000, Colorado amended its constitution to legalize medical marijuana and twelve years later approved state-wide recreational use.[149] Amendment 64, or the "Regulate Marijuana Like Alcohol Act," established that marijuana regulations should be similar to existing alcohol regulations.[150] Under the law, Colorado citizens are permitted to possess and consume up to one ounce of marijuana.[151] The law permits personal cultivation by allowing adults twenty-one and older to grow up to six indoor plants.[152] All marijuana grown for personal use must be kept indoors.[153] Commercial growers are permitted to cultivate and harvest larger quantities of marijuana for retail sale if they obtain the proper licenses from the Department of Revenue.[154] While modeling marijuana regulations on existing alcohol regulations may be sufficient for regulating consumption, sale, and distribution, it does not adequately account for the environmental effects of cultivating marijuana.[155]

Colorado's marijuana laws remain in early stages and can still be improved to better address environmental risk factors arising from the commodification of marijuana agriculture.[156] A special "task force established to investigate legal and regulatory issues" surrounding marijuana legalization has recognized environmental deficiencies in Colorado's marijuana industry, "such as the need to

146. *Id.* (recognizing state's various approaches to regulating marijuana industry).

147. *Id.* (noting various state's failure to prioritize environmental marijuana regulations).

148. *See* COLO. CONST. art. XVIII, § 16. (legalizing recreational use of marijuana for adults).

149. *See generally* COLO. CONST. art. XVIII, § 14 (addressing constitutional amendment known as "Medical Marijuana Amendment").

150. *See* Regulate Marijuana Like Alcohol Act, 2013 Colo. Sess. Laws 3291 (codifying recreational consumption and cultivation of marijuana in Colorado).

151. *See* Warren, *supra* note 2, at 395 (addressing Colorado's individual marijuana consumption laws).

152. *See id.* (specifying cultivation limits for individuals).

153. *See id.* (establishing further parameters for marijuana grown for personal use).

154. *See id.* (recognizing commercial cultivation as distinct from individual cultivation).

155. *See* Stoa, *supra* note 12, at 302 (comparing marijuana regulations to alcohol regulations).

156. *Id.* (addressing Colorado's need for environmentally conscious marijuana regulations).

regulate pesticides and waste products, tax cultivators, and establish cultivation limits."[157] Recognizing these issues is a positive start to addressing the overall environmental concerns presented by any widespread marijuana growing system.[158] The findings of the task force, however, overlooked some of the broader environmental issues.[159] For example, the task force made no mention of important environmental factors such as "water use or permitted cultivation practices."[160]

Washington state legalized recreational marijuana growth through the passage of Initiative 502 in 2012.[161] Initiative 502 was incorporated into Washington's Uniform Controlled Substances Act, which established a regulatory scheme for personal and commercial cultivation through licensing parameters for marijuana producers and retailers.[162] Under the Act, adults over the age of twenty-one are permitted to "cultivate, possess, and consume" limited amounts of marijuana for personal use.[163] Since legalization, the state has received an influx of applications for licenses to produce marijuana for commercial cultivation.[164] Like Colorado,

157. *Id.* at 312 (recognizing deficiencies in Colorado's marijuana regulatory scheme); *see also* H.R. 13-1317, 69th Gen. Assemb., Reg. Sess. (Colo. 2013) (noting task force's identification of marijuana agricultural issues).

158. *See* Stoa, *supra* note 12, at 312 (addressing necessity of considering marijuana legislation's environmental impact).

159. *Id.* (stressing need for all encompassing marijuana regulation).

160. *Id.* (recognizing inadequacy of Colorado's special task force in addressing important environmental issues in marijuana cultivation). The special task force did include a recommendation on the proper labeling of marijuana products to ensure producers "include a list of all pesticides, herbicides, fungicides, and solvents that were used in its cultivation or processing." Colo. Task Force, Report on the Implementation of Amendment 64, at 66 (2013), available at https://colorado.gov/pacific/sites/default/files/A64TaskForceFinalReport%5B1%5D.pdf (addressing need for transparency from marijuana producers in disclosing chemical treatment of products). Establishing bans on certain substances and imposing the labeling of contaminants is a part of a "tripartite strategy, along with Recommendation 9.2 to develop voluntary Good Cultivation and Handling Practices for the industry." *Id.* (recommending labeling and other requirements on marijuana products).

161. *See* Warren, *supra* note 2, at 396 (addressing marijuana legalization in Washington state).

162. *See* Uniform Controlled Substances Act, WASH. REV. CODE ANN. §§ 69.50.101-609 (West 2015) (codifying recreational marijuana use in Washington).

163. Warren, *supra* note 2, at 396 (establishing parameters for individual marijuana cultivation). Individuals are permitted to possess "up to one ounce of marijuana for personal use . . . ." *Washington Legalization,* NORML, https://norml.org/laws/item/washington-penalties-2 (last visited Feb. 1, 2019) (outlining marijuana possession guidelines in Washington state).

164. *See* Warren, *supra* note 2, at 396 (discussing approximately 2,800 licensing applications received for commercial marijuana production).

Washington has failed to fully guard against the environmental hazards of marijuana growth.[165]

In the wake of successful recreational marijuana legalization initiatives in Colorado and Washington, other states, including Oregon, Alaska, and the District of Columbia approved similar regulatory frameworks for recreational marijuana use in 2014.[166] Oregon approved legalization through Measure 91, which allows for adult "possession, use, and cultivation of marijuana."[167] Oregonians may possess up to "one ounce in public and eight ounces in private" and are permitted to grow "four plants for personal and private use."[168] Oregon also established state licensing procedures and licensing fees for commercial cultivation.[169] The Oregon marijuana industry is regulated by the Oregon Liquor Control Commission.[170]

Alaska legalized recreational use of marijuana through Ballot Measure 2.[171] Under this law, individuals twenty-one years or older may possess up to one ounce of marijuana and cultivate no more than six marijuana plants.[172] Commercial cultivation is regulated by the Marijuana Control Board, which requires a license and registration fee similar to Oregon's framework.[173]

Finally, citizens of the District of Columbia overwhelmingly approved the recreational legalization of marijuana through Initiative 71, known as the "Legalization of Possession of Minimal Amounts

---

165. *See id.* (detailing Washington state's efforts to legalize recreational marijuana).

166. *See id.* (identifying recreational marijuana legislation as result of November 2014 elections).

167. *See* Or. Legis. Serv. Ch. 1 (B.M. 91) (West 2015) (codifying recreational use of marijuana in Oregon for those over twenty-one years old).

168. Warren, *supra* note 2, at 397 (discussing Oregon Measure 91); *see also* Or. Legis. Serv. Ch. 1 (B.M. 91) (West 2015) §§ 79, 6 (identifying parameters of personal possession and consumption).

169. *See* Or. Legis. Serv. Ch. 1 (B.M. 91) (West 2015) § 28 (explaining commercial regulations on qualifying producers of marijuana). Section (4) states: "The commission shall assess a nonrefundable fee for processing a new or renewal application for any license . . . . The application processing fee shall be $250." *Id.* (describing application fees imposed on licensees). Section (5) states: "The annual license fee for any license granted . . . shall be $1,000." *Id.* (identifying costs associated with marijuana licenses).

170. *Id.* § 7 (naming regulatory agency charged with enforcing marijuana regulations).

171. *See* ALASKA STAT. ANN. § 17.38.010 (West 2015) (codifying legalization of recreational marijuana use).

172. *Id.* § 17.38.020 (specifying parameters of individual possession and cultivation).

173. *See id.* § 17.38.080 (designating agency charged with enforcing marijuana regulations).

of Marijuana for Personal Use Act of 2014."[174] In D.C., adults are permitted to possess a maximum of two ounces of marijuana and cultivate up to six plants for personal use.[175] While the Act requires personal cultivation to be conducted indoors, it does not impose any licensing standards for commercial cultivation or retail sales.[176]

Pennsylvania's recent legislation is a prime example of inadequate environmental oversight on the marijuana industry.[177] Although the recreational use, possession, cultivation, and distribution of marijuana remain prohibited under Pennsylvania law, Governor Tom Wolf approved the provisional legalization of medical marijuana in April 2016 when he signed Senate Bill 3 (SB 3).[178] Under SB 3, the Department of Health is tasked with the implementation and administration of the medical marijuana program in the state.[179] Qualifying patients can now purchase medical marijuana through designated state dispensaries, provided they have the proper physician's certification.[180] Under the law, there are twenty-one designated illnesses that qualify as a "Serious Medical Condition."[181] Patients that have been issued an identification card may legally purchase medicinal marijuana products from state

174. *See* Ballot Initiative 71, DCMJ (Feb. 26, 2015), https://dcmj.org/ballot-initiative/ (codifying recreational marijuana legalization).

175. *Id.* (establishing parameters for personal consumption and cultivation of marijuana).

176. *See* Warren, *supra* note 2, at 398 (noting lack of guidance on commercial licensing and cultivation of marijuana).

177. *See generally* 35 PA. STAT. AND CONS. STAT. ANN. § 10231.303 (West 2016) (codifying medical marijuana as legal in Pennsylvania).

178. *See* Sophie Stone, *BLOG: What You Need to Know About Medical Marijuana in Pennsylvania*, MEDICAL MARIJUANA, THE BLOG (Apr. 15, 2016), https://www.governor.pa.gov/blog-what-you-need-to-know-about-medical-marijuana-in-pennsylvania/ (addressing Senate Bill 3's passage in Pennsylvania).

179. *Id.* (designating Department of Health as regulatory agency to oversee medical marijuana program).

180. *Id.* (outlining who may access medical marijuana in Pennsylvania).

181. Dep't of Health, *Medical Marijuana Patient and Caregiver Resources*, https://www.health.pa.gov/topics/programs/Medical%20Marijuana/Pages/Patients.aspx (last visited Feb. 14, 2019) (listing twenty-one specific medical conditions required to obtain medical marijuana). The "Serious Medical Conditions" include anxiety disorders, autism, inflammatory bowel disease, Huntington's disease, and a variety of other illnesses. *Id.* (listing qualifying conditions for medical marijuana in Pennsylvania).

approved dispensaries.[182] Although SB 3 authorizes up to 150 dispensaries state-wide, only a handful have been approved thus far.[183]

Initially, SB 3 prohibited authorized dispensaries from selling smokable (dry leaf, flowering, or budded) marijuana, limiting dispensaries' and patients' retail options to marijuana products in the form of "oils, pills, and topical applications" like ointments and balms.[184] This changed, however, following a 2018 amendment to the law permitting dispensaries to sell marijuana in its dry smokable form.[185] While smoking marijuana in the traditional sense remains prohibited in Pennsylvania, dispensaries now offer patients budded marijuana flowers that can be ingested through the vaporization technique.[186] Allowing the sale of marijuana in this form benefits

182. *See* Stone, *supra* note 178 (summarizing where patients are permitted to purchase medical marijuana). In order to become an authorized grower/processor in the state, the Department of Health "may issue permits for no more than 25 grower/processors. No more than five grower/processors may also be issued a dispensary permit." Dep't of Health, *Resources for Growers and Processors*, https://www.health.pa.gov/topics/programs/Medical%20Marijuana/Pages/Growers-Processors.aspx (last visited Feb. 14, 2019) (limiting number of marijuana growers and dispensaries in Pennsylvania). The Department also issued guidance requiring applicants to provide information pertaining to "[the] [a]bility to maintain effective security and control to prevent diversion, abuse, or other illegal conduct[,] [e]vidence of municipality zoning requirements compliance[,] [p]rovide a diversity plan" as well as an "[i]nitial non-refundable fee of $10,000[,] [p]ermit fee of $200,000, [and] [p]roof of $2 million in capital." *Id.* (explaining application process and requirements for grower and processor applicants).

183. Stone, *supra* note 178 (identifying limited number of dispensaries approved to operate in Pennsylvania).

184. Kurt Bresswein, *What to Know About Medical Marijuana Buds Now Available in Pennsylvania*, LEHIGH VALLEY LIVE (Aug. 1, 2018), https://www.lehighvalleylive.com/news/index.ssf/2018/08/watch_what_to_know_about_medic.html (noting limitation imposed on dispensaries from selling budded marijuana).

185. *Id.* (explaining update to Pennsylvania's medical marijuana program allowing dispensaries to sell budded marijuana to patients). Keystone Canna Remedies, located in Bethlehem, Pennsylvania, was one of the first of sixteen dispensaries to sell budded marijuana in the state. *Id.* (recognizing allowance of budded marijuana sales in state). Twelve other dispensaries then began selling budded marijuana in Pennsylvania. *Id.* (addressing additional retail sellers of budded marijuana).

186. *Id.* (recognizing vaporizing alternative to smoking marijuana which is prohibited under Pennsylvania law). The vaporization technique "is the process of heating dried cannabis to a temperature just below its combustion point of 392°F," which negates some of the health issues associated with smoking marijuana (carcinogens, tar), and instead releases the desired psychoactive chemicals (cannabinoids) from the plant "without igniting [or] destroying the material." *Vaporization*, MEDICAL JANE, https://www.medicaljane.com/category/cannabis-classroom/consuming-cannabis/vaporization/ (last visited Feb. 14, 2019) (explaining marijuana vaporization health benefits and delivery system).

consumers by providing an additional and cheaper retail option for marijuana consumption.[187]

While the rollout of SB 3 is still underway, the law leaves much to be desired regarding individual patient regulatory oversight.[188] SB 3 provides no guidelines on permitted quantity, potency, and use and presumably places these determinations in the hands of the prescribing physicians.[189] Without guidance on individual consumption rates, or limits on dispensaries' marijuana production, growers can produce seemingly unlimited quantities of marijuana without regard for the agricultural and environmental impact of such production.[190] Even more concerning, the law is devoid of any awareness of marijuana's environmental impacts.[191] While this may be attributed to the law's already limited scope concerning who can legally cultivate, sell, or purchase marijuana, this does not eliminate the need for environmental considerations.[192] Regardless of whether Pennsylvania maintains a limited approach to legalization, lawmakers must adopt guidelines to address and mitigate the environmental impacts of legalization as the industry takes hold in the state.[193]

V. FUTURE IMPACT AND RECOMMENDATIONS

Of the states that have legalized marijuana in the past two decades, only a few recognize the environmental implications associated with marijuana growth.[194] Most states remain unprepared for, or unaware of, the extent to which widespread marijuana cultivation will impact the environment.[195] This may be attributed to a lack of institutional research concerning marijuana's environmen-

187. Bresswein, *supra* note 184 (noting consumer benefits to allowing dispensaries to sell marijuana in its budded form).

188. *See generally* 35 PA.STAT. ANN. §§ 10231.101—10231.2110 (West 2016) (establishing medical marijuana program in Pennsylvania).

189. *Id.* (instructing physicians and practitioners on medical marijuana program).

190. For a discussion of the environmental impact of marijuana agriculture see *supra* notes 63-85 and accompanying text.

191. For a discussion of the environmental impact of marijuana agriculture see *supra* notes 63-85 and accompanying text.

192. For a further discussion of the process of approving marijuana growers/processors in Pennsylvania see *supra* note 182 and accompanying text.

193. For a further discussion of the importance of recognizing the environmental harm of marijuana production prior to legalization see *infra* notes 207-219 and accompanying text.

194. *See* Stoa, *supra* note 12, at 312 (recognizing some states have addressed environmental factors of marijuana agriculture systems).

195. *See id.* (addressing regulatory shortcomings in many states that have legalized marijuana).

tal impacts or because a large portion of the industry remains underground.[196]

States with emerging marijuana laws must develop regulatory frameworks that address and prioritize environmental issues at the outset of legalization to effectively mitigate future harm.[197] While there is no one-size-fits-all approach best suited for managing the marijuana industry, states have various options in creating environmentally conscious regulatory schemes.[198] As a practical matter, states must first recognize and treat marijuana as an agricultural commodity.[199] Next, prior to enacting marijuana legislation, states will benefit from investing resources into educating consumers about the environmental impacts of marijuana cultivation.[200] This can be achieved through product labeling systems and implementation of an appellations model.[201] Similarly, based on the intended scope of a state's specific legalization efforts, some states may benefit from a limited licensing approach that emphasizes environmentally conscious growers.[202]

A. Marijuana as an Agricultural Commodity

Legislators' failure to address the negative environmental impact marijuana cultivation has on a given ecosystem is partially because most states do not recognize or regulate marijuana as an agricultural commodity.[203] Agricultural commodities are defined as "fungible goods with no qualitative differentiation, such as wheat or soybeans."[204] Many marijuana farmers are concerned that legali-

196. *See id.* at 309 (theorizing why there seems to be lack of concern surrounding environmental impact of widespread marijuana growth).

197. *See id.* at 312 (stating need for development of adequate information and regulatory response to widespread marijuana cultivation).

198. *See id.* at 362 (discussing various ways states can better address environmental impacts of marijuana cultivation).

199. *See* Stoa, *supra* note 12, at 317 (arguing that marijuana should be treated as agricultural commodity).

200. For a further discussion of raising public awareness on the environmental impacts of marijuana cultivation, see *infra* notes 207-214 and accompanying text.

201. For a further discussion of possible methods of raising public awareness, see *infra* notes 215-240 and accompanying text.

202. *See* Stoa, *supra* note 12, at 322 (stating need for development of adequate information and regulatory response to widespread marijuana cultivation). For a further discussion of the benefits of a limited state licensing approach, see *infra* notes 249-254 and accompanying text.

203. *See* Stoa, *supra* note 12, at 302 (recognizing early adopters of marijuana legalization have failed to consider environmental impact of agricultural marijuana production).

204. *Id.* at 303 (defining agricultural commodity).

zation, without proper regulatory control, will result in the market being inundated with both large agricultural corporations as well as low quality, low cost, and indistinct marijuana.[205] In response to these fears, industry advocates recently began urging states to adopt a regulatory model emphasizing regionally cultivated products to maintain quality control.[206]

B. Public Awareness Campaign: Spreading Environmental "Reefer Madness"

Raising public awareness about the environmental implications of marijuana growth is a vital first step in implementing any environmentally conscious legislation.[207] Both illegal marijuana grow operations and legal large-scale commodified agricultural operations pose distinct environmental threats.[208] First, regarding illegal grow operations, states that fully restrict all forms of marijuana products are implicitly supporting the perpetuation of the black market marijuana industry by sending growers indoors to evade law enforcement.[209] Consumers must understand the extent to which illegal grow operations strain the energy grid, pollute waterways and soil, threaten species, and damage entire ecosystems.[210] Equipped with this knowledge, consumers can urge policy-makers to introduce permissive marijuana laws, thus economically undermining and disincentivizing illegal marijuana producers.[211]

Second, in regard to legal large-scale operations, when legalization efforts have begun, consumers will begin to recognize the broader implications of a legalized marijuana industry.[212] This can be achieved by disseminating information about the harms associated with both indoor cultivation and large-scale commercialized

205. *See id.* (discussing marijuana quality control concerns).

206. *See id.* (proposing appellation model as possible quality control solution). For a further discussion of quality control, see *infra* notes 220-240 and accompanying text.

207. *See* Babcock, *supra* note 59, at 774 (addressing need for raising public awareness of environmental implications of marijuana legalization).

208. *See* O'Hare, *supra* note 9, at 3-4 (detailing distinct environmental implications of both indoor and outdoor marijuana cultivation).

209. *See id.* at 4 (recognizing indoor growth as having significant environmental impact).

210. *See id.* at 5-10 (noting various environmental harms caused by indoor and outdoor marijuana production).

211. *See id.* at 7 (explaining economic incentive for creating legal frameworks for marijuana growers).

212. *See* Babcock, *supra* note 59, at 774 (addressing psychological effect of proper information systems).

marijuana cultivation on public and private lands.[213] As a result, better informed consumers and constituents can urge state legislators to adopt environmentally conscious marijuana laws and policies.[214]

C. Marijuana Labeling System

Similar to how many consumers prefer - and will pay a premium for - organically grown products at a grocery store, marijuana products could also be categorized through a labeling system that designates certified environmentally conscious cultivators.[215] In states that have authorized the sale of retail marijuana, "eco-labels" could be utilized to educate consumers on where and how a product was sourced and grown.[216] This type of consumer education may help not only to reduce black market marijuana activity and indoor cultivation practice, but also will create a market demand for environmentally certified marijuana products.[217] The increased consumer demand will incentivize marijuana growers to adhere to environmental compliance measures and to reduce their environmental footprint in order to meet the established certification standards.[218] While there will always be a market for the lowest cost product, regardless of environmental impact, this method has the potential to impact a significant portion of both the illegal and legal marijuana markets.[219]

213. *See* O'Hare, *supra* note 9, at 5-7 (explaining environmental risk factors associated with marijuana cultivation).

214. *See* Babcock, *supra* note 59, at 774-75 (recognizing changes to individual consumer behavior can have aggregate effects by activating norms and changing broader behavior).

215. *See generally* Eric Biber, *How Certification Could Reduce the Environmental Impacts of Marijuana Farms*, BERKELEY BLOG (Jan. 16, 2013), http://blogs.berkeley.edu/2013/01/16/how-certification-could-reduce-the-environmental-impacts-of-marijuana-farms (comparing environmental certification of marijuana products to other areas of economic activity such as coffee production, paper industry, and agricultural industry).

216. *See id.* at 776 (describing large consumer base of marijuana products in United States as being environmentally conscious); *see also* Biber, *supra* note 215 (discussing benefits of environmental marijuana product labeling). Eco-labeling could impact consumer product choice based on the fact that a "non-trivial proportion of the consumers of marijuana in the United States are higher-income, left-of-center, and generally sympathetic to environmental causes." *Id.* (proposing certification of marijuana growers that meet minimum environmental standards in marijuana production and cultivation operations).

217. *See* Biber, *supra* note 215 (recognizing dual benefit to environmental certification for legal marijuana growers).

218. *Id.* (addressing increased consumer demand for environmentally certified legal marijuana growers).

219. *See id.* (admitting certification method will not alter habits of consumers looking for lowest priced marijuana products).

D. Marijuana Appellations

Another possible solution to help raise public awareness and ensure compliance with environmental regulations is through the adoption of an appellations model.[220] Generally, appellations are associated with the wine industry, where they provide "certified designation[s] of origin . . ." and impose "certain quality or stylistic standards."[221] The wine industry relies on appellations to inform consumer choice based on the belief that varying environmental conditions in each vineyard's geographic location collectively impact grape quality.[222] Appellations also impose strict quality standards to incentivize production of only the highest quality product, which in turn improves the region's reputation.[223] As a region and specific vineyard's reputation improves, consumer demand for that specific appellation increases.[224] This benefits individual farmers by creating demand for their specific product while also creating industry demarcation by "precluding other producers from free-riding on the region's reputation or duplicating its products."[225]

Appellations can be applied to any agricultural product where the geographic origin impacts the characteristics of the product and carries meaning to the consumer.[226] For this reason, the appellation model could be applied to the marijuana industry where, similar to the wine industry, environmental factors and geographic location impact marijuana quality.[227] Just as Champagne, France is

220. *See* Stoa, *supra* note 12, at 325 (proposing adoption of appellations in marijuana industry).

221. *Id.* (defining appellations generally).

222. *See id.* at 326 (associating appellations with wine industry). Environmental conditions known to affect grape quality include factors such as soil, aridity, temperature, and weather. *Id.* at 326 (discussing various factors known to impact wine characteristics).

223. *See id.* (explaining quality standards imposed in appellations system). Appellations in the United States wine industry refer only to geography, whereas appellations in Europe reference geographic region as well as impose strict quality and compliance standards on farmers. *Id.* at 325 n.178 (comparing United States and European appellation systems).

224. *See id.* at 326 (referencing market benefit of increased reputation for region).

225. *See* Stoa, *supra* note 12, at 326 (elaborating on benefit to market differentiation in wine industry). *But see* Jay Kiiha, *Trade Protectionism of Wine Brand Names at the Expense of American Viticultural Areas: Arbitrary Protection of "Big Liquor" at the Expense of Small Vineyards*, 9 DRAKE J. AGRIC. L. 157, 159 (2004) (noting prevalence of fraud due to wine producer's incorrectly claiming region as their own or attempting to confuse consumer).

226. *See* Stoa, *supra* note 12, at 325-26 (noting applicability of wine appellations to marijuana appellations).

227. *Id.* at 326-27 (comparing similarities between environmental conditions' effects on wine and marijuana crops).

known for its regional production of authentic Champagne, appellations in the marijuana industry can protect brand-name strains that grow particularly well in a given region.[228] Additionally, appellations could also include quality control, cultivation, and certification measures to ensure environmental standards are met while also improving the reputation of a region.[229] This model also has potential to reduce competition among growers by allowing them to focus on the strains best-suited for their respective region rather than competing to produce popular strains that are not suited for their environment and region.[230]

Consumers and local communities alike can benefit from marijuana appellations.[231] Consumers will benefit from both the peace of mind associated with being an informed consumer and by receiving high quality, locally sourced, and verifiably authentic marijuana products.[232] Local marijuana producers will experience increased revenue and the opportunity to differentiate themselves, both regionally and operationally, in what is sure to be a competitive market.[233] Localities can also ensure a portion of all retail sales are committed to promoting environmental initiatives that benefit their respective communities.[234]

Implementing such a system, however, does not come without challenges.[235] First, the entire appellations model depends on a broad agreement among growers within a geographical boundary

---

228. *Id.* at 326 (recommending growers cultivate certain marijuana strains based on region's characteristics).

229. *Id.* (elaborating on benefits of imposing specific standards through appellation system to consumer, environment, and cultivators). Wine appellations in France require grape farmers "only use certain varietals, limit irrigation practices that increase yields at the cost of grape quality, or attain predetermined alcohol content." *Id.* at 328 (discussing quality standards imposed on wine producers).

230. *See id.* at 327 (arguing appellation system could reduce competition among marijuana growers). For example, "France's Burgundy and Rhone regions are well-known for growing pinot noir and syrah grape varietals, respectively. Neither region is threatened by outside producers or forced to adopt ill-suited varietals because they have created individual markets for their own well-respected grapes." *Id.* (theorizing benefit of appellations application in marijuana cultivation).

231. *See* Stoa, *supra* note 12, at 326 (arguing benefit of appellation certification for consumer and overall industry).

232. *Id.* (explaining consumer benefit in form of increased quality standards).

233. *See id.* at 327 (addressing need for marijuana cultivators to produce marijuana best suited for their specific region).

234. *See id.* at 326 (describing benefit of appellation certification for consumer and overall industry).

235. *Id.* at 328 (recognizing barriers to implementing appellations system).

to adhere to the appellation designation.[236] Without a nearly unanimous agreement, local governments will have difficulty enforcing the geographic designations.[237] Unlike the wine industry, there is no federal agency to oversee the broad enforcement of a country-wide appellation system.[238] Federal oversight is unlikely to occur for the marijuana industry as long as marijuana is prohibited under federal law.[239] Under the current state of the law, states will have to adopt and enforce their own appellation regulatory frameworks while also enforcing the ban on the import and export of marijuana products pursuant to federal law.[240]

E. Selective State Licensing Approach

A limited or selective state licensing approach is a feasible regulatory option for states looking to enforce environmentally conscious marijuana legislation.[241] Many states, however, have enacted permissive marijuana legislation before ever addressing the environmental implications that accompany large-scale marijuana grow operations.[242] For example, states like California and Colorado have been inundated with commercial marijuana cultivation applications and therefore "struggle[ ] to regulate tens of thousands of marijuana farms . . . ."[243] States such as Florida and New York have taken a different approach by limiting commercial cultivation licenses to "less than a dozen" approved cultivators.[244] This model,

236. Stoa, *supra* note 12, at 328 (addressing need for agreement among growers to adhere to appellations system).

237. *Id.* (noting difficulty of enforcing appellations without grower compliance).

238. *See id.* (explaining lack of federal oversight for adopting appellations system). The United States wine industry's appellations, for example, are governed by the Treasury Department's Alcohol and Tobacco Tax and Trade Bureau. *Id.* (contrasting wine appellations federal regulatory framework with theoretical marijuana industry appellations framework).

239. *See id.* (recognizing marijuana remains illegal under federal law).

240. *See id.* (emphasizing importance of state-led appellation system).

241. Stoa, *supra* note 12, at 321 (arguing for limited state licensing approach to marijuana legalization).

242. *See id.* at 301-02, 321 (addressing detriment to legalizing marijuana without first establishing proper regulatory framework). Many states have enacted marijuana legislation due to the economic allure of collecting significant tax revenue from the industry. *Id.* at 331 (recognizing attractive economic benefits for states that allow large-scale cultivation).

243. *Id.* at 321 (highlighting increased demand for marijuana licenses in California).

244. Stoa, *supra* note 12, at 321 (addressing benefits to alternative approach to marijuana regulatory framework that limits availability of grow sites for marijuana cultivation).

however, does not always prove successful.[245] For example, Ohio attempted to introduce a similar model in 2015, limiting commercial cultivation to ten pre-selected sites.[246] In response, Ohio voters overwhelmingly rejected the initiative, citing the monopolizing effect it would have on the industry.[247] Additionally, the limited licensing approach may not provide sufficient market incentives on consumers or producers to suppress the illegal black market marijuana industry.[248]

Limiting state authorized commercial marijuana licenses to a restricted or pre-specified amount of qualified growers offers distinct regulatory advantages.[249] This approach allows regulators to vet responsible cultivators and tailor regulatory measures based on the needs of the local agricultural infrastructure.[250] By adopting a regulatory framework that limits farm size and controls the mass-production of marijuana, state regulators are better equipped to "monitor the industry and enforce regulations," thereby taking a more active approach in mitigating any harmful effects to the environment.[251]

This licensing model, however, is less likely to receive widespread public support, as it creates a monopoly of industry power for the select cultivators that are granted access to the market.[252] When included on election ballots, "pro-marijuana legalization advocacy groups urge[ ] voters to reject . . . [any] initiative" that limits industry access for commercial cultivators.[253] Although this drawback likely precludes its nationwide application, select states could adhere to this framework to differentiate their marijuana systems.[254]

---

245. *Id.* at 322-23 (recognizing limited licensing model is probably not best long-term solution).

246. Jackie Borchardt, *4 Reasons Why Ohio Issue 3 Failed*, CLEVELAND.COM (Nov. 5, 2015), https://www.cleveland.com/open/2015/11/4_reasons_why_ohio_issue_3_fai.html (discussing Issue 3's proposal to limit state licenses for commercial marijuana growers).

247. *Id.* (noting general population's rejection of Issue 3 in Ohio).

248. *See* Stoa, *supra* note 12, at 322 (describing how imposing limitations on state cultivation licenses ignores existence of black market industry).

249. *Id.* at 321 (explaining regulatory benefit to limiting commercial cultivation licenses to specified number of applicants).

250. *Id.* (discussing advantages of regulating fewer cultivators).

251. *Id.* (noting benefit of state's ability to select responsible cultivators).

252. *Id.* at 322 (discussing decreased public support for legalization initiatives that propose limiting marijuana cultivation licenses).

253. Stoa, *supra* note 12, at 322 (explaining legalization advocacy groups' opposition to monopolizing initiatives).

254. *Id.* at 322-23 (addressing negative implications and applicability of limiting commercial cultivation licenses nationwide).

VI. CONCLUSIONS

It is ultimately the state and county-level policymakers that will determine if and how to "facilitate or preclude the consolidation of marijuana agriculture."[255] As the marijuana industry evolves, state policy-makers will likely have to decide between two regulatory frameworks: (1) integrating marijuana laws into the existing legal framework by regarding marijuana similarly to other commodities such as wheat or corn, or (2) creating an entirely new regulatory framework tailored specifically to the marijuana industry.[256] Given that a large portion of the industry is transitioning from the black market, the latter option, emphasizing a "targeted regulatory scheme," may be the most feasible option for state regulators.[257]

As states continue to legalize and adopt permissive marijuana laws, it is likely that many will continue to ignore the environmental risk factors associated with the marijuana industry.[258] Environmentally conscious regulatory measures, however, are beginning to emerge in places like California, Florida, and New York.[259] The approaches used by these states can serve as models for other states as they implement their own marijuana legislation.[260] Regardless of how states with emerging marijuana laws choose to model their legislation, states that utilize an "incremental or gradual approach," which emphasizes regulatory flexibility, will be best suited to address environmental issues as they arise.[261] State policymakers find themselves in a unique position to regulate the behemoth that is the marijuana industry.[262] As the industry continues to develop, it is imperative that lawmakers strike a regulatory balance that is both

255. *Id.* at 303 (determining state lawmaker's responsibility to oversee marijuana quality control).

256. *Id.* at 302 (establishing two possible regulatory frameworks regulators may use in deciding how to approach regulating marijuana industry).

257. *Id.* at 312 (emphasizing benefit to creating targeted regulatory scheme for marijuana industry).

258. Stoa, *supra* note 12, at 361-62 (addressing states continued failure to treat marijuana as agricultural product).

259. *Id.* at 361 (recognizing states are beginning to take steps that appropriately address environmental risk factors associated with marijuana legalization).

260. *Id.* at 300 (discussing Humboldt County Marijuana Ordinance as good model for local governments with emerging marijuana laws).

261. *Id.* at 362-63 (recognizing need for flexibility in adopting regulatory frameworks for marijuana legalization).

262. *See* Warren, *supra* note 2, at 431 (recognizing opportunity to manage large marijuana industry).

fair to marijuana producers and consumers, while also safeguarding the very environment that facilitates marijuana growth.[263]

*Kahn R. Wiedis**

263. *See id.* (placing responsibility on policymakers to enact environmentally conscious marijuana legislation).

* J.D. Candidate, May 2020, Villanova University Charles Widger School of Law; B.A. Political Science, 2016, West Chester University of Pennsylvania. I would like to thank my sister, Kiya, my girlfriend, Jillian, and my parents, David and Miho Wiedis, for your constant love and encouragement. I dedicate this comment to my dad for being the ultimate role model. Without your inspiration, guidance, and unending support, none of this would have been possible.