

After legalization: Cannabis, environmental compliance, and agricultural futures[☆]

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ABSTRACT

As the largest polity worldwide to legalize cannabis, California has implemented uniquely high environmental and land use standards for cannabis agriculture. To date, however, regulations have suffered from low compliance rates, especially among smaller, “legacy” farms that existed prior to legalization. Meanwhile, both licensed and unlicensed farms are increasing in size, thus increasing environmental pressures. Is there a way to achieve environmental objectives, farmer compliance, and an equitable transition away from illegal markets? In the largest US survey of cannabis farmers to date, we found farmers are open to strong environmental protections yet face significant barriers in meeting regulatory requirements. We present this opinion article to suggest several strategies to ameliorate compliance barriers by reducing associated learning, financial, and psychological costs. Taken together, these strategies present an unprecedented opportunity to model a new kind of agriculture centered on small-farm production and environmental stewardship—a model that indicates new directions for agriculture beyond cannabis.

Can California create a sustainable, equitable, regulated market for cannabis? The answer has implications beyond California’s borders, as more governments attempt to legalize a (still) mostly-illicit market valued at \$214–344 billion globally (Arcview 2020; New Frontier Data 2019). Many hope legalization of this agricultural crop, poised to become California’s most valuable, will reduce environmental harms associated with illicit production, ensure safe cannabis products for consumers, and equitably support farmers along the way. Yet, the transition to a legal market faces challenges.

Remote imagery and public record analyses suggest most Californian cannabis farms remain unpermitted. The size of both licensed and unlicensed farms is increasing, potentially raising environmental pressures (Dillis et al., 2021a). Despite policy aims of supporting smaller-scale farmers, the new regulatory regime appears to favor larger-scale cultivators. Indeed, previous research has shown that farms with over 1500 plants are twice as likely to apply for a permit than farms with less than 500 plants (Schwab et al., 2019) and our own calculations from 2018 to 19 indicate that only 2% of small farms are becoming permitted compared to 15% generally. Meanwhile, as Dillis et al. (2021a) report in

this journal, the largest farms comprise 10% of licensees but account for 60% of total regulated cultivation area, much of it in regions of the state with little prior cannabis agriculture. In sum, California’s regulatory schema is struggling to meet three key goals stipulated in the voter-approved ballot authorizing legal cannabis: 1) to successfully transition farmers to legal economies; 2) to ensure environmental protection; and 3) to establish smaller farms as the foundation of a legal cannabis industry.

In this opinion piece, we argue that legalization’s benefits hinge on whether government agencies can support compliance among California’s cannabis farmers, the vast majority of whom currently run independent, small-scale operations and cultivate areas less than an acre (Butsic et al., 2018). If unable to overcome compliance barriers, small farmers may fuel illegal markets, with potential environmental impacts (Wartenberg et al., 2021), or cease cultivation altogether, with negative economic consequences for surrounding communities (on farmer exclusion and communal benefits see Polson and Bodwitch, 2021). If brought into regulation successfully, small farmers could maintain stable livelihoods and, with appropriate support, foster healthy

[☆] This article details barriers to and supportive measures for an equitable, environmentally sustainable transition to cannabis legalization.

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environments and vibrant communities. To do so, barriers to legal market entry must be lowered, without compromising environmental outcomes. Our recent study of cannabis farmer compliance motivations [Bodwitch et al., 2021] suggests a range of measures to mitigate farmers' administrative and financial burdens and repair historically fraught relations between government, farmers, and communities. Below, we assess the challenges currently impeding the success of cannabis regulation in California and recommend the adoption of proven methods for the successful transition of sustainable, equitable agricultural sectors.

Prohibition legacies and regulatory troubles

Historically, prohibition incentivized farmers to locate in remote sites and limit farm size to evade detection (Corva, 2014). Cultivation concentrated in California's rural regions, especially Northern California and the Sierra Nevada foothills, characterized by remote, sparsely populated communities, declining extractive industries and long, dry growing seasons (Polson, 2021). This cultivation footprint expanded with passage of medical cannabis legislation in 1996. The valuable cash crop supported livelihoods, often at small scales with high rewards. Farms tended to cluster according to social networks (as opposed to environmental factors) (Butsic et al., 2017), thus becoming a lynchpin of community life. Cannabis drove economic development, employment and land values in otherwise poor, underdeveloped areas (Polson, 2021).

For many years, as Short-Gianotti et al. (2017) reminded us in this journal, prohibition and medical quasi-legality made assessment of environmental impacts highly challenging. However, assessment is more possible six years after California legalized cannabis. When in remote areas, cannabis agriculture can cause notable environmental impacts, including deforestation, water diversion from rivers and streams, and pollutant discharge. These factors have contributed to forest fragmentation in salmon-supporting watersheds and pesticide-related poisoning of wildlife (Wartenberg et al., 2021). Water withdrawals for cannabis cultivation also can seasonally deplete ground and surface water levels in streams that support salmon and other sensitive aquatic species (Dillis et al., 2020), contributing to stream-drying, eutrophication, and toxic algal blooms, with adverse effects on aquatic and terrestrial biota.

Although many of these environmental impacts are associated with most agricultural activities and are not unique to cannabis, California's regulations hold cannabis to a higher standard. State regulations for licensed cannabis cultivators include stringent water use and reporting requirements, exclusive use of organic amendments, numerous on-site inspections, "seed to sale" tracking, and unique quality testing requirements. Cannabis growers must also comply with requirements established by local county and municipal jurisdictions, which can include redressing legacy land impacts from prior property users. Though these higher standards are partly a residue of prohibition-era stigmas (Polson, 2019), they also advance the unique possibility of an agricultural sector that is robustly regulated for environmental outcomes. While this would mark a departure from dominant models of industrial agriculture (Dillis et al., 2021b), it may inadvertently accelerate industrial consolidation and attrition among small farmer populations, who may struggle to comply with stringent environmental regulations.

Though a full accounting of regulatory effects on the environment remains elusive, it is clear that regulations are affecting farm characteristics and the geography of cannabis production in California (Dillis et al., 2021a, 2021b). In Northern California, farm mapping data suggests that compliant and noncompliant growers are increasing farm sizes: total cultivation area increased by 40% between 2012 and 2016, just prior to legalization, and an additional 30% in the following two years. Licensed farms expanded more in size than unlicensed farms; in one county, compliant farms had nearly twice as many plants as

non-compliant farms (Schwab et al., 2019). Licensing data also indicates that newer, larger compliant farms are moving closer to consumer centers, particularly in the state's Central Coast (Dillis et al., 2021a), thus making it difficult for smaller farmers in remote cannabis-producing regions to compete (Staggs, 2018).

For compliant farmers, increasing size reflects a need to recuperate high regulatory costs in the legal market, including: local and state licensing and permitting fees; participation in product tracking and testing programs; and investments to bring properties into compliance, such as land surveys, cultivation and waste management plans, professional consultations, and water infrastructure upgrades. Meanwhile, increasing farm size for noncompliant farmers likely reflects unstable prices and declines in enforcement. In avoiding regulatory requirements, noncompliant farms may offset environmental benefits from compliance, especially insofar as they persist and expand in remote, environmentally sensitive areas.

Why are many cannabis farmers, especially at smaller-scales, not complying? The results of a recent study involving surveys and interviews with compliant and non-compliant cultivators point to answers to this question. (We invite readers to review our methodology and detailed findings from the largest peer-reviewed survey of US cannabis cultivators at Bodwitch et al., 2021). Overall, the survey revealed that compliance was hindered by two major factors: high costs and stringent, confusing, and mercurial regulatory requirements. Compliant farmers credited their success to having the time and resources (i.e. social, educational, financial) to meet regulatory requirements. Meanwhile, noncompliant farmers (and compliant farmers, to a lesser degree) were concerned that regulation posed a risk to their livelihoods. The survey also indicated that farmers who grew less cannabis and depended on other sources of income (i.e. had diversified livelihoods) were least likely to seek and attain licensure.

Notably, many cultivators appreciated the need for strong environmental standards and reported widespread adoption of environmentally-friendly practices on their farms (Bodwitch et al., 2021).¹ Few were ideologically opposed to regulation generally. Instead of lacking "motivation" to become regulated, our findings suggested that noncompliance was better attributed to compliance barriers erected by regulations themselves. In particular, "administrative burdens," or costs related to learning and complying with stringent standards (Moynihan et al., 2015), impeded compliance. Those burdens can inhibit participation in and success of regulatory programs. They can also be ameliorated through policy adjustments.

Addressing regulatory burdens, supporting compliance

A range of potential solutions could be implemented to reduce administrative burdens and increase farmer compliance, particularly for small farms (see Fig. 1). First, learning costs (the costs of learning about regulatory programs and applying for approval under them) can be lowered by developing agricultural extension initiatives to collect and distribute information that facilitates compliance, reduces administrative labor, and promotes environmental stewardship. Further, cultivation research (e.g. on water usage, pathogen management, human/wildlife effects) would ensure policies are based on evidence, not empirically unfounded scenarios, thereby assuring that regulations advance environmentally desirable practices and are not unnecessarily burdensome. Prohibition has historically inhibited such research and extension programs (Gianotti et al., 2017), and federal cannabis policies continue to constrain these activities. California, for its part, has dedicated \$110 million over 11 years to research, marking the largest infusion of post-legalization funds to date.

¹ There are limits to reliability of self-reported data on environmental practices, yet high rates of adoption could be expected because of ethical norms and commitments, community pressure, or fear of detection by neighbors.

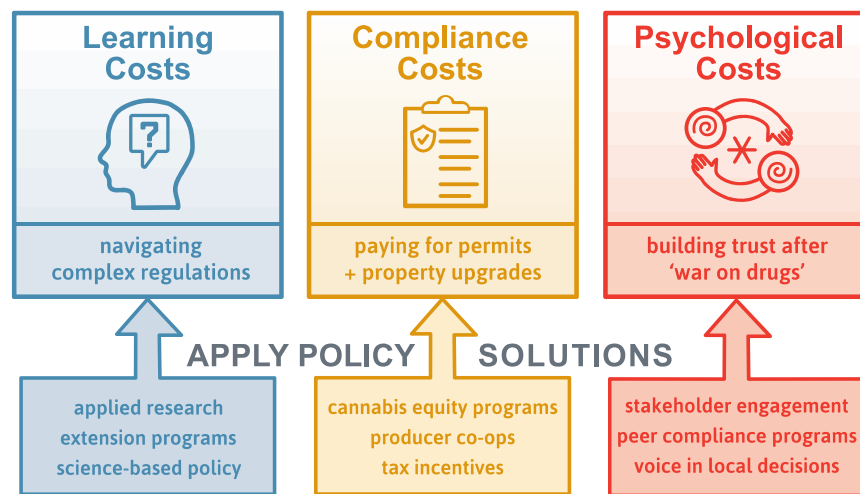


Fig. 1. Policy solutions for overcoming learning, compliance, and psychological costs.

Second, compliance costs (the costs of meeting substantive requirements of regulations) can be reduced through supportive programs for small and marginalized farmers, such as equity initiatives that facilitate compliant market access or support for producer cooperatives that collectivize information and material resources. Compliance costs can be reduced through tax incentives or stewardship funds that encourage affirmative efforts by farmers to undertake restoration and advance sustainability of shared natural resources (e.g. watershed protection) (Jack et al., 2008), especially in ways that build upon and foster collective norms around stewardship (Van Hecken and Bastiaensen, 2010) and do not simply pay farmers for avoiding environmental harms. Compliance costs might be offset by state-supported marketing schemes, such as appellation designations (which define and protect cannabis origin, cultivation style and/or ecological characteristics) that signal higher value to consumers.

It is also important to consider how psychological costs (Moynihan et al., 2015) can present barriers to entry for farmers as they exit a known, albeit illegal, system and enter an unknown regulatory schema. We found that most farmers, compliant and noncompliant, harbor doubts over whether compliance would bring greater economic opportunities: over half of unregulated farmers saw more opportunity in the unregulated market while only a quarter of licensees saw better opportunities in the regulated market. Further, qualitative responses reflected a common belief that complex regulations are unfair and favor larger firms, which are more able to afford compliance and navigate complex regulations (Bodwitch et al., 2021).

Farmer distrust in government actions is partly grounded in their historical treatment as criminals (Polson & Bodwitch, 2021). This is especially true among vulnerable populations that are otherwise excluded from civic life or have challenges accessing information and resources (e.g. non-English speakers; less educated, poor or medically ill people; racial/ethnic minorities) (Polson and Petersen-Rockney, 2019). A sense of distrust, victimhood and marginality can be amplified by stringent compliance requirements, which, however well-intentioned, were consistently perceived in qualitative responses as insensitive to the realities of cultivators, if not plainly discriminatory against them. Distrust can also be amplified when localities ban cultivation, as a majority of California counties have done. This means that many jurisdictions still approach cannabis as an exclusively illicit activity and have barred residents from any legal market participation, which can perpetuate historical stigmas. Whether through bans or costly, vexing, and seemingly biased regulations, farmers' prior negative experiences with government are reinforced, potentially serving to entrench noncompliance and any associated negative environmental consequences (Bodwitch et al., 2021).

To address these psychological costs of participation, we suggest strategies that repair and build trust between farmers, surrounding communities, and government actors. First, policies that produce new inequities and bolster old ones should be reassessed. In California, this means curtailing "license stacking" (the ability to hold multiple cultivation permits), which undermines legislative intent to restrict farm size, support smaller farms, and inhibit larger farms from consolidating the sector. Compliance requirements and permitting fees for smaller and underrepresented farmers should be modified. Localities should be incentivized and assisted to allow cultivation and avoid bans where growing can be done without environmental harm. Bans can enable excessive enforcement measures that actively reproduce prohibition-era inequities (Polson and Petersen-Rockney, 2019). Equally important, policy processes can be designed to repair trust and build cooperation between farmers, the government, and surrounding communities. Best practices emphasize working with communities to design sensitive, flexible policies that inclusively enlist actors in environmental stewardship practices (Reed, 2008). Producer cooperatives and peer-to-peer regulatory compliance programs can build upon and encourage peer-regulated norms as a regulatory mechanism (Markelova et al., 2009), rather than simply relying on enforcement. These approaches can repair relations between cultivators and regulators and reduce overall psychological costs of entering and staying in regulatory systems. Yet they will only succeed if they address power asymmetries among stakeholders (e.g. large vs. small producers; regulators vs. farmers; formerly criminalized vs. new market entrant) and explicitly aim to produce more equitable outcomes in fact and perception (Luz, 2000). Accordingly, such approaches should elevate smaller, legacy, and minority farmers, not large corporate entities, and should be designed to ensure effective environmental outcomes.

The wholesale entry of cannabis into regulation offers an opportunity to implement the foregoing recommendations, which are well-established in agricultural, environmental, and developmental policy studies (Bodwitch et al., 2021). Absent these kinds of policy interventions, cannabis agriculture will likely consolidate in predictable ways with negative outcomes for small farmers, communities, and the environment, as is beginning to occur in California (Dillis et al., 2021b). High environmental-agricultural standards are justified and supported by most farmers in our study, yet when they confer high costs and institute regulatory complexity, they can inhibit regulatory participation, accelerate consolidation, aggravate inequities, and do little to mitigate the environmental impacts of extra-legal actors. Conversely, one recent study found that lower costs of regulatory participation may result in environmental benefits (Klassen and Anthony, 2019).

Conclusion

Imaginative ways of approaching agriculture are called for in this era of global environmental change. What if cannabis were not simply brought into existing agricultural systems, but rather led the way to a new type of environmentally-sensitive agriculture that supports a multitude of farmers and communities? After all, it is rare moment when states and societies can apply new regulations to a major, previously-unregulated agricultural commodity. We know the depleting, even devastating, effects of industrial agriculture on farmers, communities and ecologies—might we apply that knowledge in this new instance? As one of the most valuable crops in California, cannabis could facilitate the transition of other crops to more sustainable, equitable agricultural practices throughout the state. As the world's largest polity to legalize and regulate cannabis, California's regulatory success or failure has implications far beyond its borders. As a global leader in agriculture and the world's fifth largest economy, California's policy decisions to holistically support cannabis-related livelihoods and ecosystem health may yet still lead, as governments elsewhere contemplate the perils and possibilities of legalization in a time of socio-environmental crisis.

CRediT authorship contribution statement

Michael Polson: Conceptualization, Methodology, Formal analysis, Investigation, Writing – original draft, Writing – review & editing. **Hekia Bodwitch:** Conceptualization, Methodology, Formal analysis, Investigation, Writing – review & editing. **Eric Biber:** Writing – review & editing. **Van Butsic:** Validation, Resources, Funding, Project administration, Writing – review & editing. **Theodore Grantham:** Writing – review & editing.

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