

Final Report

Licensed and Unlicensed Cultivation Across Ban and Permit Jurisdictions



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ABSTRACT

This project aimed to: a) provide the first empirical assessments of unlicensed production amounts and geography over time; b) identify what policies are correlated with growth or diminution of unlicensed cultivation; c) estimate unlicensed market product, including leakage from the licensed to unlicensed market; and d) test whether cultivation bans or permits are more effective at preventing unlicensed cultivation and environmental harms. It does so through a mixed method approach involving a first-in-kind mapping approach (using SWRCB's Cannavision platform), license data, consumer surveys, point-of-sale, supply chain and pricing data, interviews, observations, and secondary material research.

Keywords: Cannabis cultivation, bans, permits, California, enforcement, local government, agriculture.

EXECUTIVE SUMMARY

This project, entitled “Licensed and Unlicensed Production Across Ban and Permit Jurisdictions,” aimed to assess the evolution of unlicensed cannabis cultivation since legalization. We approached this with four objectives in mind: (1) empirically assess changes in unlicensed cultivation amounts and geography over time; (2) identify what policy, social, economic, and geophysical factors drove those changes across ban and permit counties; (3) compare unlicensed cultivation changes with proximate changes in the licensed market; and (4) assess whether local bans or permits demonstrably prevented environmental harms from unlicensed cultivation.

Over 30 months, six core researchers from environmental, data, and social sciences, along with 22 undergraduate researchers and two additional graduate students, addressed these objectives through multiple methods including ethnography, interviews, data modeling, analysis of energy records, license data, and policy. There are several top-tier takeaways:

- 1) *The boom is over:* After a post-legalization boom, cultivation levels have returned to 2018 levels.
- 2) *Licensed farms are the best deterrent for unlicensed cultivation:* The presence of a licensed farm best predicts declines in unlicensed cultivation nearby.
- 3) *Local Permit programs reduce the environmental impact of unlicensed cultivation:* Over time, counties with bans showed more negative environmental outcomes than permit counties.
- 4) *Bans do not have any consistent effects on unlicensed cultivation:* Bans correlated to increases and decreases in unlicensed cultivation.
- 5) *Eradication-oriented enforcement lost its deterrent effect, while civil regulation showed increasing efficacy:* While eradication-oriented enforcement initially discouraged unlicensed growing, it lost efficacy over time. Civil regulations (e.g. administrative fines, liens, landlord liability, hemp registrations) showed increasing efficacy as they stabilized and fostered norms.
- 6) *Unlicensed cultivation is diverging from licensed cultivation:* Unlicensed cultivators are persisting in more remote areas, far from licensed farms.
- 7) *Persistence of unlicensed cultivation is driven by socioeconomic factors:* As market conditions worsened, unlicensed cultivators who persist have few alternative livelihood options.

Stated strongly, our analysis concludes that permitting – particularly of numerous farms, dispersed over broad territories – can do more to address unlicensed cultivation and its attendant environmental outcomes than any other policy choices, including bans and eradication efforts. Bans have no consistent impact on unlicensed cultivation and eradication-focused enforcement has declining efficacy, particularly when cultivators are driven by socio-economic concerns, and lack of other opportunities. Conversely, licensed farms were the strongest localized deterrent of unlicensed cultivation and local permit programs in general were correlated with fewer environmental impacts.

Our analysis points to a number of important but less-appreciated points contained in our findings. The “whack-a-mole” dynamics referenced in enforcement efforts occur more often in ban counties. Licensed cultivation grew faster than unlicensed cultivation. Among unlicensed cultivators, there was a notable shift from outdoor to mixed-light methods. Indoor unlicensed cultivation grew while the total amount of unlicensed outdoor and mixed-light shrank (2020-2023). State regulations and permit programs can create norms that shape how unlicensed cultivation occurs and what kinds of effects it has on society and the environment. Persistent unlicensed cultivators are commonly “stuck in place” either for economic or social reasons. Surprising and counterintuitive results also abound, such as the increase of cannabis cultivation in 2022-24 in counties that are conservative, have bans, and have intensive histories of eradication-based enforcement. We invite readers to investigate the numerous results and findings detailed in this report and in the raw data reported in the Appendices.

Together, these findings point to a substantial remaking of unlicensed cultivation after legalization. Though patterns of cannabis cultivation changed numerous times over 50 years of prohibition, post-legalization patterns are distinct and divergent. A crucial difference is the application of a suite of new policy measures, from bans to hemp programs to fines to permits. This project is the first-in-kind to test how different policies affect – or do not affect – unlicensed cultivation. In doing so, it offers to California policymakers and to legalizing jurisdictions in the US and beyond, empirical feedback on policy efficacy.

Another key difference in this new landscape of unlicensed cultivation is economic: the unlicensed market is not the lucrative market of prior eras. Cultivators are responding to cost pressures by exiting cultivation, becoming more efficient, or just persisting because other viable options do not exist. These dynamics intensify in the remote geographies where cannabis was traditionally grown and among the marginalized populations that have found livelihoods and social stability in cultivation, before and after legalization.

At the conclusion of this report, we recommend several specific policies and policy approaches. Derived from our findings and takeaways, we recommend measures that strengthen and expand permitting in ways that foster normalization but do not worsen market conditions. Permitting is the key policy associated with declining unlicensed cultivation. Policies include:

maximizing the number and dispersion of licensed farms, creating new pathways for small-farm local permits, and protecting the right to personal cultivation. We also encourage the reform of enforcement and ban policies to ensure responsiveness to the drivers of unlicensed cultivation, demonstration of efficacy, and parity between cannabis and other forms of agriculture. We encourage broader developmental policies for areas affected by declines in cannabis markets and, finally, reform of track-and-trace programs to improve data quality and facilitate and increase optimal use. eliminate barriers to proper use.

INTRODUCTION

This project, entitled “Licensed and Unlicensed Production Across Ban and Permit Jurisdictions,” aims to provide an assessment of unlicensed cannabis cultivation since legalization. This includes the amount, modality, and geography of unlicensed cultivation, the policy and social factors that drive its development (e.g. bans and permit programs), and its relation to the licensed market. As such, this project addresses longstanding challenges in the measurement of unlicensed cultivation and the understudied impacts of post-legalization policy and societal factors on it.

The project pursues four primary objectives. First, it seeks to utilize innovative tools and methods to assess the amount and geographical variation of unlicensed cannabis cultivation over time, specifically since the establishment of state regulations in 2018. We rely on a first-in-use modeling of CannaVision (a product of California’s State Water Resource Control Board) to identify outdoor and mixed light production. We also innovated methods to assess indoor production by modeling and analyzing Investor-Owned Utility Company records.

Second, we analyzed what, if any, relation unlicensed cultivation might have to California’s legal supply chain. To do this we obtained data from California’s Track-and-Trace Program, specifically data on cultivation licensing, harvests amounts, and the development of cannabis supply chains across the state. We then compared these findings with data on unlicensed cultivation.

Third, we correlated this spatiotemporal evaluation of unlicensed cannabis cultivation to a fine-grained analysis of local policy and social dynamics. This involved a thorough review of local ordinances and governmental dynamics, in-person qualitative methods to assess on-the-ground dynamics that may not be obvious, and reincorporation of these findings into CannaVision modeling. As suggested in the title, we specifically investigated differences between cultivation ban and permit policies, though not exclusively

Fourth, we sought to assess the environmental impacts of shifts in unlicensed cannabis cultivation and what policy or social factors are associated with their increase or decrease. To do this, we created models that drew upon CannaVision and geophysical data to determine overlays of environmental sensitivity and cannabis cultivation.

In sum, this project a) provides the first empirical assessments of California’s unlicensed cultivation amounts and geography over time; b) identifies what post-legalization policies and/or non-policy factors are correlated with growth or diminution of unlicensed cultivation; c) analyzes the harvest, transfer, sales and consumption data to detect relational trends between legal and unlicensed production; and d) tests whether cultivation bans or permit programs (among other factors) are more effective at preventing unlicensed cultivation and environmental harms.

Through the multiple mixed methods described – mapping, energy records, supply chain analysis, policy analysis, ethnography – we aimed to deliver the most comprehensive assessment possible of shifts in cultivation since legalization. As such, this project assesses progress toward the first purpose and intent of Proposition 64 – to transition cannabis production out of the hands of the illegal market. Has this been accomplished and what factors have impeded or facilitated this transition?

The project emerges out of our prior findings. First, restrictive zoning has pushed unlicensed cannabis out of agricultural lands and onto marginal and more environmentally sensitive lands (Butsic et al 2018; Dillis, Petersen-Rockney & Polson 2024), but licensing programs have been effective in driving licensed cultivation toward less environmentally sensitive areas (Dillis et al 2021a; Dillis et al 2021b). At the local level, bans can worsen environmental and social impacts by impeding education, outreach, regulation, and beneficial adaptation (Polson & Petersen-Rockney 2019; Polson 2019), even as local permitting programs can erect barriers for farmers hoping to become licensed (Bodwith et al 2021; Biber et al 2023). Together, these findings suggested directions in how to understand licensed and unlicensed cultivation across varied local policy regimes, though they have been limited to licensure, permit and policy data, localized mapping efforts, and qualitative methods.

The project is conducted by a team of researchers with nearly 60 years of combined cannabis-related research experience. The researchers' expertise has resulted from investigations of: cannabis cultivation geographies before and after legalization; resource use in cannabis cultivation; regulatory compliance; policy design; ban policies; studies of cannabis use; and social and historical dynamics of non-legal cannabis cultivation. The research team includes experts in anthropology, legal studies, public health, water ecology, political ecology, environmental ethics, and energy resources.

LEGAL AND POLICY BACKGROUND

In this section we summarize the history of California cannabis law and policy, the issue of local control, and the background on how counties choose to regulate cannabis cultivation through bans, permits, and other correlated measures. We also discuss market and social dynamics relevant to this research (i.e. the spatial-temporal development of cannabis cultivation).

2.1 CANNABIS LAW HISTORY

1913 Poison Act: California banned cannabis by amending the Poison Act, and in 1915, the State restricted cannabis to pharmacies (Gieringer 1999).

1937 Marihuana Tax Act: Federal government prohibited cannabis and hemp by requiring a special tax stamp to sell these products. Distribution of stamps was limited, and sellers were

wary of obtaining them as they would then be identified as sellers of these products by the government.¹

1970 Federal Controlled Substances Act: Federal government deemed cannabis an illegal narcotic, designated it Schedule I and established serious criminal consequences for violation.²

1975 The Moscone Act (SB 95): California decriminalized possession of one ounce or less of cannabis and deemed it a civil rather than criminal offense.

1991 Proposition P, San Francisco: San Francisco voters approved Proposition P with an 80% vote, recommending that California and the California Medical Association include medical hemp preparations on the list of available medicines (*Proposition P*, n.d.).

1996 Proposition 215: California voters passed Proposition 215, the “Compassionate Use Act”, which decriminalized medical cannabis for seriously ill patients but was silent on the issue of local control and unified state regulation.³ It allowed patients to obtain a doctor’s recommendation for the medical use of cannabis to be used as a defense in court thereby exempting patients from criminal penalties associated with possessing cannabis.

2003 SB-420: In 2003, the California Legislature passed the “Medical Marijuana Program Act”, which gave local governments the power to regulate medical cannabis consistent with state law⁴ and created a cooperative and collective structure.

2008 Attorney General Guidelines: In August 2018, Attorney General Brown published the “Guidelines for the Security and Non-Diversion of Marijuana Grown for Medical Use.”⁵ The memo created guidelines for non-profit cannabis cooperatives and collectives.

2011 AB-1300: In 2011, the California Legislature further refined local control by giving local governments the power to regulate the “location, operation, or establishment of a medical marijuana cooperative or collective.”⁶

2011 - 2014 Case Law: Case law between 2011 and 2014 clarified that local governments’ land use powers authorize them to prohibit cannabis activities and designate cannabis activities as a nuisance.⁷

¹ 50 Stat. 551 (Pub. Law 75-238).

² Controlled Substances Act, 21 U.S.C. §§ 801 et seq.

³ Cal. Health & Saf. Code § 11362.5.

⁴ Section 11362.83 stated “Nothing in this article shall prevent a city or other local governing body from adopting and enforcing laws consistent with this article.”

⁵ Brown, E. G., Jr. & California Department of Justice. (2008). *California Attorney General’s Guidelines for the Security and Non-Diversion of Marijuana Grown for Medical Use*.

https://www.placer.ca.gov/DocumentCenter/View/15072/bosd_100406_032_p26_p37-PDF.

⁶ Cal. H&S Code § 11362.83(a).

⁷ See *City of Riverside v. Inland Empire Patients Health & Wellness Center* (200 Cal. App. 4th 885 (Cal. Ct. App. 2011)); *Browne v. County of Tehama* (213 Cal. App. 4th 704, (Cal Ct. App 2013); and *Maral v. City of Live Oak* (221 Cal. App. 4th 975 (Cal. Ct. App. 2014)).

2015 Medical Marijuana Regulation and Safety Act (“MMRSA”): In 2015, the California state legislature passed the Medical Marijuana Regulation and Safety Act (“MMRSA”) to regulate commercial medical marijuana (S.B. 643, Reg. Leg. Sess. 2015-2016 (Cal. 2015))

2016 Proposition 64: In November 2016, California voters passed Proposition 64 (The Control, Regulate and Tax Adult Use of Marijuana Act, known as AUMA). AUMA legalized cannabis consumption for adults 21+ and created a robust, detailed regulatory structure to govern the issuance of cannabis licenses across the supply chain (Cal. Bus. & Prof. § 19300.7(a)–(j)). Proposition 64 was based on the structure defined in the MMRSA, but also included new provisions.

2017-18 State Emergency Regulations and Issuance of State Cannabis Licenses: In April 2017, state agencies responsible for cannabis regulation (BCC, CDFA, CDPH) released Emergency Regulations for the medical cannabis industry. In November 2017, the agencies released Emergency Regulations for the adult-use and medical industry. The State began accepting applications in December 2017. In 2018, state regulatory agencies, including the Bureau of Cannabis Control, the California Department of Food and Agriculture, and the California Department of Public Health, began issuing licenses to businesses involved in legal cannabis activities. In 2018, the state began issuing “temporary” cannabis licenses, which did not require access to METRC's track-and-trace system but required keeping paper records. In Q4 2018, the state started issuing “Provisional” licenses, which required operators to use METRC. California commenced its relationship with METRC to conduct track-and-trace in June 2017.⁸

2017 SB-94, Budget Trailer Bill: In 2017, the State Legislature combined AUMA and MMRSA into one unified bill, called the Medicinal and Adult-Use Cannabis Regulation and Safety Act (“MAUCRSA”), which regulated adult-use and medicinal cannabis under one legal umbrella (S.B. 94, 2017–2018 Reg. Leg. Sess. (Cal. 2017)).

2018 AB-2164: In 2018, AB 2164 amended California Government Code Section 53069.4 to allow local governments to impose immediate fines for illegal cannabis cultivation without providing a prior “reasonable time period” for correction.⁹ In general, local governments must provide a reasonable period to correct for violations of building, plumbing, electrical, or other similar structural, health, and safety, or zoning requirements. However, when those same violations are related to cannabis cultivation, a fine or penalty can be issued immediately under AB-2164

2020 California State Public Health Officer List of Essential Critical Infrastructure Workers: In 2020, cannabis was deemed an “essential” business and could continue operating during the COVID-19 pandemic stay-at-home order.¹⁰

⁸ Prior, A. (2025, April 4). *Metrc California | Official Cannabis Tracking & Compliance*. Metrc. <https://www.metrc.com/partner/california/>.

⁹ *Bill Text - AB-2164 Local ordinances: fines and penalties: cannabis*. (n.d.). https://leginfo.ca.gov/faces/billTextClient.xhtml?bill_id=201720180AB2164.

¹⁰ Schroyer, J. (2021, December 18). Amid coronavirus pandemic, California gov classifies cannabis industry as ‘essential’ during state’s effective lockdown. *MJBizDaily*. <https://mjbizdaily.com/california-gov-classifies-cannabis-industry-as-essential-during-lockdown/>.

2021 AB-141, Budget Trailer Bill: In 2021, AB-141 amended state law to consolidate the three agencies regulating cannabis under the MAUCRSA, the BCC, CDPH, and CDFA, into a newly created agency: The Department of Cannabis Control within the Department of Consumer Affairs (Cal. Bus. & Prof. § 26010.7(a)).

2023 AB-1684: In 2023, the California legislature passed AB-1684, expanding on AB-2164 to include not just cannabis cultivation but all unlicensed commercial cannabis activity, including manufacturing, distribution, and retail. It expanded state law to authorize local ordinances that deem unlicensed commercial cannabis activity a public nuisance. It prohibited local governments from issuing fines or penalties exceeding \$1,000 per violation or \$10,000 per day. It allowed local governments to hold property owners, as well as each owner of a business entity engaging in unlicensed commercial cannabis activity, jointly and severally liable for fines. Finally, it allowed local jurisdictions to refer unlicensed cannabis nuisance cases to the Attorney General.¹¹

2025 SB-141: SB-141 amended local grant rules for the Board of State Community Corrections cannabis public-safety grants by repealing the prior prohibition on awarding grants to local jurisdictions that ban both indoor and outdoor cultivation, or ban retail sales. Instead, to receive state grant funding for law enforcement, fire protection and other public-safety related programming, local governments must either allow cannabis retail, and the Board must prioritize applications that include illicit cannabis enforcement. This allows local governments to receive grant funding, despite banning cultivation.

2026 - Sunset of Provisional State Licenses: Provisional state licenses expire on January 1, 2026, with the exception of some social equity retailers.

2.2 LOCAL CONTROL

California consists of 541 local governments, comprising 58 counties¹² and 483 cities.¹³ Although counties may ban commercial cannabis cultivation, the cities located within a county have the authority to establish their cannabis regulations, and many cities take a different approach from the county that surrounds them. For instance, while Fresno County prohibits commercial cannabis cultivation, the City of Mendota allows it. Local governments generally possess powers to determine land use policy – how, where, and when activities can take place within their jurisdictions. County boards of supervisors govern unincorporated areas of counties,¹⁴ whereas a City Council and Mayor govern cities. “Local control” is enshrined in the California Constitution, Article XI Section 7, which grants local governments the authority to enact local ordinances to the extent that they do not conflict with state law. Proposition 64 granted cities and counties “local control” to regulate and tax cannabis businesses or ban them

¹¹ *Bill Text - AB-1684 Local ordinances: fines and penalties: cannabis.* (n.d.).

https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=202320240AB1684&search_keywords=%22cannabis+cultivation%22.

¹² *What do counties do? - California State Association of Counties.* (2015, May 26). California State Association of Counties. <https://web.archive.org/web/20240125030912/https://www.counties.org/californias-counties>.

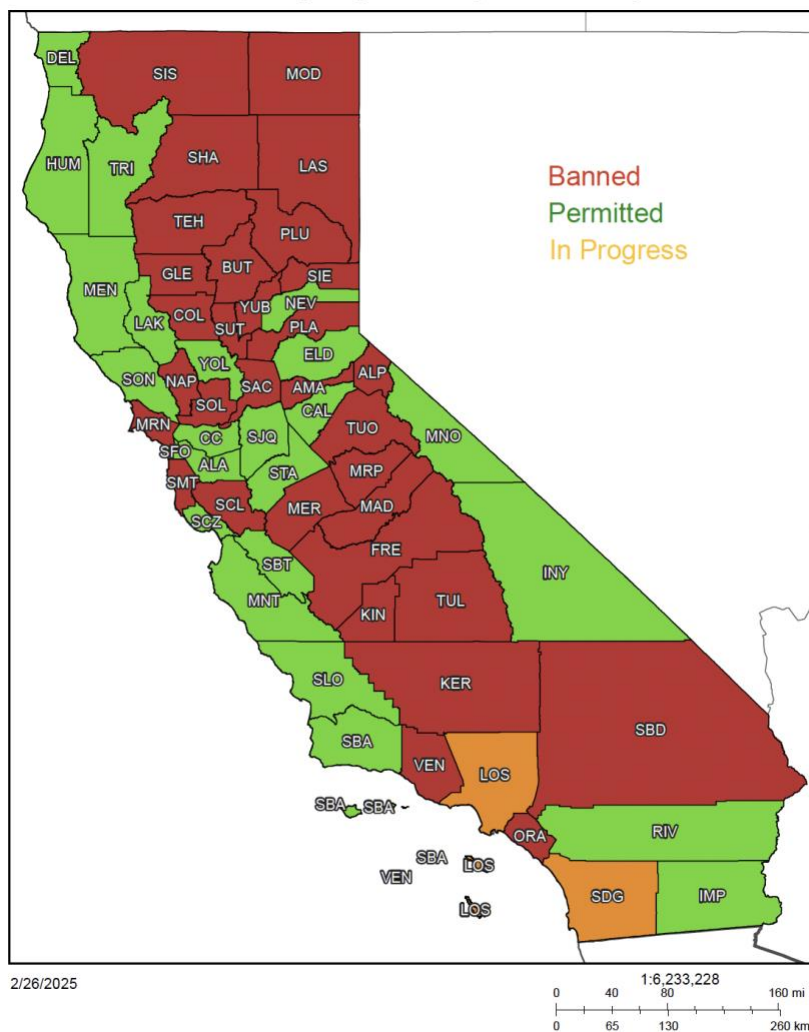
¹³ *Mountain House officially becomes California’s 483rd city.* (2024, July 2). CBS News.

<https://www.cbsnews.com/sacramento/news/mountain-house-officially-becomes-california-city/>.

¹⁴ *How Counties are Structured - California State Association of Counties.* (2015, May 26). California State Association of Counties. <https://web.archive.org/web/20240125031517/https://www.counties.org/county-structure>.

entirely.¹⁵ Local control has resulted in a patchwork of local cannabis ordinances across California. As of January 1, 2026, thirty (30) counties ban outdoor¹⁶ commercial cannabis cultivation, and twenty-eight (28) counties permit outdoor commercial cannabis cultivation. Figure 1 shows a map of the patchwork of local regulation at the county level. This study does not examine cannabis rules in California's 483 cities, except through county case studies.

Most ban counties adopted their ordinances before January 1, 2018. Many others began regulating cannabis cultivation before California voters passed Proposition 64 in November 2016. Most permit counties adopted ordinances between 2016 and 2018, with some exceptions, such as Nevada, Riverside, and Calaveras (2019), Ventura (2020), and San Diego (2022). Nineteen counties have exclusively regulated cannabis since 2016, without imposing bans.



Local control is enshrined in California's constitution, but California is not the only state that allows local governments to prohibit cannabis entirely. Of the states that have legalized cannabis, 81.25% have allowed localities some ability to bar cultivation (Getz et al., 2024).

Figure 1: Map of California Counties' Regulatory Status

3. COMMERCIAL CANNABIS CULTIVATION BANS

Counties where voters supported Proposition 64 still ban commercial cannabis cultivation.

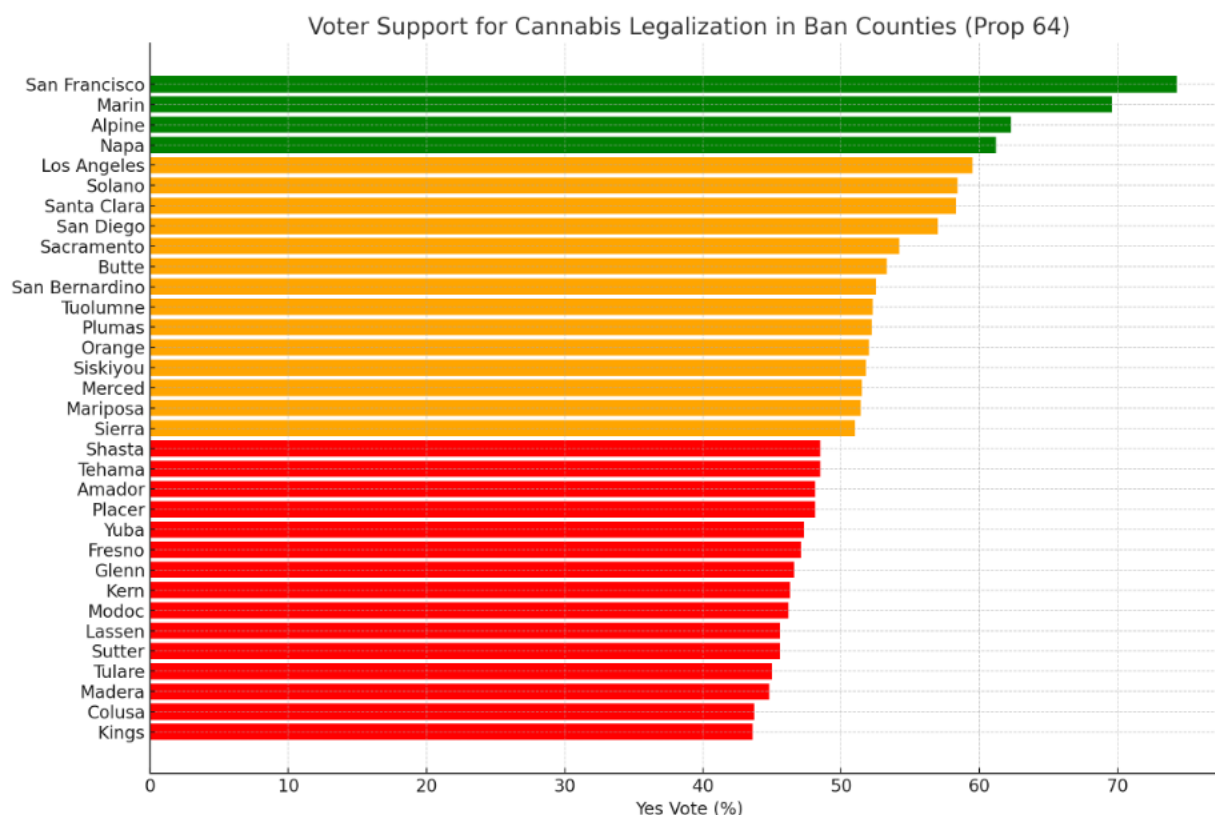
Although a majority of California voters generally supported cannabis legalization, many residents and/or county supervisors

15 ATTORNEY GENERAL & LEGISLATIVE ANALYST. (n.d.). *PROPOSITION 64 MARIJUANA
LEGALIZATION. INITIATIVE STATUTE.*
[https://slper.senate.ca.gov/sites/slper.senate.ca.gov/files/Background%20Supplemental%20-
%20Prop%2064%20Text.pdf](https://slper.senate.ca.gov/sites/slper.senate.ca.gov/files/Background%20Supplemental%20-%20Prop%2064%20Text.pdf).

¹⁶ Although a county bans outdoor commercial cannabis cultivation, it may permit indoor cultivation.

still oppose having cannabis cultivation in their communities. Figure 2 shows voter support for cannabis legalization in ban counties. Most ban counties that ban cultivation had electorates that supported legalization (56.25%). Eighteen (18) counties registered majority votes for legalization yet have banned cultivation. Marin, Alpine, and Napa had overwhelming support for legalization, but have not allowed commercial cannabis cultivation. San Francisco allows indoor cultivation but prohibits outdoor and mixed-light cultivation, mainly due to the city's limited space available for outdoor cultivation.

Figure 2: Voter Support for Cannabis Legalization in Ban Counties¹⁷



Bans are Intended to Stop Unlicensed Cultivation, Reduce Environmental Impacts, Protect Quality of Life, and Reduce Crime. County governments indicate many reasons for banning commercial cannabis cultivation, including safeguarding the quality of life for residents, mitigating public health risks, preventing criminal activities, and preserving environmental integrity (Getz et al 2024). Some counties ban cannabis cultivation because financial limitations prevent them from establishing permitting programs, which can be expensive to create and staff.¹⁸ County governments may implement bans because of “related or unrelated political or

¹⁷ State of California. (n.d.). *Supplement to the Statement of Vote Statewide Summary by County for state ballot measures*. <https://elections.cdn.sos.ca.gov/sov/2016-general/ssov/ballot-measures-summary-by-county.pdf>.

¹⁸ For instance, Lassen County’s commercial cannabis cultivation ad hoc committee found that developing a commercial cannabis cultivation permitting ordinance would be costly, time-consuming and take up considerable county resources, particularly due to CEQA review (See Recommendations from the Commercial Cannabis

institutional agendas, as from other industries, governmental agencies, political leaders, or residential groups” (Getz et al. 2024).

After Proposition 64, Unlicensed Cannabis Cultivation is Addressed as a Nuisance. Statewide, cannabis legalization reclassified commercial cultivation from a felony to misdemeanor. Local cannabis regulation is framed as a land use and nuisance issue. The landmark lawsuit, *City of Riverside v. Inland Empire Patients Health & Wellness Center* (200 Cal. App. 4th 885 (Cal. Ct. App. 2011)), decided in 2011, held that local jurisdictions retain inherent land use powers, including the right to ban cannabis entirely under their public nuisance rules. The case of *Maral v. City of Live Oak* (221 Cal. App. 4th 975 (Cal. Ct. App. 2014) held that if cannabis activity threatened public health, welfare, and security, it would qualify as a nuisance that could be banned. Local cannabis bans have shifted focus from criminal penalties, such as imprisonment, to civil penalties related to land use. Counties punish cultivators by issuing fines, asset forfeiture, and property liens that can result in forced tax sales. In 2023, the legislature passed AB 1684, further bolstering local governments’ ability to use nuisance laws to enforce against unlicensed cannabis. Attorney General Rob Bonta supported the bill, stating, “This important bill will encourage an administrative enforcement approach that will create a more efficient means to discourage and eradicate unlicensed commercial cannabis activities, while avoiding many of the harms inherent in traditional criminal enforcement.”¹⁹ Although civil enforcement is undoubtedly less punitive than criminal sanctions, it nevertheless has significant consequences for those enforced against and can result in unfairly applied penalties, particularly against marginalized communities (Getz et al 2024).

County abatement processes involve: notifying the nuisance, giving property owners opportunities to abate or attend a hearing, and ultimately destroying the cannabis. While non-cannabis violations often are subject to warnings and abatement periods, cannabis-related violations (including matters like unpermitted structures) can be abated immediately and can involve elevated fines atypical for other violations. Civil fines may be assessed on a per-occurrence basis (irrespective of number of plants) (Table 1), or per-plant basis (Table 2).

Cultivation Ad Hoc Committee regarding possible direction to staff and the Planning Commission concerning development of a commercial cannabis cultivation ordinance. File 300.18.01.60, 2/22/2022).

¹⁹ AB-1684, Bill Analysis, 09/12/23- Assembly Floor Analysis, available at: https://leginfo.legislature.ca.gov/faces/billAnalysisClient.xhtml?bill_id=202320240AB1684#.

Table 1: County Fines for First Cannabis Violation (Per Day)	
Fine for First Cannabis Violation (per day)	Counties
\$50-\$500	Alpine, Inyo, Napa, Solano, Ventura
\$100	Amador, Colusa, Contra Costa, Del Norte, Glenn, Modoc, Madera, Merced, Plumas, Sacramento, San Luis Obispo, Santa Barbara, Stanislaus, Tuolumne, Yuba
\$250-\$1000	Alameda, Kern, Kings, Lake, Lassen, Mendocino, Mono, Riverside, Sutter, Tulare
\$500	Butte, Siskiyou (before 2024)
\$1,000	Calaveras, Fresno, Kings, Lake, Lassen, Mendocino, Mono, Nevada, Plumas, Riverside, San Joaquin, San Luis Obispo, San Mateo, Sierra, Sutter, Tehama, Trinity, Tulare
\$2,500	Marin, Monterey, Orange, Santa Clara, Santa Cruz
\$5,000	El Dorado, Placer, Siskiyou (after 2021)
\$10,000	Humboldt, San Benito, Shasta, Sonoma, Yolo
\$30,000	Los Angeles
\$100-\$3000 depending on number of plants	San Bernardino
\$1000-\$19,722	San Mateo

Table 2 County Fines Per Plant	
COUNTY	DAILY FINE PER CANNABIS PLANT, PER DAY
EL DORADO, SISKIYOU (after 2021)	\$5,000
CALAVERAS, FRESNO, PLACER, SACRAMENTO, SAN JOAQUIN, STANISLAUS, SISKIYOU (after 2024)	\$1,000
KERN	\$25-\$300 (depending on the number of plants)
MENDOCINO	\$200
SAN LUIS OBISPO, SANTA CRUZ, YUBA	\$100

When deciding whether to implement per-occurrence or per-plant fines and whether to allow a grace period, counties assess the deterrent effect of the penalties and the ability of growers to illicitly relocate their operations during a grace period and avoid fines. For instance, Sacramento County initially fined illegal cannabis cultivation sites \$100 per day, regardless of the number of plants, and provided a grace period to avoid penalties. Staff realized that cannabis cultivators exploited the grace period by removing plants before reinspection, either harvesting them or moving them to another location. To create a more substantial deterrent effect, Sacramento County amended its ordinance in 2019 to introduce a per-plant penalty of \$1,000 per day imposed immediately with no grace period.²⁰ Sacramento, Stanislaus, Siskiyou, Shasta, and Los Angeles County, among others, authorize the immediate imposition of penalties, with no warning period or grace period before fines accrue. Immediate administrative fines were enabled by state law, AB 2164 (Gov. Code § 53069.4), to strengthen local enforcement powers against unlicensed cultivation (see above). AB 2164 caps immediate administrative penalties at \$10,000 per day, however local jurisdictions may cite additional local nuisance, cost recovery or civil penalty authorities to exceed the maximum of \$10,000 per day.

²⁰ Sacramento County Code, Title 6, Chapter 6.88.060(B)(1)).

Some counties ban personal outdoor/mixed light cannabis cultivation. Although Proposition 64 allows adults to cultivate up to six plants at home indoors, many counties impose stricter regulations or outright bans. Some counties prohibit all outdoor cultivation for personal use (Alpine, Amador, Colusa, Contra Costa, Fresno, Glenn, Imperial, Kern, Kings, Lassen, Madera, Marin, Merced, Modoc, Napa, Orange, Riverside, Sacramento, San Benito, San Bernardino, San Diego, San Joaquin, San Luis Obispo, San Mateo, Santa Barbara (only in Montecito), Santa Clara, Santa Cruz, Shasta, Siskiyou, Solano, Stanislaus, Sutter, Tehama, Tulare, and Yuba). Many counties restrict the scope of state-allowed indoor cultivation by requiring permits, inspections, and permissions, including electrical permits, landlord consent, or registration.

Counties Have Resorted to Compelling Landlords to Monitor Their Property for Unlicensed Cannabis Cultivation Proactively. Tenants, property owners, or both can be liable for fines, which can compel landlords to monitor tenant activities diligently. Counties may impose property liens to recover abatement costs and fines. Many counties require property owners to oversee their tenants' activities to ensure they aren't renting to unlicensed cultivators. Some ordinances make property owners, tenants, and permit holders jointly liable for fines and abatement costs. Any unpaid fees may result in property liens. To avoid liability, landowners in some counties often must demonstrate that their lease explicitly prohibits cannabis cultivation.

Some Counties Charge Unlicensed Cannabis Cultivation Associated with “Aggravating” Factors as a Felony. Proposition 64 made unlicensed cultivation of more than 6 plants a misdemeanor, punishable by 6 months incarceration and a fine of \$500.²¹ However, when certain prior convictions and the presence of “aggravating” factors are associated with cannabis cultivation, charges can become “wobblers”, meaning DA’s can charge them as a felony or a misdemeanor, based on prosecutorial discretion. Aggravating factors include unlicensed cannabis cultivation that results in environmental violations (including illegal water diversion, wastewater discharge violations, violating fish and game code relating to waters, rivers, streams and lakes, and endangered or threatened species, violations of penal code about hazardous substances, or “intentionally or with gross negligence causing substantial environmental harm to public lands or other public resources”).²² Each District Attorney has prosecutorial discretion on whether or not to charge felonies for unlicensed cultivation with associated environmental violations. For example, the San Bernardino District Attorney prosecutes cannabis related environmental crimes as felonies.²³ Law enforcement is also charging unlicensed cannabis

²¹ California Code, Health and Safety Code - HSC § 11358(c).

²² California Code, Health and Safety Code - HSC § 11358(d).

²³ *District Attorney prosecutes conspirators in massive subterranean illegal marijuana grow - San Bernardino County District Attorney.* (2022, May 25). San Bernardino County District Attorney. <https://da.sbcounty.gov/2022/05/25/district-attorney-prosecutes-conspirators-in-massive-subterranean-illegal-marijuana-grow/>.

cultivators with felonies related to grand theft of utilities²⁴ related to illegally siphoning electricity (described as power stealing).²⁵

Ban Counties Take Hardline and “Soft” Enforcement Approaches. Ban county enforcement varies. Some counties take a hard-line approach, marshalling law enforcement, state-federal-local law enforcement collaborations, special operations, steep fines, and felony charges. Prior research has found that bans only enforced by law enforcement are limited in efficacy and often counterproductive (Getz. et. al, 2024). Other counties take a softer enforcement approach by relying on code enforcement, complaint-driven investigations, civil nuisance abatements, and fines, and an ad hoc and inconsistent enforcement (e.g. some years but others). Some counties combine these methods, utilizing code enforcement and law enforcement approaches.

2.4 COMMERCIAL CANNABIS CULTIVATION PERMITS

Twenty-eight (27) counties in California issue permits for commercial cannabis cultivators to operate outdoors or in mixed-light setups. Significant variation exists in how these counties structure their cannabis permitting programs, including differences in definitions, approval processes, eligibility for farmers, and environmental considerations. California’s approach to cannabis legalization and regulation results in a patchwork of local regulation, with little uniformity in how counties regulate cannabis cultivation. Each county’s ordinance is based on a foundation of state law, but has unique characteristics reflective of the county’s landscapes, ideologies, and politics. We focus on local permitting below, in order to highlight within-state policy variations relevant for this study, but summaries of state licensing systems can be read elsewhere (Biber et al 2023; Bodwitch et al 2021).

Permit Types Key regulatory elements differ across jurisdictions, including permit eligibility, approval pathways, zoning, application process, and California Environmental Quality Act (CEQA) compliance. Some counties provide incentives and opportunities for existing operators (“legacy cultivators”) to transition from the unregulated market to the legal market by giving them priority registration or allowing them to operate while completing their permit application. In a typical land use process, a business cannot start operating until it has obtained a permit and approval from the building department, often referred to as a certificate of occupancy. In contrast, in the cannabis context, some counties allow cannabis cultivators to operate while they complete the lengthy permit process, to transition them from the unregulated market.

Counties regulate cannabis cultivation through various permit types, including ministerial, administrative, and discretionary permits, which involve different levels of public notice and public hearings. Some counties, such as Stanislaus, require a Development Agreement—a long-term contract between a property owner and a local government that outlines how to develop a property, including the conditions for approval. Development Agreements typically span 10-years or more; they are generally used in commercial real estate to give developers certainty about developing their property, even if local regulations change. Counties regulate

²⁴ Gilmour, J. (2018, August 14). Prolific pot growers stole \$200,000 in power for their 7,000 illegal plants, Calif. cops say. *Sacramento Bee*. <https://www.sacbee.com/news/california/article216698405.html>.

²⁵ Bryce, R. (2020, April 21). How cannabis farms steal megawatts to grow Mega-Weed. *Forbes*. <https://www.forbes.com/sites/robertbryce/2020/04/20/an-epidemic-of-stealing-watts-for-weed/>.

cultivators based on their size, measured in square footage, and cultivation method (outdoor, indoor, or mixed-light). Additionally, counties apply unique conditions to farms due to their location, zoning, natural resources, business model, and property conditions.

Local application processes vary. Counties utilize different departments to oversee cannabis applications, and the process timeframe can vary significantly. Prior research found that the mean approval timeframe across eleven permitting counties was 2 years (Biber et al. 2023). Applications require extensive documentation about business operations and ownership, as well as application fees and materials that need professional assistance, such as site plans, water management plans, and security plans. The lengthy application process often involves inspections and meetings with various county officials.. Navigating the complex web of applications, consultants, attorneys, and the gauntlet of local scrutiny can be too much for operators who don't have extensive permitting or land use experience, leaving more prominent operators who can afford to weather the process or have expertise in land use development at an advantage.

Permit Caps Many counties place a limit on the total amount of cannabis cultivation allowed in the county ("permit caps"), either by (a) capping the total number of cannabis permits that the county can issue, (b) the total acreage of cannabis cultivation that can be approved countywide, (c) the number of permits an individual or firm may obtain; or (d) by limiting individual farm sizes. Permit caps limit the maximum size of the cannabis market in a county and often leave many unlicensed cultivators with no entry point to the licensed market. In counties where permit caps are reached, legacy and new operators cannot enter the legal market, resulting in a semi-monopolistic structure for those who have obtained a license. When a county issues all the available permits, permit counties can be functionally equivalent to ban counties. Appendix 4 contains a list of the permit counties with a permit or acreage cap of some nature.

Environmental Regulations Many counties impose environmental regulations on cannabis cultivation, addressing factors such as water source and usage, energy consumption, wastewater disposal, protection of sensitive species, and preservation of prime agricultural soils.²⁶ Additionally, zoning restrictions dictate the permissible locations for cannabis farms. These restrictions may include minimum parcel size requirements, opt-out zones, setback regulations, and limitations on proximity to sensitive land uses or cities.²⁷ Approaches to CEQA vary. Some counties use a programmatic approach with Programmatic Environmental Impact Reports, or Programmatic Mitigated Negative Declarations (MNDs). In contrast, others issue ministerial permits that are not subject to CEQA or rely on CEQA exemptions. Permit and approval pathways also vary. Methods range from staff-approved ministerial permits to extensive conditional use permits, competitively graded applications, and hybrid approaches. Appendix 4 contains a comparative analysis spreadsheet, showing the different permit types and CEQA process across each permit county.

²⁶ Humboldt County prohibits cultivation sites from using more than 20 percent of the Prime Agricultural Soil on the Parcel and the cultivation must occur only in native soil unless an exemption is acquired with a Conditional Use Permit (Humboldt Cty., Cal., Cty. Code § 55.4.6.4.3.).

²⁷ Humboldt County requires cultivation sites located within 1,000 feet of an incorporated city to obtain a Conditional Use Permit (Humboldt Cty., Cal., Cty. Code § 55.4.6.7.).

Legal and Political Challenges Statewide, counties that permit cannabis cultivation have faced legal challenges from environmental groups, local communities, Native American tribes, competing agricultural industries, and residential communities. Local cannabis ordinances are not static and constantly evolve in response to changes in state laws, political pressures, litigation, shifts in county governance and leadership, and refinements to the regulatory structure.

Permit Maintenance After obtaining a local permit, cultivators must comply with ongoing compliance requirements, including annual permit renewals, inspections, paying cannabis taxes, and adhering to any conditions outlined in their permit. Some of these conditions require continued site improvements that can take years to complete (Biber et al. 2023). Additionally, cultivators must continually adapt to evolving local regulations, ordinance changes, and enforcement patterns, leaving them constantly running a gauntlet of regulatory hurdles and shifting goals. Many operators have failed to maintain compliance with their permits, have let their permits expire, and have left the licensed market, either moving elsewhere, leaving the cannabis industry entirely, or reverting to the unlicensed market. At the state level, the expiration of provisional license allowances and Lake and Streambed Alteration Agreements (from CDFW), among other shifts, have pushed cultivators out of licensure (and hence permits).

2.5 ENFORCEMENT AGAINST UNLICENSED CULTIVATION

Both permit and ban jurisdictions have unlicensed cultivation within their borders and take enforcement action against those unlicensed entities. Counties take different approaches to enforcement. Some adopt a proactive approach, meaning they proactively seek out, identify, eradicate, and abate unlicensed cannabis cultivation sites. Others take a reactive approach, relying primarily on citizen complaints to conduct enforcement. Enforcement has significant limitations, including cost, staffing, legal challenges, and the sheer volume and geographic area of unlicensed cannabis can overwhelm the county. The following sections describe the two primary approaches to enforcement: the civil approach, which involves code enforcement, fines, and civil judgments, and the criminal approach, which involves law enforcement, criminal penalties, and jail or prison time.

2.5.1. LOCAL CIVIL ENFORCEMENT

Some counties use a (primarily) code enforcement approach, relying on citizen complaints about unlicensed cultivation or using satellites or drones to identify unlicensed cultivation sites. These counties send code enforcement officers to abate nuisances and issue notices, citations, and fines. This can involve efforts not only by code enforcement, but by environmental health, public health, agricultural agencies, and other entities. Civil approaches seek to address issues like zoning, building, environmental and other violations and differ from criminal approaches, primarily, by working through economic sanctions to discourage activity. Generally, civil enforcement is responsive to problems, rather than proactively pursuing violations. Further, civil enforcement generally seeks to enlist violators in changing their behaviors prior to punishment via warnings and abatements. With cannabis, however, the State has allowed localities to eliminate and abridge abatement periods, elevate fines well beyond what

is customary for other violations, and enable the immediate (see AB-2184 and AB-1684 above). (At the state level, the Cannabis Administrative Prosecutor Program (CAPP), launched in 2023 by Attorney General Bonta, uses a civil strategy to quickly shut down unlicensed operations, using tools such as citations and cease-and-desist orders.) Therefore, civil approaches can be more or less punitive or lenient, depending on local codes and practices (Getz et al 2024).

The emergence of technological advancements to have an “eye in the sky” allows enforcement agencies, including code enforcement, to identify unlicensed cultivation without a site visit. Unmanned aircraft systems (drones), are currently being used in Nevada, Lake, Sonoma and Solano counties, among others. Deploying drones in potentially hazardous situations minimizes risk to law enforcement officers by providing information without direct exposure to danger (Marijuana - California Central District Drug Threat Assessment, n.d.). Satellite detection is being used in Humboldt and El Dorado counties and have multiplied the amount of administrative actions by “tenfold” according to the California State Association of Counties (Kemp 2020). In Humboldt, this resulted in significant revenue raised via fines and citations (Kramer 2019). Satellite and drone programs can be expensive to implement and maintain, though, and have raised complaints and incited lawsuits over civil liberty protections, like due process, privacy expectations, and concerns over excessive fines and infringement on property rights (Kemp 2024).

2.5.2. *CRIMINAL ENFORCEMENT*

Local Law Enforcement

County Sheriffs and City Police Departments typically enforce against unlicensed cultivation, and several counties have established specialized task forces and regional drug units to specialize in cannabis enforcement, listed in Table 3. Some of these task forces focus solely on cannabis, others concentrate on narcotics and drugs, including cannabis. Local law enforcement often conducts inter-agency collaborations with neighboring law enforcement and state and federal agencies to conduct raids and investigations. Twenty-two counties have specialized Sheriff units or divisions dedicated to cannabis enforcement, or drug-related enforcement that includes cannabis as one of the priorities. They typically utilize specialized equipment and have dedicated staff focusing on cannabis investigations and enforcement. Sheriff’s Departments have taken different approaches to enforcing against unlicensed cannabis cultivation, including emergency declarations on cannabis cultivation in Yuba, Siskiyou and Tehama calling for federal, state and regional assistance to tackle unlicensed cultivation, and special enforcement campaigns in Riverside and San Bernardino.²⁸

²⁸ In 2021, San Bernadino Sheriff’s Marijuana Enforcement teams conducted “Operation Hammer Strike” which resulted in 34 arrests and the execution of 26 search warrants across various locations, including Twentynine Palms and Rancho Cucamonga (McGee, 2021).

Table 3: Sheriff Specialized Cannabis Enforcement Units	
Task Force	Enforcement Team
• Amador County Combined Narcotics Task Force (Amador) • Glenn Interagency Narcotics Task Force (Glenn) • Narcotics Task Force (Kern, San Diego)	• Special Enforcement Unit (Butte) • Marijuana Enforcement Team (Calaveras, Humboldt, Mariposa, Mendocino, San Bernardino, Santa Clara, Stanislaus) • Marijuana Safety Team (Fresno) • Narcotics Enforcement Team (Mono) • Marijuana Eradication Team (Monterey, Shasta) • Sheriff Special Investigations Unit (SIU) (Nevada) • Sheriff Cannabis Compliance Team (Santa Barbara) • Special Enforcement Team (Santa Cruz) • Siskiyou Interagency Marijuana Investigation Team (SIMIT) and North State Marijuana Investigation Team (NSMIT) (Siskiyou) • Tulare Area Gang Narcotics Enforcement Team (Tulare)

Proposition 64 Public Health & Safety Grant Program

Proposition 64 allows counties that permit cannabis cultivation and retail to receive state funding from cannabis tax revenue to support law enforcement, including programming to address public health and safety associated with implementing Proposition 64. Grant projects include environmental remediation, compliance and enforcement, and cannabis public health education programs (The Board of State and Community Corrections, n.d.). Prior to 2025, counties that banned commercial cannabis cultivation and retail were ineligible for the Public Health & Safety Grant Program, though recent legislation (AB-141 in 2025) allowed counties that ban cultivation to receive these funds if they allow retail.

State & Federal Law Enforcement

Several state agencies conduct enforcement against unlicensed cannabis, described in Table 4. In 2024, the United Cannabis Enforcement Task Force seized 480,991 plants (Crofts-Pelayo 2025) and the State destroyed a total of 1.7bn lbs of cannabis between 2019 and 2025

(Marissasaldivar, 2025). The Drug Enforcement Administration (“DEA”) is the primary federal agency involved in cannabis enforcement. Between 2019 and 2022, the DEA eradicated an average of 4.2 million plants and 480 thousand pounds of product per year in the US with 82% of that total coming from California alone (ERA Economics, 2025). The Federal Bureau of Investigation (FBI) and the Department of Homeland Security (DHS) investigate organized crime and interstate trafficking of cannabis.

Table 4: State Law Enforcement Agencies Enforcing Against Unlicensed Cannabis	
The California Department of Fish and Wildlife (CDFW)	CDFW’s Marijuana Enforcement Team (MET) is made up of CDFW Law Enforcement Officers tasked with eliminating unauthorized cannabis cultivation on state and federal lands. MET’s core mission is to apprehend trespass cultivators and restore public lands damaged by illegal marijuana sites (<i>Cannabis Cultivation Law Enforcement</i> , n.d.). CDFW works with CDFA and the SWRCB on its Watershed Enforcement Program to enforce against environmental damage from unlicensed cannabis cultivation on private land.
State Water Resources Control Board (SWRCB) Cannabis Enforcement Section	The SWRCB collaborates with CDFW, DCC, and the California Department of Pesticide Regulation on enforcement initiatives (State Water Resources Control Board, n.d.).
Department of Cannabis Control	The DCC’s Law Enforcement Division collaborates with local sheriffs and police departments to conduct enforcement against unlicensed operators.
California’s Unified Cannabis Enforcement Task Force (UCETF)	The Unified Cannabis Enforcement Task Force (UCETF), created in 2022 by Governor Newsom, coordinates multiple agencies to target illegal cannabis operations and disrupt illicit financial networks. UCETF is co-chaired by the Department of Cannabis Control (DCC) and CDFW. ²⁹

²⁹ Department of Cannabis Control - State of California. (2025, April 10). *Unified Cannabis Enforcement Taskforce (UCETF)*. Department of Cannabis Control. <https://cannabis.ca.gov/about-us/about-dcc/unified-cannabis-enforcement-taskforce-ucetf/>.

Department of Justice’s Campaign against Marijuana Planting (CAMP)	Established in 1983, the Campaign Against Marijuana Planting (CAMP) is a California DOJ–managed, multi-agency task force involving over 110 local, state, and federal partners, dedicated to eradicating illegal cannabis cultivation and trafficking.
Eradication and Prevention of Illicit Cannabis (EPIC)	Led by the California DOJ, EPIC is a multi-agency partnership between the USDA Forest Service, BLM, and National Park Service; CDFW; DEA; California National Guard Counter Drug Task Force; Central Valley HIDTA; State Parks; and local law enforcement. EPIC investigates and prosecutes illicit cultivation, with a focus on environmental and economic harms and labor exploitation.

NON-POLICY DYNAMICS INFLUENCING CANNABIS CULTIVATION

3.1 MARKET DYNAMICS

Cultivation is heavily influenced by market dynamics. Prior to rule issuance in 2018, many cultivators grew a significant amount, thus leading to a price drop. Prices stabilized amidst a general downward trend until Covid in 2020, when a price spike was followed by a significant crash in the Winter of 2020-21. This depression has persisted, defining a new price equilibrium that has pushed operators throughout the supply chain to the edge of solvency. Partly in response, the logic of investment has switched from capacity-building and market share capture to return-on-investment. With dropping prices, ROI was difficult to demonstrate, leading investment to become scarce across California. Very recent signs of new investment on discounted firms, following federal rescheduling orders in 2025 (Black 2026).

Since medical decriminalization in 1996, cannabis supply chains have been transforming, largely with the effect of diminishing the power of cultivators to establish prices and capture value (Polson 2017). Since legalization this diminishment of the cultivation sector’s power has been amplified in California, a state with large numbers of cultivators and farms. Even before the 2021 price drop, cultivators were under tremendous cost pressures as they became legal, largely due to significant compliance, licensing, and tax burdens (Bodwitch et al 2021). In recent years, the State has taken measures to ease licensing procedures and eliminate the cultivation tax, though structural issues in California’s supply chain have prevented the sector from rebounding.

Based on ethnographic work, some of us have argued that the cannabis market is oversaturated and cannabis operators are failing due to a lack of retail opportunities (Polson et al, 2024). The oversaturated market has several root causes. The first is overproduction. California places no controls on legal supply, farm license amounts, or farm size (the latter of which was undermined by an allowance for “license stacking”). As a result, the licensed market produces

too much cannabis to be consumed by the California market (ERA Economics 2025; Polson et al, 2024). As a result, many unlicensed cultivators decided not to enter the market, where they would have to compete with large firms. Also because of oversaturation, many legal firms sold on the unlicensed market to stay solvent and realize returns on significant amounts of debt they had incurred to operate, become compliant, and achieve licensure. On the consumption side, there are not enough California retailers to sell the cannabis produced in California. This is due to local bans on cannabis retail and permitting restrictions that limit retailer locations and numbers. Another factor is overinvestment: large, venture-backed cultivation companies, and a plethora of investors swarmed California after legalization. They tried to capture as many licenses and square feet of cultivation as possible, leading to oversupply, particularly when investors demanded returns. Oversupplied legal markets – within and beyond California – flooded unlicensed markets, pushing many unlicensed cultivators out of business (Polson et al, 2024). In sum, overproduction, overlicensing, underconsumption, and overinvestment all led to significant declines and price that drastically affected the structure and character of licensed and unlicensed cultivation. In 2017 California Growers Association estimated there were approximately 68,000 cultivators in California (Roberts 2020). State records show that 12,889 entered the licensing process. As of January 13, 2026, there are 4,416 active cannabis cultivation licenses, many of them owned by the same person or entity.³⁰

Before legalization, collectives and cooperatives, storefront and delivery, provided patients with cannabis. None of these retailers had state licenses because they were not available until 2018. Now, licensed retail permits are limited, due to permit bans, caps, zoning restrictions, not to mention the prohibitive cost of obtaining a license in a market yielding low prices and margins and lacking investment. The Humboldt Institute of Interdisciplinary Marijuana Research estimated that there were 2,174 medical cannabis dispensaries (both storefront and delivery) in California in 2015, though they could only confirm that 37% were active (Eschker 2015). As of January 13, 2026, there are 1,208 active retailer licenses in California.³¹ As a comparison, Alcoholic Beverage Control has 48,078 on-sale licenses.³² The opportunities to purchase alcohol are endless, but cannabis is limited to storefront or delivery sales.

3.2 SOCIAL AND ECOLOGICAL DYNAMICS

Social and ecological dynamics affect where, how and to what extent cultivation occurs. There are many areas of environmental concern around cannabis agriculture (Wartenberg et al 2022), as there are with any new land use in post-climate change California. Fires, droughts, floods, and other climactic events likely affect the decisions cultivators make about siting and production (e.g. Martin et al 2022). The expansion of cannabis cultivation has triggered significant social and legal conflicts, particularly between cultivators and various stakeholders. These tensions have resulted in many legal challenges across multiple counties, such as Trinity (Trinity Action Assoc. v. Cty. of Trinity, 2019), Yolo (Yocha Dehe Wintun Nation v. Cty. of Yolo, 2021), Humboldt (Friends of the Eel River v. Cty. of Humboldt, 2018), Santa Barbara

³⁰ DCC Cannabis Unified License Search (n.d.). <https://search.cannabis.ca.gov/results?searchQuery=>.

³¹ 1225 Results found for. (n.d.). <https://search.cannabis.ca.gov/results?searchQuery=>.

³² California, S. O. (n.d.). State Totals | Alcoholic Beverage control. <https://www.abc.ca.gov/licensing/licensing-reports/annual-report-archives/license-summary-counts-for-fy-2021-22/state-totals/>.

(SBCRBC, Inc. v. Cty. of Santa Barbara, 2020), and Siskiyou (Ger Chong Ze Chang et al. v. County of Siskiyou et al., No. 2:22-cv-01378-KJM-AC, Doc. 85 (E.D. Cal. Aug. 21, 2024)). The friction often stems from concerns over environmental impact, land use conflicts, and perceived regulatory deficiencies in cannabis ordinances. Residents, non-cannabis farmers, tribes, and environmental groups have been active in stalling and opposing cannabis cultivation across the state. This has contributed to the pushing of cannabis into more marginal, environmentally sensitive areas and away from traditional agricultural landscapes (Dillis et al 2024).

Social dynamics also shape cultivation decisions about siting and production amounts. Cannabis cultivators have formed trade associations to lobby and shape policy in their county, such as the Humboldt County Growers' Alliance, the Nevada County Cannabis Alliance, and the Trinity County Agriculture Alliance. These organizations shape county responses to both licensed and unlicensed cultivation. Non-cannabis land users are often resistant to cannabis cultivation (Dillis et al 2024; Valakovic et al 2019), leading to struggles over zoning, land use, environmental, and nuisance policies. Some areas, however, are accustomed to cannabis cultivation historically and provide zones of allowance for unlicensed cultivation to occur (Polson et al 2024).

OBJECTIVES

This project measures the degree to which the first Purpose and intent of Proposition 64 – to transition cannabis “production...out of the hands of the illegal market” – has been accomplished and what factors facilitate that transition effectively. As defined in Proposition 64, we also address issues related to cannabis’ “criminal justice impacts,” “environmental issues related to cannabis production,” and which agencies and approaches might achieve AUMA’s purpose “more effectively” (see RTC 34019(b)(7-10)). As listed in the project proposal, the study objectives were:

- 1) Assess Unlicensed Production Amounts and Geography;
- 2) Identify factors influencing the observed extent of unlicensed cultivation;
- 3) Compare Licensed and Unlicensed Production and Estimate Leakage of Licensed Product into Unlicensed Market;
- 4) Assess Potential for Environmental Impacts of Unlicensed Production in Ban and Permit Counties.

METHODS AND RESULTS

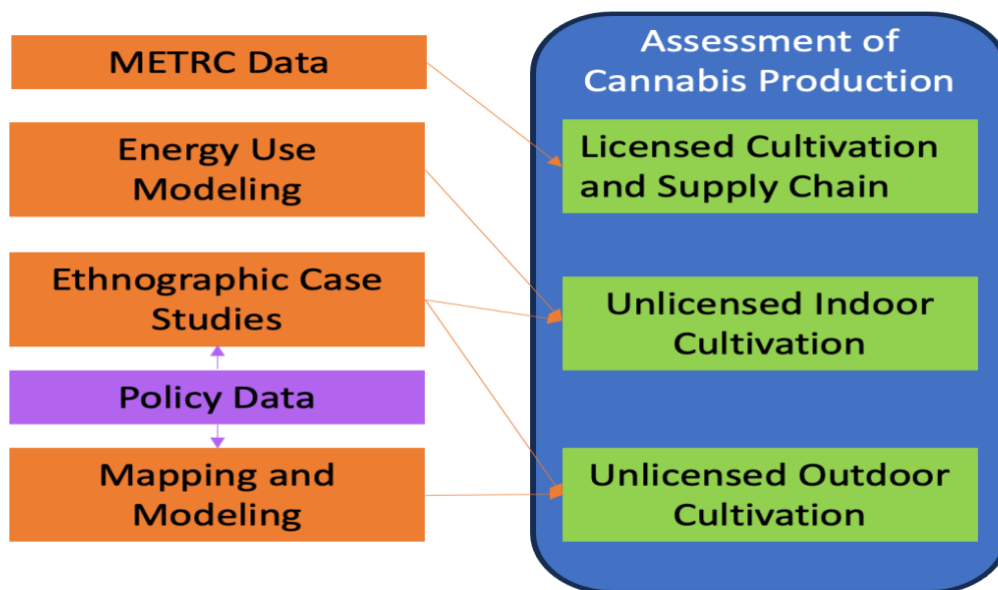
This research employed a mixed-methods approach and involved collaboration with experts in anthropology, political ecology, energy resources, environmental ethics, environmental science, and legal studies. Quantitatively, we utilized statewide mapping data, licensing data, and energy use records to understand indoor, outdoor and mixed-light cultivation

trends across the legal and unlicensed markets. Qualitatively, we conducted policy analyses at state and local levels and six (6) in-depth case studies of select counties. We met biweekly for 2.5 years to coordinate and harmonize research across these methodological domains and aimed to establish feedback loops between different research approaches, to ensure robust and integrated findings. We found that quantitative, policy, and qualitative data each offered different yet complementary takes on what is happening and why. By summing and integrating them, this study comprehensively assessed California’s state of unlicensed cultivation.

Mixed-methods research approaches are valuable in answering policy-focused questions and addressing social problems because they combine broad, generalizable insights of quantitative data with the meaningful, person-centered understanding gained through qualitative inquiry. The combination allows researchers to explore both *what* is happening and *why*, thereby covering the gaps or weaknesses in using singular approaches alone (Martin et al., 2023; Tzagkarakis & Kritas, 2022). This integration is beneficial because qualitative data can reinforce the reliability of big data by ground-truthing the findings (Bamberger, n.d.).

All researchers are affiliates of UC Berkeley’s Cannabis Research Center (CRC), established in 2017. The CRC is dedicated to interdisciplinary cannabis research, focusing on cultivation, policy, and environment. CRC researchers include ecologists, wildlife and conservation biologists, hydrologists, geographers, anthropologists, and policy experts in agriculture, law, and land use. This research expands upon prior studies conducted by CRC-affiliated researchers on bans (Getz et al., 2024), local control (Biber et al., 2023), unlicensed cultivation (Polson et al., 2024), cannabis water use (Dillis et al., 2023) and fire risk (Martin et al 2022), and barriers to entry in the legal market (Bodwitch et al., 2021).

Figure 3: Diagram of Methodological Approaches



5.1 LOCAL ORDINANCE ANALYSIS

5.1.1. ANALYTICAL FRAMEWORK & DESIGN FLOW

What is the effect of local policies and social dynamics on cannabis cultivation and commerce? Prior studies have pointed to the importance of local policies (Biber et al 2023; Heddleston 2012; Holmes 2019; Matthay et al 2022; Moiseeva 2023; Polson 2015; Polson & Petersen-Rockney 2019) in influencing the development of legal cannabis markets and in shaping the unlicensed market. Our recent work on cannabis bans (Getz et al 2024) indicates that ban policies may be consequential in shaping unlicensed cultivation. Similarly, the design of local permitting programs can affect unlicensed cultivation (Polson et al 2024) as well as legal market involvement and development (Biber et al 2023).

Building from this prior work, our team analyzed local and state policy timelines. We then integrated these timelines with spatial modeling based on the CannaVision mapping data, which identifies unlicensed cultivation (see below). Through this, we aimed to correlate local policies with the growth or decline of local unlicensed cultivation and the roll-out of state policies with the growth or decline of statewide unlicensed cultivation. The first step in this process was to create a policy analysis of California's 58 counties. We analyzed cannabis-related policies and practices across all counties to assess their impact on the unlicensed market. We examined whether counties had bans or permit ordinances, the specifics of those programs, and the enforcement mechanisms utilized to curb unlicensed cultivation. Our review included county ordinances, zoning codes, public nuisance provisions, enforcement procedures, environmental reports, and litigation related to cannabis cultivation. In this phase, we sought to compile, index, and compare cannabis policies across all 58 counties.

Then, these policies were sorted into typologies. The first tier typology was "ban" and "permit." Within these two categories, we identified other policy typologies to characterize the varied policy measures in ban and permit counties (e.g., presence/absence of sanctions for landowners or properties where unlicensed cultivation occurs). These policies were then placed on a timeline according to when they were passed. This policy analysis was then converted into a spreadsheet that can be integrated into the mapping analysis of cultivation across the state (via CannaVision) and over time. This resulted in a model that offers insight into how local and state policy measures may have affected the growth or decline of unlicensed production. We did this by looking across counties for statistically significant patterns

Through this, we were able to identify policies that are effective and ineffective at addressing unlicensed cultivation, including whether bans or permits are more effective in this effort. By simultaneously considering terrain-based factors, including remoteness and ruggedness measures, we could estimate their effects independently and therefore more

effectively isolate policy factors with our models. After the CannaVision model was run incorporating the policy variables, we analyzed the trends and tried to ascertain if any local policy changes may have impacted the growth or diminution of unlicensed cultivation and drafted an analysis of the dataset.

Policy analyses were also used to inform case studies of select counties. For these counties, more in-depth policy histories and social analyses were compiled utilizing secondary sources, including census data, local news, reports from local and regional nonprofits, etc. Qualitative researchers utilized these policy and social analyses to inform interview scripts and participant prompts. They were also used in compiling the full case studies in the Appendices.

5.1.2. DATA USED

Policy analyses were conducted using the following sources: cannabis ordinances, zoning ordinances, local cannabis tax measures, environmental impact reports, Board of Supervisor meeting minutes and agendas, cannabis application documents, county cannabis websites, county sheriff websites, litigation, and grand jury reports. For more in-depth analyses of case study counties, we accessed news sources, census data, and reports on various aspects of county life.

5.1.3. METHODS FOR POLICY ANALYSIS

For each California county, we generated a planning code summary. To prepare the summary, we analyzed county cannabis-specific ordinances, including the zoning code and code provisions applicable to public nuisances, administrative abatement, and civil fines and penalties. After conducting legal research on the county code, we reviewed county staff policy documents, regulations, and county websites dedicated to cannabis. We also reviewed the County Sheriff's website to learn about specific cannabis enforcement teams. In some counties, we supplemented our understanding of the code by reviewing minutes from the Board of Supervisors' public meetings. For permit counties, we reviewed environmental documents for each cannabis program, including Program Environmental Impact Reports and Program Mitigated Negative Declarations. We analyzed Grand Jury investigations of commercial cannabis programs in Humboldt, Nevada, Monterey, and Santa Barbara.

For permit counties, summaries include significant dates, permit and acreage caps, types and sizes of allowable cultivation, site conditions, CEQA pathways, types of permits, standard conditions, and enforcement mechanisms. For ban counties, we examined enforcement approaches, investigation strategies, fines, property liens, owner liability for unlicensed cultivation, Sheriff's office enforcement teams, and criminal penalties.

5.1.4. RESULTS

After completing 58 planning code summaries, we created a comparative analysis spreadsheet comparing notable policies across all counties. Table 5 includes the key questions examined in our comparative analysis. The spreadsheet is included in Appendix 4.

Table 5: Key Variables in Permit and Ban Counties	
Permit County Factors	Ban County Factors
• When was the first commercial cannabis cultivation ordinance passed? • Is there a permit or acreage limit, and when was it reached? • Are new applications for cultivation being accepted? • What are the conditions for cultivating properties? • What type of CEQA documents were prepared for the cannabis ordinances? • Are there application processes requiring discretionary review? • What types of permits are available, and who reviews them? • Is outdoor and mixed-light cultivation allowed? • How many approval terms and conditions apply to cultivation sites? • Tax rate information.³³	• The date that commercial cannabis cultivation was banned. • If personal outdoor cultivation is prohibited. • If satellite investigation is used. • If a drone investigation is used. • The fine amount per occurrence per day. • The fine amount per plant per day. • If fines are capped. • If each day constitutes a separate offense for fines. • If the property owner is held responsible for fines. • If property liens are available for failure to pay fines. • What type of special enforcement team exists, separate from the Sheriff? • What criminal penalties are applicable?

³³ Both ban and permit counties were examined for cannabis business tax information, including: The date tax measures were passed, tax structure (gross receipts, square footage, or production), and any changes to the cannabis business tax rate, including a reduction or waiver of the tax for a time period.

• What are the fines (per plant or occurrence)?	• What criminal penalties apply to environmental crimes associated with cannabis cultivation?
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The policy variables listed above and outlined in the comparative analysis spreadsheet were isolated and fed into the CannaVision model. Variables that had no statistical impact were excluded from the model, and several variables remained, as listed in **Table 5**, including: whether a ban existed, fine amount, fine per plant, landowner responsibility, enforcement task force, and code enforcement.

Planning code summaries were used as a framework for ethnographic projects to explore the relationship between policy factors and changes in local cultivation dynamics. They were also referenced in drafting a synthetic summary for each county of interest (see Section 5.5).

5.2 CANNAVISION MAPPING OF UNLICENSED CULTIVATION

5.2.1. ANALYTICAL FRAMEWORK

For decades, reliable data on cannabis cultivation, aside from qualitative ethnographic data (Corva 2014; Polson 2021), has been difficult to ascertain. They often derive from limited, unreliable, and potentially biased law enforcement estimates (Kalacska & Bouchard 2011; Leggett & Pietschmann 2008) or from remote sensing techniques, which requires significant amounts of inference (Dillis et al 2020; Gianotti et al 2017; Franklin et al 2017; see Meisel 2017 for discussion). Innovative cross-disciplinary approaches to estimating cultivation have grown alongside liberalization of cannabis policy, as cultivators and cultivation become more visible (e.g. Bouchard 2008; van der Giessen et al 2016; Werb et al 2012). At UC Berkeley, researchers innovated an empirical method to estimating cultivation via satellite and aerial imagery (Butsic et al 2017; Butsic & Brenner 2016), however this approach is time- and resource-intensive.

The ability to accurately estimate unlicensed cultivation impedes the assessment and design of interventions in the unlicensed market. A lack of methods for assessment can leave policymakers and the public uninformed about the existing scale of cultivation, potentially leading to inappropriate or ineffective responses. If assessments overestimate cultivation, punitive and overzealous responses can result, which may be motivated by other institutional or social agendas (Getz, Petersen-Rockney & Polson 2024). This can undermine the transition to cannabis legalization by amplifying re-criminalizing and stigmatizing approaches above other more proportional approaches (Adinoff & Reiman 2019; Polson 2019).

To address the lack of consistent data on cultivation amounts, this project provided first-in-use modeling of CannaVision, a product of California’s State Water Resources Control Board (SWRCB). This model was used to identify outdoor and mixed-light cannabis cultivation across thirty counties, utilizing advances in aerial surveillance data and object detection modeling. The SWRCB has trained this model extensively, investing significant time in not only tool design, but in ground-truthing its identified objects for accuracy.

CannaVision was used to identify outdoor (including mixed-light) cannabis cultivation sites. Licensed cultivation was removed using Department of Cannabis Control (DCC) license data. The model is a custom-trained Detectron2 system developed by the State Water Resources Control Board (SWRCB) and trained on approximately 100,000 labeled examples using National Agricultural Inventory Program (NAIP; USDA) imagery. CannaVision summary data can be generated biennially following the NAIP acquisition schedule.

Although CannaVision provides consistent spatial coverage, several methodological constraints limit the reliability of absolute area estimates. The model identifies objects by locating and outlining them within satellite imagery. This process can miss small or partially visible features or detect them inconsistently, which introduces sensitivity-related errors that affect total area calculations. The training data, while extensive, do not fully capture the full range of visual variation found across California, and this can lead to inconsistent detection rates in different settings. Detection accuracy is also affected by lighting conditions, shadows, vegetation cover, and background complexity, all of which vary across NAIP imagery and cannot be fully corrected after detection has occurred. Small errors in identifying or outlining objects accumulate when results are aggregated across thousands of images, which produces total area estimates that may differ substantially from the true extent of cultivation. For these reasons, absolute values are not reliable indicators of the actual scale of cultivation activity.

Given these constraints, the analysis emphasizes *relative* measures, which provide more stable and interpretable results at regional scales. Relative deviations, normalized values, and year-to-year comparisons offer more robust indicators of the spatial distribution of cultivation activity and its temporal dynamics. These metrics form the basis for identifying hotspots, characterizing geographic patterns, and assessing changes in cultivation concentration over time.

Using this framework, all available CannaVision datasets from 2018 through 2024 were compiled and analyzed. Identified cultivation features were converted to area estimates and aggregated within grid cells, and county-level summaries were generated to assess the distribution and evolution of unlicensed outdoor and mixed-light cultivation across 30 counties. Analyses focused on three outcomes: (1) county-level summaries of unlicensed cultivation across years, (2) trends in the relative expansion or contraction of cultivation activity within and across counties, and (3) evaluations of spatial and environmental characteristics associated with cultivation patterns.

5.2.2. DATA USED

Source data for cannabis mapping using CannaVision were acquired from the US Department of Agriculture’s National Agricultural Imagery Program (NAIP). Imagery is produced and publicly released every two years. The years included in this project were 2018, 2020, 2022, and 2024.

A comparative analysis spreadsheet was created using planning code summaries to generate variables to be analyzed as predictors of unlicensed cannabis cultivation. Additional socioeconomic and demographic variables in our models were generated using data from the California State Franchise Tax Board (CSFTB), the US Census Bureau (USCB), and voting records from the California Secretary of State (CSoS). Additional geographical and terrain-based variables required the use of data from the Microsoft Buildings Footprint Layer (Microsoft), CALTRANS, the US Geological Survey’s (USGS) National Hydrography Dataset, the USGS National Land Cover Database, the USGS National Elevation Dataset, CALFIRE, the California Department of Cannabis Control (DCC), the California Department of Food and Agriculture (CDFA), and the California Division of Water Resources (CDWR). All model variables and their data sources are outlined in **Table 6** below. Our assessments of potential environmental impact used data from the National Land Cover Database (USGS), the National Hydrography Dataset (USGS), and species distribution data from the National Oceanic and Atmospheric Administration (NOAA).

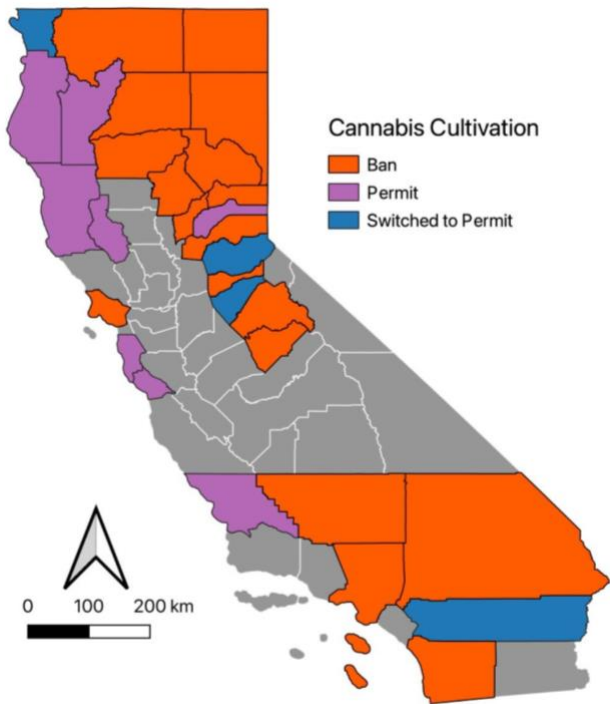
5.2.3. METHODS

The CannaVision computer vision model was applied to aerial imagery to produce the outcome variables used in the analysis. The study area for the model’s application was initially limited to 17 counties that could offer reliable accuracy of object detection. Some of the excluded counties included significant centers of cultivation, including all of Southern California. Since Cannavision was largely trained on the North Coast and its particular land type, application to other parts of the state were tenuous. To address this, we partnered with SWRCB to expand the geographic applicability of Cannavision from 17 to 30 counties and to increase the reliability of object identification in each of these counties to an acceptable range. To refine and expand the model, we supervised approximately 30 undergraduate researchers over two semesters to identify and validate objects. All students were trained in appropriate methods and given supervision by project personnel and SWRCB liaisons.

The final modeling based on Cannavision data was limited to 30 counties in which sufficient training data were available. This included: Amador, Butte, Calaveras, Del Norte, El Dorado, Humboldt, Kern, Lake, Lassen, Los Angeles, Marin, Mendocino, Modoc, Nevada, Placer, Plumas, Riverside, San Bernardino, San Diego, San Luis Obispo, San Mateo, Santa Cruz, Shasta, Sierra, Siskiyou, Tehama, Trinity, Tuolumne, and Yuba. Analyses were restricted to

private lands, since public land trespass grows are not subject to the same landowner penalties and disincentives, however we did analyze polygons that included public and private land to analyze cultivation trends at this public-private interface.

Figure 4: Study Area Map. *Counties included in the study (n=30) are colored either orange if cannabis cultivation is banned, purple if cannabis cultivation is permitted, or blue if cultivation changed from banned to permitted during the study period.*



The CannaVision model produced polygons representing predicted outdoor and greenhouse cannabis cultivation gardens. Prior to distribution, the State Water Resources Control Board (SWRCB) aggregated these polygons to a generic sampling grid with a typical cell size of 9 km² to protect anonymity. The sampling grid was aligned to county boundaries to allow for county-level summarization. When county borders split grid cells, a minimum cell size of 2.25 km² was maintained by merging adjacent cells when necessary.

Cannabis density, expressed as square meters per square kilometer, was calculated for each grid cell for the years 2018, 2020, 2022, and 2024. Differences between

consecutive years (2018 to 2020, 2020 to 2022, and 2022 to 2024) were then used as outcome variables in the statistical models. Consult Appendix 4 link to see variables.

Predictors of Unlicensed Cultivation

All models were Generalized Additive Models (GAMs) that account for spatial clustering through the use of smoother functions, in this case, applied to the latitude and longitude of the spatial unit (i.e., grid cells). They were also hierarchical models, which included county as a random effect variable to control for unmeasured county-specific factors. For each model, we paired the full model matrix (i.e., all variables) using stepwise AIC to prioritize useful variables. Because the data were zero-inflated (i.e., many grid cells showed no change in cultivation density between time points), the hierarchical GAMs were fit as hurdle models. This is accomplished by fitting separate component models: a binary model to predict whether or not the change in cultivation density is non-zero and a second conditional model to predict the amount

of change, assuming it is non-zero. Hurdle models are appropriate when there is presumed to be a particular reason for values being zero. In this dataset, values of zero were almost always present due to a complete lack of cannabis cultivation, rather than a complete lack of change in mapped cultivation between time points. Because this analysis was focused on the predictors of change in cannabis cultivation, the presentation of the analysis will focus exclusively on the conditional model in which only non-zero values are included in the model fitting data.

Table 6. Predictor variables for GAMs		
Variable	Description	Source
Cultivation Ban	Binary; presence/absence of cultivation ban during time period	Planning Code Summaries
Fine Amount	Integer; Dollar value of daily fine for unlicensed cultivation	Planning Code Summaries
Fine Per Plant Basis	Binary; whether/not fines are assessed on a per-plant basis	Planning Code Summaries
Land Owner Responsibility	Binary; whether/not landowners are responsible for tenant cannabis cultivation violations	Planning Code Summaries
Personal Cultivation	Binary; whether/not personal cultivation allowances (up to six plants) were present	Planning Code Summaries

Enforcement Rank	Rank; rank among study counties of lbs of cannabis seized since 2011	ERA Economics
Public Land Boundary	Binary; presence/absence of public land within the sampling grid cell	CALFIRE
Presence of Licensed Farm	Binary; presence/absence of a licensed cannabis farm within the sample cell	DCC
Presence of Hemp	Binary; presence/absence of a hemp license within the sample cell	CDFA
Proportion Conservative	Continuous, bounded (0-1); proportion of county registered voters identifying as Republican	CSoS
Median Income	Continuous; county median income	CSFTB
Proportion Retirement Age	Continuous, bounded (0-1); proportion of county population aged 65 or older	USCB
Building Density	Continuous; number of buildings per km ²	Microsoft
Road Network Density	Continuous; length of paved public roads per km ²	CALTRANS
Stream Network Density	Continuous; length of streams per km ²	USGS NHD

Proportion Forest	Continuous, bounded (0-1); proportion of sample cell that is covered in forest	NLCD
Proportion Planted	Continuous, bounded (0-1); proportion of sample cell that is cultivated (non-cannabis agriculture)	NLCD
Proportion Barren	Continuous, bounded (0-1); proportion of sample cell that is barren rock	NLCD
Average Slope	Continuous, bounded (0-1); average hill slope of the sample cell	USGS DEM
Remoteness	Continuous; distance from sample cell to nearest incorporated area	CALFIRE
Groundwater Present	Binary; presence/absence of SGMA groundwater basin within the sample cell	DWR
High Fire Hazard Severity	Binary; presence/absence of area mapped as either “high” or “very high” fire hazard severity within the sample cell	CALFIRE

Intra-County Volatility

This analysis assessed how patterns of unlicensed cannabis cultivation changed over time within counties. Data were organized into spatial cells nested within counties, and variables used to predict unlicensed cultivation (as described above) were adapted, where necessary, to reflect county-level characteristics. For instance, the presence of a licensed farm in a cell was aggregated to represent the proportion of cells in a county containing licensed farms. The goal was to understand whether hotspots of activity (i.e., areas with higher levels of unlicensed cultivation) tended to persist in the same places across multiple years, or whether they shifted over time.

To measure this, a nonparametric, rank-based approach was used. For each county, cell-level cannabis cultivation values were converted to within-year ranks for four time points: 2018, 2020, 2022, and 2024. These ranks were then compared across three adjacent year-pairs (2018 to 2020, 2020 to 2022, and 2022 to 2024) using Spearman correlation coefficients. Each coefficient captures the degree to which the relative ordering of cells (from highest to lowest cultivation) was maintained between two time points. A high correlation indicates that cells with high cultivation levels in one year tended to remain high in the next; in other words, the spatial pattern was stable. A low correlation, by contrast, suggests that hotspots moved or were replaced by other areas, indicating instability in the spatial distribution of activity.

To summarize these temporal comparisons, the three Spearman correlation values were averaged to produce a single rank stability score for each county. This score reflects how consistently cultivation intensity was distributed across space over time. Counties with high stability scores exhibit persistent hotspots, where the same areas remain high in cultivation across years. Counties with low scores show more dynamic, shifting patterns, consistent with a “whack-a-mole” effect in which enforcement, policy, or other pressures displace activity from one place to another rather than eliminating it outright. The outcome variable was bounded between 0 (no correlation between time periods- maximally dynamic) and 1 (perfect correlation between time periods- absolute stasis) and was modeled using a beta regression with a logit link function.

Environmental Impact Analysis

In order to assess the potential environmental impacts of unlicensed cultivation since legalization, we compared the expansion and contraction of unlicensed cultivation in the study counties, relative to the county’s environmental sensitivity. Environmental sensitivity was scored based on the composite of three metrics:

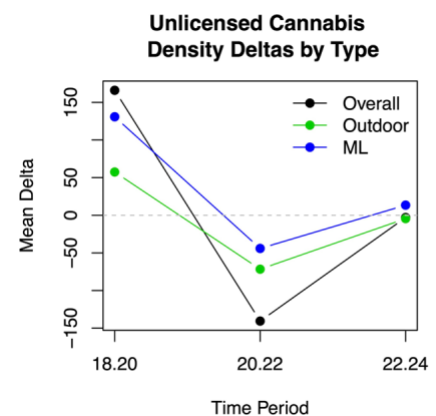
- 1) Proportion of county watersheds containing critical salmonid habitat, as outlined by the National Oceanic and Atmospheric Administration (NOAA);
- 2) The amount of aquatic habitat, as measured by the length of perennial streams per km² of county land area, using the USGS National Hydrography Dataset (NHD)
- 3) The proportion of land area undeveloped and uncultivated, as identified by the National Land Cover Dataset (NLCD).

Each metric was calculated for every county in the state, and rankings were summed to produce a composite rank for each county. Cannabis cultivation data were acquired for each of the 30 study counties using CannaVision. Separate OLS models were run for permit and ban counties (and altogether,) comparing county environmental sensitivity rank to the average change in cannabis cultivation during the time periods 2018-2020, 2020-2022, and 2022-2024.

Table 7. Ranking Metrics for Environmental Impact Analysis.		
Variable	Description	Data Source
Proportion Undeveloped	Continuous, bounded (0-1); the proportion of private land in a county that is not classified as developed or cultivated	USGS
Stream Network Density	Continuous; the length of streams on private land within a county, divided by the area of said land	USGS
Proportion of Watersheds Sensitive	Continuous, bounded (0-1); the proportion of watersheds within a county that contain critical habitat for protected fish species	NOAA

5.2.4. RESULTS

From 2018 to 2020, unlicensed cannabis cultivation expanded markedly (mean = 165.99 m² / km²; SD = 507.24). Among cultivation types, mixed-light operations exhibited greater expansion than full-sun outdoor cultivation. During the second time period (2020 to 2022), the extent of unlicensed cultivation decreased substantially, effectively reversing the relative gains observed in the previous period (mean = -140.59 m² / km², SD = 456.05). Reductions in outdoor unlicensed cultivation slightly exceeded that of mixed-light during this time. In the final time period (2022 to 2024), overall unlicensed cultivation remained relatively stable (mean = -3.06 m² / km², SD = 190.68). However, during this period, mixed-light cultivation continued to increase slightly, while outdoor unlicensed cultivation decreased slightly.

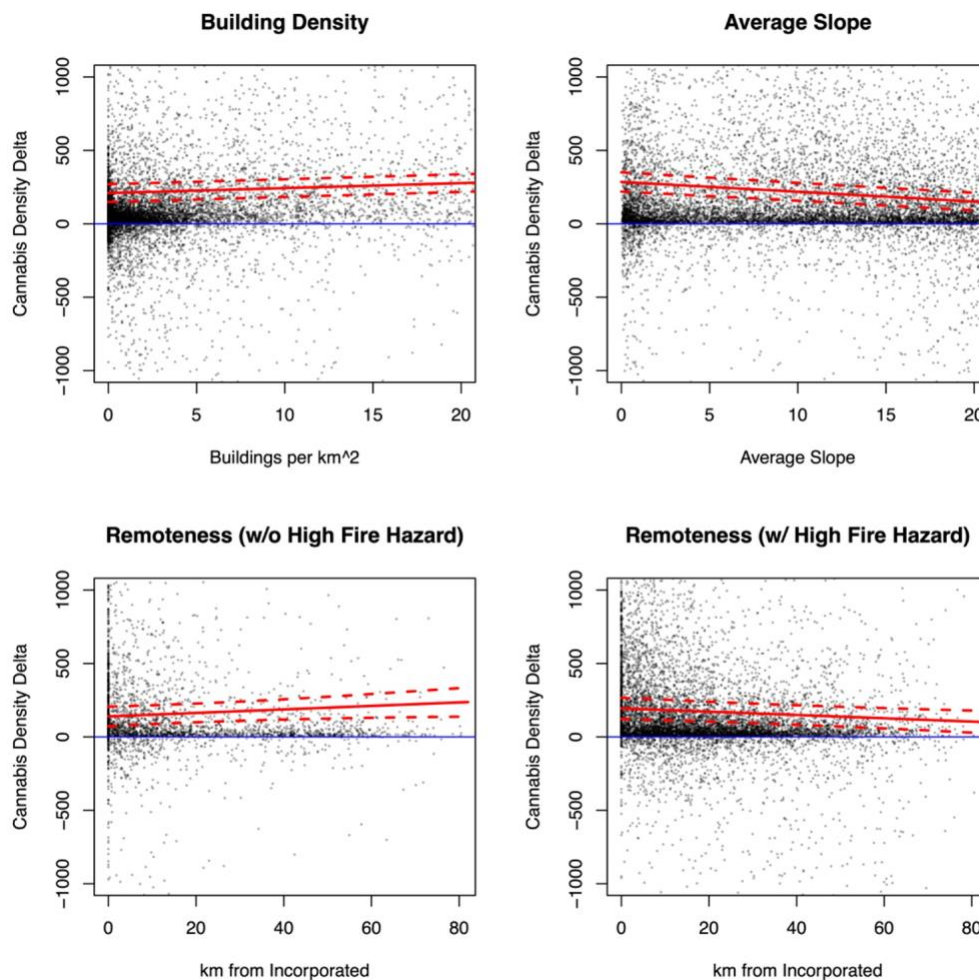


Predictors of Unlicensed Cultivation

Physical and Terrain-Based Variables

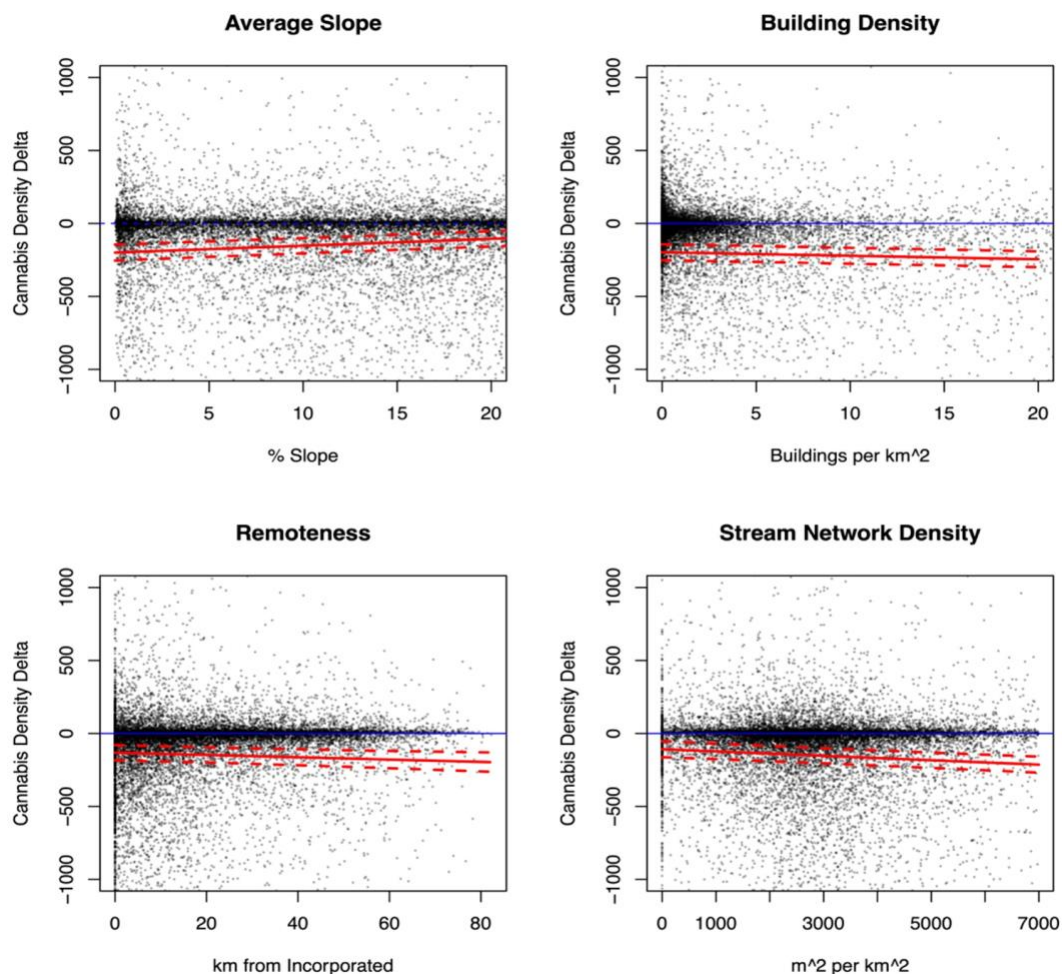
Between 2018 and 2020, cultivation densities increased most significantly in areas characterized by flatter terrain (average slope: MLE = -6.67, SE = 0.83) and more buildings (building density: MLE = 3.40, SE = 0.16). Expansion was sensitive to fire hazard, in that remoteness (MLE = 1.19, SE = 0.60) was only associated with increasing cannabis density in the absence of high fire hazard; in the presence of high fire hazard the effect was negative (remoteness $\times$ high fire hazard interaction: MLE = -2.32, SE = 0.63). Fire-prone areas were widespread during this period, with over 60% of all cells containing at least one region classified as high fire hazard severity.

Figure 6: 2018-20 Physical/Terrain Predictors



From 2020 to 2022, reductions in unlicensed cultivation were most pronounced in flat areas (average slope: MLE = 4.69, SE = 0.64), while cells with steeper average slopes showed smaller declines. Areas with lower building density (MLE = -2.39, SE = 0.13) also experienced smaller reductions, as did cultivation in the public/private boundary areas (MLE = 68.36, SE = 9.14), although the magnitude of these changes was relatively modest. Decreases were smaller in less remote areas (remoteness: MLE = -1.05, SE = 0.42), suggesting cultivators valued proximity to infrastructure, but the cover of hills and the absence of neighbors. Finally, there was also an effect of stream network density, with cells containing more streams seeing a larger decrease in cannabis density (MLE = -0.015, SE = 0.003).

Figure 7: 2020-22 Terrain/Physical Predictors

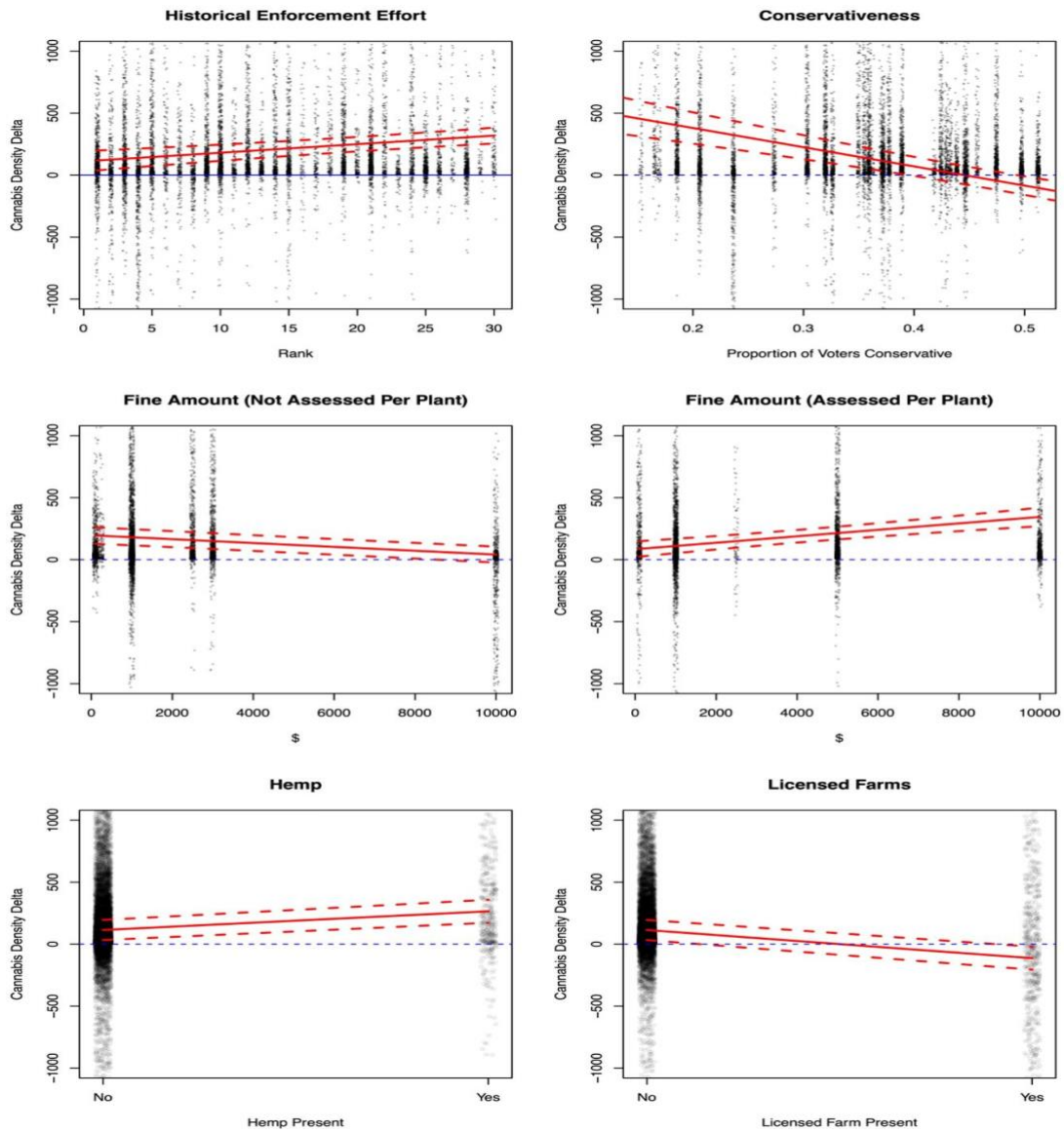


From 2022 to 2024, there was no strong positive or negative trend in cannabis cultivation, although there was still substantial spatial variation. Somewhat paradoxically, both remoteness (MLE = 0.29, SE = 0.11) and building density (MLE = 0.65, SE = 0.06) were positively associated with small increases in cannabis density. Also, cells with denser stream networks experienced increases of cannabis density (MLE = 0.005, SE = 0.0011) in an unexpected reversal of the prior trend, potentially reflecting shifting enforcement focus or adaptation strategies by cultivators. The effect sizes of these variables were substantially smaller than those seen in prior time periods however, indicating that while they were statistically significant, they are not necessarily meaningful.

Socio-Political Variables

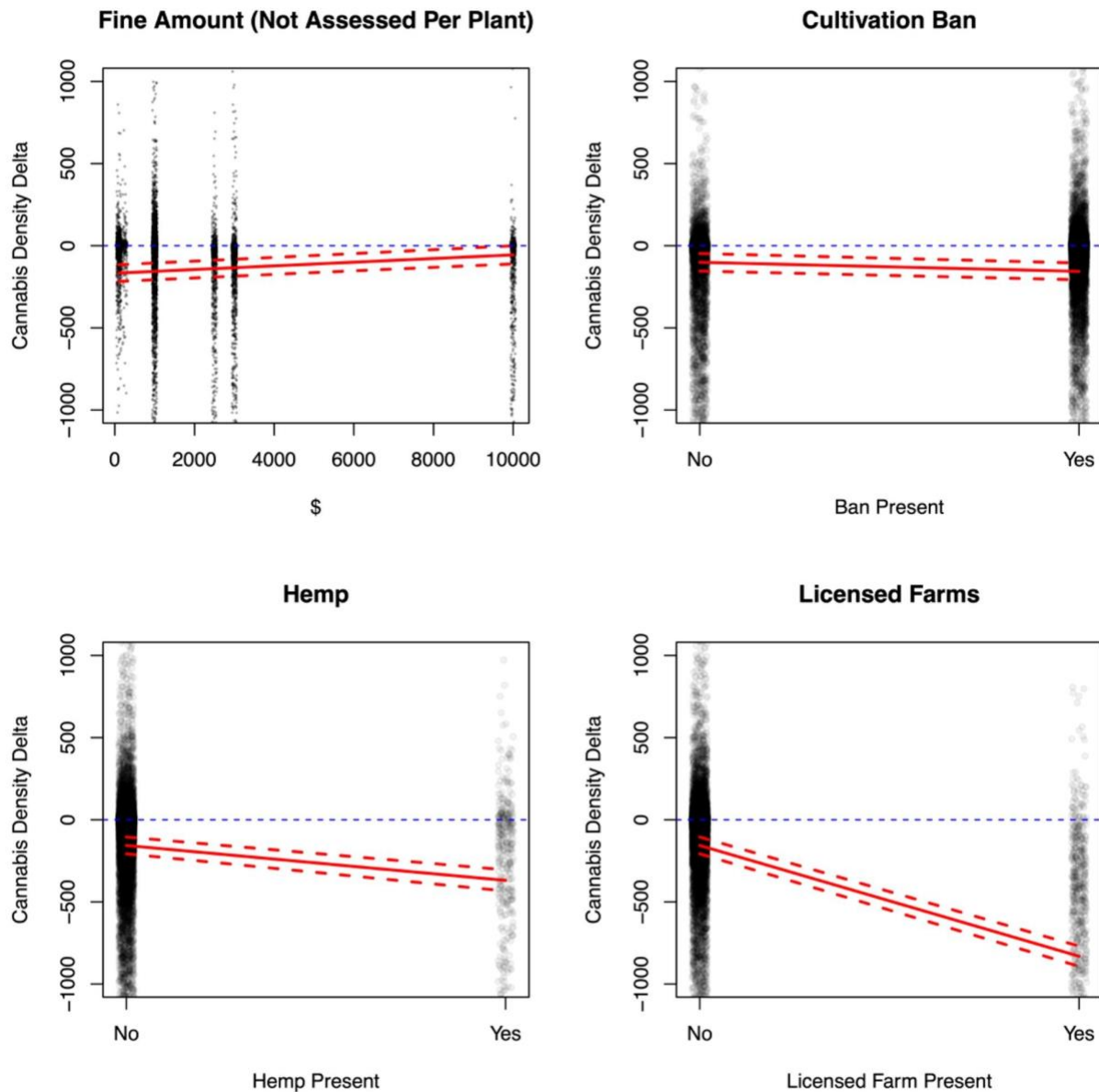
During the first time period (2018–2020), counties with historically lower enforcement efforts showed larger increases in cannabis cultivation (MLE = 7.09, SE = 2.89). Counties that assessed fines on a per-plant basis experienced smaller increases (MLE = -111.97, SE = 28.45), and higher fine amounts were negatively associated with cannabis cultivation (MLE = -0.01554, SE = 0.0017). The interaction between fine amount and per-plant fines was positive during this period (MLE = 0.042, SE = 0.0054). Among social variables, conservatism had a pronounced influence, with the proportion of conservative voters negatively associated with cannabis density change (MLE = -1548.39, SE = 202.42). Hemp presence was positively associated with cannabis cultivation (MLE = 151.17, SE = 23.28). The presence of licensed farms had a negative effect on cannabis density (MLE = -227.20, SE = 22.26).

Figure 8: 2018-20 Socio-Political Predictors



Policy variables had more muted effects during 2020–2022. Fine amounts were associated with declines in cannabis density only when not assessed per plant (fine amount: MLE = 0.011, SE = 0.0011; interaction with per-plant fine: MLE = -0.012, SE = 0.004). Cultivation bans were associated with somewhat larger declines (MLE = -55.40, SE = 14.53). The presence of licensed farms was the most influential factor, with cannabis density declining three times more in their presence (MLE = -674.52, SE = 17.11). In areas without licensed farms, the model estimated continued increases. Hemp presence was now associated with reductions in cannabis cultivation (MLE = -212.96, SE = 19.85).

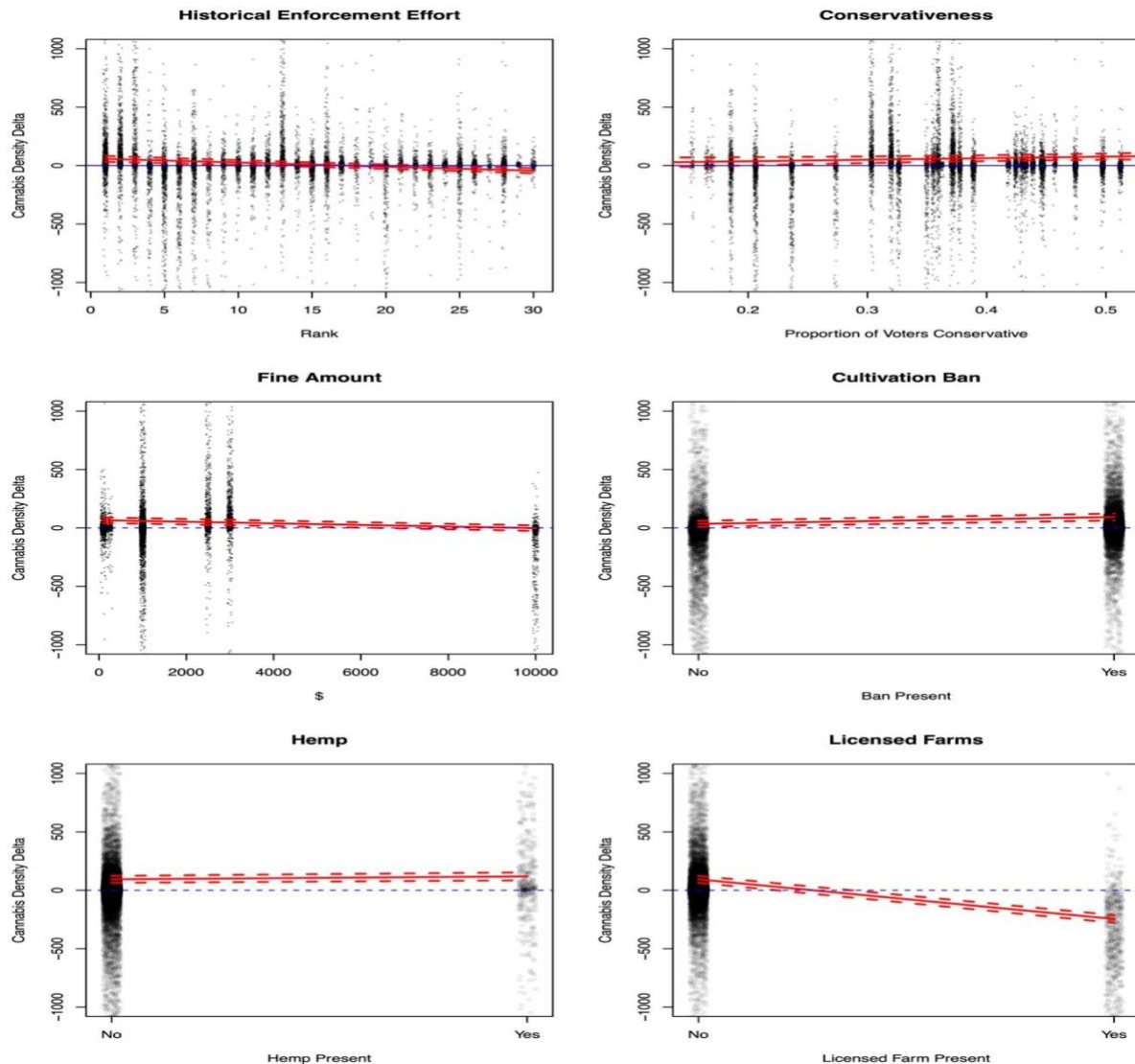
Figure 9: 2020-22 Socio-Political Predictors



In the third time period (2022–2024), enforcement history was negatively associated with cannabis density change ($MLE = -2.45$, $SE = 0.70$), indicating historically enforcement-heavy counties saw larger increases. Fine amounts were negatively associated with cannabis cultivation ($MLE = -0.007$, $SE = 0.0005$), regardless of per-plant fine structures, which were not significant ($MLE = -0.002$, $SE = 0.0019$). Cultivation bans reversed their association and were estimated to have a small positive effect on increasing in cannabis density ($MLE = 59.03$, $SE = 10.13$). Social patterns flipped, with the proportion of conservative voters positively associated with cannabis

density change (MLE = 131.68, SE = 56.46), indicating increases in more conservative counties, while more liberal areas experienced declines. The presence of licensed farms remained the strongest factor, with a continued negative association with cannabis density (MLE = -339.10, SE = 7.74).

Figure 10: 2022-24 Socio-Political Variables

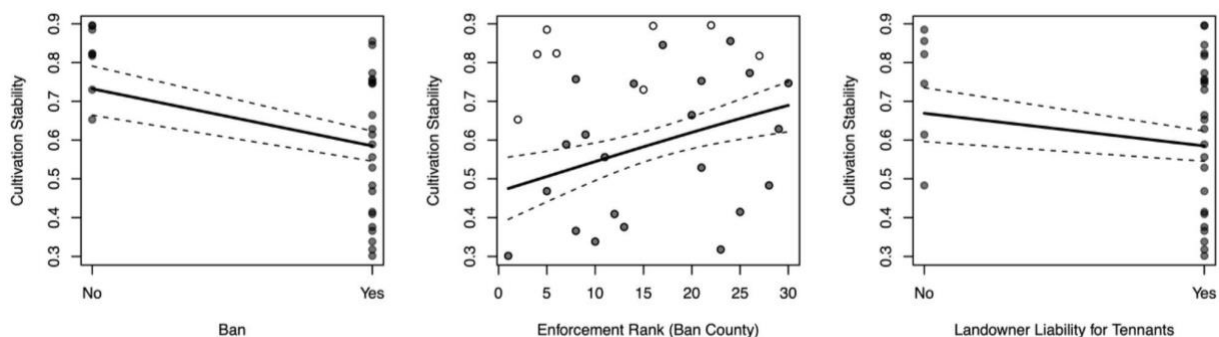


Intra-County Volatility

Over the study period (2018-2024), the distribution of cannabis cultivation was significantly more volatile in counties with local cannabis bans (MLE = -1.65, SE = 0.32). That is, cultivation exhibited more “whack-a-mole” dynamics in these counties. Cultivation stability was also lower in counties with stronger historical enforcement reputations, as measured by enforcement rankings (MLE = -0.034, SE = 0.019). However, this association was only reliably

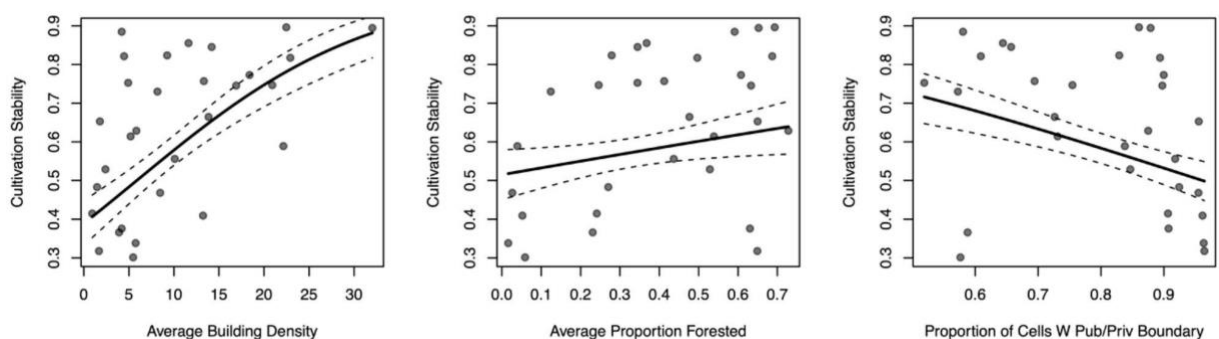
associated with reduced cultivation stability in counties where a ban was in place, as indicated by a statistically significant interaction ($MLE = 0.065$, $SE = 0.022$). Policies holding landowners liable for tenant cultivation were also associated with lower stability ($MLE = -0.36$, $SE = 0.18$), suggesting these measures may be linked to more mobile or short-lived cultivation activity.

Figure 11: Within-County Cultivation Movement - Policy Factors (2018-24)



Several spatial and environmental characteristics were significantly associated with cultivation stability. Counties with greater average building density showed higher levels of stability ($MLE = 0.077$, $SE = 0.011$), as did those with more forest cover ($MLE = 0.70$, $SE = 0.33$). In contrast, cultivation was significantly less stable in counties with a higher proportion of grid cells containing both public and private land ($MLE = -2.09$, $SE = 0.46$), a pattern that may reflect uncertainty or complexity in land access or enforcement.

Figure 12: Within-County Cultivation Movement - Terrain Factors (2018-24)



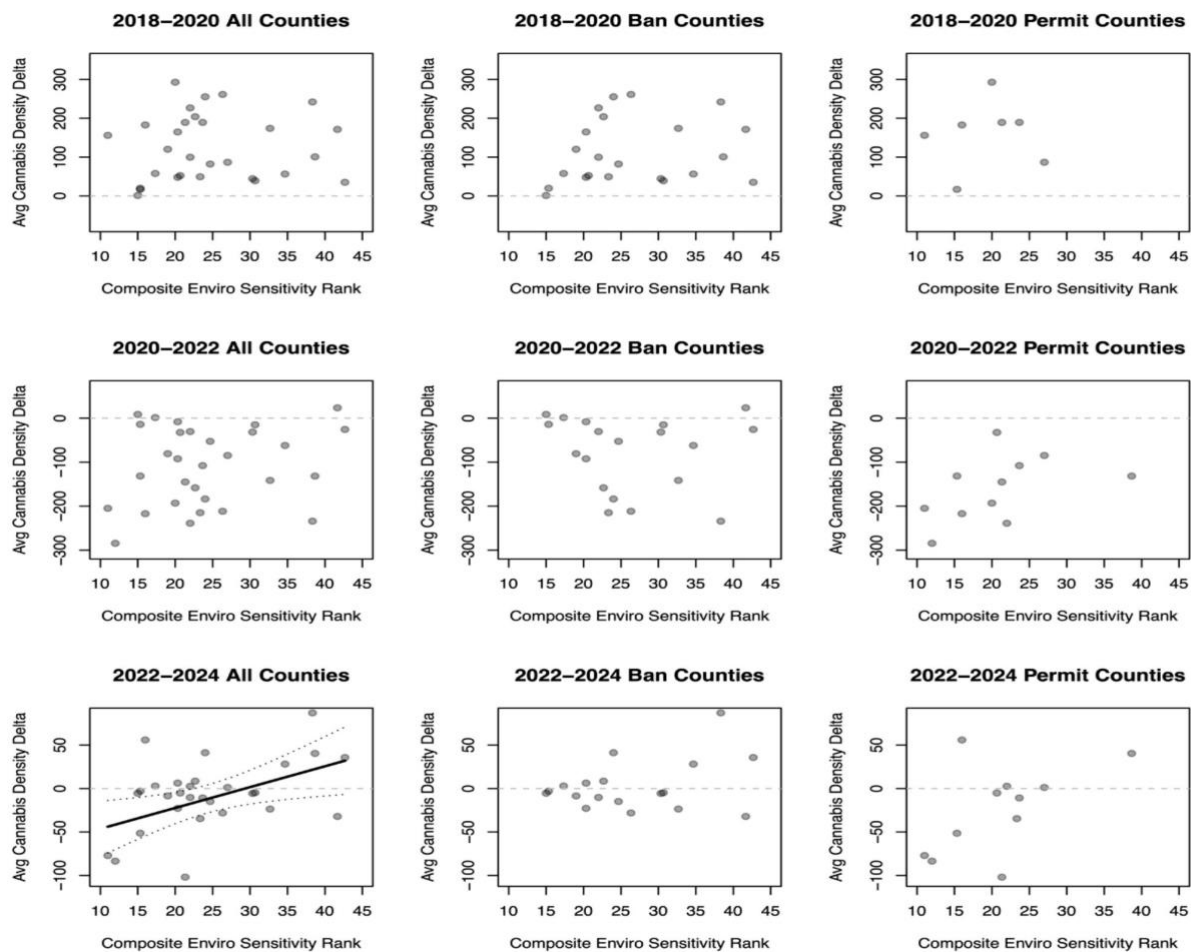
Environmental Impact Analysis

In the first two time periods (2018–2020 and 2020–2022), there was no significant relationship between environmental sensitivity rank and cannabis density delta. However, by the second time period (2020–2022), a trend appeared to be emerging specifically among permit counties of a positive relationship between the change in cannabis density and environmental sensitivity rank. That is, more environmentally sensitive counties experienced greater declines in

cultivation, while less sensitive counties saw smaller decreases (the overall trend was universal decreases during this time period). The sample size in this group ($n = 12$) was too small to detect a statistically significant effect despite a large R^2 value of 0.22, reflecting limited power ($\sim 43\%$) to reach statistical significance. By the third time period (2022–2024), the relationship was strong enough in permit counties (and somewhat emerging in ban counties), that when all counties were analyzed together there was a statistically significant relationship (MLE = 2.40, SE = 0.94). In the third time period, environmentally sensitive counties experienced decreases in unlicensed cultivation, while the least sensitive counties experienced unlicensed increases.

During this third period, it remained clear that the relationship was primarily driven by permit counties ($R^2 = 0.21$), rather than ban counties ($R^2 = 0.09$), with the small sample size of permit counties limiting statistical significance due to low power ($\sim 43\%$). Observation of this pattern *among* permit counties specifically suggests that ban/permit status alone was not solely responsible for reductions in cultivation relative to environmental sensitivity.

Figure 13: Cultivation x Environmental Sensitivity - All, Permit & Ban Counties



5.3 INDOOR PRODUCTION ESTIMATION

5.3.1. ANALYTICAL FRAMEWORK & APPROACH

This project component uses electricity consumption data as a proxy to estimate the distribution of unlicensed indoor cannabis cultivation in California. The primary objective was to determine the extent of such activity by analyzing distinctive patterns of energy usage, particularly in indoor cultivation facilities.

The analytical framework was built on the premise that indoor cannabis cultivation exhibits identifiable energy usage characteristics due to its high energy demands and regimented light cycles. Mills (2012) found that indoor cannabis production requires approximately 2,000 kWh per pound of finished product, with lighting accounting for the majority of energy consumption. More recent work by Summers et al. (2021) confirmed that indoor cultivation's greenhouse gas emissions stem primarily from high-intensity lighting systems operating on strict 12-hour on/off cycles during the flowering phase when plants produce harvestable flower. Research on cannabis photobiology demonstrates these rigid photoperiod requirements, Chandra et al. (2008) and Bilodeau et al. (2019) documented that cannabis is a photoperiod-sensitive plant whose growth stages are triggered by specific light durations, with the flowering phase universally requiring a 12-hour light/12-hour dark cycle to stimulate bud production. This concept is supported by consultations with plant biologists, cannabis cultivators, regulatory enforcement officials, and energy utility representatives who all noted these distinctive diurnal flowering patterns in indoor cultivation operations. The research draws upon a diverse set of sources, including public regulatory data, anonymized utility records, and documented enforcement actions. The process of obtaining and integrating these datasets involved significant coordination and institutional engagement over the length of the project.

The methodology began with the acquisition of data on licensed indoor cannabis cultivation sites from the California Department of Cannabis Control (DCC). This data was used to establish a reference energy profile for legal commercial operations. A machine learning model was then trained using this profile to detect similar patterns in a broader dataset of commercial energy users to enable the identification of likely unlicensed indoor cultivation facilities.

To obtain training data for unlicensed cultivation occurring in residential settings, the project utilized records from warrant-based inspections and requested records from blocks where media-reports indicated indoor cannabis cultivation in homes. Following the identification of specific locations, corresponding historical energy usage data (specifically for the 12 months preceding enforcement action) was requested and analyzed. This analysis produced a representative energy profile of residential indoor cultivation, which was subsequently used in the development of the machine learning model. The model was applied to a randomized sample

of residential energy customers across California to estimate the incidence and geographic distribution of unlicensed residential indoor cultivation.

In summary, the analytical process followed these key steps:

1. **Identification of Known Cultivation Sites:** Data on licensed and unlicensed indoor cultivation operations were obtained from DCC records and documented law enforcement actions, respectively.
2. **Acquisition of Utility Data:** Energy usage data from these known cultivation sites were collected from Pacific Gas & Electric.
3. **Energy Signature Analysis:** The data were analyzed to extract a distinctive energy signature characterized by (a) high energy intensity and (b) a recurring 12-hour on / 12-hour off usage cycle—an operational pattern atypical of most other energy-intensive commercial activities.
4. **Machine Learning Implementation:** These signatures were used to train machine learning models that were then applied to large-scale datasets of commercial and residential utility customers to identify probable unlicensed indoor cannabis cultivation activity.

Institutional Review and Ethical Oversight: Given the sensitivity of the subject, particularly the consideration of potentially unlicensed cannabis operations, we sought to update our existing protocol and obtain Institutional Review Board (IRB) approval from the University of California, Berkeley for this specific portion of the project. The approved protocol outlined data privacy measures, legal boundaries, and public interest value, and was a prerequisite for engaging with utilities and requesting proprietary data.

5.3.2. DATA USED

To develop an energy-based model of indoor cannabis cultivation, datasets were integrated from three primary sources:

- **Licensed Commercial Cultivation Facilities:** Publicly available licensing data from the California Department of Cannabis Control (DCC) was used to identify commercial indoor cultivation sites. This included facilities operating under indoor and mixed-light cultivation licenses, which, while operationally distinct, collectively represent the spectrum of electricity usage patterns typical of licensed indoor cannabis production. The dataset contained spatial information, license type and status, facility type, and operational size, enabling the establishment of energy usage benchmarks based on the scale of cultivation activities.

- **Suspected Unlicensed Cultivation Sites:** Two key efforts were undertaken to identify properties potentially involved in unlicensed indoor cultivation. First, a manual review of police and media sources—including online news archives, local newspapers, court records, and law enforcement press releases—was conducted to compile addresses linked to past enforcement actions related to indoor cannabis cultivation. Second, a confidential list of residential and warehouse addresses was obtained from the DCC, representing sites where unlicensed cultivation had been confirmed through enforcement activity. These locations had been subject to energy-related warrant inspections, indicating that anomalous energy signatures were a factor in investigative efforts.
- **Anonymized Electricity Consumption Data:** Anonymized electricity usage data was requested through the California Public Utilities Commission (CPUC)’s Energy Data Request (EDR) Program from the state’s three major investor-owned utilities: Pacific Gas & Electric (PG&E), Southern California Edison (SCE), and San Diego Gas & Electric (SDG&E). Each utility required a separate application process under the EDRP, including submission of Institutional Review Board (IRB) approval, a detailed project proposal outlining data use and rationale, data protection and encryption protocols, and signed legal agreements. Although requests were initiated in late 2023, as of October 1, 2025, only PG&E had fulfilled the data request.

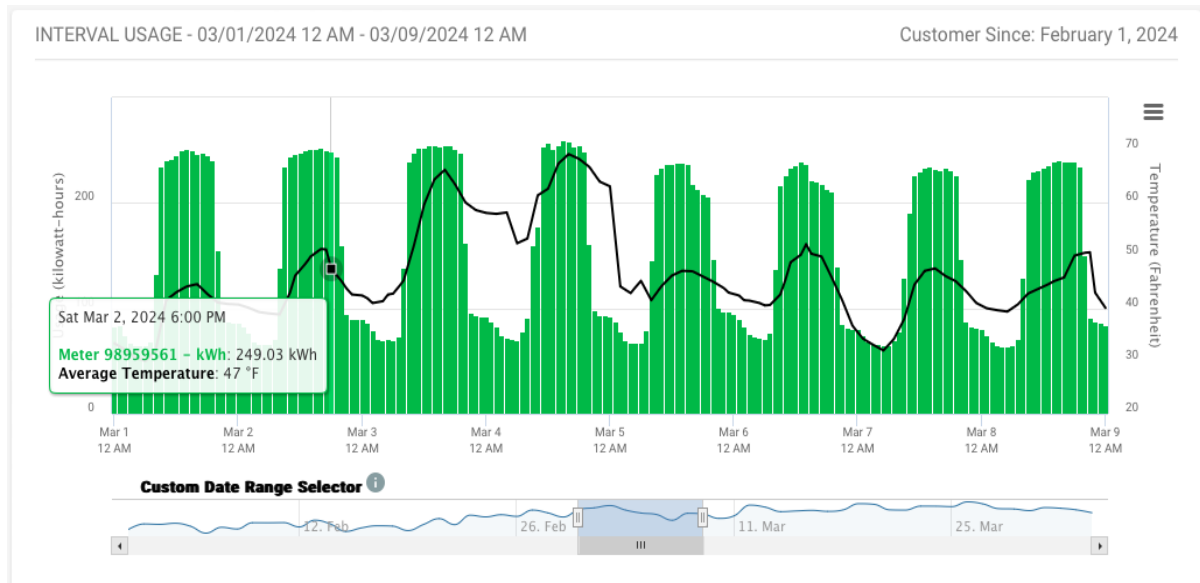
5.3.3. METHODS

Identifying Indoor Cultivation Energy Signature: Cannabis is a photoperiod-sensitive plant, meaning its growth stages are triggered by the duration of light exposure. Indoor cultivators replicate these natural cycles using artificial lighting systems, which creates highly predictable patterns of electricity consumption. Specifically, cannabis is typically grown in two phases: a vegetative phase, during which plants grow from seedlings to maturity under an 18 to 24 hours on, 0 to 6 hours off light cycle; and a flowering phase, during which plants begin producing flower buds, which are harvested and sold as cannabis flower or processed into other products. This stage almost universally occurs on a 12 hours on, 12 hours off cycle, which mimics the shortening photoperiods of late summer and early fall (Moher et al., 2022). These consistent lighting schedules produce a distinctive diurnal load shape in electricity usage data, characterized by sharp, repeating peaks and troughs (Figure 2). This pattern is widely recognized in both industry reports (e.g., Mills 2012; Summers et al. 2021) and in discussions with utility analysts and enforcement personnel as a strong indicator of indoor cannabis cultivation.

Figure 2 shows an example of this load profile. Between March 1 and March 9, 2024, the cultivation facility displayed regular evening spikes in electricity demand, consistent with lighting schedules used during the flowering stage. The green bars represent hourly kilowatt-hour (kWh) usage, while the black line shows average outdoor temperature. The pattern repeats across multiple days, with sustained nightly use and temperature-driven variation linked to

HVAC activity. Based on this energy signature, it was hypothesized that the load profiles of known cannabis cultivation facilities could be used to develop a machine learning model capable of identifying similar energy usage patterns across a broader sample of user accounts.

Figure 14: Indoor Cultivation Energy Signature



Data was obtained from Pacific Gas & Electric (PG&E) consisting of hourly kilowatt-hour (kWh) readings for approximately 300,000 customer accounts, covering the period from January 1, 2020, to December 31, 2023. This dataset included electricity usage for both residential and commercial addresses identified as known cannabis cultivation sites through a records review process. In addition to these known cultivation operations, addresses associated with other high-energy-use facilities, such as data centers, laundromats, hospitals, and agricultural processing facilities, were also submitted for inclusion in the sample.

Given the large dataset of hourly intervals, we aggregated hourly values to daily values to first identify the 30-day period within each year of the maximum amount of energy use. These 30-day windows were then characterized using the following criteria (i.e., variables) to identify a signal of cannabis cultivation:

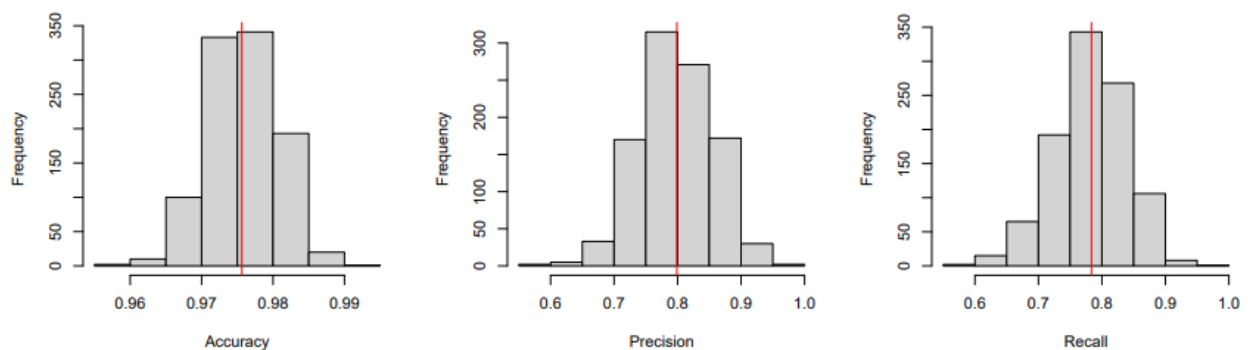
- 1) Proportion of hourly intervals in which kWh remained constant (within 5%, 10%, and 20% of total variation) for at least 6 hours
- 2) Proportion of hourly intervals in which kWh remained constant (within 5%, 10%, and 20% of total variation) for at least 8 hours
- 3) Proportion of hourly intervals in which kWh remained constant (within 5%, 10%, and 20% of total variation) for at least 12 hours

- 4) Proportion of hourly readings within 5%, 10%, and 20% of the max overall reading
- 5) Proportion of hourly readings within 5%, 10%, and 20% of the minimum overall reading
- 6) Periodicity of readings, as determined by the correlation of hourly readings to the daily average reading at each hour

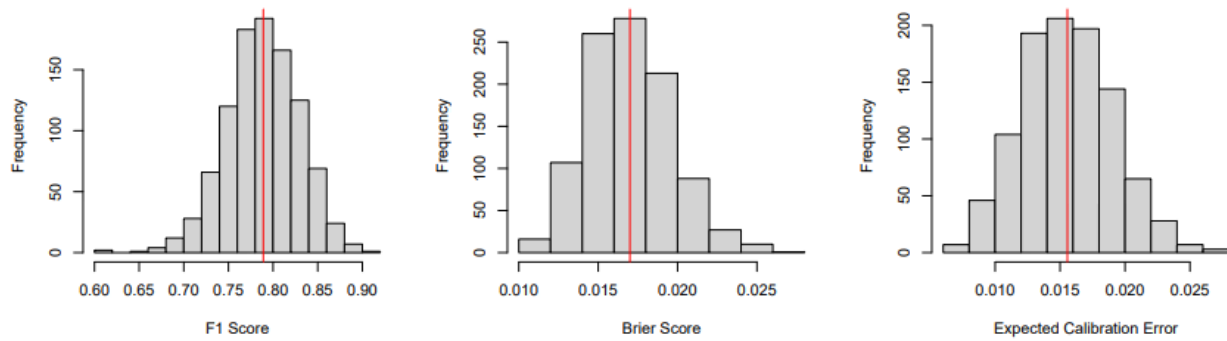
These 16 variables were then used as predictors of cannabis cultivation in a random forest machine learning model implemented using the ranger package in R (citation). In total, there were 223 accounts in the sample confirmed to have been cultivating cannabis. Of the random sample of utility accounts (125,000), approximately 20% were used for model training. Aside from accounts that were specifically identified as high-energy-use facilities, any other account using more than an average of 2 kWh during the 30-day sample period were excluded following the conservative assumption that growing cannabis would require more than this threshold. The same principle was applied in reverse to cannabis accounts, with any “cannabis” account using less than an average of 10 kWh, excluded from the analysis. These “cannabis” and “non-cannabis” accounts were aggregated into a single “labeled” dataset to be used for model training.

The reliability of the model was assessed by evaluating both its predictive performance and the accuracy of its probability estimates. The labeled dataset was divided into training and testing portions, and subjected to 1000 iterations of cross validation to measure model performance. The model’s mean precision, recall, and F1-scores indicated strong predictive performance, and calibration tests, using measures such as the Brier Score and Expected Calibration Error (ECE), showed that the predicted probabilities were consistent with observed outcomes in the test data (i.e., the model was well calibrated).

Figure 15: Random Forest Model Performance Metrics



The prevalence of cannabis in the training set (5%) was necessarily arbitrary, given the lack of data with which to make a true population estimate. Therefore, an important consideration was whether the model’s predictions were biased toward the 5% cannabis prevalence in the training data. This issue, known as prior probability shift, occurs when the



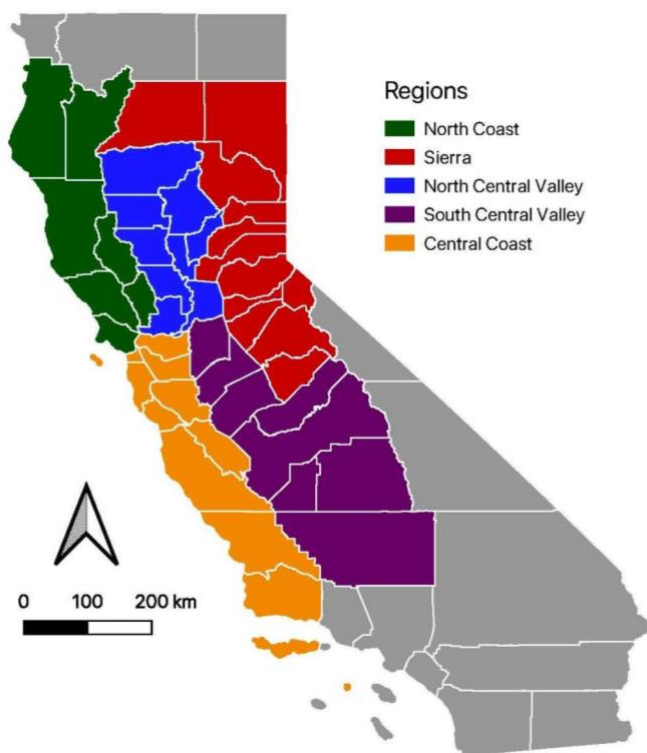
proportion of positive cases differs between the data used to train the model and the population to which it is later applied. If the underlying prevalence changes, the model's predicted probabilities may no longer correspond to the true likelihood of a case. To test for this, the model was applied to simulated datasets with different known prevalence levels. These simulated datasets were generated prior to and separate from model training, using a reserved 20% of the entire labeled dataset. These simulated tests (with known prevalence) showed that the model tended to slightly overestimate prevalence when applied to very low-prevalence populations and underestimate it when applied to higher-prevalence ones, confirming that the model's predictions were affected by the training data's baseline rate.

To account for this, a Bayesian prior adjustment was applied to the model's predicted probabilities. This statistical correction adjusts the model's outputs so they reflect a population with a different overall prevalence, without requiring the model to be retrained. The method, which is well established in both epidemiological and machine learning research (Saerens et al., 2002; Forman, 2008), is based on Bayes' theorem and assumes that the relationship between predictors and outcomes remains stable, while the overall prevalence may differ. In practical terms, the Random Forest model produces a probability of cannabis presence for each observation, but those probabilities are influenced by the 5% prevalence of the training data. To account for this, a Bayesian prior adjustment is applied to the model's predicted probabilities. This method modifies the model's outputs to reflect a different overall prevalence than that seen in the training data, without changing the model itself. It draws on Bayes' theorem, which provides a way to combine the model's predictions with prior information about how common the outcome is in a given population. In this context, the adjustment reweights the probabilities so that they align with an assumed new overall rate of cannabis presence. The approach assumes that the relationships between the predictors and the outcome remain stable across populations, while allowing the total number of cases to differ. In practical terms, this means the model's estimated prevalences are scaled to what would be expected if the population's true prevalence were lower or higher than in the data used to train the model.

Because the true prevalence of cannabis in the target population cannot be known from available data, predictions were made over a range of assumed prevalence values from 0.25% to

1.75%, in increments of 0.25%. For each assumed level, the Bayesian adjustment was applied to the model's predictions to produce adjusted probabilities for every observation. These adjusted probabilities were then averaged within each subgroup (region by year) to generate prevalence estimates under each assumed scenario. This approach provides a transparent and statistically grounded way to explore how estimated prevalence might vary across a plausible range of true population rates. Because of inconsistencies and missing data at the county level, results are reported at the aggregated regional level. This aggregation reduces the influence of local data gaps and improves the stability of estimates, allowing for more reliable regional-level comparisons across years.

Figure 16: Counties and Regions Included in Data Record Analysis



4. RESULTS

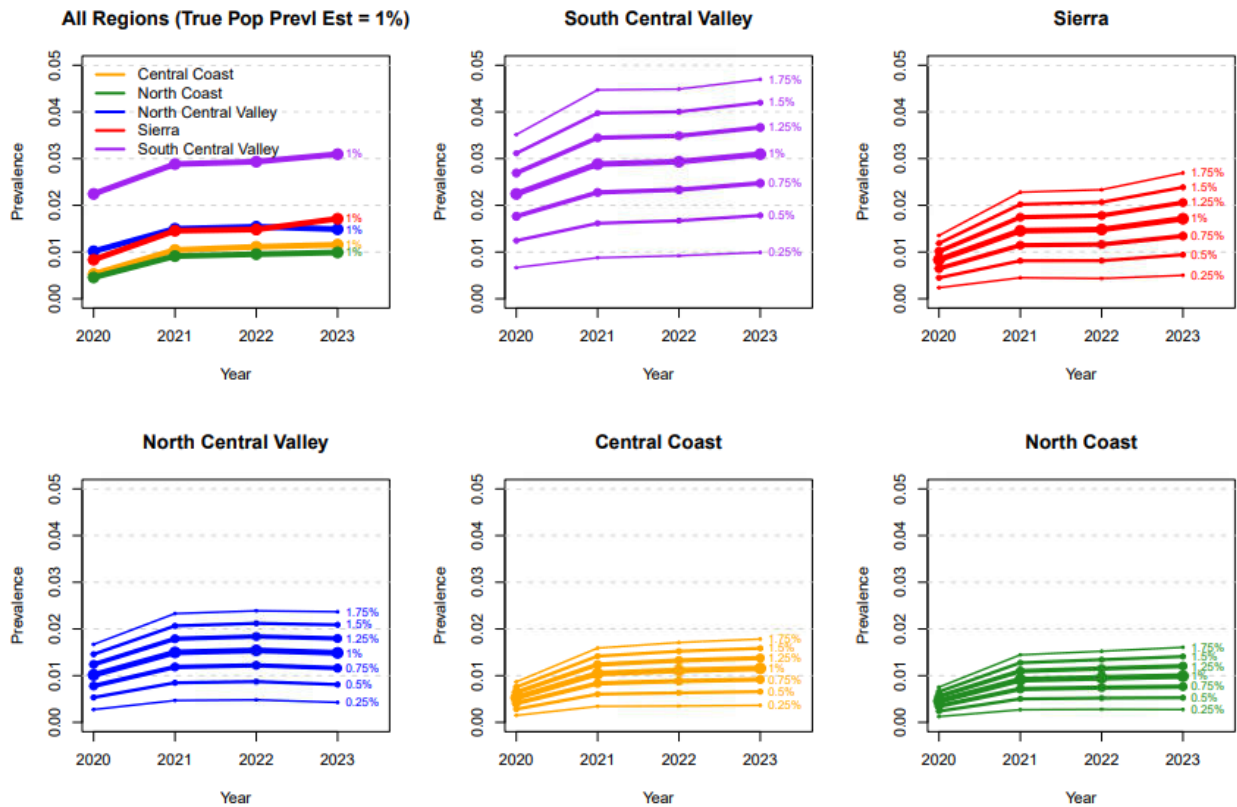
Across all regions, adjusted cannabis prevalence estimates were evaluated under a range of assumed true overall population prevalence levels (0.25–1.75%). For reporting clarity, results are expressed as percentages corresponding to the lower, midpoint, and upper bounds of this range. Each estimate is presented as $x\%$ ($y\text{--}z\%$), where $x\%$ represents the value under the 1% assumption, bracketed by the 0.25% and 1.75% assumptions.

Overall, the most dramatic increase in estimated prevalence across all regions occurred between 2020 and 2021, followed by more gradual changes in later years. The South Central Valley and Sierra regions continued to show sustained growth through 2023, while the other regions appeared to have largely plateaued after the initial increase in 2021. Prevalence in the North Coast region remained comparatively low, but showed steady increases across the four-year period, beginning at 0.46% (0.12%–0.76%) in 2020 and rising to 0.96% (0.28%–1.51%) in 2021, 0.98% (0.29%–1.57%) in 2022, and 1.04% (0.29%–1.69%) in 2023. The Central Coast exhibited a similar upward trend, but at slightly higher levels, with estimates of 0.53% (0.15%–0.86%) in 2020, 1.05% (0.34%–1.59%) in 2021, 1.12% (0.36%–

1.72%) in 2022, and 1.16% (0.36%–1.79%) in 2023. Both regions show incremental year-over-year increases, with the most substantial gains occurring between 2020 and 2021.

The North and South Central Valley regions displayed higher overall prevalence levels, particularly in the South. In the North Central Valley, estimates increased from 1.00% (0.27%–1.64%) in 2020 to 1.49% (0.47%–2.30%) in 2021, 1.54% (0.48%–2.39%) in 2022, and 1.48% (0.43%–2.36%) in 2023. The South Central Valley exhibited by far the highest values observed across all regions, beginning at 2.24% (0.67%–3.50%) in 2020 and rising steadily to 2.87% (0.88%–4.44%) in 2021, 2.95% (0.93%–4.50%) in 2022, and 3.09% (0.99%–4.68%) in 2023. In the Sierra region, prevalence rose more gradually, but consistently from 0.70% (0.20%–1.14%) in 2020 to 1.26% (0.39%–1.97%) in 2021, 1.31% (0.38%–2.07%) in 2022, and 1.46% (0.42%–2.30%) in 2023, reflecting steady year-to-year growth.

Figure 17: Indoor Cultivation Prevalence (2020-23)



5.4 LICENSED MARKET ANALYSIS

5.4.1 ANALYTICAL FRAMEWORK

For our analysis, we looked at the harvest data contained in the METRC track and trace system and entered by cultivators to reflect the number of plants per harvests, number of harvests per year, and weight of each harvest. This allowed us to note differences in plant counts, harvest numbers and weight for various license types, as well as specific counties and geographical regions. This differs from the methods used in a recent report prepared by ERA Economics, which analyzed cultivation tax data to estimate licensed production from 2018-2021 (the cultivation tax program was suspended in 2022). This method relied on reporting done by cultivators as to how much cannabis they produced and then stratified by the plant material (e.g. leaves vs. flowers) with each plant component charged a different amount of tax. The ERA report also looked at sales receipts on the retail side to track backwards to estimate production levels.

For methods deployed by ERA and methods used for this study, a major limitation was data quality. This is expounded upon in the Limitations section. The directionality of the analyses impacted the estimates from both groups, as diversion at the cultivation level can happen prior to tax payments, resulting in our harvest estimates being higher than ERA's post tax estimates. Furthermore, product sold at the retail level does not include diverted product, product that is brought to retail and never sold, or is used for promotional purposes, further shrinking the estimates of licensed production made by ERA.

We aimed to present a fuller picture of how the amount of licensed product produced compared to the amount of whole flower sold in dispensaries as reported through PoS systems. We also used self-reporting of flower amounts consumed annually by CA cannabis consumers. To do this, we used a sample of PoS data as well as a consumer survey administered to a national sample, including California.

We also used Transfer Data from the CTTTP database to track the most common manifest origins and destinations. This allowed us to compare where the most cannabis is grown, to where most transfer manifests originate and end up.

5.4.2. DATA USED

We utilized consumer and point-of-sale data from New Frontier Data (NFD), and inferences from California Track and Trace Program (CTTP) data to produce average estimates of production for each license type and indoor unlicensed output as well. (California has 20 different licenses available for cultivation categorized by size: large, medium, small, specialty, and specialty cottage. These categories are then divided based on cultivation method (outdoor³⁴,

³⁴ Outdoor licenses grow cannabis outside without using any artificial lighting.

mixed-light³⁵, or indoor³⁶.) NFD utilized CTPP data to analyze total production amounts. These figures from 2022-2023 were compared with consumer survey and POS data to evaluate these data sources as indicators of cannabis flower purchased and consumed through the regulated system. Consumer data was analyzed to assess reliance on the licensed and unlicensed markets and to compare differences in acquisition and consumption patterns across licensed and unlicensed markets. These figures allowed us to compare licensed vs. unlicensed production and consumption and to cross-check our production estimates with trends in consumer sourcing and potential diversion from the licensed supply chain. It also highlighted the issues with using multiple data sets to triangulate data with vulnerabilities in reliability and validity. The CTPP data was also used to track the origin and destination of cannabis manifests.

Obtaining METRC Data: To assess licensed cannabis harvests in California from 2018 to 2024, harvest data from the seed-to-sale tracking program METRC were received from the Department of Cannabis Control. We intended to document trends from 2018, but the earliest data available from the DCC was from January 2019.

5.4.3. METHODS

We referred to the CTPP data to estimate the amount of cannabis grown in the licensed market in 2022-2023. This data is reported in weight from harvested plants. We calculated the weight of the flower being produced for whole flower sales and compared it against the weight of whole flower sold through retailers (minus prerolls) according to the CTPP.

Analyzed Retail Sales: To triangulate the sales data, we examined a sample of 419 licensed retailers in California and determined the volume of cannabis flower sold for the 2022-2023 period. We then obtained licensing numbers from the DCC for the number of retailers licensed in January and December 2022 and took the average. We removed the lowest and highest 5% of retailers by sales volume to account for outliers, for a final sample of 377. The sample of retailers was generalized to the average number of retailers open during that year to arrive at the final estimate (N=1622.5) While we are able to see the weight of the flower sold in the PoS system, we are not able to see the weight for prerolls sold (preroll weights can vary from .25 grams to 1 gram) so we omitted prerolls in the analysis. In the PoS system, a preroll is entered the same way regardless of weight.

Estimated Consumption: To estimate consumption amounts, we first narrowed our sample of 497 California consumers by selecting those who said they use cannabis flower and those who said they primarily source from regulated sources. We then looked at the range of consumption (from once or twice a year to multiple times per day) as well as the amount of

³⁵ Mixed-light licenses grow cannabis in a: Greenhouse, Hoop-house, Glasshouse, Conservatory, Hothouse or Other similar structure.

³⁶ Indoor licenses grow cannabis in a permanent structure using at least 25 watts of artificial light per square foot.

flower reported by consumers as their average monthly intake. From this, we determined the low and high ends of flower consumption per year. To generalize to the entire California population of consumers, we used the consumption rate in California for those aged 18 and above and applied it to the entire population of Californians aged 18 and above. Then, from that sample, we applied the proportion of consumers who said they consume cannabis flower (as opposed to only non-flower products) and those who primarily source from regulated businesses. This gave us a low and high estimate for annual consumption of cannabis flower by weight, for consumers in California 18+. We did the same process for consumers who say they primarily source from outside the regulated market. We included those 18+ in our sample because consumers 18+ can access cannabis retailers with a medical cannabis card.

Analyzing Harvest Data: The data was provided as a series of monthly CSV files. Each CSV covered one month of data, and each file had 25 columns. Data was downloaded and ingested into Snowflake software, which was consolidated into a master table called “DCC_HARVEST” and analyzed in a separate software, Sigma. Regarding the data makeup, columns 1-13 were specific to the harvest batch, while columns 14-25 were specific to each package generated from the harvest batch. These first 13 columns were separated into a table labeled “DCC_HARVEST_FIRST.” Unique identifiers (UUIDs) were created for each individual harvest based on the columns “HarvestLicenseNumber” & “HarvestBatchName.” From there, the first 13 columns were split into a separate table for analysis. To calculate the number of and weight from harvests, several columns were added to these original 13, including: UUID; Maximum square footage allowed by each Harvester Facility Type; Region each City / County falls under. Regions were selected based on categorization in other areas of the study (Central Coast, North Coast, San Francisco Bay Area, Sierra Foothills/Northern California, San Joaquin Valley); Standardized Unit of Measurement for Harvested Weight; and Packaged Weight Harvested Per Plant.

When analyzing harvests by license type, several license types were filtered because the products they produced were not mature flower, but other plant components like seeds and clones. These included Nurseries & Microbusiness Licenses.

Data Cleaning and Analysis: Some data anomalies were identified and accounted for during the data cleaning and analysis. Several outliers were identified during initial analysis. For example, Harvest Batch “Mendo Breath – 05/10/21”, harvested from a small Mixed Light Tier 1 facility in Monterey County, claimed 720 plants produced 413,414,949.36 kg of flower. This was an unrealistic number because Small Mixed Light Tier 1 average weight per harvest is 154kg, with an average of 471 plants per harvest. Lake County data was also excluded due to the vast majority of Harvest Batch UUIDs accounting for a single plant. It is extremely unlikely that a harvest would contain only one plant. The assumption is that this harvest was broken up by plant in the data, and each plant was granted its own entry into METRC. Filters were also applied based on Packaged Weight Per Plant. Several Harvest Batches had negative or null values. On

the higher end, some harvests reported 14+ KG of dried flower per plant. The top 5% of Harvest Batches by Packaged Weight Per Plant were filtered out. (See Limitations and METRC Data Issues in Appendix for additional details).

After the data was ingested, cleaned, and normalized, the following values were calculated by Region / County / License Type:

- Distinct UUIDs
- Total KG Harvested
- Avg Harvested KG by License Type
- Total Harvested Plant Count
- Avg Plants per Harvest
- Avg KG per Plant

Data was reported by license type, county, and region for the state.

Analyzing Transfer Data: While the DCC dashboards can provide data on the amount of cannabis produced for continuation in the supply chain, no data shows where in the supply chain the cannabis goes next. To address this gap in supply chain movement data, we analyzed CTTTP manifest data for the study period. Manifest data was reported quarterly for the years 2019-2023. Data for the period of January 2022 – September 2022 was not available. The data was provided as a series of monthly CSVs. Each CSV covered one month of data, and each file had 34 columns. Data was downloaded and ingested into Snowflake, where it was consolidated into a master table called “DCC_TRANSFER” and analyzed in Sigma. Data was reported in April, July and October for each year. We noted the number of manifests by county of origin and county of destination. Before Q3 2022, most transfers included a null value for both “Origin County” and “Destination County” of transfers. These values were updated based on the zip code of the facility in question. Transfers from each Origin Facility Type to each Destination Facility Type were extracted on an annual, monthly, and total time frame. The number of distinct manifests was also specifically identified from Harvest Origin Facilities and their destinations over time. We divided the analyses into four areas: regions, the top ten counties for manifest origin and destination, counties of interest, and counties not included in the counties of interest.

5.4.4. RESULTS

According to CTTTP and the DCC, there were approximately 1,680 tons of cannabis harvested for continuation in the supply chain in 2022 (i.e. 3.36m lbs or 1.524m kg). This includes cannabis that went to a manufacturer as well as cannabis that was sold as whole flower

through a retailer. When looking at the PoS data, there were 466.6 tons of cannabis flower sold in 2022, not including prerolls. According to the consumer self-report, there was an average of 1,402 tons of cannabis flower consumed in 2022 by people who state they primarily source from regulated businesses (low end = 756.4; high end = 1316.86). For people who report mainly using unlicensed sources (including dealers and family/friends), there was an average of 1007.68 tons of cannabis flower consumed in 2022 (low end = 744.02; high end = 1271.35).

Table 8: Consumer Self-Reporting on Consumption & Source

Source Category	Average Consumption (tons)	Low End (tons)	High End (tons)
Licensed Retailers	1,402	756.4	1,316.86
Unlicensed Sources (dealers, family/friends)	1,007.68	744.02	1,271.35

As can be seen in the difference between the production data and sales and consumption data, a significant amount of the cannabis being produced in California is going into making manufactured products, meaning it is either packaged into prerolls, or becoming oil, isolate, distillate or other forms of isolated cannabinoids to be used in the making of vape cartridges, gummies and other products. The amount of raw product needed to make a manufactured product will vary based on cannabinoid density and method of extraction. There are not measurements of flower contained in pre-rolls or amounts of flower used to produce manufactured products, so this study was limited to tracing flower and inferring amounts for other kinds of products. The gap between production and consumption data could indicate lost or diverted product, as with “burner distros,” or entities using DCC distributor license numbers that have not been removed from CTP systems (Reisman, 2025).

Also notable is the difference between self-report measures of consumption and sales data from retailers. Measuring the use of an intoxicating substance via self-reporting has been shown to have reliability and validity issues. Often, people underreport their consumption because they do not remember, or because the vessel they use for consumption varies in size across different consumption sessions (Dawson 2003). There are also limitations in relying on PoS data to calculate the weight of prerolls sold because the weight of the preroll is usually not entered into the PoS system; rather, it is sold as one unit, regardless of weight. Furthermore, just because an individual is buying a certain amount of cannabis, does not mean they are using the entirety of what they buy. Especially prior to COVID, sharing joints was common, so someone may have bought a preroll, but shared it with three other people which makes self-reporting difficult beyond consumption sessions per day. Currently, for cannabis, there has not been an established rate of over/under reporting. When looking at alcohol, more accurate rates have been attempted by having the consumer sample use their own vessels, including ice and mixers and then measuring the amount of actual alcohol that is being added to the glass. Similarly to edibles,

it is easier to estimate consumption with standardized doses like a bottle of beer, but wine and mixed cocktails present barriers similar to raw flower and prerolls.

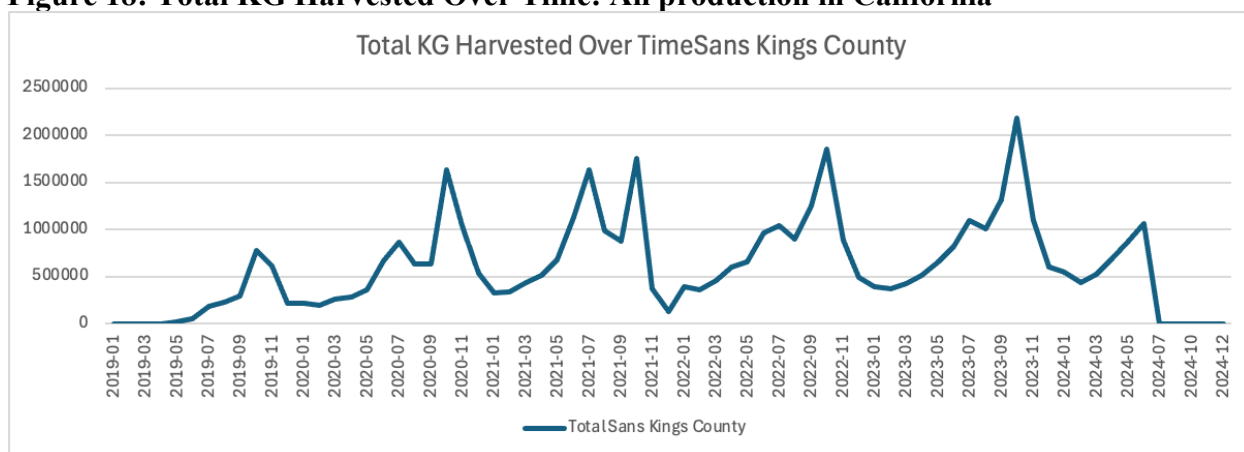
Harvest Data by License Type

Deploying the methods described [above](#) total harvest weight (in KG) per license between January 2019 and July 2024 was calculated, as well as average harvest weight (in KG) per license type and average number of plants per harvest.³⁷ Between 2019 and 2024, 50.4M KG of cannabis was reported by cultivators as harvested in METRC. Small outdoor licensees produced the most (18.2M KG), followed by Small mixed-light tier 1 (13.3M KG). The smallest amount reported came from large mixed-light tier 2 (771 KG) but that was also the category with the fewest harvests reported (16).³⁸

The Small mixed-light tier produced the largest number of harvests (86.4K), followed by small indoor (78.6K) and medium indoor (61.9K). Mixed-light and indoor cultivation facilities can produce multiple harvests per year, while outdoor facilities are limited to one, perhaps two if light deprivation is used. Large outdoor cultivation licensees reported the highest average weight per harvest at 763 KG, followed by small outdoor with 315 KG and large mixed-light tier 1 at 284 KG.

Small mixed-light tier one licensees reported growing the most plants over the study period (40.6M), followed by small outdoor (25.9M) and small indoor (17.3M). This tracks with the number of harvests reported, the total weight harvested and the average weight per harvest. However, because of a smaller number of total harvests, the highest number of average plants per harvest was reported by large indoor licensees (1.7K), followed by large outdoor (1.2K), and large mixed-light tier 1 (659). (See Appendix 2.4.1 for full table of harvest data by license type).

Figure 18: Total KG Harvested Over Time: All production in California



³⁷ See Appendix 2.4 on limitations with Kings and Lake County data irregularities and subsequent exclusion from analysis.

³⁸ It should be noted that the DCC began issuing Large licenses in 2023.

Figure 18 shows the total KG harvested by licensed facilities over the study period ending in July, 2024. Those licensees that did report a decline in flower production averaged - 48% reduction over the study period. Otherwise, there was a small boost during the periods when the outdoor product was harvested, usually September to November. There was a dip in production in November 2021 which was the lowest point of production during the study period. This followed two spikes in production, one in the expected outdoor harvest time of September to November, but another earlier that year from May to July.

Harvest Data by County

Below is a summary of which types of licenses reported harvests in which counties during the study period (including municipalities within counties). (Not every county allows for every type of cultivation license.) No counties reported harvests from large indoor licenses. See Appendix 2.4 for the types of cultivation licenses issued by counties of interest and for the complete harvest data.

Overall, Santa Barbara accounted for the most harvests with just over 72K, followed by Monterey with 63.4K, Los Angeles county with 59.7k, 41k from Humboldt, Sacramento with 30.8k and 26.8K from Mendocino. Marin County reported the fewest harvests (2), followed by El Dorado (13), Siskiyou (32), Mono (73) and Del Norte (125). License types were limited in these counties; for instance El Dorado and Siskiyou only reported one type and Del Norte reported two. Santa Barbara was the top producer by weight, with over 18m kg of cannabis harvested, followed by Monterey with 8.7m, Humboldt with 2.6m kg, Los Angeles and Mendocino, both with 1.4m kg, and Riverside County with 1m kg. On the low side, Siskiyou reported harvesting 501 kg, El Dorado 2.7k kg and Del Norte 4.1k kg.

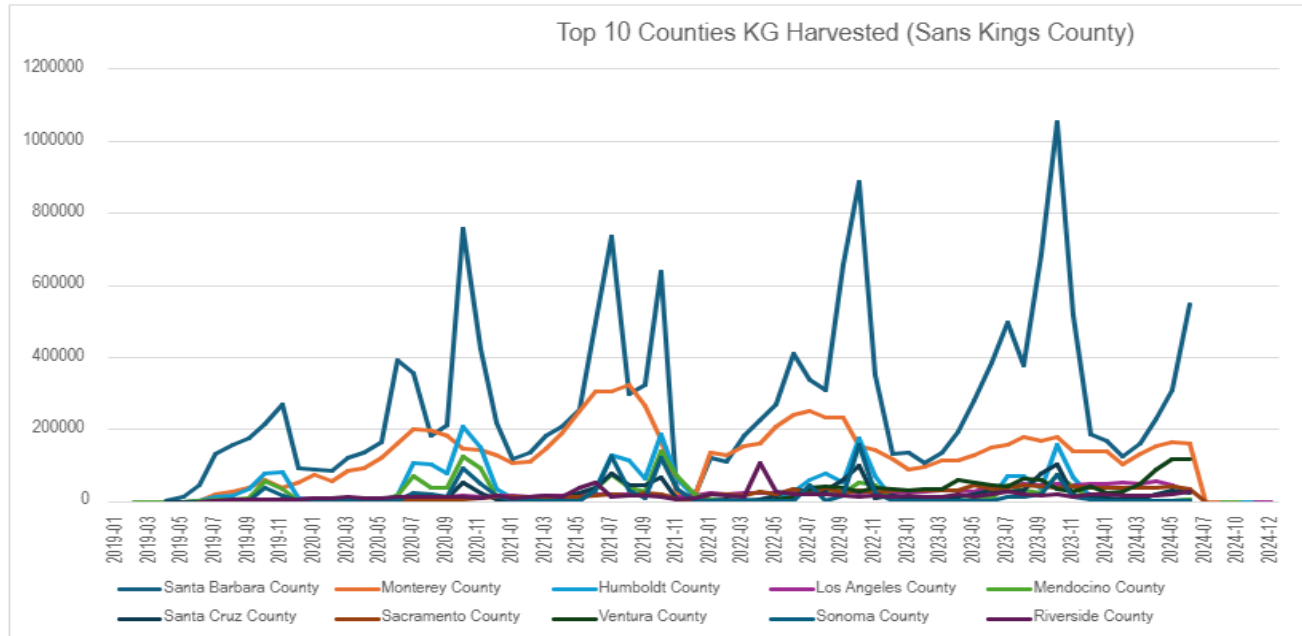
As mentioned in a previous section, Kings County is an anomaly. Although reporting just 1221 harvests, they reported the third highest harvest weight at 7.1M KG, equating to 2333 plants per harvest, a total far above the other counties. Also of note is Inyo County. Reporting just 275 harvests, they also reported 1175 plants per harvest, far above the other counties, with the exception of Ventura County, which reported an average of 1328 plants per harvest from their 2541 harvests (See Appendix 2.4 for the full harvest data by additional counties).

The outdoor nature of harvesting can be seen in counties like Humboldt and Mendocino, which show spikes during the outdoor harvest season (October-November), but remain dormant for most of the year. Overall, Santa Barbara dominates the cultivation landscape in California due to its use of large, all-season greenhouses to produce harvests every few months.

Sub-Sample Analysis: We selected 12 counties (plus Los Angeles) to analyze closely, as these counties aligned with Cannavision and case study analyses. These counties were:

Calaveras, Humboldt, Mendocino, Trinity, Siskiyou, Shasta, San Bernardino, Riverside, Del Norte, San Diego, Nevada, El Dorado and Los Angeles.

Figure 19: Total KG Harvested Over Time: Top 10 producing counties (excluding Kings and Lake County)



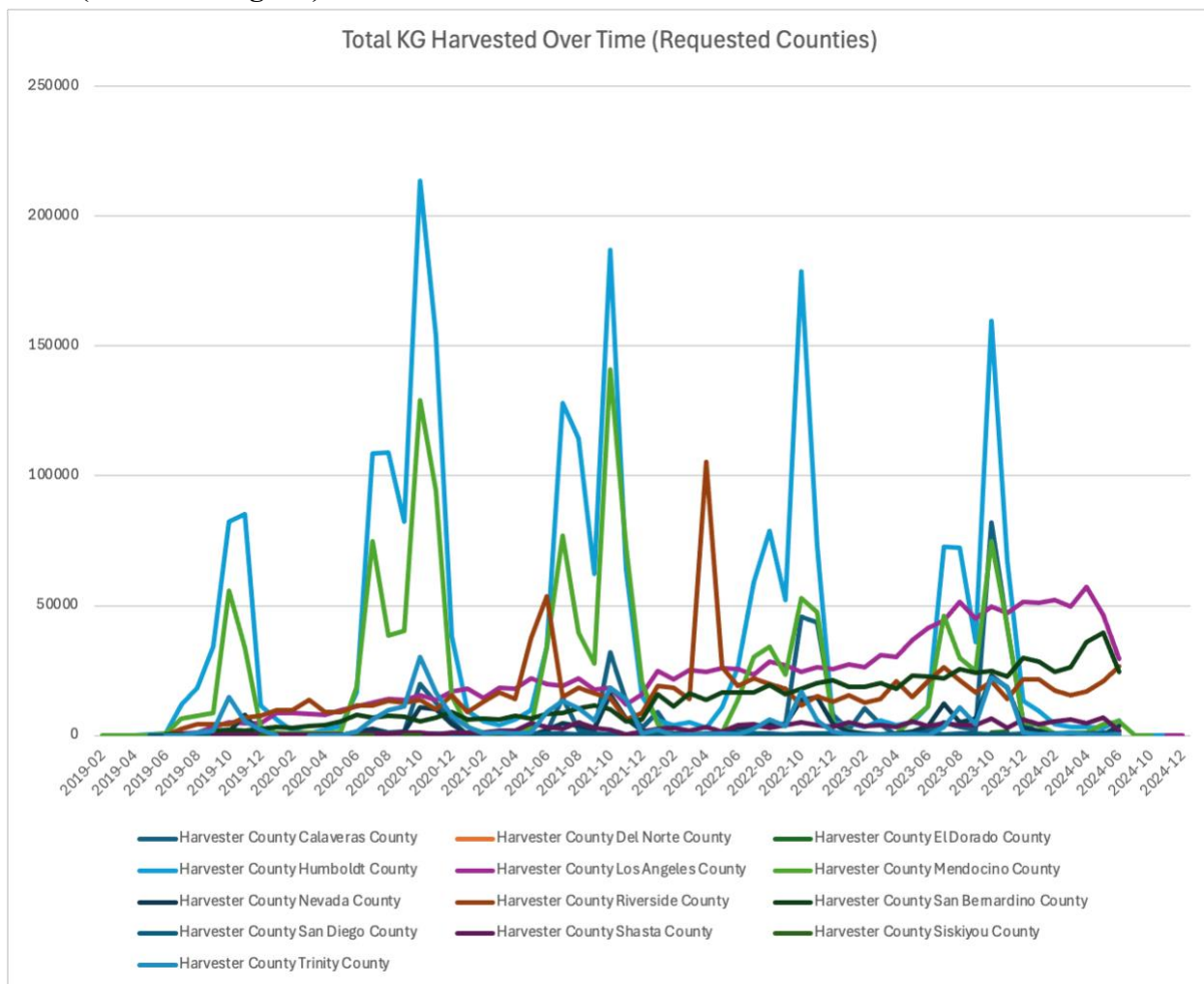
Of the 13 study counties, specialty indoor was reported in all but El Dorado and Trinity counties. Large mixed-light tier 1 was only reported in Calaveras and Humboldt counties and large mixed-light tier 2 was only reported in Humboldt County. Siskiyou only reported harvests from specialty indoor licenses and El Dorado only from medium outdoor licenses. Humboldt County had harvests from the widest variety of license types, reporting for everything except large and medium indoor license types.

Even though El Dorado County only reported 13 harvests from medium outdoor licensees, they also had the largest average weight per harvest at 208 KG. The smallest average weight per harvest came from Siskiyou County at 16KG. Interestingly, Los Angeles County, which has one of the widest ranges of license types and the most overall harvests and harvest weight was on the lower end of average weight per harvest at 24 KG, likely because of the density of indoor licenses

Humboldt County reported the most plants harvested during the study period (14.4M) followed by Los Angeles with 11.5M. Although Mendocino was third in number of harvests and total weight harvested, they were 5th in number of plants (4.5M), suggesting that Mendocino farmers are getting more yielded weight per plant than in other counties. And although Del Norte has harvests reported from only two license types and is on the low end for all other metrics, they had the second highest number of average plants per harvest at 353, topped only by San Diego at

380. El Dorado reported the lowest number of plants per harvest at 118, followed by Mendocino at 169 and Nevada at 190. Counties favoring indoor licenses will have higher number of harvests per year, with more plants per harvest, but likely less weight per plant since indoor plants tend to be smaller. While regions that traditionally grow outdoors may have fewer harvests per year, bigger plants, resulting in higher weights per plant.

Figure 20: Total KG Harvested Over Time: 13 Counties Overlapping with Cannavision Data (Plus Los Angeles)



Harvest Data by Region

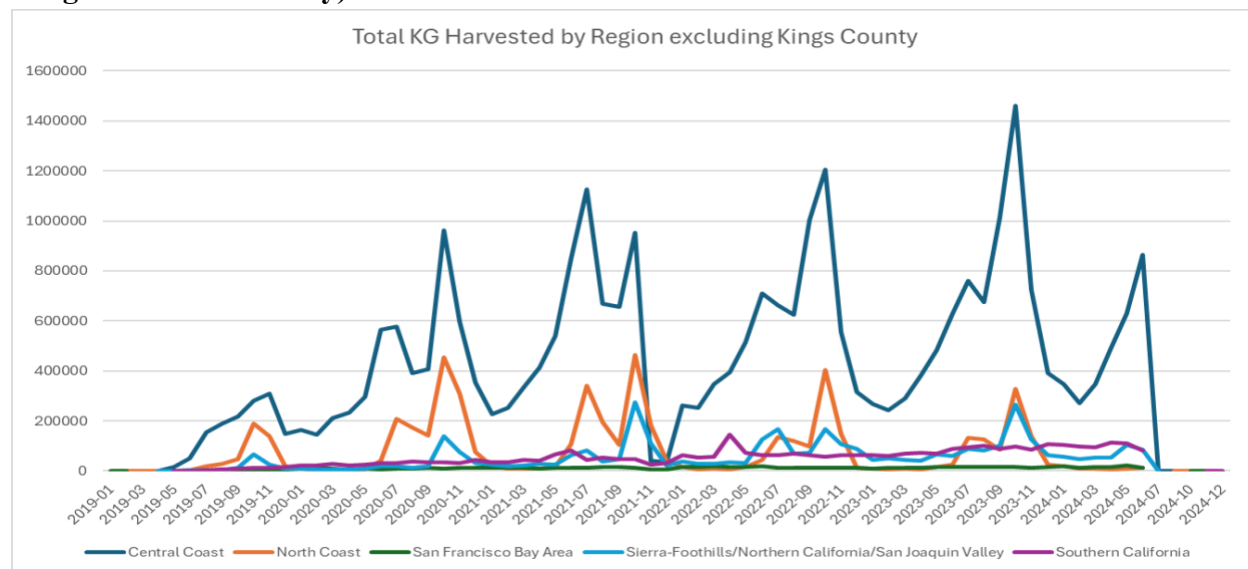
To explore regional differences in cannabis harvests, the counties permitting cultivation were categorized by region based on the US Census. Figure 20 provides harvest data by region.³⁹

³⁹ The data for the Sierra Foothills region contains Kings County, which has already been identified as an outlier and may represent errors in the data. Kings County has been removed from the line graph to better view the trends over time for the regions (See Appendix 2.4 for the complete harvest data by geographical region).

The Central Coast region reported the most harvests during the study period with just over 150K harvests. The San Francisco Bay Area region reported the fewest with just over 27K. The Central Coast also led with total KG harvested with 29.4M KG and the San Francisco Bay Area had the least with 712K. The Sierra Foothills region reported over 1M KG in weight harvested, but their number of harvests was 63.9K, the second lowest out of the five regions. The Central Coast, by far, reported the highest number of harvested plants with 72.4M, followed by the North Coast and Southern California, both with just over 23M. The Central Coast also had the highest number of plants per harvest at 480 and Southern California the lowest with 191.

The data conveys regional differences. Southern California counties like Los Angeles, San Bernardino, Riverside and San Diego mostly license indoor facilities, which harvest multiple times per year and therefore have higher numbers of harvest. Central Coast region has large mixed-light and outdoor operators, allowing both large numbers of harvest and kilograms harvested. Primarily driven by outdoor farms in Humboldt and Mendocino counties, the North Coast reports fewer harvests than the Central Coast and Southern California, likely because outdoor farms only do one harvest a year. The North Coast is second in the number of plants harvested only to the Central Coast. The San Francisco Bay Area has not licensed substantial cultivation and licenses smaller sites, resulting in lower numbers of harvests. Variations between indoor, outdoor, and mixed light harvest times give each region a different harvest rhythm. For instance, Southern California shows consistent harvests while Central Coast and North Coast (largely outdoor) shows seasonal rhythms.

Figure 21: Total KG Harvested Over Time: California geographical regions (excluding Kings and Lake County)



Regional Data

As shown in Figure 22 there were 3.38M manifests created for the products in the state of California between April 2019 and October 2023. Southern California accounted for 47% of these manifests. The San Francisco Bay Area was next with 15%, followed by the Sierra Foothills/Northern California/San Joaquin Valley and Central Coast regions with 13% each, and the North Coast with just 1%, indicating that most supply chain movement occurs in urban areas (See Appendix 2.4 for a table of the manifests by region of origin).

A total of 3.36M manifests were received during the study period. The counties of receipt were in the same order as the counties of origin in terms of % of total manifests received. Los Angeles (49%), San Francisco Bay Area (18%), Sierra Foothills/Northern California/San Joaquin Valley (14%), Central Coast (12%) and the North Coast (<1%). Graph 6 presents this data as a stacked bar chart.

Figure 22: Manifests by Region of Origin

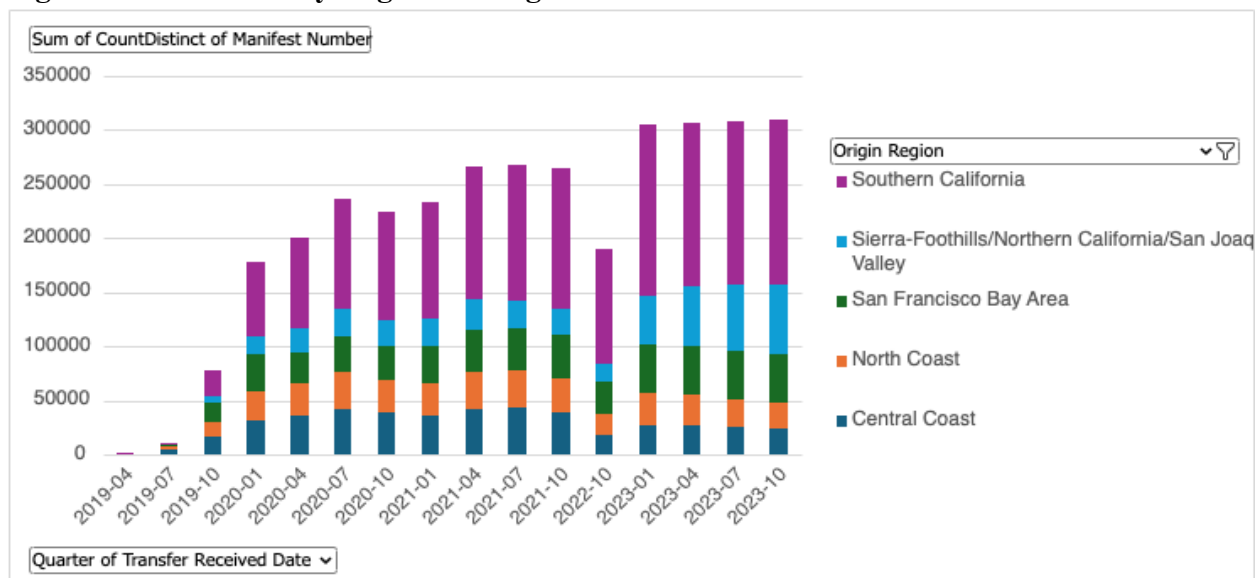
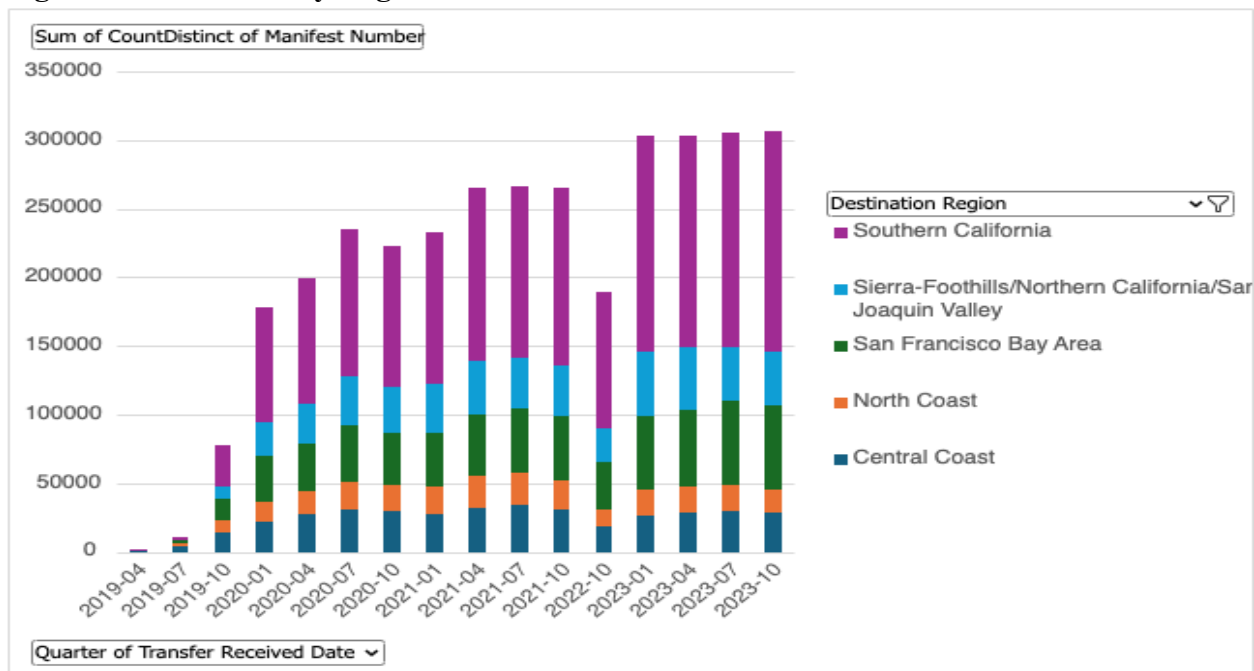


Figure 23: Manifests by Region of Destination



Top 10 Counties

Figure 24 displays the number of manifests for the top 10 counties where they originated for the study period. There were 2.8M manifests sent from their county of origin during the study period. Los Angeles had the most manifests with 39%, followed by Alameda County with 15% and Riverside County with 7%. We see the same dip in October of 2022.

Figure 24: Manifests for Top 10 Counties of Origin

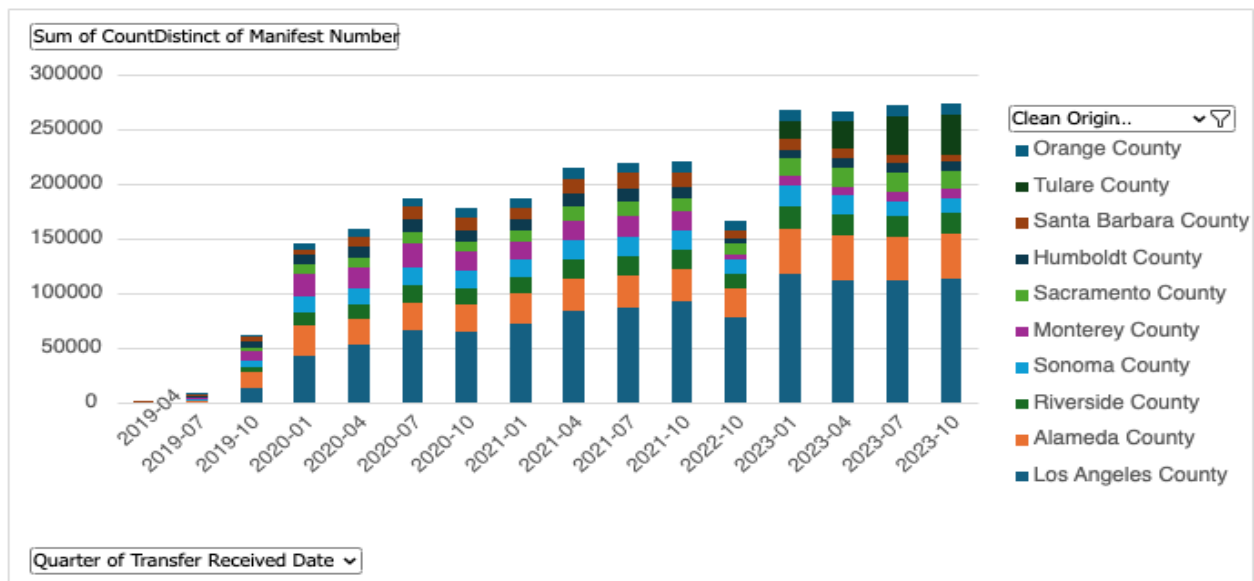
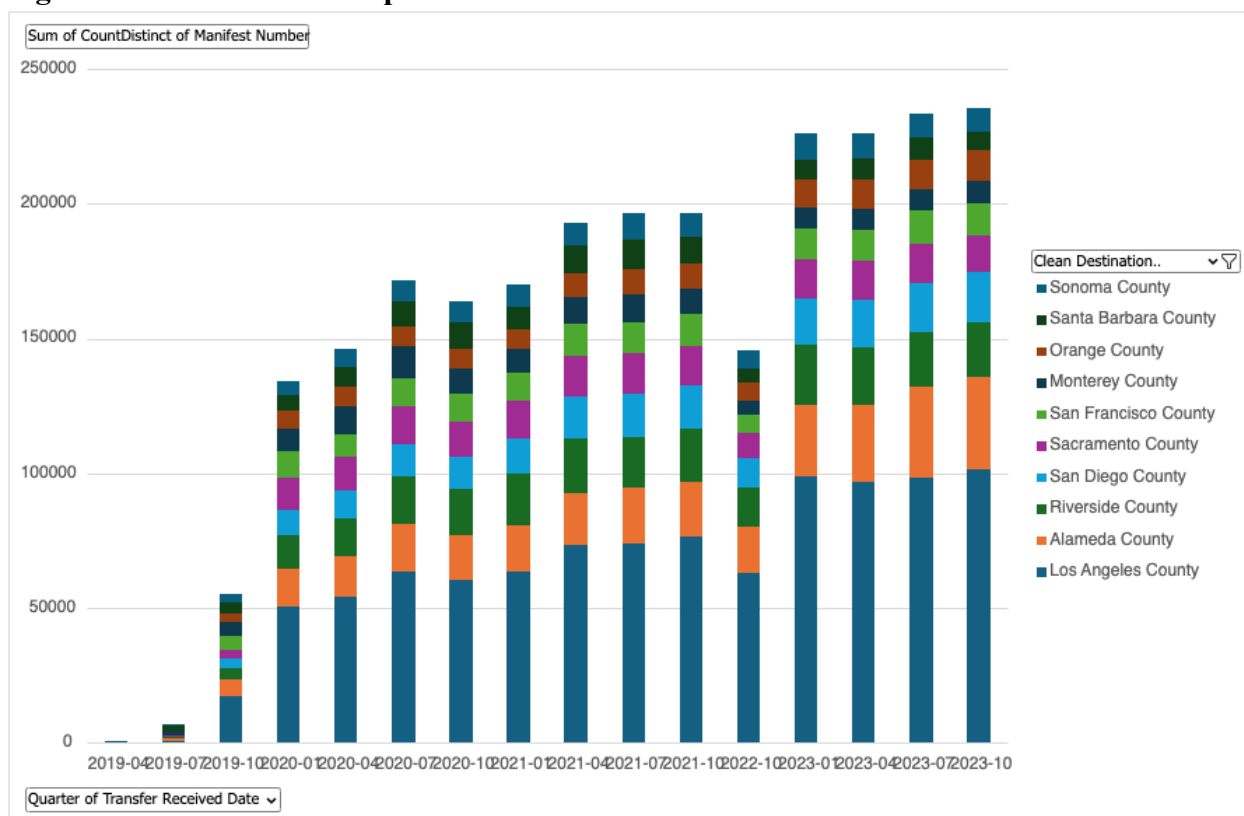


Figure 25 displays the number of manifests for the top 10 counties where they were received for the study period. The top 10 counties sent a total of 2.5M manifests during the study period. Los Angeles county accounted for 40% of manifests received. Alameda County was next with 12%, followed by Riverside County with 10%. When compared to the number of manifests sent from these counties, Los Angeles sent about the same percent as they received. Alameda sent slightly more than they received (15% vs. 12%) and Riverside sent slightly less than they received (7% vs. 12%). This may reflect the level of production in these counties compared to the number of retail outlets. As with the other analyses, there was a dip in October of 2022, but otherwise the number of manifests has grown steadily since 2019. There was a slight decrease in Q3 2020 and Q1 2021 which could have been related to COVID and slowed production.

Figure 25: Manifests for Top 10 Counties of Destination



5.5 CASE STUDY ANALYSIS OF PRODUCTION AND POLICY

While policy, mapping, and market analysis provide important perspectives on unlicensed cannabis cultivation, numerous studies have demonstrated how non-policy factors and unexpected policy effects can play a critical role at local levels in determining patterns of unlicensed cultivation (Corva 2014; Polson 2013; Polson & Petersen-Rockney 2019; Polson et al

2024; Getz et al 2024). A useful approach to assessing these less obvious factors is ethnographic research. Consisting of interviews and in-person observations of everyday environments, ethnographic research can detect factors that may not be apparent through more remote sensing methods and existing data sets, especially around hidden or criminalized activity (Adler 1990; Boeri & Shukla 2019).

Guided by the outputs of our predictive model, we deployed a rapid response interview and ethnography team to investigate policies correlated with significant increases or decreases in unlicensed cannabis production. This included a targeted inquiry into the effects of local cultivation bans and permitting schemes on the geography of unlicensed activity. We conducted qualitative analyses informed by interviews in jurisdictions exhibiting major shifts or anomalies in unlicensed production, alongside a secondary source historical review to contextualize findings and test underlying assumptions. The team pursued in-depth fieldwork in policy-reactive jurisdictions to understand the history, implementation, and social dynamics surrounding key policies, conducting interviews until thematic saturation was reached. Interviewees included over 100 stakeholders such as county supervisors, sheriffs, code enforcement officers, cannabis advocates, licensed and unlicensed cultivators, environmental health officials, and local water agency representatives. Informed by mapping outputs, we focused on hyper-local trends and potential confounding factors, such as the presence of non-cannabis greenhouses, and assessed the influence of events like enforcement actions, elections, and natural disasters. Fieldwork was concentrated in six counties, both ban and permit jurisdictions, where policies were particularly effective or ineffective at mitigating unlicensed activity. This work builds on and integrates findings from Polson and Peteren-Rockney’s concurrent DCC-funded research in four ban counties and several permitted jurisdictions. Our benchmark for success is a clear, evidence-based understanding of which local policies reduce unlicensed cultivation and its associated environmental harms.

5.5.1. CASE STUDY SELECTION

We used CannaVision model data to identify the impact of different variables on licensed and unlicensed cultivation in twenty one counties (at the time of county selection, we had model data for 2020-2022 available). We then selected six counties aiming for a balanced representation of permit and ban jurisdictions, geographical and ecological diversity, and a range of policy variables that our ethnography would test. We also looked for counties with dramatic changes in the amount of cultivation. For ban counties, we selected Siskiyou with secondary research in Amador and Shasta and drew on prior research in Napa, Yuba, and San Bernardino. We selected Nevada, Mendocino, Lake, Riverside and Trinity for permit counties. **Table 9** contains county background information.

Table 9: County Background (data from 2020 US Census and 2022 USDA NASS Census)						
	Lake	Mendocino	Nevada	Riverside	Siskiyou	Trinity
County size (square miles)	1,256	3,506.82	957.76	7,209.27	6,278.77	3,179.27
Population	67,878	89,108	102,037	2,492,442	42,905	15,670
Density (population per square mile)	54.2	26.1	106.8	335.4	7.0	5.1
Median household income	\$58,738	\$64,688	\$84,905	\$89,672	\$55,499	\$53,498
Poverty rate	17.6%	13.9%	10.9%	11.3%	17.1%	20.8%
Racial Demographics (Top 3 listed)	-64.9% White alone, not Hispanic or Latino	-62% White alone, not Hispanic or Latino	-83% White alone, not Hispanic or Latino	-31% White alone, not Hispanic or Latino	- 74.1% White alone, not Hispanic or Latino	-81.3% White alone, not Hispanic or Latino

plus Hispanic/Latino	- 4.8% American Indian and Alaska Native - 5.1% Two or More Races - 25.4% Hispanic/Latino	- 6.5% American Indian and Alaska Native - 4% Two or More Races - 28.1% Hispanic/Latino	- 1.7% Asian alone - 3.6% Two or More Races - 10.9% Hispanic/Latin o	- 7.6% Black alone - 8.1% Asian alone - 51.9% Hispanic/Latin o	- 5.3% American Indian and Alaska Native - 6.0% Two or More Races - 13.7% Hispanic/Latino	- 5.0% American Indian and Alaska Native - 5.6% Two or More Races - 6.4% Hispanic/Latino
Number of farms (non- cannabis)	581	975	620	2,424	655	139
Average size of farm (acres)	238	695	104	149	1027	411
Top Agricultural products (by acre)	Cattle, forage (hay,alfalfa)	Cattle, forage (hay, alfalfa), Grapes	Forage (hay, silage), Cattle, Sheep and Lambs, Greenhouse crops	Cattle, Poultry, Wheat, Cotton, Corn, Forage	Forage, Cattle, Sheep/Lamb, Chicken, Vegetables, Wheat,	Forage (hay/haylage), Grapes, Vegetables harvested, Apples, Land in berries

Average per farm government payment	\$2,033	\$7,567	\$420	\$5,505	\$7,139	\$261
Average per farm net cash income	-\$6,338	\$6,819	-\$11,903	\$111,471	\$66,115	\$1,063

5.5.2. ANALYTICAL FRAMEWORK

Building on an existing array of informants and key stakeholders, this study used interviews, focus groups, and participation observation sessions to gain a qualitative understanding of local policy's impacts on the licensed and unlicensed markets. We analyzed changes in cultivation geography and practices in seven California counties (Nevada, Lake, Siskiyou, San Bernardino, Mendocino, and Trinity) through in-person semi-structured interviews with licensed and unlicensed cannabis cultivators, business owners and industry representatives, cannabis advocates, and local officials responsible for regulation, planning, and law enforcement. By examining “on the ground” experience of cultivators and perceptions about the effects of local policy, ethnographies investigated what policy variables influence the extent of unlicensed cultivation. This qualitative analysis of policy outcomes supplements large-scale data analyses through a localized understanding of the social, political, and economic variables that determine market actor behaviors. Interview questions examined cultivators’ policy awareness, decision-making, experiential outcomes, perceptions of the industry, and other stakeholders’ perceptions of changes in cultivation and the effects of local cannabis policy. Answers to these questions help explain the decisions of licensed and unlicensed cultivators in both ban and permit counties, nuancing and sometimes balancing data procured through other methods.

5.5.3. METHODS

Summary of IRB Work: We first secured Institutional Review Board (IRB) approval, ensuring that human subject research adheres to the highest ethical standards. Our protocol, classified as Soc-Behav-Ed Non-Exempt, was crafted to outline our study's framework, with a strong emphasis on protecting participant data and handling sensitive information responsibly. Given the multi-method approach, careful consideration was given to protecting human subjects involved in both qualitative interviews and the privacy interface of geospatial technology. Special attention was paid to ethical considerations surrounding our engagement with individuals potentially involved in unregulated activities, ensuring their safety and privacy were prioritized. The IRB protocol detailed research aims, methodology, and data management plans. The IRB protocol was reviewed, revised, and strengthened iteratively, including an update for the energy data request (described above) as outlined in the CPUC guidelines. Our study received IRB approval on January 9, 2024, from Colleen Kohashi, IRB Analyst/Administrator at the University of California, Berkeley’s Office for Protection of Human Subjects. For more information on data security refer to Appendix 13.

Ethnographic research protocol: Once county selection was finalized, ethnographers divided up counties for fieldwork and followed a standard protocol. In preparation for fieldwork, the research team meticulously reviewed key county policy variables and planning code summaries. This included analyzing policy timelines related to local cannabis legislation,

discourse timelines of significant events, and other background materials, such as equity programs and existing cannabis reports. By examining spatial and temporal model data, the team identified crucial policy variables, refining their approach to ensure interview questions aligned with emerging patterns. Ethnographers collaborated and agreed upon a set of specific interview types and alternatives, as described in **Table 10**.

Table 10: Cannabis Interviewee Categories	
Interview Type	Alternative
Sheriff / Appropriate Sheriff Official	Cannabis Enforcement Team Member/Leader, Enforcement Official/Staff relevant to Cannabis
Pro-Cannabis Supervisor	Neutral Supervisor, County Administrator or equivalent
Pro-Ban / 'Anti'-Cannabis Supervisor	Neutral Supervisor, County Administrator or equivalent
Code Enforcement Official (dealing with Cannabis)	-
Planning Director or Staff (if county regulatory program)	-
Cannabis Program Director/Manager (if county regulatory program)	-
Environmental Health/Services Official	Agriculture Agency Official
Water Official (where relevant)	-

Toxic/Hazardous Waste Official (where relevant)	-
Unlicensed Grower x2	Former Unlicensed Grower
Licensed Grower x2 (new and legacy, if county regulatory program)	-
Grow Store Owner/Operator/Staff	-
Soil Provider	-
Dispensary Owner	-
Pro-Cannabis/Regulation Advocate x2 (knowledge of local policy history)	-
'Anti-Cannabis' / Pro-Ban Advocate (e.g., neighborhood groups, environmentalists)	-
Hemp Official/Staff (if hemp program)	-

To streamline outreach, researchers developed a comprehensive spreadsheet to track informant recruitment. They followed a structured list, leveraging professional networks, government websites, media sources, and referrals from initial contacts. To protect participant confidentiality, each informant was assigned a unique identifier, which was used exclusively in field notes and interview transcripts.

Before beginning interviews, ethnographers read a consent form aloud and obtained verbal consent from participants. They provided information sheets outlining the study's purpose. Ethnographers conducted semi-structured interviews using a standard list of questions (Appendix 5) tailored to specific county conditions and interview type. Each interview ended with a set of "universal questions" that tested initial spatial model data. Whenever possible, interviews were recorded and transcribed using specialized transcription software, ensuring accuracy in data collection.

After interviews, ethnographers composed a two-page summary that included the participant’s identifier, relevant geographic details, a summary of key themes, an analysis of findings, and significant quotes.

Team Retreat: To integrate findings, ethnographers convened a retreat in January 2025 and collaborated virtually, aligning case studies with spatial mapping data, policy analysis, and insights into the legal cannabis market. This collective effort ensured that the research provided a holistic and well-contextualized understanding of the evolving cannabis landscape.

Synthetic Summaries: After completing fieldwork, ethnographers drafted a 10-15 page [Synthetic Summary](#) for each county, which included a top-level summary, research summary, background information, a historic account of unlicensed cultivation, discussion, findings, and conclusions. The synthetic summaries included references to: [planning code summaries](#), [comparative analysis spreadsheet](#), CannaVision data, and county background summaries. They specifically assessed unlicensed cultivation trends over time and discussed how findings aligned or diverged from spatial analysis. Plausible explanations for discrepancies were explored, culminating in a set of conclusions. See Appendix 6.

5.5.4. DATA USED

We conducted a total of 145 interviews across six counties between July 2024 and March 2025 (with an additional 9 interviews in Amador and Shasta counties). We built contacts with residents, staff, officials, law enforcement, business owners, cannabis advocates, and cultivators, and conducted in-depth interviews. We also conducted remote interviews via Zoom with certain interviewees. Though we did not quantify non-interview ethnographic interactions, we spent time at county meetings, cultivator gatherings and meeting spots, celebratory dinners, farm tours, and in community meetings.

Table 11: Interviews in Each County						
Interviewee Category	Trinity	Lake	Mendocino	Nevada	Siskiyou	Riverside
State agency staff	0	0	4	2	4	2
Local government staff & officials	3	6	3	2	5	3
Local law & code enforcement staff	2	3	1	3	0	4

Local business owners & residents	3	3	4	2	12	6
Cannabis advocates	1	1	3	2	6	2
Cannabis cultivators (licensed)	3	3	3	6	0	5
Cannabis cultivators (unlicensed)	3		2	5	20	3
Total per County	15	16	20	22	47	25

5.5.5. LAKE COUNTY RESULTS

The Lake County Synthetic Summary is included in Appendix 6. No informants had good visibility into overall unlicensed production, but law and code enforcement officers observed a decline in unlicensed production, and cannabis industry insiders estimated that 33-50% of legacy growers have dropped out. Respondents attributed this decrease in unlicensed cannabis to saturation of and downturn in the cannabis market, dwarfing other contributing factors. Other factors cited include: law and code enforcement pressure; wildfire risk and effects; and cultural factors (e.g. resistance to licensure), but these factors were not cited nearly as often as market conditions. Additionally, licensed cultivators may report on unlicensed cultivators who they see as perpetuating stigma around cannabis and competing for narrow margins. The pandemic, which led many to stay home and grow cannabis, may be an underappreciated contributor to the market collapse from 2021 to 2022, with significant effects in Lake. See Appendix 6.

CONTEXTUAL FACTORS

- Inland, semi-agricultural county. Population of ~68,000. Second poorest county in CA with a poverty rate of 16.8%. Annual government budget of \$417M.
- Prone to flooding and wildfire. Fire has affected 60% of land since 2015.
- Considered by some to form the southern point of the “Emerald Diamond,” Lake has a multigenerational history of cannabis cultivation. From 2003-11, it ranked highest in CAMP eradication statistics.

- Enforcement led to “high risk, high reward” practices like having multiple, large grows on public lands. It also led to polarization and stigmatization around cannabis.
- Under medical cannabis, Lake allowed small growers to “self-certify” that they were growing as part of cannabis collective or “cooperatives” and loosened enforcement on 99 plants or fewer, paving the way for quasi-legalization.
- Lake was an early adopter to legal cannabis. Officials saw it as an opportunity to attract big business and increase the tax base. Measure C (2016) and K (2018) imposed tax structures on cannabis cultivation and retailers. Many license-holders find these onerous.
- Lake aimed to expedite the transition to the licensed market through “early activation” (EA) of self-certified operations. County staff were overwhelmed by the number of applicants they received and EA license holders operated for years without oversight. The EA program ended Summer 2021.
- Under EA, cannabis cultivation was initially permitted in low-lying and densely populated areas of the County.
- Cannabis faced intense oppositional pressure from the agricultural lobby, organized under the Farm Bureau, resulting in passage of “Farmland Protection Zone” (FPZ) ordinance in 2021. FPZ prohibited outdoor cultivation in areas zoned for agriculture and pushed cannabis cultivation indoors and/or to more arid county areas.
- Prior to 2023, applicants were allowed to “stack” up to 15 Type 3 (Medium sized) licenses for outdoor cultivation and unlimited Small licenses. In 2023, the county discontinued new stacking and encouraged cultivators to acquire Large Cultivation licenses. By early 2026, Lake County had the most Large outdoor cultivation licenses (26) of any county in California (70 total) as well as a mix of pre-2023 stacked Medium and Small licenses (outdoor and mixed light).
- In 2022, Lake formed a Cannabis Ordinance Task Force (COTF), charged with making recommendations for updating the county’s ordinance to align with state laws and regulations. COTF meetings were frequently derailed by anti-cannabis activists. BOS disbanded the COTF in March 2025. Community Development planned to summarize COTF’s recommendations and put them before the BOS in 2025.
- Lake does not have a designated Marijuana Enforcement Team. The Sheriff’s office has a robust narcotics division that has historically been involved in cannabis eradication. Two code enforcement officers are dedicated to cannabis (funded by the state). Lake is experimenting with joint campaigns between Planning and Sheriff (previously the Roadmap Task Force and now COPTR). Enforcement campaigns are known to target both large backwoods grows and smaller backyard grows.

SPATIAL DISTRIBUTION OF UNLICENSED CANNABIS

- Most enforcement respondents have the (correct) impression that unlicensed cultivation is in decline based on how many unpermitted plants they encounter and cut down each year

(~200,000). Licensed cultivators and those around the industry believe unlicensed production remains prevalent because county permitting and state licensing procedures are slow, expensive, and onerous. For those fortunate enough to get a permit and license, state and local taxes add another burden.

- Licensed grows are now more visible and prevalent in low-lying parts of the county as farmland becomes available. Some agriculturists are diversifying crops by growing cannabis. Some unlicensed grows are mixed in, but local residents are often aware when this occurs. Many “craft” or “cottage” grows remain in the hills. Some legacy growers may be “straddling the market” with permitted grows in more central areas and unpermitted grows in the hills. Meanwhile, opposition groups are lobbying to expand the Farmland Protection Zone and push licensed cannabis to outlying regions.
- Many legacy cultivators have exited the cannabis market, especially since 2021. Informants estimated between 33% and 50% of legacy growers have dropped out, some after trying to obtain a license and “stalling out” in permitting. Informants did not have a good explanation for those “hanging on.” It is possible that cultural factors help to explain the obstinacy of some cultivators who “were never going to get a license” and those who persist despite increasingly narrow profit margins. Cultural factors may also impede best business practices.
- From 2018-20: unlicensed cultivation density increased (matched overall trend), particularly in more densely populated areas and areas with higher proportions of non-cannabis agriculture, despite above-average enforcement.
- From 2020-22: unlicensed cultivation density decreased (matched overall trend), especially near licensed farms and in areas with hemp presence, with some unlicensed cultivation increasing in outlying areas, especially where there were no licensed farms (the absence of licensed farms predicted increase in unlicensed cultivation).
- From 2022-24: cultivation density continued to decrease (more decrease than overall trend), driven most by proximity to licensed farms, with greater declines in areas with fewer roads and higher proportions of population over 65.

ETHNOGRAPHIC SUMMARY: CONTRIBUTING FACTORS TO UNLICENSED CULTIVATION

- Permitted cannabis operations set up shop in more visible, flatland areas. Many smaller, unlicensed operations stayed in the hills. Tight-knit communities make it hard for unlicensed operators to “hide in plain sight.” Strong oppositional groups, however, are actively lobbying to push cannabis back into the hills.
- Market failure was the overriding variable leading smaller cultivators to stay in the unlicensed market or drop out of the cannabis market altogether.

- According to grow store earnings data, the pandemic may have played a role in cannabis' boom-bust cycle by leading people to stay home and grow cannabis, contributing to market glut that crashed the market.
- County-level policy created barriers to licensure, including onerous tax and regulatory structures (which relate to compliance costs and mandatory infrastructure investments) and an unclear or dysfunctional permitting process, especially with regard to CEQA, burdened permit-seekers and deterred unlicensed growers from permitting.
- In short, the costs and difficulty of licensure and competition from large-scale businesses quashed opportunities for smaller operators.
- Nearly all interviewees believed enforcement efforts were ineffective and not a deterrent, despite sustained efforts to shut down unlicensed operators. Many used the phrase "whack-a-mole" and a law enforcement officer told the fable of "the Boy and the Dike."
- Smaller operators may have succeeded in the licensed market had the state provided more funding and technical assistance to transition legacy growers and helped counties streamline permitting.

5.5.6. MENDOCINO COUNTY RESULTS

Mendocino County experienced a distinct boom-and-bust in cannabis cultivation following legalization, with expansion from 2018 to 2020, followed by significant contraction during 2020-2023. Economic factors, particularly the price collapse below production costs, reduced unlicensed cultivation more than enforcement or regulatory efforts. The county's complex and unstable permitting system, which underwent multiple iterations between 2017-2023, created significant barriers for small operators. Cultivation patterns shifted geographically from traditional mountain hideaways to more accessible valley locations, driven by water access concerns, infrastructure needs, and environmental compliance considerations. See Appendix 6.

CONTEXTUAL FACTORS

- Mendocino County (3,507 square miles) features diverse microclimates ideal for cannabis cultivation, with distinct regional cultivation cultures across coastal areas, valleys, and northern regions.
- The county's economy historically relied on timber and fishing with cannabis becoming a major significant economic force following the decline of these industries.
- Median household income (\$65,500) falls below state average with a 19% poverty rate, approximately 1.5 times higher than state and national averages.
- Mendocino attempted multiple regulatory approaches:
 - (1) the Sheriff's "zip-tie" program (2012), (2) a three-phase permitting system (2017) that established size limits ranging from small ($\leq 2,500$ sq. ft.) to large

(5,001-10,000 sq. ft.) cultivation on parcels 5-10+ acres, restricted cultivation to agricultural, residential, and industrial zones while prohibiting it on Forest Land and Timber Production zones, and (3) delegation of environmental review to the state (2023).

- Administration of cannabis permitting bounced between departments: Agricultural Commissioner (2017-2019), Planning Department (2019-2021), and a dedicated Cannabis Department (2021-present).
- As of 2024, the county issued 762 state cultivation licenses, with 98.55% remaining provisional (indicating incomplete regulatory (CEQA) compliance). No remaining provisional licenses remain in 2026.
- As of January 2026, of the 1157 permits processed, 462 (40%) remained active.

SPATIAL DISTRIBUTION OF UNLICENSED CANNABIS

- Model data shows unlicensed cultivation increased by +158 m²/km² during 2018-2020, then decreased by -205 m²/km² during 2020-2022, followed by continued decline of -77 m²/km² during 2022-2024, for a net reduction of about -124 m²/km² over six years. These patterns occurred in a permit county with \$1,000 per-plant fines and moderate enforcement (rank 3 initially, rising to rank 5).
- Geographic patterns shifted across periods. From 2018-20, cultivation grew in both remote areas (strongest predictor) and areas with more buildings, with hemp presence also strongly linked to growth. From 2020-22, cultivation contracted countywide, with slightly greater declines in remote, built, and flatter areas. From 2022-24, this reversed: cultivation increased substantially in the most remote areas while continuing to decline in more accessible, developed locations.
- Licensed farms had minimal deterrent effect initially (2018-20) despite high licensed farm density, but became increasingly significant, doubling the expected decline in cannabis density by 2020-22 near licensed operations.
- Pre-legalization cultivation methodology of multiple small grows (25 plants each) across different parcels shifted toward larger, more consolidated operations.
- The Sheriff's office estimates dealing with approximately 200,000 unlicensed plants annually, significantly down from peak years.
- From 2018-20: Unlicensed cultivation density increased by approximately 200 m²/km² (matched overall trend), particularly in remote areas and areas with hemp presence, with building density also positively associated with increases. Despite high density of licensed farms, their presence had minimal deterrent effect.
- From 2020-22: Cultivation density decreased substantially (matched overall trend), with strongest contractions in areas with higher building densities and flatter terrain. The

presence of licensed farms became significant, doubling the expected decline in cannabis density compared to areas without licensed farms.

- From 2022-24: Cannabis density continued to decrease, exceeding the overall average decline (diverged from overall trend). Most dramatically, remoteness reversed its prior effect; cultivation increased substantially in the county's most remote areas while declining in more accessible locations.

ETHNOGRAPHIC SUMMARY: CONTRIBUTING FACTORS TO UNLICENSED CULTIVATION

- **Market Economics:** The Mendocino experience demonstrates that market forces can drive unlicensed behavior more than enforcement or policy structures.
 - Cannabis prices collapsed dramatically in 2021-2022, falling below \$300/lb (often beneath production costs of \$250-400/lb).
 - Market forces drove reduction in unlicensed growing. As one legacy cultivator turned permitted operator stated “The economy has been the best enforcer of illegal, black market, unlicensed grows.”
 - Licensed operators face competitive disadvantages due to compliance costs adding \$200-300 per pound to production expenses.
- **Regulatory Challenges:** The county's unstable permitting system with multiple iterations created uncertainty that discouraged participation. One-size-fits-all environmental requirements disproportionately burden small operators and can inadvertently encourage consolidation.
 - Complex environmental regulations, particularly CEQA requirements, created significant barriers to legal market entry.
 - Permitting system underwent multiple iterations and department transfers, creating confusion and uncertainty.
 - Many operators attempted to enter legal market but became stuck in permit limbo due to constantly changing requirements.
- **Water and Infrastructure Access:** Environmentalist resistance to cannabis cultivation increases financial, compliance, and locational pressure on cultivators.
 - Environmental activism aimed at protecting oak woodlands effectively limited cannabis industry expansion in Mendocino County.
 - Drought conditions made water access a critical factor in cultivation location decisions.
 - Valley locations offered better road access, proximity to services, and more reliable water sources.

- Water hauling costs became prohibitive for many remote operations (reported up to \$40,000 annually).
- **Enforcement Limitations:** Limited enforcement capacity necessitates strategic prioritization, rather than complaint-based or revenue-focused approaches,
 - County lacks a dedicated cannabis enforcement task force.
 - Complaint-based enforcement system leads to inconsistent actions.
 - Limited resources prevent systematic address of unlicensed cultivation, particularly in remote areas and near tribal lands.
 - Stakeholders considered enforcement ineffective compared to market forces.
- **Blurred Market Boundaries:** Policy approaches that maintain strict distinctions between legal and illegal markets fail to address market realities.
 - Licensed operators often maintain both legal and illegal sales channels to survive economic pressures.
 - Strict categorization between legal and illegal markets breaks down in practice
 - Licensed cultivators face high business failure rates due to compliance costs.
- **Community Economic Impact:** The disappearance of cannabis industry’s informal economic support reveals broader challenges in rural development.
 - Traditional “mom and pop” operations (25-100 plants) squeezed out by market forces and regulatory burdens.
 - Local businesses in cultivation dense areas reported sales drops of over 50% as the cannabis economy contracted.
 - Informal economic support system that previously funded community projects largely disappeared.
 - Supervisor assessment: “There’s no timber, there’s no fish, there’s no cannabis, there's really no exports.”

5.5.7. NEVADA COUNTY RESULTS

CONTEXTUAL FACTORS

- Relatively small county spanning Sierra Nevada foothills and mountains from the Central Valley to the Nevada state line.
- Population quadrupled from 1970 to 2001 and is concentrated in western foothill region, with 30% in incorporated cities.

- Non-Hispanic white (83%), Democratic-leaning, below average poverty (11%). Half the county is under 300% of poverty line with low rates of workforce participation (53%).
- Economic history of mining and timber but present-day economy dominated by residential growth, service sector, government and retirement/investment incomes.
- Agricultural land has declined precipitously since 1970 and is dominated by cattle.
- Housing prices have risen by approximately 20% since 2020.
- Cannabis has become the county's second most valuable (legal) agricultural product.
- Nevada County was destination for many cannabis cultivators since 1970s.
- In 2016 an outdoor cultivation ban failed and voters approved Proposition 64.
- Supervisors formed community/stakeholder group to inform cannabis permitting program, which was passed in 2018.
- Permitting program delayed until 2019 to conduct CEQA review.
- Permit program excluded cannabis from contentious residential-agriculture areas but allowed it in forested and agricultural areas, which comprised most county lands and land already in use for cannabis cultivation
- Permit limited farm size to 10k square feet and later expanded this to 40,000 square feet if multiple contiguous parcels were obtained.
- County made multiple reforms from 2021-2025 to support permittees.
- County responded to persistent unlicensed cultivation by expanding code enforcement powers, particularly in flatter more populated areas, and expanding Sheriff enforcement in remote areas.

SPATIAL DISTRIBUTION OF UNLICENSED CANNABIS

- Cultivation was historically concentrated in more remote mountainous areas, particularly in county's northwest.
- As medical cannabis cultivation grew, growers moved into flatter lands throughout the county's populated western region, generally growing plots with 99 plants or less.
- 2017 study estimated 3250 county parcels with cultivation covering 303 acres of cultivated area. Most was outdoor, on land with relatively low environmental sensitivity,

and in agriculturally-zoned land. Current licensed cultivation is 1/10th this area, approximately 32 acres.

- Only 5% of pre-existing cultivated area made it into licensure.
- Most pre-existing cultivation (approximately 88%) was on land later zoned for cannabis cultivation (i.e. ag and forest resource land) under county permitting programs.
- From 2018-20: unlicensed cultivation expanded significantly (highest in sample), but in areas not populated by older populations and more populated by younger populations.
- From 2020-22, unlicensed cultivation (particularly outdoor) decreased, especially near licensed farms.
- From 2022-24, unlicensed cultivation decreased most of any sampled county, thus returning to 2018 levels, with outdoor driving declines. Reversing trend, it declined least in areas with older populations and most in areas with younger populations.

ETHNOGRAPHIC SUMMARY: CONTRIBUTING FACTORS TO UNLICENSED CULTIVATION

- *Market as Reason for Unlicensed Exit:* Exit from unlicensed cultivation was generally attributed to market challenges, not enforcement risk.
- *Early Move Toward Licensed Areas:* Unlicensed cultivation was initially ('18-20) hidden “in plain sight” in agricultural areas, often near licensed farms. These areas were less remote, closer to amenities, had better weather, and posed less environmental enforcement risk.
- *Later Divergence of Licensed and Unlicensed Cultivation:* After 2020 unlicensed production moved away from licensed farm areas. This was due to intensifying civil/code enforcement, particularly around licensed farm areas in flatter, more agricultural areas as well as persistent cultivation in remote areas, where few other livelihood options existed, particularly for older and jobless populations.
- *Supportive Policies Fostered Small Farm Legal System:* County regulations limited farm size, required on-site residences, and fostered local supply chain. Iterative reforms aimed to reduce barriers to cultivation, generally.
- *Enforcement Aimed to Prioritize Harm Reduction:* In 2022, code enforcement and law enforcement reformed their approach to enforcement. Law enforcement focused on remote regions, prioritizing sites with environmental impacts and large spatial footprints. “Notices of violation” were placed on parcels with persistent cultivation (particularly out-

of-state LLCs) to inhibit sale. Code enforcement tightened inspection and enforcement against unlicensed cultivation, utilizing a range of tools from compliance mandates and education to stringent tactics, as necessary.

- *Unlicensed Cultivators Adapted to Enforcement:* Growers reported avoiding waterways, steep hills, unpermitted road grading, and large grows that would incite enforcement. They also: adopted mixed-light cultivation to avoid aerial detection, used autoflower strains and light-deprivation techniques to shorten cultivation periods to avoid detection (and increase productivity); and kept properties clean to avoid code enforcement fines and inspections. Savvier growers adhered to permit requirements (e.g. having an on-site residence; growing in allowed zones) to blend in.
- *Various Types of Unlicensed Cultivators Exist:* (1) personal cultivators for personal consumption and/or small, supplemental funds; (2) small, legacy cultivators, often older and “stuck” on devalued post-cannabis land, cultivating as sole livelihood; (3) larger-scale unlicensed cultivators in remote areas with cheap land and little investment; (4) larger-scale unlicensed cultivation scattered over multiple parcels, often in ways that mimicked permit conditions; (5) licensed farmers that partially depended on unlicensed market for viability.
- *Economic Decline:* Declining cannabis cultivation has deepened poverty and insecurity for economically and socially marginal growers, as well as working-age populations, with unknown consequences on surrounding ecologies as residents seek new income source and land uses.
- *Cultural and Quality of Life Factors Keep Former Growers Local:* Cannabis market fostered a vibrant culture which now contributes to rising property prices and displacement. Former cultivators report a loss of meaning/direction – and economic stability – but express hope of staying local.
- Local cultivator organization has been key in shaping regulations, supporting farmers, defusing conflict, and promoting shared values among all cultivators.

5.5.8. SISKIYOU COUNTY RESULTS

Siskiyou has positioned itself as a pioneer in cannabis prohibition within California, by developing intensive and innovative enforcement strategies. Despite this, unlicensed cultivation has remained relatively steady. As observed elsewhere in California, cultivation expanded between 2018 and 2020, but slowed from 2020 to 2022, and contracted from 2022-2024. Research participants attributed this plateau primarily to the cannabis market downturn rather than enforcement efforts. Aggressive enforcement paradoxically shifted cultivation’s geography and scale, with smaller cultivators leaving, only to be replaced by larger operations, cultivation

spreading across multiple parcels to distribute risk, and more intensive cultivation practices being adopted to harvest before potential raids. The county's enforcement approaches have disproportionately impacted socially marginalized growers, particularly Asian and Asian-American farmers, while consuming substantial local resources and hindering environmental and social protection agencies' ability to mitigate cultivation impacts. See Appendix 6.

Contextual Factors

Siskiyou is a large, rural county in far-northern California with approximately 44,000 residents and a population density of just seven people per square mile (compared to California's average of 250).

County is among California's most economically disadvantaged with a 16.8% poverty rate (compared to 12.2% statewide), 7.5% unemployment, and median household income under \$50,000 (about half the state average).

Population is predominantly white (74.2%).

Economy is based on agriculture, forestry, and tourism, with 60% of the county's area comprised of state and federal public lands.

The county faces intensifying wildfire risks and drought conditions that have placed pressure on water resources.

- County's annual budget is approximately \$115 million. Primarily conservative voters, who approved Proposition 64 in 2016.
- 2015: county established permissive medical cannabis regulations after extensive public input. County quickly shifted to restrictive policies.
- Sheriff's Office led efforts to restrict cannabis cultivation. After Proposition 64, county quickly placed moratorium on commercial cannabis activity, declared state of emergency, and ultimately banned cultivation. Sheriff also enlisted state agencies into enforcement.
- County innovated enforcement approaches including water restrictions, significant fine penalties, and elimination of abatement periods.
- Multiple civil rights lawsuits allege racial discrimination in county enforcement, resulting in court injunctions against some ordinances.
- County has created no pathways for cultivation permitting, despite wishes by cultivators to comply.

SPATIAL DISTRIBUTION OF UNLICENSED CANNABIS

- Pre-legalization cultivation occurred primarily in remote mountainous regions with limited enforcement against predominantly white cultivators.
- Cannabis cultivation patterns shifted dramatically in mid-2010s as Hmong farmers purchased small, inexpensive parcel in rural subdivisions. Many initial Hmong immigrants described being refugees and veterans who sought affordable retirement opportunities and return to agrarian roots.
- After legalization in 2016, cultivation further shifted from public lands to private properties in rural subdivisions, bringing cultivation closer to agricultural and residential areas
- By 2017, approximately 6,000 Hmong Americans had moved to Siskiyou since 2014, purchasing approximately 1,500 parcels
- County officials frame cannabis cultivation as primarily conducted by "outsiders" threatening the local "way of life."
- From 2018-20: Siskiyou County saw an increase in unlicensed cultivation on par with the general study average. However, several factors had more dramatic effects: a) flatter areas saw increases in cannabis density more than double the overall study average, with no increases in cultivation density in more hilly areas, b) poorer areas tended to have substantially larger increases in cannabis density (2.5x the study average) relative to the wealthiest areas, which saw very little increase, c) like other counties, increases in cannabis density were more pronounced in areas with more buildings, and d) the increase in cannabis density was greater in more fire prone areas in Siskiyou County.
- From 2020-22: an overall decrease in average cannabis density, which was especially pronounced in areas with increasing building density and in less forested areas
- From 2022-24: average contraction in cannabis density, with the strongest reductions in flatter areas with potentially some increases in cultivation in more sloped areas.

ETHNOGRAPHIC SUMMARY: CONTRIBUTING FACTORS TO UNLICENSED CULTIVATION

- Expansion then Plateau: Cultivation expanded during 2018-2020 but plateaued from 2020-22, unlike other counties that saw significant decline.
- *Multiple Causes for Slowing Production:* Slowing production was attributed to declining cannabis prices. In targeted subdivisions, slowing production was also due to social and ecological impacts of the 2021 Lava Fire, and limited access to water (for cultivation as well as basic household needs, livestock care, and subsistence growing) due to cannabis-related enforcement.
- *Cultivation Adapted to Enforcement:* (1) Shift to less visible, mixed-light methods; (2) Distribution of operations across multiple parcels to spread risk; (3) More intensive

cultivation practices to harvest quickly before potential raids; (4) Smaller operations giving way to fewer but larger, better-capitalized operations.

- *Enforcement-First Approach Produces Counterproductive Results:* Siskiyou's ban and intensive enforcement failed to significantly reduce unlicensed cultivation while consuming substantial resources. Enforcement has driven adaptation, consolidation, and increased scale of operations. Adaptation and economic/social insecurity – not elimination – appears to be most significant impact of enforcement.
- *Environmental Justifications Applied Inconsistently:* While environmental protection is a primary justification for cannabis restrictions, intensive enforcement has pushed cultivators onto more marginal land, led to environmentally maladaptive practices, and reduced opportunities for environmental education and amelioration.
- *Ethnic Trajectories of Cultivation:* Many white growers significantly scaled back cultivation due to enforcement concerns, or moved to jurisdictions with permit programs. Hmong and Hmong-American growers remain in Siskiyou due to community ties, poverty, and sunk investments in land. Cultivation is one of few viable economic options on subdivision lands.
- *Racial and Ethnic Disparities:* Asian and Asian-American farmers have been disproportionately impacted by cannabis enforcement. Surveillance and enforcement has been concentrated on rural subdivisions with predominantly Hmong populations. Lack of infrastructure in subdivisions makes primarily low-income residents vulnerable to drought, water restrictions, wildfire, and complaint-driven enforcement.
- *Economic Necessity Drives Persistence:* People continue to grow unlicensed cannabis primarily because they have few other economic options on marginal lands. Siskiyou's cheap land attracted cultivators with limited financial means, many of whom cannot afford to relocate to permit jurisdictions (and otherwise lack necessary capital to seek licensure).
- *No Stakeholders Satisfied with Current Approach:* Not one research participant described the current policy regime as functioning well. County officials face escalating cultivation with limited resources. Cultivators have a narrow path to legal markets and little social and economic stability. Residents concerned with cultivation impacts are denied opportunities for monitoring and addressing concerns through regulated pathways.

5.5.9. TRINITY COUNTY RESULTS

Trinity County is a rural place with a legacy cannabis economy. The county's cannabis program established a cap of 530 licenses—a fraction of the estimated 4,000-6,000 cultivation sites—leaving approximately 90% of the county's cultivators with no legal pathway to licensure. Trinity treats cannabis cultivation as a land use issue with its Cannabis Division housed in the Planning and Building Department. Trinity's permit program made notable efforts to support smaller-scale farms, including limiting permits to one per parcel, requiring residence on farms, restricting large-scale cultivation by allowing only 15 Type 3 licenses (up to one acre), and

reserving licenses for legacy growing regions like Hayfork. Our spatial analysis shows an initial increase in unlicensed cultivation between 2018-2020, followed by a decrease between 2020-2022 and 2022-2024, with most significant reductions occurring near licensed farms. Stakeholders consistently identified the cannabis price collapse as the most significant driver of cultivation decline. Trinity's experience highlights how well-intentioned regulations can create unintended barriers to legal market participation. See Appendix 6.

CONTEXTUAL FACTORS

- Trinity has a population of approximately 16,000 residents and a population density of just five people per square mile, making it one of California's most rural counties.
- Trinity has one of lowest median household incomes in California (just over \$40,000) with a poverty rate exceeding 22% (compared to 12.2% statewide).
- Trinity County's steep, mountainous terrain and dense forests create high wildfire risk, with several major fires affecting the region in recent years.
- County budget is approximately \$76 million per year, with about \$4 million dedicated to law enforcement.
- Approximately 85% of county is public land, with just over 3% zoned for agriculture.
- The economy historically depended on timber before its decline from 1970-1990. Cannabis cultivation became a significant economic force, especially during economic downturns. One resident noted that "the 2008 and 2009 U.S. market crash wasn't even felt here because cannabis provided such a cushion."
- Trinity's cannabis landscape is shaped by distinct communities: especially legacy cultivators (many former timber workers) and ethnic growers, especially since the late 2000s. Approximately 1000 Hmong farmers operate in one especially dense locale.
- Proposition 64 passed by only six votes in the county (50.10% in favor).
- Trinity enacted its first commercial cannabis ordinance in October 2017, establishing enrollment caps (530), zoning restrictions, and property requirements.
- County has generally supported small grower entry into licensed market, by providing educational opportunities to comply, limiting permits to one per parcel requiring residence on farms, restricting large-scale cultivation, and reserving licenses for legacy growing regions
- Trinity Action Association (TAA) filed 2019 lawsuit challenging CEQA compliance, resulting in requirement of CEQA reviews for each farm. This lawsuit effectively shut down the licensing program for two years (2020-2022) and substantially increased permitting costs.

- As of January 2025, approximately 335 cultivation licenses have been issued, over half of the 600 that entered the licensing process. (This latter number does not account for those cut off by county permit caps.)
- While the county does not have a Marijuana Enforcement Team, it employs a multi-agency enforcement approach against unlicensed cultivators that includes the Sheriff's Office, neighboring county law enforcement, EPIC team, State Water Resources Control Board, California National Guard, and CDFW.

SPATIAL DISTRIBUTION OF UNLICENSED CANNABIS

- From 2018-20: Trinity County did not have any reliable predictors of change in cannabis density and experienced a close to zero change.
- From 2020-22: an overall decrease in average cannabis density that was most pronounced in areas with high building density and flatter terrain. Like other counties, the most significant decreases in unlicensed cultivation occurred in proximity to licensed farms that attract enforcement activity.
- From 2022-24: average contraction in cannabis density, with the strongest reductions in flatter areas and places near licensed farms.
- Due to market downturn, many legacy growers exited the industry, while ethnic growers, including Hmong growers, have persisted due to limited economic alternatives, substantial investments in land, and strong intra-community ties.

ETHNOGRAPHIC SUMMARY: CONTRIBUTING FACTORS TO UNLICENSED CULTIVATION

- *Market Forces Eclipse Enforcement:* Cannabis price declines held greater explanatory power for reductions in unlicensed cultivation than enforcement or policy measures.
- *Regulatory barriers create unintended consequences:* License caps combined with costly requirements has effectively locked most cultivators out of licensure, creating a de facto ban for 90% of pre-existing cultivators. This has perpetuated unlicensed cultivation despite grower willingness to participate in the legal market.
- *High-profile enforcement can backfire.* Trinity's enforcement experience, particularly when permitting was stalled, demonstrates how targeting growers attempting to enter the legal market (because they are easier to identify) creates disincentives for compliance.
- *Community-tailored approaches show promise.* Policies that accommodate diverse community needs, such as grandfathering legacy operations, opt-out zones for cannabis-opposed communities, and overlay zones for unique areas like Trinity Pines—can reduce overall opposition while supporting existing cultivators.

- *Demographic shifts reshape cultivation patterns:* While market pressures have forced many legacy growers to exit the industry, Hmong cultivators in Trinity Pines have largely persisted due to limited economic alternatives, substantial investments in land, and strong community ties.
- *Environmental and Infrastructure Challenges:* Water access, fire risk, and erosion concerns shape cultivation patterns. Market declines can also place pressure on cultivators to increase scale or face debt and livelihood loss.

5.5.10. RIVERSIDE COUNTY RESULTS

CONTEXTUAL FACTORS

- Riverside is large (7209 square miles), reaching from Arizona to Orange County, and encompasses mountainous, desert and agricultural valleys with 84% public land.
- Large population (2.4m residents) makes it 4th largest California county.
- Economy historically centered on agriculture, defense, and service sector.
- Riverside County and City spearheaded efforts to resist statewide cannabis regulations and ban cannabis under land use laws.
- In 2006 County banned cannabis distribution and in 2015 expanded the ban to cover all cultivation and delivery, except a personal/medical exception of 24 plants per property.
- Limited cannabis enforcement from 2013-17 but, after 2017, intensified enforcement via Sheriff and Planning Department's Cannabis Regulation Task Force (CRTF).
- 2019: County implemented cannabis permitting program with stringent, costly terms.
- Most firms sought permits in cities, which had established permitting programs early, often with less restrictions, easier administration, and lower costs.
- Approximately 52% of cultivation licensees in Riverside County (including cities) were in active status in January 2025

SPATIAL DISTRIBUTION OF UNLICENSED CANNABIS

- History of indoor cannabis cultivation since 1990s, particularly in warehouses and housing tracts of urban/suburban Inland Empire.
- Growth of rural cultivation sites in Anza-Aguanga-Sage area of southwest Riverside in early 2010s.

- Post-2015 growth of suburban and urban backyard cultivation with the passage of personal/medical allowances.
- 2018-2020: cultivation increased, nearly all mixed light, particularly around Anza, Coachella Valley, and eastern desert areas along I-10, with localized declines near southwestern urban/suburban areas of Moreno Valley and along the I-15. Cultivation moved to more open and less remote areas (i.e. toward more building-dense areas, closer to hemp permit sites, and further from public lands);
- 2020-22: cultivation decreased overall, especially in rural/suburban areas of southwest county (Anza and Coachella valleys). Localized cultivation growth around City of Riverside, Perris, and areas near the San Geronio Pass on I-10. Cultivation reversed trend by moving toward more concealed areas (i.e. toward areas with lower building density, near public land and further from agricultural areas and hemp permits).
- 2022-2024: Overall increase of cultivation (4th highest), against study-wide trend of decline. Cultivation increased far from permitted farms in areas with higher building density, hemp permits, and traditional agriculture, but declined near permitted farms. 75% of cultivation increase came from mixed-light cultivation.
- Other noted trends:
 - Most small-scale suburban/urban cultivation has stopped, except for some gardens under the personal limit in greenhouses and basements.
 - Public awareness of grow houses combined with high energy and production prices and need for scaling up to drive cannabis away from residential areas, though some sophisticated, scaled-up, multi-house operations have persisted.
 - Little to no growth in indoor cultivation.
 - Virtually no new cultivators. Current operators are trying to remain operational.
 - Cultivation appears to have mostly left the legacy area of Anza Valley.
 - Growers avoid operating on public lands because of elevated consequences.
 - Price declines and profitability challenges have pushed many growers out of operation but proximity to LA markets and inter-state highways, as well as lack of opportunities to become licensed, may explain the modest (and off-trend) growth in cultivation in 2022-24.

ETHNOGRAPHIC SUMMARY: CONTRIBUTING FACTORS TO UNLICENSED CULTIVATION

Permitting Programs Insufficiently Incorporated Most Cultivators:

- Expensive, stringent and delayed county permitting program made cultivation permits inaccessible for most, except those with significant resources.
- County regulations stimulated unlicensed cultivation by categorically excluding most pre-existing cultivators through restrictive zoning and an outdoor cultivation ban.
- Early-starter cities received the most benefit and growth from permitting programs, while legacy cultivation areas saw less cultivation but also declining economies.

Political Conflict Over Cultivation Amplified by Enforcement:

- Exclusion of legacy cultivation areas ensured that those cultivators would become perennial targets for enforcement agencies.
- Vocal rural residents, who drove zoning restrictions and enforcement pushes, disliked cannabis cultivation but benefited from it, via increasing property prices.
- Calls for enforcement by rural residents were part of a larger desire for county resources and investment, which enforcement could not deliver.
- Cultural and racial animus played a role in justifying more stringent approaches.

Code Enforcement and Law Enforcement Approaches Had Mixed Results

- Code enforcement was effective at discouraging smaller-scale residential cultivation in more populated areas, addressing cannabis cultivation near hemp farms, and, across localities, ensuring cultivation did not return once addressed.
- Law enforcement was effective at stopping remote cultivation in the short run
- Despite a reputation for stringent enforcement, cultivation increased in 2 of 3 study periods.
- Enforcement can drive where cultivation occurs (e.g. in more/less remote areas, near/far from public lands; near/far from hemp permitted areas; near/far from agricultural lands) but does not drive *whether* cultivators grow cannabis.
- Market factors appear to determine *whether* cultivators grow

5.6 UNDERGRADUATE RESEARCH

Over 30 undergraduate student research assistants (RAs) assisted with research, writing, data analysis, GIS work, and policy fact sheet creation. RAs worked on:

- Research and writing projects related to: county news summaries, cannabis laws, county use of drones and satellites, state enforcement programs, comparative analysis between county polices, social equity programs, and legislative tracking;

- Creation and design of fact sheets on various topics, including local county fact sheets, permit and acreage caps, infographics, and maps;
- Comparative analysis spreadsheets comparing county political and demographic information, local cannabis tax rates, support of Proposition 64, and county background information, including budgets;
- Research and design of maps;
- GIS & Machine Learning Annotation, where students were trained to annotate machine learning output from the Water Board's CannaVision platform using the Computer Vision Annotation Tool (CVAT).

DISCUSSION

6.1 OVERVIEW

In this section, we discuss and synthesize the results of this study. The section is organized according to the four guiding objectives of the project, as originally proposed. This includes: (1) assessing unlicensed production amounts and geography; (2) identifying influential factors that drive or are correlated with unlicensed production; (3) comparing licensed and unlicensed production; and (4) assessing potential environmental impacts of unlicensed production. This section draws from the “Results” sections of Section 5, including Sections 5.1.4 (Policy Analysis), 5.2.4 (Spatial Modeling), 5.3.4 (Licensed Market Data), 5.4.4 (Energy Data Analysis), 5.5.4-5.5.10 (Ethnographic Analysis). For further detail on results, please consult Appendix.

6.2 OBJECTIVE 1: ASSESSING UNLICENSED PRODUCTION AMOUNTS AND GEOGRAPHY

Finding #1: Since legalization, unlicensed cultivation initially expanded, rapidly retracted, then stabilized.

Between 2018 and 2020, CannaVision data showed a clear expansion in the absolute amount of cannabis cultivation (i.e. outdoor and mixed-light operations). Growth was evident across case study regions. Ethnographic data suggested that this initial surge reflected grower market optimism, combined with delayed and uneven licensing rollouts. Early permitting delays, rule changes, and high entry barriers pushed many growers to begin, continue or expand unlicensed production. Local variation in enforcement and permitting timelines also shaped these early outcomes, with less stringent enforcement and slower program implementation associated with temporary expansion in unlicensed cultivation.

From 2020 to 2022, spatial modeling showed a significant decline in unlicensed cultivation. Ethnographic accounts supported this, describing how collapsing wholesale prices, often below production costs, led to widespread attrition among cultivators. Many smallholders exited the market, unable to sustain operations amid low prices, regulatory uncertainty, and limited access to legal permits. In counties where enforcement activities and regulatory structures matured, unlicensed cultivation receded notably. Ethnographic evidence also suggested that localized enforcement in historically strong cultivation zones contributed to this reduction, even in counties where permits could not be obtained or permitting barriers were high.

Between 2022 and 2024, spatial modeling indicated relative stabilization in cultivation levels at lower volumes (approximately equivalent to 2018 levels). Ethnographic data depicted a markedly transformed unlicensed sector: in some regions, participants reported that unlicensed cultivation had nearly disappeared, while in others (particularly remote or economically marginal areas) it persisted at reduced scale. Counties that had earlier adopted or stabilized their permitting programs tended to show sustained reductions, while jurisdictions maintaining prohibitions or imposing restrictive licensing saw modest rebounds. Across study sites, interviewees in 2024 depicted a sector that had contracted substantially, with unlicensed operations continuing primarily among cultivators who lacked alternatives or were adapting to new economic and policy realities.

Finding #2: Cultivation moved from the hills to the flatlands and back again.

Between 2018 and 2020, spatial modeling indicated that cannabis cultivation expanded in flatter, less remote areas with higher building densities, more roads, and more distance from public lands. Ethnographic data suggested that this movement reflected both *pull* and *push* factors. Pull factors included increasing social acceptability of cultivation in populated valleys, the perception that flatter lands would be easier to permit, and the opportunity to “blend in” with licensed or transitional operations. Push factors included intensified environmental enforcement in steep terrain, complex permitting terms in hillside zones, and fears of legal exposure tied to environmentally sensitive “tripwires.” Across multiple counties, cultivators relocated from rugged, legacy sites toward more accessible, arable, and infrastructure-proximate lands, often anticipating permits that never arrived. Others took advantage of early leniency or proximity to licensed and hemp operations to operate in plain sight.

During 2020 to 2022, spatial modeling showed that contraction was strongest in these same flatter areas, while hillier and remote regions experienced more modest declines. Ethnographic data indicated that the maturing of county enforcement and inspection programs, combined with new zoning restrictions, such as Lake County’s Farmland Protection Zone Ordinance, Trinity County’s opt-out zones, or Riverside’s zoning exclusions and code enforcement efforts, discouraged unlicensed cultivation in visible or easily accessed places. Civil complaint mechanisms and code enforcement activities further prompted cultivators to seek

more discreet locations, balancing concealment with proximity to infrastructure. Simultaneously, falling wholesale prices incentivized relocation to lower-cost or marginal parcels where profitability could be sustained. Ethnographic accounts emphasized that remoteness was not synonymous with isolation: cultivators sought spaces that offered both discretion and logistical practicality, rather than the extreme remoteness characteristic of pre-legalization eras.

By 2022 to 2024, spatial modeling and ethnographic evidence jointly depicted a cultivation stabilization and persistence in remote areas, accompanied by selective re-expansion in flatter zones. Spatial modeling confirmed that remoteness became positively associated with unlicensed cultivation during this period, reflecting the struggle of producers with limited alternatives in economically marginal locations. Ethnographic data showed that many who remained in remote areas did so because of low land costs, limited mobility, or cultural and social ties to place, with some modestly expanding cultivation area to offset falling prices. However, economic considerations increasingly dominated siting choices: as land values rose in accessible valleys and proximity to markets became critical, some cultivators, especially in Southern California counties, moved closer to consumer and logistics hubs. Licensed market data demonstrated that Southern California, particularly along the corridor from Monterey through Santa Barbara to Los Angeles, became the epicenter of market activity. Ethnographic accounts suggested that unlicensed cultivation mirrored this geography, co-locating in regions that benefited from the infrastructure, supply chains, and market velocity of the legal sector.

Finding #3: Over time, those who persisted in unlicensed cultivation were increasingly in tenuous socio-economic situations and attached to place for cultural-historical reasons.

Between 2018 and 2020, CannaVision and licensing data indicated widespread participation in the unlicensed market across counties. Ethnographic data suggested that participants during this period represented a broad cross-section of cultivators, from smallholders in hilly legacy regions to suburban and exurban producers experimenting with small-scale grows. Established and new growers thrived in the unlicensed market.

From 2020 to 2022, participation in the unlicensed sector declined sharply and its demography began to shift. Ethnographic data showed that many middle-income and mobile growers exited the market entirely. Those remaining were increasingly individuals with constrained economic or geographic mobility, such as people who owned or occupied marginal parcels and lacked feasible livelihood alternatives. In places like Nevada, Trinity, and Siskiyou, participants linked cultivation persistence to barriers associated with age, poverty, race, or rural isolation. Older residents, often on fixed incomes or with limited capacity to relocate, were especially likely to continue growing. In Nevada County, for instance, older age correlated with continued or expanded cultivation through 2024, supported by ethnographic reports that such growers were land-rich but cash-poor, unable to sell property, and invested in their properties. In

some cases, predatory land arrangements emerged, with distressed or uninformed cultivators leasing plots from absentee LLCs, only to face repeated enforcement raids.

By 2022 to 2024, quantitative and ethnographic evidence portrayed the unlicensed sector as increasingly defined by marginalization and immobility. Ethnographic data revealed that those still cultivating were overwhelmingly situated in economically depressed rural enclaves, particularly in the dense, infrastructure-poor subdivisions of Siskiyou, Trinity, and Nevada counties. These small parcels, often created before California's 1974 *Subdivision Map Act*, had become strongholds of persistence due to their affordability, established social networks, and collective self-reliance. Residents in communities such as Shasta Vista, Hayfork, and Trinity Pines, The Ridge described enduring cultivation not purely as an economic pursuit but as an outcome of cultural identity, mutual aid, and attachment to place. Such "stickiness of place" was reinforced by shared histories of interdependence, distrust of regulatory authorities, and adaptive cooperation in the face of enforcement risk. As economic returns dwindled, the unlicensed landscape bifurcated: a small number of larger, adaptive, multi-site cultivators coexisted with a growing base of subsistence-level or semi-personal growers maintaining cannabis as a survival livelihood. Together, the data depict a residual unlicensed sector rooted less in opportunism than in social persistence, economic exclusion, and deeply embedded rural community ties.

Finding #4: Unlicensed cultivators moved away from public lands into private land.

Ethnographic data consistently recorded a movement of cultivators away from public lands, where consequences for cultivation were more significant than private land (i.e. felonies vs. misdemeanors). Additionally, with cannabis legal, stigma and official complaints on private lands appeared to decline, especially in areas with significant cannabis cultivation. The ability to invest in private lands, rather than cultivate on public ones, attracted some growers. Finally, with the intensification of environmental policing and multi-agency attentions on public land, growers sought to avoid this land altogether. By 2024, officials in Nevada, Trinity, and Siskiyou reported near-zero observed grows on public land. The relative affordability and accessibility of land (particularly private subdivision parcels) in remote northern counties enabled cultivators to continue operations with lower risk of felony charges. In Lake, Trinity and elsewhere, extensive wildfire damage and post-fire aerial surveillance drastically reduced the viability of forested public land sites. Meanwhile in Riverside, some growers allegedly forged partnerships with tribes to cultivate as they were pushed off of public and private lands alike. Ethnographic evidence shows that shifts out of public lands were not simply reactive to enforcement but reflected deeper calculations around risk, enforcement, norms, and jurisdictional differences.

Though spatial modeling did not include data from public lands, it did track areas that bordered public land. From 2018-20, cultivation generally moved away from those public-

private areas with a minor reversal in 2020-22, due to factors that include less visibility, cheaper land, maturing private-land enforcement, and a growing need for concealment. In the final period (2022-'24) cultivation moved minimally back toward public-private border land.

Finding #5: Cultivation Transitioned from Outdoor to Mixed-Light Production.

Over the 2018–2024 study period, spatial modeling indicated a transition from outdoor to mixed-light (greenhouse) production, with the shift accelerating after 2020. Ethnographic data suggested that the motivations for this shift varied considerably by region and over time. Between 2018 and 2020, cultivators pursued mixed-light facilities to access higher prices for visually superior flower and to avoid aerial identification and enforcement actions, especially in areas that banned outdoor cultivation. From 2020 to 2022, these factors persisted. Two new factors emerged as drivers: (1) environmental disruption, particularly wildfire smoke, pushed cultivators toward mixed light and (2) market price drops incentivized mixed light cultivation, which made possible more harvests, higher-value crops. By 2022-24, outdoor cultivation (including unlicensed product) was valued low as biomass input for a growing manufacturing sector.

Finding #6: Unlicensed cultivation was sensitive to major fire years.

Spatial modeling in 2018-20 indicates that cultivation was negatively associated with remoteness, but only in high fire hazard areas. (In the absence of high fire hazard, cultivation increased. Though 2018 was at the time the worst fire season on record, 2020 broke the record and was extremely and broadly disastrous (2021 was similar, but slightly less severe). For 2020-22, both fire hazard and remoteness were significant negative predictors of unlicensed cultivation. As 2022 and 2023 were more moderate fire seasons, data from 2022-2024 indicates no significant effect of fire hazard on unlicensed cultivation. From 2022-24 remoteness once again became a reliable predictor of increasing unlicensed cultivation.

Ethnographic data suggested that fire impacts did not uniformly drive abandonment. Some cultivators, especially in higher-income groups, relocated or paused production, whereas others (particularly marginalized or immigrant growers) adapted by altering practices, shifting crop cycles, or relaunching operations in place. Fire exposure appeared to disrupt production in the short term but rarely eliminated unlicensed activity entirely, instead prompting adaptive responses that reshaped how and where cultivation persisted.

Finding #7: Indoor cultivation exhibited increasing prevalence, particularly in 2020-21.

Energy records show significantly more indoor cultivation in Central Valley (North and South) and Sierra regions than in coastal regions, with 2020-21 showing more relative growth

than 2021-23. Based on the results of the random forest model, the estimated prevalence of unlicensed indoor cannabis cultivation in the South Central Valley region was approximately double the estimated prevalence of the next highest region. Under an assumption that 1 out of 100 utility accounts grow cannabis in California, that prevalence was an estimated 3 out of 100 in the South Central Valley. Even under an assumption that only 1 out of 400 utility accounts grow cannabis statewide, the estimated prevalence in the South Central valley was approximately 4 out 400. It is therefore reasonable to assume that at least 1% of utility accounts in this region may be growing unlicensed indoor cannabis- the power load of which would likely well exceed 1% of the electrical grid in this region, given the higher energy demand of cannabis relative to other power users.

Finding #8: Unlicensed indoor cultivation has shown more consistent growth than unlicensed outdoor cultivation.

Unlike outdoor cultivation which saw a rapid increase, followed by a rapid retraction, results from the random forest model suggested that unlicensed indoor cultivation increased in 2020-21, stabilized in 2021-22, and grew in most areas from 2022-23, except in the Northern Central Valley region, which contracted. Furthermore, the two regions with the highest estimated prevalence of unlicensed indoor cultivation over the study period also showed the largest increases in the most recent year of available data. Finally, the largest increases across study regions occurred between 2020 and 2022, precisely the time period when unlicensed outdoor cultivation saw its dramatic retraction.

6.3 OBJECTIVE 2: IDENTIFYING FACTORS INFLUENCING THE OBSERVED EXTENT OF UNLICENSED CULTIVATION

Finding #1: Presence of licensed cultivation was most consistently correlated with declines in unlicensed cultivation.

Across all three study periods (2018–20, 2020–22, and 2022–24), spatial modeling showed that the presence of licensed cannabis cultivation sites was associated with reduced unlicensed activity. From 2018-20, while unlicensed cultivation grew overall, it grew most slowly near licensed operations. This was a period when unlicensed growers were generally moving out of hills to less remote areas, thus explaining some movements of unlicensed toward more licensable areas. Further, regulatory systems were not well established in this period and many skeptical growers hovered at the edge of permitting. Prior work (Bodwitch et al 2021) shows that cultivators did not feel pressured by other cultivators at the time to obtain a license or stay unlicensed, thus indicating less differentiation among licensed and unlicensed growers.

From 2020-22, the deterrent effect of licensed cultivation became more pronounced. Spatial modeling outputs showed sharp declines in unlicensed growing near licensed sites. However, the presence of a permitting program was not enough to deter cannabis – unlicensed cultivation decreased somewhat more in ban counties in this period. Therefore, in this period it is not permitting, per se, but the widespread dispersion and presence of farms across a jurisdiction that affects unlicensed cultivation. Ethnographic findings indicated that increased inspections and regulatory enforcement contributed to this trend – inspections of a licensed farm brought officials to farms where they could often see or otherwise detect nearby unlicensed cultivation. Thus, during inspections a “knock on” effect against unlicensed sites was more likely around permitted farms. Additionally, communities around licensed farms became more informed about cannabis laws, fostering some local intolerance of unlicensed cultivation, especially as prices declined. Simultaneously, social norms among cultivators began shifting toward compliance as licensed operators invested more heavily in legal frameworks and infrastructure.

By 2022–24, licensing had become the strongest predictor of reduced unlicensed cultivation. Unlike the prior period, the presence of a permitting program (not just a permitted farm) was correlated with steeper declines in cultivation. Stated differently, jurisdictions with bans or stalled licensing programs saw ongoing or displaced unlicensed production (see below). Ethnographic data emphasized that the industry was becoming increasingly bifurcated: licensed cultivators, typically capital-intensive and rooted in place, contrasted with unlicensed operators who were more mobile and sought increasingly marginal, less regulated terrain.

These patterns collectively suggest that permitting *and dispersing* cannabis cultivation was an effective long-term deterrent to unlicensed activity. Because only “permit counties” have permitted farms, it stands to reason that permitting programs are also associated with declining unlicensed cultivation, but in this study sequence we only saw this effect in the last period, potentially indicating that the capacities of permit programs need to mature before a general effect on unlicensed production takes effect. Ethnographic and policy analysis shows that permit programs have more capacities and agencies at hand to address unlicensed cultivation than ban counties, where law enforcement (alone or in lead position) enforces in more narrow ways (Getz et al 2024).

Finding #2: Bans were not a consistent or powerful indicator of growth or decline in unlicensed cannabis cultivation.

Across time periods, spatial modeling revealed that cultivation bans had no reliable effect on unlicensed cannabis activity. In the first period (2018-20), bans had no significant effect on unlicensed cultivation. Both banned and permitted counties exhibited a mix of increases and decreases. Factors such as geography, enforcement intensity, and local cultivation histories were more influential than ban/permit status alone. Ethnographic data supported this interpretation,

showing that unlicensed activity was shaped by community tolerance, enforcement practices, and economic rationales rather than by the mere existence of a formal ban.

From 2020–22, spatial modeling indicated that unlicensed cultivation declined overall but the contraction was slightly more pronounced in ban counties overall. (The results, however, were lopsided: 9 of 10 counties with the least decrease or slight gains all had bans.) In the 2022–24 period, however, this trend reversed: unlicensed activity expanded in banned jurisdictions but declined in permit counties overall. Seven of the ten counties with the highest growth in cultivation density had bans, and two others, Riverside and El Dorado, operated under de facto bans due to stalled permitting programs. Ethnographic findings suggested that as permitting and enforcement systems matured in regulated counties, these areas gained the institutional capacity to manage both licensed and unlicensed cultivation through coordinated civil enforcement, education, and abatement tools. Ban counties, in contrast, generally lacked these mechanisms and relied on resource-intensive, short-lived law enforcement actions.

By the final period, the divergence between banned and permitted counties reflected a larger structural shift. Counties that had developed integrated regulatory programs were better able to control unlicensed cultivation, while those dependent on prohibition or intermittent enforcement saw unlicensed activity persist or rebound. Humboldt County, which implemented early and continuous permitting and enforcement, was the only county to demonstrate absolute declines in unlicensed cultivation in every period, while Siskiyou and Riverside, which leaned heavily on policing approaches, experienced diminishing returns. (Notably, in 2022–24 the six counties with the most decrease in cultivation were all legacy counties with robust permitting programs. Humboldt was the only county that continuously declined relative to 2018 numbers.) Ethnographic evidence further indicated that bans often displaced cultivators into more remote areas and encouraged more coordinated and covert operations. Overall, these results support the conclusion that comprehensive permitting frameworks, rather than outright bans, serve as the more effective long-term deterrent to unlicensed cannabis cultivation.

Finding #3: The perceived likelihood of strong enforcement was an initial deterrent, but became less important over time.

Spatial modeling showed that jurisdictions with strong reputations for law enforcement experienced initial reductions in unlicensed cannabis cultivation during the first study period (2018–20). Using total plant eradication as a proxy for enforcement intensity, areas with high historical enforcement ranks demonstrated measurable declines in unlicensed cultivation. However, this effect weakened in the second period (2020–22) and reversed in 2022–24, when stronger enforcement reputations were correlated with greater relative growth in unlicensed activity. These findings indicate that while a reputation for aggressive enforcement was initially a deterrent, its influence declined as cultivators adapted to the enforcement landscape.

Ethnographic data supported this observation. In the early years, cultivators actively avoided counties or localities with visible, punitive enforcement. Over time, however, the deterrent value of enforcement diminished as growers learned to adapt through relocation, technological adjustments, and changes in cultivation methods. Some moved operations into greenhouses, smaller parcels, or more remote areas, while others consolidated into more organized and discreet networks.

By 2022–24, enforcement-based strategies had entered a cycle of diminishing returns: they remained costly, displaced growers into more environmentally fragile or inaccessible zones where cultivation could occur, and often reinforced inequities by targeting more vulnerable populations, causing headaches for and imposing costs on counties. Some counties continued robust enforcement but other counties with limited resources and attention decelerated enforcement. Short-term crackdowns, like those in Siskiyou and Riverside, often created adaptive responses (like moving sites) rather than long-term deterrence, especially when cultural, locational and economic logics were at play. The evidence suggests that a reputation for aggressive enforcement loses efficacy over time.

Finding #4: Civil policy and civil enforcement efforts became key drivers of declines in unlicensed cultivation over time.

Spatial modeling and ethnographic data jointly indicate that civil enforcement strategies such as code enforcement, fines, landowner liability rules, and environmental regulations, grew increasingly effective over the study period in curbing unlicensed cultivation. Following the boom of 2018–2022, the decline of 2020–22 was more pronounced in areas with denser stream networks, potentially reflecting enforcement priorities. Though cultivation had co-located with hemp in 2018–20, tightening hemp programs reversed that trend in 2020–22, leading to a negative correlation between hemp and cannabis. Hemp and water regulations may have had appreciable effects on reducing cultivation statewide.

By the 2022–24 period, civil enforcement had matured into a general and consistently applied policy framework across several counties. Modeling results showed that landowner liability, the existence of permit programs, and higher fine levels correlated with reductions in unlicensed cultivation. Ethnographic data supported this correlation, noting that counties such as Nevada and Trinity relied on discretion, education, and abatement processes to reduce unlicensed activity, while more punitive jurisdictions such as Riverside experienced renewed increases. This suggests that, over time, consistent, predictable, targeted and transparent civil enforcement systems may be more effective deterrents than law enforcement–led approaches. Across counties, cultivators learned to adapt their practices to conform to civil codes, often adjusting farm locations and designs to avoid enforcement triggers such as proximity to streams or visible environmental degradation. As enforcement predictability and public awareness of environmental standards increased, cultivators became more compliant, and overall unlicensed

cultivation declined. This is in contrast to adaptations to law enforcement, which are often perceived by growers as arbitrary and unpredictable and thus induce any manner of (mal)adaptations to avoid detection.

Civil enforcement, like law enforcement, encounters limits over time. From 2022–24, slight increases in unlicensed cultivation near permitted hemp farms and in stream-dense regions indicated potential declining returns to civil enforcement or difficulties in sustaining enforcement over time. Civil and law enforcement may matter less than other pressures, like those of economic viability and cultural belonging. Economic conditions likely pushed some growers back into marginal lands where environmental enforcement was difficult. While civil enforcement provides clearer rules and a broader range of regulatory tools, its long-term effectiveness depends on consistent funding, clear communication of standards, and the legitimacy of its aims (i.e. serving a discernible, consistent public good). No or limited pathways to licensure may also affect the legitimacy and efficacy of civil regulation. The evidence overall points to the long-term advantages of mature civil enforcement systems.

Finding #5: Issues in permitting programs prevented many cultivators from becoming licensed.

Ethnographic data indicated that delays, suspensions, and overly restrictive permitting requirements were among the most significant causes of continued unlicensed cultivation across the study period. In accord with previous findings (Bodwitch et al 2021), it was access – not willingness to comply – that typified non-licensure, though many cultivators cited negative attitudes toward regulatory systems they see as benefiting larger, capitalized firms.

Lawsuits and administrative delays prevented participation in permit programs. Growers who sought to transition into the legal market were unable to do so because programs were halted, redesigned, or burdened with unclear requirements. In Trinity, a lawsuit and a county-imposed permit cap effectively froze licensing activity. In Mendocino, shifting regulatory standards and the repeated suspension of provisional permits created uncertainty and discouraged participation. Nevada was delayed due to CEQA concerns (though the program operated efficiently once launched in 2019). Though Riverside launched a program in 2019, it was years before the first cultivation license was issued. Across this initial period, unlicensed cultivation boomed because cultivators lacked a viable path to licensure.

Permitting counties struggled to reconcile compliance expectations with the realities of transitioning a large legacy industry into regulated frameworks. Ethnographic accounts from this period described Riverside County’s permitting system as overly burdensome, characterized by high financial barriers, strict zoning, and long review timelines that excluded most small or legacy cultivators. Many were instead drawn to nearby municipalities offering more attainable

local permits. Mendocino and Trinity offer similar cautions, particularly after environmental and residential groups raised compliance requirements that excluded many farmers and imposed significant costs on those seeking licensure. In contrast, Nevada County's permitting system was intentionally structured to support small-scale farms and was aided by strong communication between cultivators and local government.

Jurisdictions that maintained transparent and stable frameworks, like Nevada and Humboldt, preserved modest but functioning legal cultivation sectors. Others, such as Trinity, Mendocino, Lake and Riverside, had low program participation as programs stalled, became prohibitively complex, or failed to support permittees amidst economic decline. Ethnographic data suggested that the presence of trade associations was a key factor in facilitating program success. Where such organizations were active, cultivators benefited from advocacy, technical assistance, and clearer communication with regulators (e.g. Trinity, Nevada), although they have not been able to consistently overcome organized opposition from environmental, residential, agricultural, or other land user groups (e.g. Riverside, Lake, Trinity). In contrast, counties such as Siskiyou, which maintained bans on commercial cultivation and severely limited personal cultivation, left cultivators with no realistic legal pathway. In sum, the evidence indicates that failures in local permitting systems, rather than a lack of willingness to comply, sustained unlicensed cultivation across much of the study region.

Finding #6: Cultivation bans and other enforcement policies were linked with “whack-a-mole” dynamics around unlicensed cultivation.

Spatial modeling shows that “whack-a-mole” patterns – in which displaced growers re-establish operations elsewhere rather than exiting the market altogether – are strongest in ban counties and in jurisdictions with historically high levels of law enforcement activity. Ethnographic data supported this finding. Ban enforcement efforts in Siskiyou targeted unlicensed sites aggressively, but the primary outcome was relocation rather than cessation. Cultivators frequently moved to new parcels with lower oversight, often in areas with cheaper land or weaker enforcement capacity. Enforcement officials and cultivators alike described an ongoing cycle of removal and reestablishment that was costly for both sides. In some cases, growers returned to the same sites after abatement or eradication, suggesting that enforcement created temporary disruptions rather than long-term deterrence. This dynamic was most evident in rural zones with active social networks and accessible parcels. In contrast, counties with stable permitting programs and active civil enforcement frameworks (e.g. Nevada) exhibited more spatially stable cultivation, even if unlicensed activity persisted.

There was also more whack-a-mole patterning when landowners were liable for tenant cultivation activities, suggesting that landowners were more likely to evict and require movement by cultivators. This policy environment led to shorter-term tenancies and more transient cultivation activity. These policies may have encouraged land ownership by cultivators,

as in Riverside, where some growers reportedly conducted “re-grows” on the same sites after fines or raids, particularly in more isolated zones.

Ethnographic data indicated that local social structures played an important role in shaping these patterns. In Trinity and Siskiyou, tight-knit cultivation communities and permissive or pro-cannabis Property Owners Associations allowed movement within informal networks, sustaining unlicensed cultivation despite repeated interventions. Conversely, anti-cannabis associations and declining economic viability in certain areas reduced both the frequency and persistence of site relocation, as in Riverside and ag-res zones of Nevada. This suggests that local norms, shaped by social structures, can influence how much ability to move between places there is.

Finding #7: Market forces and price decline were major factors in driving unlicensed cultivation decisions.

Declining cannabis prices since 2021 were a central influence on cultivation siting decisions across all case counties. From 2018 to 2020, all cultivators reported relatively stable market conditions, and site choices were shaped primarily by regulatory and enforcement factors. Despite (or because of) a brief spike in prices in 2020 due to Covid, prices began to fall sharply in 2021. Growers increasingly prioritized economic survival over licensure or long-term planning. They sought cheaper land, reduced labor costs, and assumed more of the work themselves to sustain minimal profitability. Many reported difficulties selling products or covering costs. Some left the unlicensed market altogether. Others downsized to small personal gardens for self-provisioning or supplemental income, particularly in counties that permitted limited outdoor or mixed-light personal cultivation with low compliance costs.

Growers adapted to the economic crisis by relocating to lower-cost areas and cutting operational expenses. This often meant moving into more remote or less regulated zones where land was inexpensive and enforcement capacity limited. In counties like Riverside and Nevada, interviewees noted visible expansion of cultivation into marginal lands, including the eastern desert areas of Riverside and remote uplands in central Nevada County. Siskiyou also experienced dispersed small-scale activity in low-value parcels (a trend earlier noted in San Bernardino; Getz et al 2024). Across cases, site mobility appeared increasingly tied to affordability and cost reduction rather than enforcement avoidance alone (see Getz et al 2024 on Napa and the pricing out of unlicensed cultivation).

By 2022 to 2024, the consequences of sustained price decline were visible across the unlicensed landscape. Ethnographic data suggested that cultivators continued to shrink or abandon operations depending on their access to capital and alternative livelihoods. Lower-income growers and those with limited land-use options often continued cultivating despite the risk of fines, as cessation would jeopardize their basic financial stability. Others shifted from

outdoor to mixed-light cultivation to improve yields and reduce detection risk, even though this required higher upfront investment. The financial impacts of enforcement, including fines and abatement fees, intensified pressure on cultivators, but only up to a point. For those already on the economic margins, enforcement penalties were less deterrent than existential threats. The data also showed a demographic shift in this period, with older cultivators and retirees comprising a larger share of those remaining active in cultivation, as younger participants increasingly exited the market. Overall, the findings suggest that the price collapse, more than enforcement or environmental regulation, became the defining force guiding whether, where and how unlicensed cultivators continued.

These shifts had negative economic implications for rural economies that had previously been supported by unlicensed cultivation. The most visible effect was the closure of stores that depended on cultivation money, though these were symptomatic of the general evacuation of younger growers, the increasing economic tenuousness of older residents, and the disintegration of cultural-economic fabrics that sustained cultivation-dense areas. Some sought other livelihoods, where possible, though formal sector jobs are rare in many cultivation-dense areas, leading to out-migration, significant turnover in properties, and disruption of the social systems that cannabis had stabilized.

6.4 OBJECTIVE 3: COMPARING LICENSED AND UNLICENSED PRODUCTION AND ESTIMATE LEAKAGE OF LICENSED PRODUCT INTO UNLICENSED MARKET

To assess the relationship between licensed and unlicensed cultivation, we compared the volume of licensed cultivation in key counties over time and compared it to the trends in unlicensed cultivation. We were not able to estimate the leakage of licensed products into the unlicensed market due to licensed data source limitations. Detecting leakage requires accurate data on (1) on-farm accounting for all plants grown and material moved off of the farm; and (2) the movement of product through the supply chain as individual products and not grouped into manifests or re-assigned ID numbers through the process. Licensed harvest data had numerous gaps and reporting errors, and the supply chain tracking did not allow for the analysis of how individual products moved from cultivation to manufacturing to retail, making any estimate of diversion there impossible. Further, in California's track-and-trace system, products are combined into new batches and assigned new ID numbers when they move from one place to another. These shipments are tied to manifests. While we can see where manifests originate and end, we cannot see which products are in each manifest and cannot trace those product ID's back to their place of cultivation or production (see more in the limitations section).

Finding #1: Growth of licensed cultivation was more consistent than unlicensed cultivation over the course of the study period.

Harvest data indicated that licensed production rose every year. Yet, CannaVision data demonstrated a different pattern among unlicensed cultivation. Although there was a sharp rise in unlicensed cultivation between 2018 and 2020, the 2020-2022 time period showed a drastic reduction in mapped unlicensed cultivation that matched the magnitude of the 2018-2020 increase. Between 2022 and 2024 cultivation, on average, stabilized and neither demonstrated dramatic expansion or contraction. Reduction in unlicensed outdoor and mixed light cultivation was likely somewhat offset by small increases in unlicensed indoor production, as suggested by our limited analysis.

Finding #2: As licensed cultivation increased in counties like Santa Barbara, activity decreased in rural, legacy production counties, like Mendocino.

There are several possible regulatory and industry related reasons for this trend. First, Santa Barbara allowed for larger scale cultivation, attracting larger companies with greater capital and the ability to grow at scale, increasing their margins. Counties like Mendocino and other legacy counties, however, often capped cultivation and required more extensive permitting and CEQA processes due to environmentally sensitive lands (unlike Santa Barbara, which did not have the same land features; see Dillis et al 2021). As an illustration of this, the harvested weight in Mendocino steadily decreased every year after the 2021 harvest peak, while in Santa Barbara harvest sizes continued to increase annually.

Second, distance to market disadvantaged licensed and unlicensed cultivation alike. Most transfers of licensed goods occur near population centers. It is more cost effective to move flower shorter distances for processing, manufacturing and retail. While Humboldt County was one of the top 10 counties for manifests of origin, neither Mendocino nor any other rural Northern California county was in the top 10 for manifests of destination. Los Angeles County dominated manifests of origin and destination, demonstrating the relationship between population centers and cost effectiveness for a highly regulated industry.

6.5 OBJECTIVE 4: ASSESSING POTENTIAL FOR ENVIRONMENTAL IMPACTS OF UNLICENSED PRODUCTION IN BAN AND PERMIT COUNTIES

Finding #1: Environmental sensitivity eventually became associated with reductions in unlicensed cultivation, particularly in permit counties.

Between 2018 and 2020, cannabis cultivation expanded across nearly all counties, with no clear connection to environmental sensitivity. From 2020 to 2022, cultivation generally

declined, and there was a weak, non-significant tendency for larger decreases in counties with higher environmental sensitivity. This pattern was more noticeable in counties with permits, although the sample size was too small to reach statistical significance, and there was no such pattern in counties under bans. Finally, from 2022-24, a clear pattern emerged: counties with higher environmental sensitivity experienced absolute declines in cultivation, while less sensitive counties saw absolute increases. This trend was again more pronounced in permit counties than in ban counties. This indicates that permit counties were more effective than ban counties in driving cannabis away from environmentally sensitive areas. This was likely due to numerous reasons including the involvement of environmental protection agencies, more resources and tools dedicated to environmental protection, and targeted prioritization of decreasing environmental harms rather than generalized policing of cultivation.

6.6 KEY TAKEAWAYS

- 1) **Despite an initial boom, total unlicensed cultivation contracted to 2018 levels.** After initial expansion from 2018-20, unlicensed cultivation decreased. By 2024, total acreage was equal to 2018 levels with some variation across geographies and policy approaches. *See Obj 1, Finding 1.*
- 2) **Unlicensed cultivation is diverging from licensed cultivation.** This is occurring along geographic and socioeconomic lines. Unlicensed cultivation persists in more remote areas, away from permitted farms. Frequently, those persisting to cultivate without licenses have few or no other formal livelihood options, are bound to place for cultural or economic reasons, and are economically and socially marginalized. Local policies – bans, permits, enforcement regimes – and socioeconomic conditions has created a wide array of developmental patterns across California. *See Obj 1, Finding 2-4, 6; Obj 3, Finding 1-3.*
- 3) **A permitted farm is the most effective deterrent for unlicensed cultivation.** The presence of a licensed farm best predicts declines in unlicensed cultivation. Correlatively, more licensed farms can diminish unlicensed cultivation. This occurs for several reasons including increased presence of inspectors and officials near licensed farms, more open landscapes near licensed farms, and community norms that develop over time. Notably, it is not the presence of a permitting program in general that is consistently and powerfully correlated to unlicensed cultivation (though it did have an appreciable effect from 2022-24). It is the localized effects of permitted farms, suggesting an importance to *dispersion* of numerous licensed farms across an area. *See Obj 2, Finding 1.*

- 4) **Permit programs are important in addressing environmental impacts of unlicensed cultivation.** Where permitting programs are present, negative environmental impacts decline. Bans were associated with more cultivation on sensitive lands, including “whack-a-mole” dynamics of churning cultivation sites. Permit programs often have a larger suite of agencies and capacities to address unlicensed cultivation. Permit programs can also increase awareness – even among unlicensed cultivators – of the impacts of cultivation and mitigation techniques. Even if cultivators are not licensed they can still absorb local norms and a “culture of compliance” fostered by permitting programs. *See Obj 2, Findings 1-2, 4, 6; Obj 4, Finding 1.*
- 5) **Bans were not a consistent indicator of growth or decline of unlicensed cultivation.** However, *how* ban policies are implemented (i.e. enforcement, related policy) and other factors (e.g. land affordability, cultural belonging) may matter more than the presence of a ban. Bans *do* successfully render cultivators unlicensed by fiat. This affects vulnerable, immobile, lower-income populations more to the degree relocation or alternative livelihoods are not an option. *See Obj 2, Finding 2, 4, 6.*
- 6) **Eradication-oriented enforcement loses efficacy over time.** While enforcement reputation initially deterred unlicensed cultivation, over time it lost deterrent efficacy. Those intending to exit cultivation because of enforcement did so in the first few years but those with higher risk tolerance or fewer alternative options, stayed. By 2022-24, enforcement reputation was actually correlated with an *increase* in unlicensed cultivation. This suggests that, by itself, enforcement is less effective over time in addressing unlicensed cultivation, particularly to the degree it forfeits other civil enforcement approaches, like code enforcement, water and hemp inspections, etc. The only consistent effect of punitive, eradication-focused enforcement, particularly in ban counties, is that it causes cultivators to move to other places within jurisdiction. *See Obj 2, Finding 3, 6; Obj 4, Finding 1.*
- 7) **Civil regulatory policies that foster norms can effectively discourage unlicensed activity over time.** Regulatory policies take time to disperse through populations. The increasing correlation of civil approaches (e.g. permit programs, landlord liability, fine regimes) to declining unlicensed cultivation suggests civil policies need time and consistency to spread through communities and create the kind of adaptations desired. Enforcement is important, but education *prior* to enforcement is key for fostering social adjustment to new policies. *See Obj 2, Finding 4-6.*
- 8) **Decisions around unlicensed cultivation are driven by economic concerns.** Livelihood prospects drove decisions by cultivators to continue or abandon unlicensed cultivation. As economic conditions (i.e. wholesale price of cannabis) worsened, unlicensed cultivators with other livelihood options stopped growing. Those who

persisted cultivating, however, often lacked other livelihood possibilities. In both cases, economics were key factors. Economics also affected *how* (e.g. outdoor or mixed light) and *where* cannabis was grown (e.g. remote, cheaper land). *See Obj 1, Finding 3; Obj 2, Finding 7.*

POLICY RECOMMENDATIONS

The following policy-related recommendations derive from the above research, as deliberated by the team of co-authoring researchers.

- 1) Maximize quantity of licensed, owner-occupied farms throughout the state.** As licensed farms were the most significant factor in declines of unlicensed cultivation, we recommend maximizing licensed cultivator participation and dispersion throughout the state. These farms should be owner-occupied to ensure that local norms and a “culture of compliance” can be communicated and maintained through local networks (as opposed to absentee owner-operators). To avoid overproduction and farm failure, farms should be small. Correlated policies include: reducing or eliminating barriers to cultivation licensure; expanding areas where cannabis can be locally permitted; programs to retain and support existing licensed farmers; clawbacks of large and stacked licenses, which reduce farm numbers and are more likely to be absentee owned. Expansion of retail opportunities (e.g. more dispersed retail, longer hours, direct-to-consumer sales, cannabis events,) is also important to ensure markets can sustain new producers (See Polson et al 2022 & 2023 for specific recommendations.)
- 2) Create statewide small-farm carve-outs or ministerial pathways for localities to permit farms.** In order to reduce unlicensed cultivation, increase farm counts, and reap the social, economic, and environmental benefits of licensure, new pathways to licensure are needed. Since many localities do not have the bandwidth or resources to create permitting programs, alternative pathways could be created. A statewide exception for small farms (e.g. up to 2500 or 5000 square feet), with lowered barriers to entry (Polson et al 2022) even in ban areas, could encourage small farm dispersion throughout the state. Allowance of a ministerial local permit and state license (Biber et al 2023) could also create pathways for localities to benefit from small farm production. State assistance to ban counties could be conditioned on such pathways and supported by the creation of a Best Practices template from the DCC on what regulatory and implementation strategies have been most effective.
- 3) Ensure personal cultivation is affordable and feasible throughout the state.** Maximizing allowance for personal gardens allows an exit from unlicensed production in

ways that enable continued enjoyment of cultivation and foster norms around cannabis. Eliminate local barriers to personal cultivation, especially restrictions on outdoor or mixed light cultivation that would otherwise be acceptable for other gardens. Conduct a state audit of personal cultivation allowances, costs, and restrictions to ensure that the intent of Proposition 64 to allow personal cultivation is not being abridged.

- 4) Address economic and social drivers of unlicensed activity in enforcement responses.** Our research suggests that eradication-focused law enforcement has declining efficacy over time and that multi-agency responses that incorporate civil, non-punitive measures can reduce unlicensed cultivation by addressing the economic and social drivers of unlicensed cultivation. Economic consequences (e.g. fines) may be effective at discouraging unlicensed cultivation but if other livelihood and land use opportunities do not exist, economic consequences can simply compound harms on already-vulnerable populations. Providing education on how to avoid violations and services to increase resilience and social integration are more suitable alternatives than adversarial enforcement.
- 5) Tie enforcement funding to accurate data assessments of extent and development of unlicensed cultivation.** Claims about unlicensed/illegal activity, including their environmental impacts, are commonly used to acquire limited public resources. However, these claims often use blunt, outdated, or inaccurate measurements. Enforcement agencies should utilize up-to-date methods and data sources, like those modeled here, to substantiate the need for enforcement and demonstrate the efficacy of prior enforcement strategies. This should include resource requests by counties with ban policies (including requests to the Board of State and Community Corrections, as authorized under AB141), which not only fail to stop unlicensed cultivation but are associated with more significant environmental impacts.
- 6) Support policy responsiveness to the economic and social predicaments of unlicensed cultivators.** Ethnographic research consistently conveyed the importance of economic considerations among unlicensed cultivators. Land prices, wholesale cannabis prices, and market access mediate whether and how cultivators persist. Economic vulnerability is often rooted in social marginalization (e.g. age, location, race/ethnicity, immigration status). Many persist because other economic options do not exist, indicating a need to (a) innovate approaches to economic development in remote, low-income, non-white, and legacy cultivator communities and (b) include persistent cultivators and communities in economic development planning and programming.
- 7) Eliminate exceptional penalties regarding cannabis agriculture and integrate cannabis into existing agricultural processes.** In recent years, regulators have adopted cannabis policies that apply uniquely stringent penalties to cannabis agriculture (e.g.

SB753). This is often done without adequate substantiation that environmental impacts of cannabis are more dire than any other agricultural form or that heightened consequences would effectively discourage these impacts. Environmental impacts should be accurately assessed and addressed through processes that already exist for other forms of commercial agriculture – including through outreach and education.

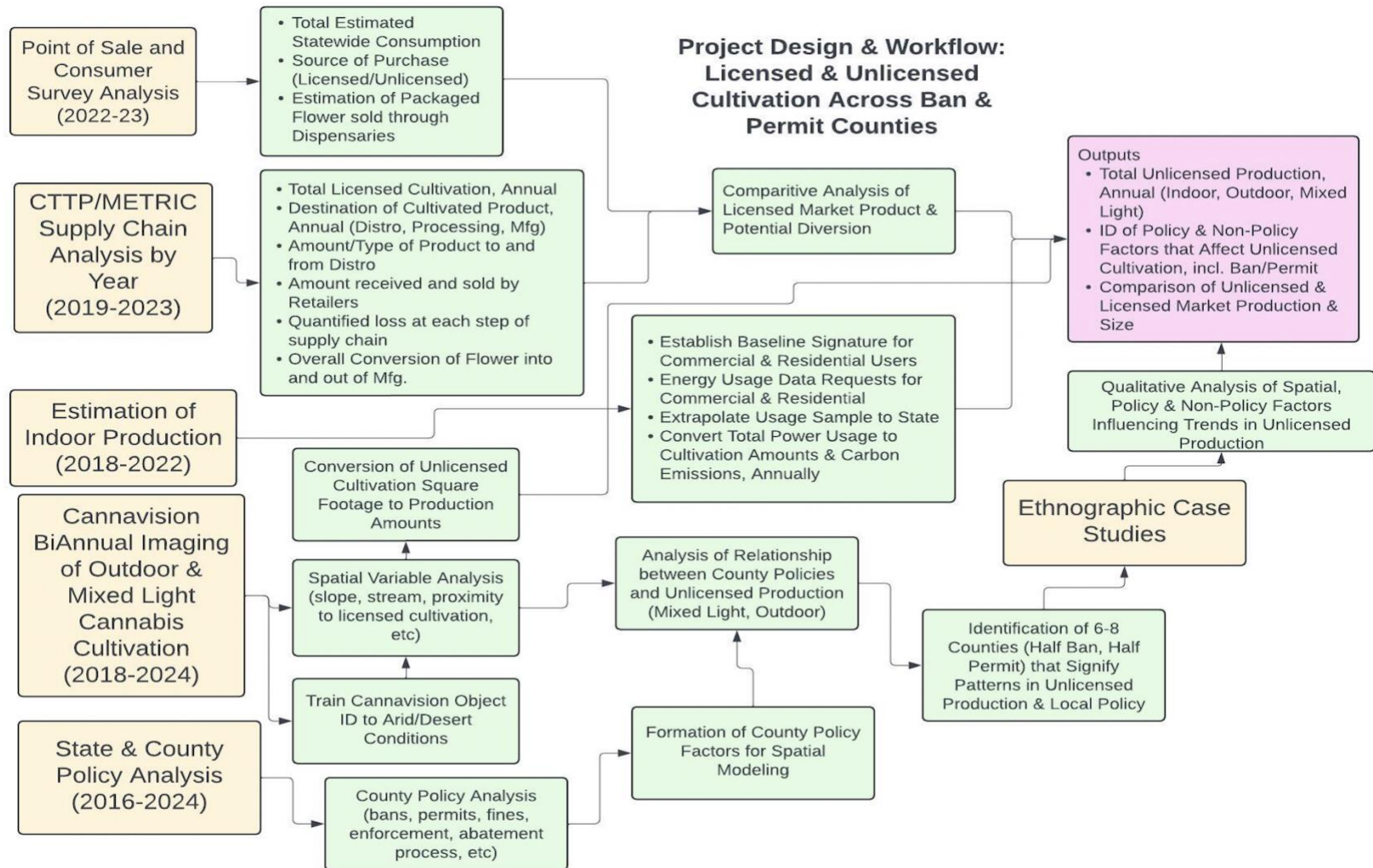
- 8) **Improve California’s Track-and-Trace Program (CTTP) to minimize human error and enhance traceability.** Assessing supply chain flows is hindered by inaccurate data and an inability to track a harvest forward through the supply chain. Human errors could be minimized by implementing a non-punitive, non-onerous audit system or by streamlining farm reporting to off-farm transfers and reducing/eliminating plant tags. Supply chain analysis could be enhanced by adjusting the batching processes to ensure that harvests can be traced from the point of origin to point of sale, which would enable a more clear understanding of how the supply chain operates.
- 9) **Foster a Culture of Compliance.** Effective regulation and discouragement of unlicensed cultivation requires the fostering of social-regulatory norms. To foster a “culture of compliance” that grounds regulation in communities, efforts have to be made to positively integrate cultivation into communities. Destigmatizing cannabis, integrating it into existing systems (see above), and upholding positive examples of cultivation helps to build communal norms that, among other things, discourage unlicensed cultivation.

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APPENDIX 1: PROJECT DESIGN & WORKFLOW



APPENDIX 2: LIMITATIONS

2.1 LOCAL ORDINANCE ANALYSIS

The component of the project that analyzes local ordinances has several limitations. First, our research only studied county ordinances. We did not examine city, or tribal, ordinances. Our research investigated ordinances in all 58 counties, but did not look at city ordinances. Many counties have large cities with significant populations that may influence on cultivation patterns (e.g. Nevada City vs. Nevada County). When compared with CannaVision data, a particular polygon may include land that covers both cities and counties, therefore it is challenging to identify whether the pattern is related to city or county ordinances. Second, our research provided a background of state policies, but did not closely examine each and every state policy, law, regulation and enforcement priority that may have influenced the growth or diminution of the licensed and unlicensed market. State policies greatly influence the cannabis industry, and it is hard to distinguish, using ordinance analysis alone, whether a state or local policy influenced certain behaviors. That said, state laws generally would affect all state cultivators and are therefore less critical for sub-state variation analysis. Third, written law is often applied very differently in practice. Counties have wide discretion on implementation and enforcement. This study assessed the presence, absence and quality of laws but could not assess implementation of those laws, except through ethnographic case studies, which explored issues of enforcement, implementation, and perception of laws.

2.2 CANNAVISION & SPATIAL MODELING

CannaVision has some limitations. The temporal scope is limited to 2018 onward, as that is the most reliable data; data before 2018 is not reliable, as the available imagery is of prohibitively lower resolution. CannaVision may mis-identify sites as cannabis cultivation that are non-cannabis greenhouses (for example, the cut flower industry). This is why much of the Central Coast (e.g. Santa Barbara, Monterrey) and Central Valley are omitted, as it is not possible to reliably identify cannabis greenhouses versus non-cannabis greenhouses. Some regions' data (particularly the North Coast) have been ground-truthed by SWRCB site inspections and are very reliable, and others have not. Over the course of the study, it became apparent that land prices may be a significant factor in unlicensed cultivation geographies, however, data was not readily accessible without subscriptions that exceeded our budget. There was also some interest in understanding how local laws were enforced and what their outcomes were, but local records are uneven, preventing uniform analyses and this project did not have enough personnel to take on this significant amount of work.

2.3 INDOOR PRODUCTION

Our proposal acknowledged that we might face challenges in estimating indoor production, and we indeed encountered several. We received data only from PG&E, which

provides service to approximately 16 million people across a 70,000-square-mile service area in Northern and Central California, covering 46 counties. We intended to estimate total unlicensed indoor production statewide, but are limited to the counties that PG&E serves. Despite requesting data from Southern California Edison (SCE) and San Diego Gas & Electric (SDG&E) in fall 2024, we did not receive that data in time to use it. Additionally, we were unable to obtain energy data from Publicly-Owned Utilities (POUs), which serve approximately 25% of the state's population. POUs are not regulated by the CPUC and are not legally mandated to make data available to institutions for academic purposes. Estimating unlicensed indoor cultivation based on energy records is also limited because not all unlicensed indoor cultivation sites use grid power, and may rely on generators to power their lights, sometimes specifically to avoid detection.

Several methodological limitations affect the interpretation of our results. Our model produces probabilistic estimates of cannabis cultivation prevalence (the percentage of utility accounts likely growing cannabis) rather than definitive identification of specific sites or any estimates of precise production volumes. The model was trained using approximately 500 licensed cultivation facilities, over 100 addresses from DCC enforcement actions, and several dozen media-reported bust locations. While this provided validated training data, the sample size was limited relative to the hundreds of thousands of utility accounts analyzed. Ideally, we would have had access to many hundreds more verified, ground-truthed cultivation addresses with detailed operational characteristics, such as actual HVAC loads, lighting specifications, operational timing, and cultivation area, to enable more precise model calibration and validation.

Our analysis reports cultivation prevalence under a range of assumed baseline rates (0.25%–1.75%) because the true prevalence of cannabis cultivation in the general utility customer population is unknown. We applied Bayesian prior adjustments to account for this uncertainty, but the resulting estimates remain sensitive to these assumptions. Additionally, due to incomplete or missing data at the county level, we aggregated results by region rather than by county, which may obscure important local variations in cultivation patterns that may result from local policies. Finally, while our model detects distinctive 12-hour photoperiod energy signatures strongly associated with cannabis flowering cycles, we cannot rule out other indoor agricultural operations using similar lighting schedules, nor can we reliably account for novel production methodologies (e.g. mixed light) that may not rely on a standard 12/12 lighting cycle.

2.4 LICENSED MARKET ANALYSIS

Ideally, track-and-trace data enables tracking the product through the supply chain. However, as outlined in the limitations section, issues with the validity, reliability, and accuracy of the CTPP data prevented us from tracking products through the supply chain. Instead, they restricted analyses to specific stages in the chain, namely harvest and transfer. Please refer to the limitations of the data referenced in the methodology and the threats to reliability and validity of

the data accuracy. Without a robust auditing process, outliers, replicated and inaccurately entered data were quite common in the underlying dataset.

2.4.1 CTTTP DATA

Our proposal acknowledged that potential challenges may arise with limited or no access to CTTTP data. Other challenges have manifested. The underlying data from METRC have several limitations, and data quality issues limited the analyses. Track and Trace was implemented at the cultivation level to prevent diversion and track the product through the supply chain, starting with the plant. Other crops used to create intoxicating products (hops, grapes) are not tracked at the plant level. Analysis of CTTTP data at the cultivation level revealed inconsistencies in data entry, a lack of oversight into how data was reported, and an absence of auditing to identify faulty data or remove anomalies from the dataset.⁴⁰ This not only made accurate analysis difficult, but it also calls into question the utility of tracking at that level.⁴¹ There was a 10-month gap in available transfer data from January 2022 to October 2022, meaning that the analysis could not be completed for that time range. The table below lists METRC data quality and reliability issues.

Table: CTTTP Data Quality and Data Reliability Issues	
CTTTP Data Quality Issues	County-Level Data Reliability Issues
● A lack of unique identifiers for batches. Instead of a unique batch identifier, strain names are used, which are duplicated across multiple harvests. As many as 104 Distinct Total Packaged Weight values can be associated with a single Harvest Batch Name. ● Once harvests are combined into batches, a new ID is assigned. Sometimes plants from the same harvest end up in different batches. This made it impossible to track plants all the way through the supply chain. Instead we had	● Lake County: Of the 527k distinct Harvest Batch Names from Lake County, over 521k account for only a single plant. Moreover, the PackageUIDs are not unique, leading one to inquire if a possible data error has occurred where PackageUID and Harvest Batch Name have been swapped. They do have very similar organization in many of these cases. ● Kings County: Only Lemoore City allows for cultivation within Kings County. There was a spike in 10/22 where 193 individual licensees

⁴⁰ Examples of Data Outliers: Harvest Batch “Mendo Breath – 05/10/21” is a clear example of outliers not being identified and removed from the dataset. A small Mixed Light Tier 1 facility in Monterey County claimed 720 plants produced 4.13M (413,414,949.36) kg of flower. When considering small Mixed Light Tier 1 as a license category, the reported average kg per entire harvest was 154kg, with an average of 471 plants per harvest. This outlier should have been identified by METRC as an incorrect entry.

⁴¹ A recent report on the CA market did not use CTTTP cultivation data to estimate production, but rather relied on cultivation tax receipts. While also problematic for other reasons including unpaid taxes, this source of data may be more reliable for tracking harvested data than plant level data entries (ERA Economics, LLC, 2025).

to track transfer data using the number of manifests rather than original plant/harvest ID's.	produced harvest batches and then many cultivation sites closed resulting in a large drop in harvests for subsequent years.
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Due to CTTTP data issues, we were unable to answer the following questions:

- How much cannabis does not get transferred to the next step in the supply chain, and how much of that can be accounted for by moisture loss, crop loss (e.g. contamination), byproducts (e.g. stems and leaves,) and destruction due to inability to sell? We could not complete this analysis because, although there was a waste weight associated with each harvest, there were many where no water weight or waste weight reported. Additionally, we did not have parity between Transfer IDs in the Harvest Table & Transfer Tables.
- What is the flow of cannabis by volume through the supply chain and how has this changed over time? We could not complete this analysis because there is no through line for products from harvest to sale. Each step generates a new set of ID's and transfer manifests and there is no way to track a specific transfer to a specific licensee, only a license type. For example, tracking movement from a cultivator to a distributor, but not the specific distributor. Furthermore, there was no way to know if the destination license was held by the same company as the license of origin. For example, if a product went from a farm to a distributor, was the distributor a new entity? Or a second license held by the origin farm?
- Are there regional or farm type differences in harvest destination? E.g. is flower from one region or one type of farm more likely to be sold whole and flower from another more likely to go to manufacturing? Although there is a product category associated with each transfer, license type, region, etc, we could not complete this analysis because of the 10 month gap in the transfer data. Additionally, once flower is packaged to move off of the farm, it is assigned a new batch ID number. Flower from a farm might be re-assigned a new batch number and sent to a distributor where it is combined with flower from other farms and assigned new ID numbers and then sent to a manufacturer or retail establishment. This makes it impossible to track the flower from a particular farm as some may go through one supply chain channel, and some through another.
- How much product is lost in the supply chain at each level of custody? We could not complete this analysis because, while there is data on the weight of a product shipped from point A to point B, we had no insight into processing. For example, we may know that three tons of flower went from farm to processor and then 100 lbs of extract went from processor to retailer, but we can't say if the extract solely came from the three tons of flower or if it was a blend of flower they got from multiple farms and combined into a new batch with a new ID.

2.4.2 HARVEST DATA

There is a lack of unique identifiers for batches. Instead of a unique batch identifier, strain names are used, which are duplicated across multiple harvests. For example:

8. 106 Distinct Harvester License #s have a Harvest Batch Name "Ice Cream Cake" with Harvest Start Dates ranging from 7-30-2019 to 06-03-2024

9. 98 Distinct Harvester License #s have a Harvest Batch Name “Wedding Cake” with Harvest Start Dates ranging from 10-30-2000 to 11-30-2023
10. 60 Distinct Harvester License #s have a Harvest Batch Name “Gelato” with Harvest Start Dates ranging from 10-1-2019 to 5-8-2024

As many as 104 Distinct Total Packaged Weight values can be associated with a single Harvest Batch Name.

When trying to calculate harvest weight based on Distinct Package UUIDs, it was discovered that the number of IDs in the Harvest and Transfer Data do not match, and very few of the IDs in the Harvest Data actually appear at all in the Transfer Data. This made tracking products from harvest by a cultivator to transfer for a particular licensee difficult.

- # of Distinct PackageUUIDs in Harvest data: 1,358,862
- # of Distinct PackageUUIDs in Transfer data: 25,602,470
- # of Distinct PackageUUIDs in Transfer data that appear in Harvest Data: 758,885 (3%)
- This is exacerbated by a 10-month gap in available transfer data from January 2022 to October 2022.

County Data Limitations: Two counties could not be included in our analysis because they contained data inaccuracies and were outliers in the dataset: Lake County and Kings County.

Lake County: Of the 527k thousand distinct Harvest Batch Names from Lake County, over 521k account for only a single plant. Moreover, the Package UUIDs are not unique, leading one to inquire if a possible data error has occurred where Package UUID and Harvest Batch Name have been swapped. They do have very similar organization in many of these cases. Example:

PackageUUID: 1A4060300034135000000037

Harvest Batch Name: 1A40602000341350000000559

Of those 521k single plant Harvest Batch Names, more than half carry the same weight in grams, either 80g (84k), 90g (83k), 140g (163k).

Moreover, 306k Identify the Item Name as simply “Assorted Unnamed Strains.”

Kings County: Only Lemoore City allows for cultivation within Kings County. There was a spike in October 2022 where 193 individual licensees produced harvest batches and then many likely ceased operations due to bottoming out price pressure and overproduction in the state overall. These market factors may influence a much higher average number of plants and average KG per harvest compared with other counties.

2.4.3 Transfer Data

CTTP is limited by an inability to accurately track products through the supply chain from seed to sale. Each stop in the supply chain is treated as a new occurrence without data transferring over from the previous location. For example, only 3% of the Harvest Unique ID's are in the transfer data. This means that the data is being collected piecemeal. A licensed cultivator enters their harvest weight and number of plants and that is given an ID. Then, when

they send it to a distributor, the harvest batch is given a new ID and the program only ensures that the sender and receiver both have valid licenses. Then, the distributor may combine harvest batches and create a new manifest with a new ID to send it to the manufacturer or retailer. This is an issue in CA due to the frequency with which a third party distributor sits between the other licensees and the movement from one licensee to another. This is why we are not able to track a given plant through the supply chain. This is also why diversion at any level is hard to detect. A licensed cultivator may only enter 75% of their harvest into CTPP. A distributor may combine three harvests into a new batch with a new ID for transfer to a manufacturer but only include 75% of the product they received in that new batch. A manufacturer may receive 100 lbs of flower and convert that to oil, but only record 75% of the oil produced into CTPP. Without audits and oversight, the system is designed to only ensure that those entering data have a valid license and that there is some recorded activity accounted for by a person with the appropriate permit.

Transfer Data blank Origin County / Destination County: The vast majority of manifest #s from 2019 Q3 – 2021 Q3 show an Origin County or Destination County of “none.” Data from January through September 2022 was not included in the original set of data sent over from METRC: Prior to Q3 2022, the majority of transfers included a null value for both “Origin County” and “Destination County” of transfers. These values were updated based on the zip code of the facility in question.

It was concluded that the program is not designed to follow individual plants from harvest to sale, but rather to create documentation of chain of custody at each step in the chain and to allow for problematic products (testing fail, issues with packaging) to be traced backwards through the supply chain to establish where the issue originated. For example, if a vape cartridge fails a test, the specific ingredients of that cartridge can be identified and traced back to the gardens where they originated. However, it is not possible to track all harvests produced forward through the supply chain. In this regard, the program does ensure that the product is moved from one licensed entity to another, that there is a record of that movement and that problematic products can be traced backwards. It does not, however, track plants from harvest through the supply chain.

2.5 CASE STUDIES

Ethnographic research has built-in methodological limitations – and advantages – around hidden, vulnerable populations like unlicensed cultivators. Respondents are necessarily limited to those able to be contacted, which can be a challenge in researching hidden populations. (Simultaneously, qualitative ethnographic data collection is often the only way to conduct research on informal, illegal, or otherwise hidden topics that people may hesitate to fill out a survey about.) Particularly in places that had experienced booms and busts, finding unlicensed cultivators to interview was a challenge. (This was both a limitation as well as a research finding:

unlicensed cultivation had indeed declined in numerous areas.) Respondents we did connect with were more likely to be rooted in place and less mobile, for a variety of reasons including age, income, demographic identity, and social belonging, while those who left the area or were present but harder to identify may have been less connected to place and more mobile (for varying reasons of age, income, demographics, and belonging).

Access to other kinds of respondents also limited our sample. In some counties (particularly ban counties), law enforcement did not respond to requests for interviews, even when they were the primary agency tasked with addressing unlicensed cultivation. Some counties are vast and our ethnographic research was necessarily localized to places most likely to contain cultivation or areas where we could find respondents.

Our research took place between 2023-25, although we were interviewing people about relevant topics ranging back to 2018 and before. Retrospective interviews raise issues of memory accuracy and of filtering past events through current lenses.

Finally, while we anticipated that ethnographic research would be responsive to Cannavision modeling, delays in obtaining high quality data required us to initiate ethnographic inquiry with less determinate data. This order affected the questions we asked and where we focused research.

For all these reasons, responses and analyses of participants often varied. No one respondent could convey the totality of unlicensed cultivation in a given jurisdiction. We attempted to address this and the above issues by conducting multiple interviews, across different types of informants, in varied locales, with specific interview prompts to help informants reconstruct accurate assessments of unlicensed cultivation over time.

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APPENDIX 4: PERMIT COUNTIES WITH PERMIT CAPS

Permit County	Cap on Permits	Acreage Cap	Permits per Person Cap	Farm Size Cap
Alameda	✓ 10	×	×	×
Contra Costa	✓ 10	×	×	×
Humboldt	✓ 3,500	✓ 1,205	✓ 4 medical permits	✓ 8 acres adult-use
Lake	×	×	×	×
Mendocino	×	×	✓ 2 per parcel	✓ 10,000 sq. ft. per parcel
Mono	✓ 10	×	×	×
Monterey	×	×	×	×
Nevada	×	×	✓ 3 per person	✓ 10,000 sq. ft. per parcel
Riverside	×	×	×	✓ 43,560 sq. ft. per lot
Santa Barbara	×	✓ 1,575; 186	×	×
San Benito	✓ 50	×	×	×
Santa Cruz	×	×	×	22,000 sq. ft. per parcel
San Luis Obispo	✓ 141	×	×	×
San Mateo	×	×	×	×
Sonoma	×	×	×	×
Stanislaus	✓ 61	×	×	×
Trinity	✓ 530	×	✓ 1 per parcel	✓ 10,000 sq. ft. per parcel
Ventura	×	×	×	✓ 500 acres
Yolo	✓ 65	×	×	✓ 2 acres

[COMPARATIVE ANALYSIS SPREADSHEET](#)

APPENDIX 5: INTERVIEW QUESTIONS

Sample Interview Questions for: Licensed and Unlicensed Cultivation Across Ban and Permit Jurisdictions: Predictors of Growth and Total Production Estimates

Interviews will be semi-structured. The following list of questions is not exhaustive. Please update this document to include notes on specific questions that generate good responses /

are capturing key data during interviews.

Questions for Cultivators (Licensed and Unlicensed)

This section is designed to understand the decision context of cultivators and the reason for changes they have undergone, especially since legalization.

Context Setup: Provide the interviewee with a timeline and/or model/maps of the specific county. Then, ask the following questions:

- 7) What's your background growing cannabis?
 - a) How long have you been growing? Where have you worked? Are you still growing? (Try to get a general timeline and then you can ask questions about why they started, stopped, or changed locations.)
- 8) Have you applied for a license?
 - a) If you have a license:
 - i) What type of license is it (indoor, outdoor, mixed-light)?
 - ii) What size is it (small, medium, large)?
 - iii) Do you have an annual or provisional license?
 - iv) Would you describe yourself as a family farm, craft cannabis, etc.?
 - b) What was that like? Did you get stuck and did you persist?
 - c) Were you ultimately successful?
 - i) If so, what do you attribute that to?
 - ii) If not, what prevented you from obtaining a license?
 - (1) Did conditions being applied to the entire property stop you from applying or delay your application process? For example, was getting your entire property up to code a challenge? Were there issues with getting roads and culverts compliant, etc.?
 - iii) What was your experience navigating the CEQA process?
 - iv) Do you think creating a pathway for existing (legacy) cultivators to slowly transition into the regulated market while continuing to operate was helpful in transitioning you into the licensed market?
 - (1) If you hadn't obtained a temporary/provisional license during the transitional time, would you apply today? Would it be more difficult or more easy to apply today?
 - v) Did your permit require a public hearing? If yes: Did that make the process of obtaining a permit more difficult?
- 9) What do you think of cannabis policy in your county?
 - a) Do you feel like cannabis policy in your county is stable, or unpredictable?
 - b) What do you think about local cannabis taxes in your county? How do local cannabis taxes influence your decision to participate in the licensed market?
- 10) Have you changed where or how you cultivate since legalization in 2016?
 - a) Have you changed location?
 - i) If you changed location: Why did you change?

- (1) Did you move to a different location on the same parcel? A different property? A different county?
- (2) Did water/access to water influence your decision to move? Did any of your wells dry up during the drought?
- (3) Did wildfire or the threat of wildfire influence your decision to move?
- b) Have you changed how many plants you grow? If yes, why, and when?
- c) Have you shifted how you actually grow the plants? Lights, soils, etc.
- d) How has your ability to sell cannabis changed?
 - i) Are you selling in different networks now than before?
- e) Have relations with your neighbors shifted?
- f) Has your ability to obtain water/the drought shifted your cultivation practices?
- g) Has wildfire or the threat of wildfire influenced your business?
- 11) Were you ever involved politically or publicly around cannabis and has this changed in the past 6 years?
- 12) What, if any, relation do you have to government regulators or officials of any sort?
- 13) Does it seem more economically risky to grow these days? Risky in other ways?
- 14) What has legalization meant for you, your family, and your community of friends and acquaintances?
- 15) How is legalization going for the legacy growers you know?
- 16) How have you seen the underground market shift since legalization?
 - a) What do you think about/how would you describe the “grey” market? Do people have a foot in both worlds?
- 17) Do you plan to continue cultivating?
 - a) What factors are you considering?
- 18) (For unlicensed producers) What policies or other considerations would lead you to apply for a license?
- 19) What has enforcement looked like in your county? Have you ever been enforced against?
 - a) Has a neighbor ever submitted a complaint against your farm?
 - b) Do you think the county’s enforcement efforts are effective? Do they deter you or people you know from unpermitted activity?
 - c) Is law enforcement or code enforcement more effective?
 - d) Do you think satellite imagery and fines have stopped unlicensed cultivation (Humboldt)?
 - e) Do you think drone surveillance is effective at enforcement?
 - f) Do you think cannabis fines are effective? Are they effective if they are per plant or per occurrence? Is a \$100/fine a deterrent, or is a \$5000+/fine a deterrent?
 - g) Have you ever received a fine for cannabis activity?
 - h) Do you think landlords are less likely to lease to cannabis farmers due to enforcement in your county, the risk of fines, having their property seized via a

property lien etc.?

- i) Do you think the County Cannabis Task Force is effective at enforcing against the unlicensed market?
 - j) Have you ever been subject to a county, state, or federal raid?
 - k) Do you think criminal penalties of a misdemeanor has a deterrent effect?
 - l) Do property liens have a deterrent effect?
- 20) For permit counties: Do you think the county having reached it's permit or acreage cap has influenced the growth of the unlicensed market? If there wasn't a cap, would you apply?

Questions for Non-Cultivating Stakeholders

This section aims to capture the views of non-cultivating stakeholders, such as county officials, law enforcement, activists, trade association representatives, and community residents/leaders, on the broader impacts and effectiveness of cannabis regulations.

- What is your relation to cannabis and cannabis-related debates?
 - How has your relationship changed over time?
- a. What have been the successes and drawbacks (or stumbling blocks) of legalization since it was passed?
 - How do you think the system is working?
- Do you lean towards supporting regulation or bans?
- Do you think your county's ordinance regulating cannabis has been successful?
 - Do you think enough permits have been issued?
 - For permit counties: Do you think the county having reached it's permit or acreage cap has influenced the growth of the unlicensed market? Do you think a permit cap is good policy?
 - Has there been opposition to regulation?
 - What are the successes and challenges of the regulatory framework and permitting rollout?
 - How has the CEQA process worked in your county? What issues, if any, exist with CEQA? What would you change about it?
 - Do you think creating a pathway for existing (legacy) cultivators to slowly transition into the regulated market helped transition unlicensed cultivators into licensed cultivators?
 - What do you think about the local cannabis tax rate?
- Can you describe the situation with unlicensed cultivation in your area?
- Do you think the county's ban on commercial cannabis cultivation is effective?
 - What kinds of enforcement do you think are effective against unlicensed cultivation?
 - What has enforcement looked like in your county, how has it changed over time?
 - Do you think the county's enforcement efforts are effective, do they deter

people you know form unpermitted activity?

- Do you think law enforcement/code enforcement is more effective?
- Do you think satellite imagery and fines has stopped unlicensed cultivation (Humboldt)?
- Do you think drone surveillance is effective at enforcement?
- Do you think cannabis fines are effective? Are they effective if they are per plant or per occurrence? Is a \$100/fine a deterrent, is a \$5000/fine a deterrent?
- Do you think landlords are less likely to lease to cannabis farmers due to enforcement in your county, the risk of fines, etc.?
- Do you think the County Cannabis Task Force is effective at enforcing against the unlicensed market?
- Do you think criminal penalties of a misdemeanor has a deterrent effect?
- Do you think property liens have a deterrent effect?
- What kinds of effects do you see your county's policy is having?
- What do you think are the main causes of unlicensed growing?
 - What, if anything, do you think could be done to address unlicensed growing?
 - Whose responsibility is it to address it?
- What sources do you rely on to know about unlicensed cultivation?
- Can you describe how cannabis—licensed and unlicensed—fits into the broader picture of local life, politics, and economics in this area?

Questions for ALL Counties (based on Model Data)

This section aims to gather insights from various stakeholders about the effectiveness of county regulations, enforcement mechanisms, and observed trends in cultivation practices based on model data. Ask these questions at the end, as they are leading.

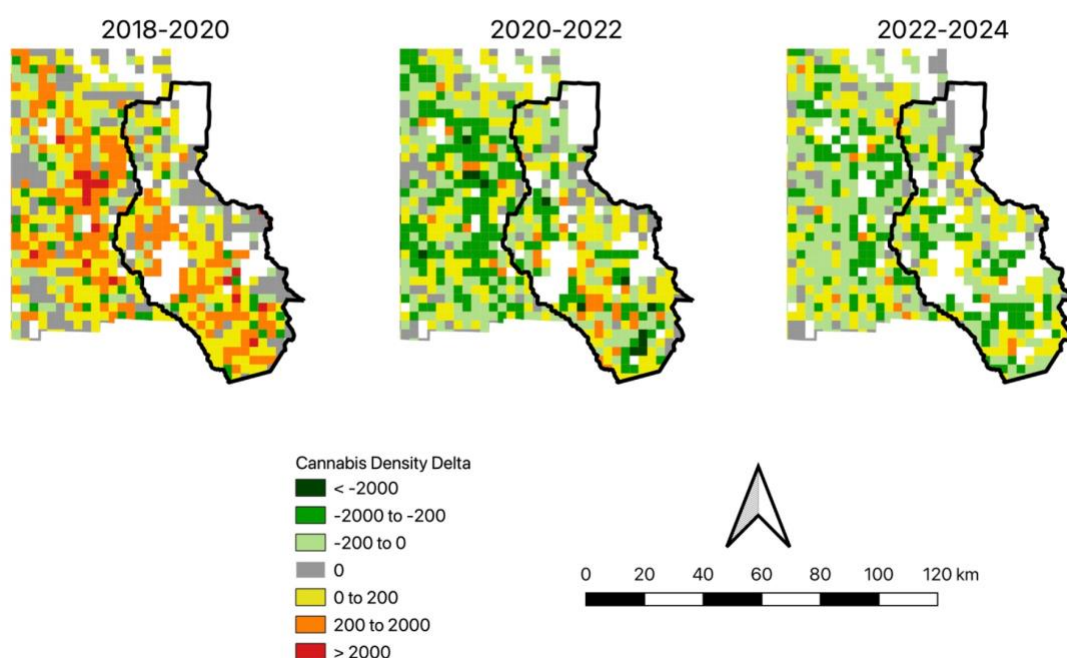
- Would you say that unpermitted cultivation is decreasing or increasing overall in your county?
 - What evidence do you have for this?
 - Why do you think this is happening?
- Our preliminary data have shown that the density of unpermitted grows has increased/decreased in your county.
 - Does this correspond to what you have seen?
 - What do you attribute this to? Policies/regulations? What else?
- What specific policies (fines, abatement, landowner responsibility, etc.) have contributed the most to increasing/decreasing unpermitted cultivation? Please explain.
 - What has enforcement looked like in your county, how has it changed over time?
 - Do you think the county's enforcement efforts are effective, do they deter people you know form unpermitted activity?
 - Do you think law enforcement/code enforcement is more effective?

- Do you think satellite imagery and fines has stopped unlicensed cultivation (Humboldt)?
- Do you think drone surveillance is effective at enforcement?
- Do you think cannabis fines are effective? Are they effective if they are per plant or per occurrence? Is a \$100/fine a deterrent, is a \$5000/fine a deterrent?
- Do you think landlords are less likely to lease to cannabis farmers due to enforcement in your county, the risk of fines, etc.?
- Do you think the County Cannabis Task Force is effective at enforcing against the unlicensed market?
- Do you think criminal penalties of a misdemeanor has a deterrent effect?
- Do you think property liens have a deterrent effect?
- Do you think enforcement mechanisms (e.g., MET, code enforcement) have been effective? Why or why not?
- With some exceptions, cultivation is moving away from fire-prone areas and toward groundwater dense areas (away from high stream density).
 - Does this accord with what you've seen?
 - What explanation do you have for this?
- Our data show that licensed and unlicensed cultivators are not growing in the same areas.
 - Have you observed this in your county? Do you have examples of this? Why do you think this is?
- In agricultural counties (e.g., the 4 largest ban counties), there is a tendency for an increase in cultivation.
 - Do you see that here? Explain.
- Based on our data, we are seeing a decrease in unpermitted cultivation in counties that permit cannabis and an increase in unpermitted cultivation in counties that have banned cannabis.
 - Do you see this trend in your county?
 - How would you explain these findings?

LAKE COUNTY: ETHNOGRAPHIC ANALYSIS

PREPARED BY JEREMY SORGEN

AUGUST 1, 2024

*Top Level Summary*

In Lake County, model results correspond with on-the-ground observations among those working in the cannabis industry as well as code and law enforcement officers. From 2018-2020, unlicensed cultivation trended upward overall and found its way into population-dense areas, matching trends in other counties. From 2020-2022, unlicensed cultivation decreased, nearly to pre-2018 levels, again matching trends in other counties. From 2022-2024, unlicensed cultivation bucked trends elsewhere by continuing to decrease in Lake County.

The increased prevalence of unlicensed cannabis in the first time period corresponds to widespread optimism in Lake, a county with a history of cannabis cultivation, about the social acceptability and de-felonization of the crop. In the second time period, the pandemic led many to stay home and grow cannabis and is likely the largest contributor to market collapse between Fall 2021 and 2022. Market saturation and the subsequent downturn in the price of sale led to a

decline in both licensed and unlicensed production, dwarfing other contributing factors. During this time period, non-cannabis agriculture also mounted a successful lobby to push cannabis back to outlying areas. As in other counties, the presence of a licensed farm was a strong predictor of decrease in unlicensed cannabis, since licensed farms drew unwanted attention and possibly also because of citizen policing. In the third time period, poor market conditions, more sophisticated enforcement, and opposition from the agricultural community combined to make Lake County a hostile environment for unlicensed growers. While no informants had perfect visibility into overall unlicensed production, law and code enforcement officers corroborated the decline, given fewer backwoods grows and smaller abatements, and cannabis industry insiders estimate that between 33-50% of legacy growers dropped out. Those hanging on may be doing so because of cultural factors, rather than economic incentives.

Research Summary

The Lake County ethnography involved 13 one-on-one interviews and one focus group for a total of 16 participants and 14 transcripts. Interviews were conducted between July 28 and 31, 2024 with the following participants:

- Cannabis industry
 - Three licensed growers (one possibly “straddling” to unlicensed production)
 - One grow store manager
 - Two dispensary owners
 - One pro-cannabis advocate
- County staff
 - One high-ranking law enforcement officer
 - Two Board of Supervisors
 - Three high-level planning staff
 - Two code enforcement officers
 - One agriculture commissioner staff

*Some of these individuals were part of a focus group along with County Attorney Council and an Office Assistant who did not contribute to the discussion.

LCCA president was the primary connector for all interviewees, many of whom are involved in local politics through LCCA (on the industry side) and the Cannabis Ordinance Task Force on the government side. LCCA president connected me with the Director of CDD who oversees all of planning, building, and code enforcement (40 staff). It was difficult to speak with unlicensed growers, even though at least six people reached out on my behalf. Lake County has a “small town” ethos where everyone seems to know each other and people wear multiple hats. People who commented on the unlicensed industry have limited visibility – cannabis industry types get information through their friends and government types get impersonal information through law and code enforcement. Other major sources of information used for this analysis were the Lake County planning code summary (2024) and Cannabis Equity Assessment (2021).

County Background

Lake County has a relatively small population of ~68,000 residents, 26 natural lakes, a high acreage of state and federal public lands (51% of the county), and an economy based on agriculture and tourism. It consistently ranks among the poorest counties in California with a poverty rate of 16.8% (as compared to 12.2% statewide) and annual county budget of approx. \$417,000,000 (2025). Clear Lake, purported to be the oldest lake in North America, separates the county into north and south shores, and is a center of fishing, water-based sports, and other tourism. Lakeport, the county seat, and Clearlake, the largest town, both border Clear Lake. Lake County is prone to flooding and wildfire, with 60% of the land-base devastated by wildfire since 2015. Demographically, Lake County is predominantly white (~65%), with Hispanic or Latino residents making up around 23%, followed by Native American, African American, and Asian communities. The population tends to lean Democrat.

Lake County has a multigenerational history of cannabis cultivation, going back to the 1970s, and some consider it to be the southern point of the “Emerald Diamond,” an expansion of the “Emerald Triangle” region of Mendocino, Humboldt, and Trinity counties. In the 1980s, it was a focal point of the war on drugs and ranked the highest in CAMP eradication statistics from 2003 to 2011, the last year the state kept records. This climate of prohibition incentivized “high risk, high reward” practices like growing multiple large cannabis farms on public lands. Lake was historically home to a diversity of small, medium, and large farms that attracted youth with little formal education. These factors led to cannabis being polarizing and widely stigmatized in local politics. 58.6% of the county voted “yes” on Prop 64.

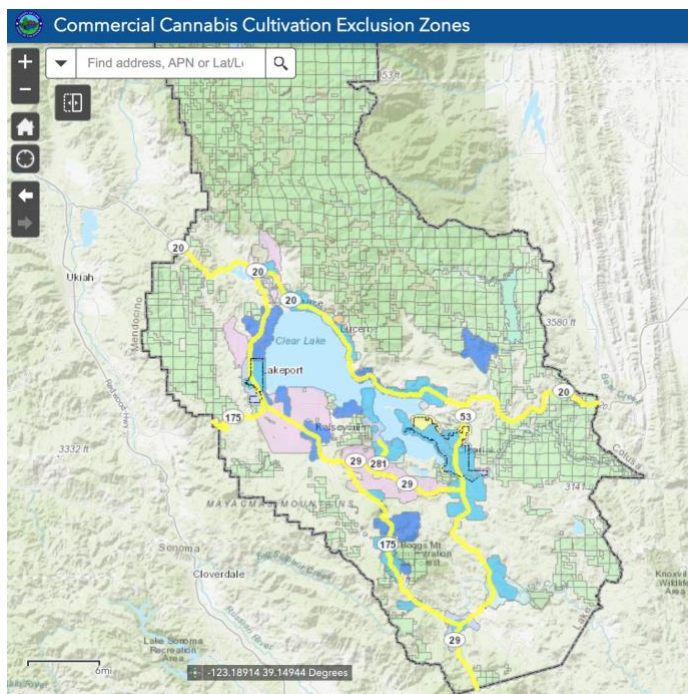
Prop 215 (1996) helped to decriminalize cannabis and SB 420 (2004) created the “collective” or “co-op” system that allowed small cannabis businesses to operate as nonprofits for medical purposes. Under the collective system, many growers became “primary caregivers” to “qualified patients,” and grew up to 99 plants, which kept them under the federal threshold of a mandatory 10-year prison sentence for 100 plants or more. The “99 plants rule” dramatically expanded illicit cannabis cultivation for two decades. In 2011, under the SB 420 model, Lake County added Article 72A, which allowed up to 36 mature or 72 immature plants. The county created a “self-certification” program for growers to openly say that they were growing fewer than 100 plants for nonprofit purposes. From 2012-2013, Ordinances 2977 and 2997 imposed limits on cannabis gardens, but many small growers stuck to the 99 plants rule under Prop 215 and there was a sense that “cannabis was everywhere.” Starting with MAUCRSA (2015) and continuing with Prop 64, the “collective” model was sunsetted and replaced with a tandem system of state licensing and local permitting (or bans) applicable to all forms of “commercial cannabis activities,” as newly defined. Measure C in 2016 and Measure K in 2018 supplanted Article 72 with Article 27 and imposed a tax structure on legally permitted grows in Lake County (at \$1/sqft for outdoor cultivation).

Some people perceive Lake County as creating a welcoming environment for large-scale operations. The County did not limit stacking permits as other counties did; for example, in 2021 BarX was approved for 63 medium-sized permits (80 acres outdoor/greenhouse combined), making it possibly the largest cultivation project at the time.

Urgency Ordinance 3070 (2017) gave self-certified growers priority for what became known as “early activation” (EA). EA enabled self-certified growers in good standing to begin their operations while their applications with the county and state were still in process. This program, however, proved to be a disaster when the county planning office, understaffed and

inexperienced with CEQA compliance, was unable to process applications in a timely and judicious manner. Many EA permittees operated for years with little regulatory oversight and without making progress toward state licensure. One planner involved in the melee described this period as a “shit storm” with unconscionable environmental impact. The EA program was shut down in July to August 2021 and ceased to exist.

Other county ordinances of note allowed industrial hemp (Ordinance 3087) and created a “Farmland Protection Zone” (Ordinance 3101). Summer 2020 was the “long, hot summer of hemp,” which saw over 40 hemp applications that first year. However, hemp crops mysteriously disappeared after the harvest, suggesting that growers grew cannabis under their hemp license. In 2024, there were fewer than five active hemp permits. “Traditional Ag” in Lake looks down its nose at cannabis, and some chalk this up to conflict over limited land and water resources. When a cannabis cultivator threatened to sue a big viticulture project over alleged contamination due to pesticide use, the ag community was able to push through a “Farmland Protection Zone” (FPZ) ordinance that forced cannabis operators to cultivate indoors (fixed-frame, powered greenhouses were included, unpowered hoop houses were excluded) or to move outdoor operations to, as one informant put it, “the hinterlands” within two years. As seen on the map below, restricted zones border the lake and are concentrated in Big Valley and Scotts Valley. A NIMBY group “CAPS” has recently (as of Summer 2025) been trying to expand this zone to other farmland types. Due to FPZ, one cannabis project converted to indoor and another five or so shut down.



Cannabis is excluded from cultivation in:

- The Farmland Protection Zone (red).

Lake County’s first cannabis ordinance declared cannabis CEQA-exempt, aiming to rely on CDFA’s 2018 statewide PEIR. When that route did not pass muster at the state level, Lake began to require initial studies for all cultivation permit applicants, although no project has yet required an EIR. Another ordinance that was onerous and controversial for cannabis operators was 3016 (July 2021), which required a Hydrological Report and Drought Management Plan as part of CEQA compliance, reflecting the county’s disorganization on this front. While the current cannabis ordinance is widely viewed as cumbersome and expensive, it is well regarded

by state agencies for CEQA compliance. The new ordinance underway (as of 2025) may trigger fresh CEQA review, possibly including an integral study or Programmatic EIR. For a full list of cannabis-related ordinances and resolutions, see [Lake County planning code summary](#).

As of August 2024, the Lake County Planning Division had received 276 cannabis use permit applications, including 262 for cultivation with the vast majority for outdoor and mixed light. 151 of those permits had been approved (219 total acres and fewer than 2% of licenses statewide), 38 had been withdrawn or closed due to inactivity, and 7 had been denied. Another 64 were still pending, many of them waiting on CEQA compliance review or corrections.

Unlicensed Cultivation Over Time

County level data is scarce on how much unlicensed cultivation currently exists. By most accounts, however, it is a lot. Cannabis industry informants had limited visibility into unlicensed cultivation overall and talked about the unlicensed growers they know personally and what they have heard via word of mouth.

Law and code enforcement may have more consistent visibility into overall unlicensed cultivation. A representative of law enforcement reported a sharp reduction in large backwoods grows after Prop 215 on USFS, BLM, and other federal lands. A planning authority suggested that wildfires may have wiped out some of these operations, evidenced by aerial footage taken after large fires. Small and large hoop house grows on private property are now more prevalent. Law enforcement also uses the number of plants they eradicate each year as a barometer. They estimate yearly eradication in the 200,000 range, far fewer than 330,000+ yearly eradication during the CAMP campaigns. But in recent years (starting around the time of Prop 64), they have not noticed a significant change in the amount of unlicensed cultivation besides the backwoods grows. If numbers are falling, law enforcement would guess that it has to do with the economics of cannabis and streamlined permitting. Nor did they view enforcement as especially effective. Whereas “whack-a-mole” was a common metaphor across our interviews, this law enforcement officer told the fable of the “Boy and the Dike” where a boy sticks his finger into a dike and a new leak springs – and so on until all his fingers and toes are tied up in the dike. This metaphor suggests that enforcement suffers from capacity issues and may not be a major deterrent to the production of unlicensed cannabis.

Code enforcement was more sanguine about the effectiveness of enforcement, saying that large grows have drastically decreased since legalization and early activation. These grows are big and easy to spot, especially with Google Earth and the other new aerial imagery technologies that the county employs, such as drones. While abatement is their “best tool” right now, the fine structure does not have “teeth” in Lake because of the 10-15 day waiting period to impose financial penalties, which is ample time for violators to remove and possibly to relocate grows. They guessed that unlicensed grows are decreasing in the county, citing the difficult market conditions. They also said that high electricity costs have made it hard for indoor cultivation, echoing a grow store manager’s statement that “PG&E killed indoor.” Indeed, as of August 2024 there was only one active indoor permit in the entire county.

While code enforcement said that the grows they target are a “mishmash” that include smaller, unlicensed grows, especially where there are repeated citizen complaints, most public officials identified large-scale, backwoods operations as the primary target, given concerns about

Anecdotally, licensed growers and others working in the cannabis industry commented on observations about the unlicensed community. One licensed grower estimated that, since 2016, 25-33% of legacy growers went for a license (part of that group failed), 33% are still unlicensed, and 33% have quit. A grow store owner estimated that 50% of their unlicensed customer base is still growing, 35% of their unlicensed customer base dropped out, and 15% went for a permit, with about half of those permittees having dropped out. They also estimated that over 50% of their unlicensed clientele is Hispanic, a number that increased since 2018 (a coworker chimed in with “90%”), explaining that this population is largely undocumented, may not have other viable job opportunities, and is able to work with smaller profit margins (he used multi-family living situations as an example).

[illegible]

27

become. This view tracks with the sharp learning curve that a legacy grower described and the disappointment with the emerging industry and personal doubts about whether they are still “producing medicine, or merely a drug.”

The jury is out on how much Lake County tried to help legacy growers transition to the regulated market. In terms of policy, the county made few provisions to support legacy growers. Early activation helped people continue to operate in the gray market while they went through permitting, but one interviewee questioned whether EA doomed applicants since many “stalled out” in the first, messy years of permitting. The county also received state funds to help with the transition in the form of Local Jurisdiction Assistance Grants (LJAG) and Equity Grants. While one licensed grower we talked to reported that the \$15-20,000/year from the equity grant was a huge help, others complained that they were disqualified from the equity grants (because they were not cultivators) or that the grants only provided tax relief rather than training and technical assistance, which is what they felt they really needed. LJAG funds were used to hire consultants to help applicants navigate the complexities of county and state compliance and licensure, but no cultivators that we talked to cited the benefits of LJAG. Code enforcement officers also talked about taking a more lenient and “solutions-oriented” approach to first round inspections, treating compliance as an education opportunity.

In April 2022, the BOS also approved a “Cannabis Tax Relief” Resolution to reduce the cultivation tax by 50% and buoy the sinking market. Licensed growers talked about the immense tax burden (“getting crushed on both sides”) and double standards that other agricultural sectors do not face. One legacy grower described the tax relief as “too little, too late.” In conclusion, while one cannabis advocate maintains that “the County tried to help,” anti-cannabis public sentiment, driven by other agricultural sectors, and a lack of organizational capacity in County planning may have undermined better support for cannabis growers.

Ethnographic Insights

According to model data, unlicensed production increased at an average rate between 2018 and 2020 before decreasing (again at an average rate, i.e. $-324.5 \text{ m}^2/\text{km}^2$) between 2020 and 2022. From 2022 to 2024, unlicensed production diverged from trends in other counties and continued to decrease. Lake County does not have a multi-agency Marijuana Enforcement Taskforce, but the Sheriff’s Office has an active narcotics division, which continues to prioritize cannabis, and it has a Cannabis Enforcement Unit, composed of two code enforcement officers and an office assistant dedicated full-time to cannabis eradication.⁴² Relative to other counties under consideration, Lake County has high building density (4th), it has an average amount of agriculture, average density of unlicensed cannabis in areas with licensed farms, and high wildfire risk but average density of unlicensed grows in fire-prone areas. When asked about these trends, informants reported the following:

- Most thought unlicensed production is down and pointed to market factors – it’s just not profitable anymore to cultivate cannabis. Other factors included wildfire, enforcement, and the consumer “culture of convenience.” A couple people mentioned that “PG&E

⁴² One of the code enforcement officers was recently arrested for taking bribes.
<https://www.lakeconews.com/news/79300-lake-county-code-enforcement-officer-arrested-for-bribery-extortion-and-grand-theft>

“killed indoor” (due to high electricity costs), but indoor cultivation was never a popular practice in Lake County. One anti-cannabis person said that unlicensed production is down because the licensing process is working to convert growers, with enforcement efforts reinforcing this process. One pro-cannabis person was surprised to hear that unlicensed production amounts are down, saying that the sentiment on the street is still “illegal pot is everywhere.”

- With regard to unlicensed cultivation, informants downplayed policy factors. At most, policy deterred growers from seeking licensure insofar as it often doesn’t make sense for growers to pay fees, get reports, and make other kinds of investments, with no guarantee of obtaining a license.
- Why the spatial separation between licensed and unlicensed? Most people immediately said that permitted grows, which get annual inspections and periodic visits from law and code enforcement, attract the kind of attention that unpermitted grows try to avoid. Most unlicensed growers therefore avoid licensed grows. Several informants said, moreover, that licensed grows report and push to eradicate unlicensed grows (because unlicensed cultivators are giving licensed cultivators a bad name, more so than because of market competition). A law enforcement officer confirmed this theory, saying that they get calls from licensed cultivators about unlicensed cultivators on their property or in their area. But a planning director said that licensed growers are not reporting unlicensed growers. However, a code enforcement officer rejected the question, saying that they see a lot of “clustering” of licensed and unlicensed grows on the same parcels. These grows can be difficult to tell apart.
- Informants were split as to whether enforcement works. Many people used the metaphor “whack-a-mole” to suggest that enforcement efforts are not responsible for the decline in unlicensed production, but others suggested that enforcement is effective at a more local scale and in more limited ways. A planning director talked about innovations such as law and code enforcement working in tandem to destroy plants and then abate infrastructure to cause a more serious financial loss and prevent the reuse of infrastructure in another area.
- Informants linked grows moving away from fire-prone areas and toward groundwater. Several people talked about drought forcing grows toward the valley. According to a law enforcement officer, it is also hard to get to fire-prone areas. Few were surprised by this finding in a county where 60% of the land area has burned in recent years.
- When talking about why unpermitted cultivation may rise in ban counties, most were not surprised and talked about the unintended consequences of alcohol prohibition. Several people brought up Siskiyou County when talking about enforcement and out-of-control unpermitted cultivation.
- No one on the ground, including unlicensed cultivators, has good visibility into the unlicensed market. Cannabis operators mostly get information through friends and hearsay. Of the people interviewed, law and code enforcement encounter the greatest number and widest range of unlicensed cultivation. Their visibility has been recently enhanced through use of Google Earth, remote sensing (they work with Waterboards),

drones, and other aerial imagery. Recent wildfires have also increased visibility on public lands by decreasing tree cover (the planning director commented that they now see a lot of water tanks where large, backwoods cannabis grows used to be). Most informants in the enforcement category have the (correct) impression that unlicensed cultivation is in decline based on how many unpermitted plants they encounter and cut down each year (~200,000).

- While law and code enforcement may be shutting down unlicensed operations, nearly all interviewees believed that enforcement efforts were ineffective. Many used the metaphor “whack-a-mole” and a law enforcement officer told the fable of “The Boy and the Dike.”
- Unlicensed cultivation is in decline primarily due to poor market conditions. The market collapse for raw cannabis (2021 - 2022) had an outsized impact that overshadows all other policy events and sociopolitical dynamics for on-the-ground decision making about whether to continue or drop out of the market. Cultivators who had already invested in obtaining a license may feel locked in, whereas unlicensed growers have more flexibility to abandon ship in turbulent market conditions.
- Based on grow store earnings data, the pandemic may have played a significant role in the market saturation that led to market collapse (boom/bust cycle), as many people engaged in unlicensed cannabis production at the outset of the pandemic.
- Taxes, including a “cultivation tax” that applies to cannabis but not other ag, permitting and compliance costs, and dysfunction in county planning (especially with regard to CEQA) burdened people pursuing a permit. These burdens, along with expensive infrastructure investments, may have deterred unlicensed growers from pursuing a permit.
- Strong opposition to proposed cannabis projects leave applicants “stuck in the pipeline” and may be another deterrent for unlicensed cultivators contemplating the legal route.
- The County is using abatements to shut down unlicensed operations, but fines are not effective because of a 10-15 day waiting period imposed by the state, giving people time to move their grows.
- Many legacy cultivators have dropped out of the cannabis market, especially since 2021. Informants estimated between 33% and 50% of legacy growers have dropped out, some after trying to obtain a license and “stalling out” in permitting. Informants did not have a good explanation for those “hanging on.” It is possible that cultural factors help to explain the obstinacy of some cultivators who “were never going to go for their license” and who persist despite increasingly narrow profit margins.
- Cultural factors also created a challenge for legacy growers transitioning to the formal market. One cultivator described a “sharp learning curve” as they were forced to learn advanced planning, administration, and budgeting to compete with big players. This way of thinking is antithetical to legacy cannabis culture, and two legacy growers described painful cultural loss. Another grower, relatively new to the market, described her legacy business partner’s “sentimental attachments” as a major disadvantage.

- State funding, such as Local Jurisdiction Assistance Grants and Equity Program Grants, marginally helped legacy cultivators transition to the licensed market, but did not make a big enough difference to “convert” legacy growers. More funding would have helped to support legacy growers with technical assistance to obtain their license or transition out of the cannabis market.
- Some legacy cultivators felt that they never had a chance to succeed in the legal market because they “didn’t have the right property” to grow at scale, pay high application fees, infrastructure, and regulatory compliance costs, and develop new distribution networks. The 5-year waiting period for large-scale licenses was insufficient to help small growers get established because license stacking loopholes undermined competitive conditions for smaller operations and, in any case, county inefficiency erased any head start advantage. The initial promise made it worse for small growers, some of whom reportedly “invested their life savings” but were doomed to fail.
- Licensed cannabis is in conflict with “traditional ag” over scarce land and water resources. In Lake County, the ag lobby successfully passed a “Farmland Protection Zone” ordinance, forcing cannabis cultivators to move away from desirable land.
- Many legacy growers lament the “corporate consolidation” of the cannabis market and its impact on local economies and businesses. Many informants reported that there is a mass exodus of people, some moving out-of-state to emerging markets (e.g. NY and OK) where their skills growing cannabis are more valuable.

Conclusion

Unlicensed cultivation in Lake County went through a boom-bust cycle, reaching its zenith in fall 2021 and contracting thereafter following collapse in pricing and sales of cannabis. Industry insiders estimate that 33-50% of legacy growers dropped out of cannabis cultivation during this time. While other factors like law enforcement, wildfires, and cultural barriers have contributed, they pale in comparison to the economic pressures caused by market collapse and narrow profit margins. This timeline also suggests that the COVID-19 pandemic may have inadvertently contributed to market saturation, as many people stayed home and began growing cannabis, flooding the market. The County made efforts to help legacy growers transition to legal cultivation through programs like early activation permits and state grants, however burdensome regulations, high taxes, and planning office dysfunction deterred many unlicensed growers from pursuing legal permits.

Contributions to Report Findings

Objective 1 Assessing Unlicensed Production Amounts and Geography

Finding #1: In the years following legalization, unlicensed production showed an initial expansion, rapid retraction, then stabilization.

- Ethnographic data reflected moderate early growth (2018–2020) in unlicensed cultivation, followed by notable declines (2020–2022), which continued through 2024.

- The trajectory approximated that of neighboring legacy counties: initial expansion followed by contraction driven by market downturns and maturing local regulatory programs.

Finding #2: Cultivation moved from the hills to the flatlands and back again.

- Ethnographic data indicated a strong “greenrush” between 2018 and 2020 as investors and legacy growers acquired cheap, flat land under the county’s “early activation” permit pathway, intended to facilitate transition into legal cultivation.
- Many unlicensed cultivators operated alongside or even on the same properties as licensed farms (“the back 40”), taking advantage of relaxed early enforcement and expectations of eventual licensing.
- Between 2020–2022, the introduction of the *Farmland Protection Zone Ordinance* (sponsored by the agricultural lobby) curbed cannabis activity in valley and low-lying farmland, pushing cultivators back toward more marginal terrain.
- CannaVision and ethnographic data suggested that declines were concentrated in flatter areas, with relative persistence in more remote sites.
- By 2022–2024, market forces, prohibitive costs of regulation, and rising land values in the valleys further discouraged cultivation in flatter zones, reinforcing the return to hills and marginal lands.

Finding #3: While participation in the unlicensed market was broad initially, increasingly the people left cultivating are those in tenuous socio-economic situations and attached to place for cultural-historical reasons.

- Ethnographic data suggested that, while Lake County experienced continued decline in unlicensed activity between 2022–24, persistence remained among certain landholders who were unable or unwilling to sell properties purchased or developed during the early legalization period.
- Some legacy cultivators, particularly those who had invested in early activation permits or infrastructure before the *Farmland Protection Zone Ordinance* (2021), remained “stuck” in place, unable to recoup sunk costs or transition to other economic activities.
- Although Lake’s unlicensed sector did not display the same density or cohesion seen in Siskiyou and Trinity, ethnographic accounts noted pockets of older and lower-income cultivators, often in marginal agricultural lands or mixed-use zones, who continued small-scale production.
- Declining land values and limited economic diversification reinforced this persistence, even as county policy and enforcement became increasingly exclusionary.

Finding #4: Unlicensed cultivation generally migrated out of public lands because of lower consequences on private land.

- Ethnographic data indicated that fire risk and post-fire surveillance were the primary deterrents to public land cultivation in Lake County.
- Between 2018 and 2024, more than 60% of the county’s land area was affected by wildfire, which not only destroyed vegetation but also stripped away concealment for unlicensed grows.

- In the wake of these fires, enforcement agencies, including CDFW and the county’s narcotics division, increasingly used aerial imaging to detect remaining operations, discouraging further cultivation on public lands.
- Environmental sensitivity, particularly near creeks, watersheds, and burned zones, also drew sustained CDFW enforcement, further disincentivizing public land use.
- Cultivators who remained active during and after these fires overwhelmingly migrated to private parcels, especially in marginal agricultural areas or lower foothills with easier access and reduced enforcement risk.

Finding #5: Transition from Outdoor to Mixed-Light Production.

- Ethnographic data suggested several contributing factors: wildfire smoke impacts, efforts to mimic permitted cultivation structures, local Fire Protection Zone (FPZ) restrictions that limited outdoor sites, and ongoing market preferences for greenhouse-quality product.
- Some growers reportedly used hoop houses strategically to “hide in plain sight,” blending regulatory mimicry with practical production benefits.

Finding #6: Unlicensed Cultivation Was Highly Sensitive to Major Fire Years.

- Ethnographic data and CannaVision imagery indicated that repeated fires (affecting an estimated 60% of the county since 2015) eliminated many large unlicensed operations.
- Extensive tree loss and canopy reduction, combined with growing use of aerial surveillance technologies, discouraged reestablishment of such sites.
- This pattern contrasted with inland northern counties, where unlicensed activity rebounded more quickly after fire impacts.

Objective 2 Identifying Factors Influencing the Observed Extent of Unlicensed Cultivation

Finding #1: Presence of licensed cultivation was the primary deterrent of unlicensed cultivation.

- Ethnographic data described early clustering of licensed cultivation under the county’s initial permitting program, but many participants struggled to maintain compliance over time.
- Resistance from the broader agricultural community contributed to a retreat of cultivators from the lowlands to upland and more marginal areas.
- This dispersion likely weakened the deterrent impact of licensing, though at the outset, permitted sites moderated the expansion of unlicensed activity.

Finding #4: Over Time, Civil Policy and Civil Enforcement Efforts Became Key Drivers of Declines in Unlicensed Cultivation.

- Ethnographic data indicated that Lake moved from a mixed law enforcement and code enforcement model early on toward a more civil-centered approach by 2022–24.
- The county refined its code enforcement strategy over time. Seen as ineffective in the early-stage, later-stage enforcement used a coordinated strategy between law and code enforcement.
- By the final period, evidence pointed to better outcomes in identifying and resolving unlicensed cultivation through civil channels.

Finding #5: Troubles in Permitting Programs Prevented Many Cultivators from Becoming Licensed.

- Ethnographic data indicated that Lake’s permitting rollout faced early coordination challenges but improved through incremental adjustments by 2022 to 2024.

- Supportive local trade organizations assisted cultivators in navigating program requirements and encouraged participation.
- The county achieved moderate success in maintaining a functioning licensing base relative to its regional peers.

Finding #6: Cultivation Bans and Other Enforcement Policies Were Linked with Whack-a-Mole Dynamics of Unlicensed Cultivation.

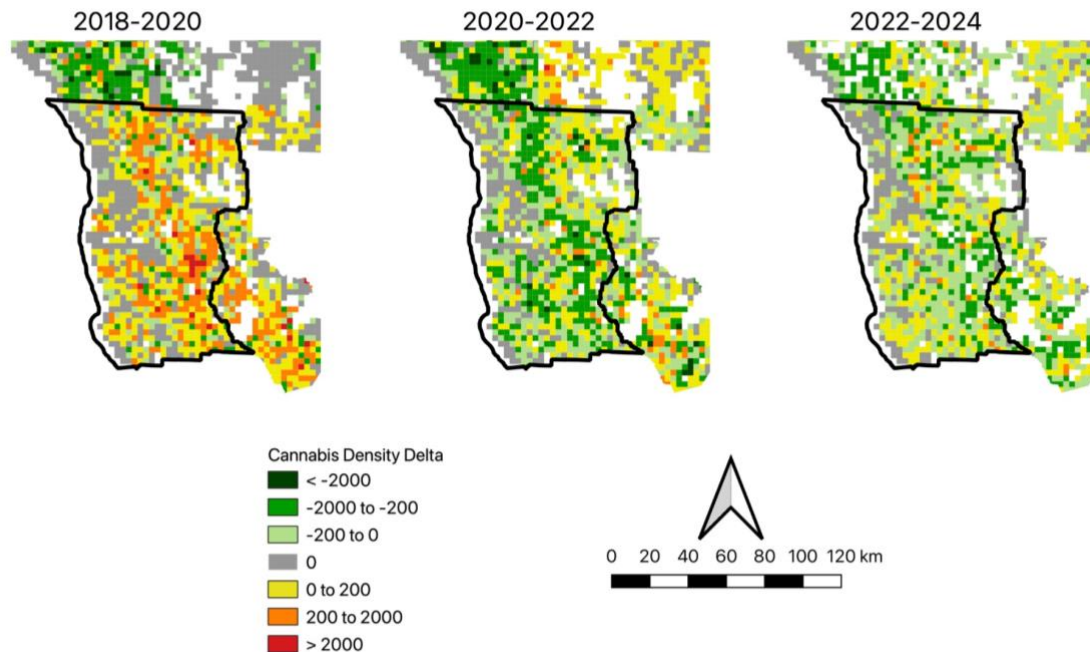
- Ethnographic data indicated that unlicensed cultivation in remote areas of Lake exhibited mobility similar to that of northern counties.
- Cultivators relocated among low-cost parcels with limited enforcement visibility, but site movement decreased where civil enforcement programs expanded.
- The county's mix of public and private land borders contributed to periodic displacement of grows as enforcement targeted sensitive environmental areas.

Finding #7: Market Forces and Price Decline Were Major Factors in Siting Decisions.

- Increased cultivation during COVID-19 pandemic led to market saturation and contributed to price decline and increase in unlicensed activity after 2022.
- Ethnographic findings indicated modest re-expansion of cultivation in southern Lake County during 2022 to 2024, attributed to relatively lower land prices and accessible transport routes.
- Earlier price declines caused many cultivators to consolidate or exit, but remaining growers concentrated activity in areas with cheaper land and limited regulation.
- Respondents noted that falling wholesale prices made compliance costs prohibitive, reinforcing the shift toward unlicensed or semi-licensed activity.

PREPARED BY: SETH LAROSA

DECEMBER 19TH 2024



Top-level Summary

Cannabis cultivation in Mendocino County from 2018-2024 demonstrates how market forces, rather than policy interventions, drive unlicensed production patterns. Model data indicates unlicensed cultivation increased from 2018-2020, then declined from 2020-2024, corresponding with cannabis price collapse from over \$1,000 per pound to below \$300 per pound. The county's regulatory framework, characterized by administrative instability and jurisdictional conflicts, failed to facilitate legacy cultivator transition to licensed status. Multiple ordinance iterations, departmental reorganizations, and CEQA compliance crises created conditions favoring unlicensed persistence over legal participation. Environmental regulations, designed to protect natural resources, inadvertently encouraged cultivation consolidation in valley locations with greater infrastructure impact potential. Law enforcement limitations, exacerbated by Tribal Sovereignty conflicts and resource constraints, rendered enforcement largely ineffective against unlicensed operations. The state's 2023 intervention through the Department of Cannabis Control, providing \$17 million in assistance, represented acknowledgment of local regulatory failure. County supervisors estimate the program cost more than it generated in revenue, while 88% of licensed operators reported zero production for tax purposes, indicating widespread gray market participation among legal participants.

Research Summary

Research was conducted during October 21-24, 2024, involving seventeen interviews across multiple stakeholder categories. Eleven interviews occurred in person throughout Mendocino County, with additional follow-up interviews via telephone and video conference in November 2024. Interview duration ranged from 50-90 minutes, following a semi-structured format with standardized interview guides adapted for different participant types. Recruitment employed multiple methods including professional networks from previous regional research, systematic internet searches for business owners and county officials, direct outreach to county government departments, and snowball sampling among county workers and cannabis industry participants.

Cannabis Industry Participants (8):

- Three licensed cultivators operating under county permits
- Two unlicensed cultivators maintaining traditional operations
- Two ancillary business owners (garden supply and compost retailers)
- One former licensed cultivator who exited the legal market

Government and Agency Staff (7):

- Three county supervisors representing different districts
- One environmental health department official
- Two California Department of Fish and Wildlife officers (enforcement and environmental divisions)
- One cannabis compliance consultant with county contracting experience

Environmental Stakeholders (3):

- Two environmental advocacy organization representatives
- One environmental consultant specializing in cannabis compliance
- One conservation district staff member

Key county officials, including the cannabis program director and head code enforcement officer, declined interview requests despite multiple outreach attempts. However, alternative sources provided institutional perspectives, including the Agricultural Commissioner's insights on early regulatory challenges and the Environmental Health Director's observations on compliance pattern evolution.

County Background

Mendocino County encompasses 3,507 square miles extending from Pacific coastal areas through redwood forests to interior agricultural valleys, creating diverse Mediterranean microclimates conducive to cannabis cultivation. The county's population of 91,601 residents reflects a complex social composition including descendants of extractive industry workers

(mining, logging, fishing), ranching families, and 1960s counterculture migrants who established rural communes and alternative communities. This demographic confluence shaped a political culture characterized by self reliance, skepticism toward government authority, and preference for community based solutions and economic arrangements.

Economic conditions significantly influence cannabis cultivation patterns. County median household income of \$65,500 falls substantially below the state average, while the poverty rate of 19% exceeds state and national averages by approximately 1.5 times. Traditional economic foundations in timber harvesting and commercial fishing declined precipitously beginning in the 1980s, creating economic conditions conducive to alternative income sources. Cannabis emerged as a critical economic stabilizer beginning in the 1970s, with major expansion periods in the 1990s, 2006, and 2016 corresponding with regulatory changes and market developments.

Geographic and Cultural Cannabis Patterns

Regional differentiation within the county produced distinct cultivation cultures reflecting topographical and social differences. Coastal areas around Fort Bragg and Mendocino emphasized smaller-scale operations integrated with tourism economies, while inland regions like Laytonville and Covelo developed as traditional cannabis strongholds with multigenerational cultivation knowledge. The Ukiah Valley supported larger agricultural operations on flat, well-watered land, and Anderson Valley evolved a mixed wine-cannabis agricultural economy. These regional differences later influenced differential regulatory compliance patterns and enforcement challenges.

Mendocino's position within the "Emerald Triangle" alongside Humboldt and Trinity counties established its global reputation as a premier cannabis-producing region. This regional identity created both economic opportunities and enforcement attention, with federal eradication programs like the Campaign Against Marijuana Planting (CAMP) targeting the area intensively during the 1980s and 1990s. Decades of sustained enforcement pressure contributed to cultivation adaptation strategies including indoor production and geographic dispersion across multiple sites.

Cannabis Policy Development Timeline

Mendocino County's regulatory evolution demonstrates the challenges of transforming informal economies through formal regulatory frameworks. Initial medical cannabis provisions emerged through Chapter 9.31 in 2008 under Measure B, establishing a registration system allowing up to 25 plants per parcel through a simple Sheriff's office registration. This system expanded incrementally, with amendments in 2010 and 2011, then substantially in May 2016 to allow up to 99 plants per parcel, reflecting the influence of state medical cannabis law evolution.

The contemporary commercial framework originated April 4, 2017, with adoption of the Mendocino Cannabis Cultivation Ordinance (Ordinance No. 4381), creating Chapter 10A.17 and complementary zoning regulations in Chapter 20.242. This ordinance established a three-phase implementation strategy designed to prioritize legacy cultivators while gradually expanding participation. Phase One (December 31, 2018, extended April 1 to October 4, 2019) restricted permits to cultivators demonstrating pre-January 1, 2016 cultivation at the same site. Phase Two (beginning January 1, 2018) allowed new indoor and mixed-light cultivation on industrial-zoned parcels. Phase Three was scheduled for April 1, 2021, opening applications to all applicants regardless of cultivation history.

Administrative Instability and Regulatory Dysfunction

The county's cannabis regulation represents a case study in how institutional dysfunction emerges from misaligned political incentives rather than deliberate sabotage. Cannabis regulation created unprecedented challenges for a county government that supervisors candidly admitted was unprepared. As Supervisor Ted Williams observed, counties "weren't necessarily ready to implement a legal cannabis permitting program county wide" when Proposition 64 passed, yet were legally required to provide access.

The initial decision to house oversight in the Agricultural Commissioner's office reflected this unpreparedness. The Agricultural Commissioner managed the program from 2017-2019 despite lacking land use expertise and discretionary permitting experience, with officials recalling long lines snaking around the building and noting "We can only fit like 15 people in this room!" The county chose what former cannabis director Kristin Nevedal described as the ministerial approach because "it was easier, and they were understaffed" with "no one seeming to understand the importance of getting it correct, rather the focus was to get an ordinance out fast."

This institutional inadequacy created mutual distrust between regulators and regulated communities. Environmental advocates from the Willits Environmental Center claimed county staff "didn't want our ordinance to work. They wanted it to fail," while county officials like Nevedal described earnest attempts to make the system work for legacy cultivators amid impossible political pressures. As Nevedal noted, "what we've created in some arenas, Mendocino's one of them, is there's no incentive to be permitted, and there's no consequences to cultivate without a permit."

The migration of oversight from Agriculture to Planning and Building Services in 2019, then to a dedicated Cannabis Department in April 2021, reflected ongoing attempts to develop institutional competence rather than programmatic maturation. However, each transition disrupted application processes and cultivator relationships while understaffed departments struggled with novel regulatory responsibilities under intense political scrutiny.

Political tensions culminated in the failed 2021 expansion ordinance (Chapter 22.18), which would have allowed larger cultivation areas. Supervisors, driven by tax revenue needs in a county where Williams noted "there's no timber, there's no fish, there's no cannabis, there's really no exports," supported expansion. However, environmental groups successfully organized opposition, collecting sufficient signatures for a referendum that prompted the Board of Supervisors to voluntarily rescind the ordinance on September 14, 2021. This political defeat further destabilized the regulatory framework and discouraged both cultivator participation and county engagement with policy development.

CEQA Compliance Crisis and State Intervention

The CEQA crisis exemplifies how regulatory design choices created unintended class-based exclusion mechanisms. A fundamental crisis emerged in November 2018 when state agencies implemented emergency regulations under MAUCRSA requiring site-specific CEQA analysis for annual state licensing. Mendocino's ministerial permit system, designed to be categorically exempt from CEQA under a Programmatic Mitigated Negative Declaration (SCH#2016112028), proved incompatible with state requirements.

The county chose the ministerial approach for administrative convenience rather than regulatory precision. As Nevedal explained, they wanted "to get an ordinance out fast" without fully understanding state environmental review requirements. This mismatch created what officials described as "significant confusion" and "moving goalposts" for cultivators who believed they had completed local review processes.

County response involved developing the "Appendix G Checklist" through lengthy negotiations with state agencies, finalized in early 2021. This checklist requires completion of Sensitive Species Habitat Review, Air Quality Management District referral processes, state provisional licensing verification, and Lake and Streambed Alteration Agreements. The complexity and cost of CEQA compliance became a significant barrier to annual licensing. Environmental Health Director Marlina Dumule noted the cannabis community was "completely unfamiliar with regulation at all," making CEQA compliance "a very steep learning curve."

The CEQA process effectively created class-based market segmentation. As one cultivator noted, consultant fees of around \$10,000 just for the Appendix G document preparation created barriers that only well-capitalized operations could navigate. Licensed cultivator Howard Harris exemplified successful adaptation, noting "I bought it like this on purpose [new grow site] because I knew that people that were growing in the mountains, their days were limited" due to environmental compliance requirements. His strategic property selection - flat agricultural land with no waterways or culverts - demonstrated how capital and foresight enabled regulatory compliance.

Environmental advocates characterized the county's CEQA approach as fundamentally flawed from inception. Representatives of the Willits Environmental Center claimed "the county didn't prioritize enforcement in the beginning because they didn't want our ordinance to work. They wanted it to fail." However, this opposition perspective overlooks the more complex dynamic of institutional incompetence rather than deliberate sabotage.

By February 2023, the Mendocino Cannabis Alliance documented systematic county failure to facilitate legacy cultivator transition to annual licensing in a letter requesting state intervention. On May 23, 2023, the Board of Supervisors unanimously authorized the Department of Cannabis Control to assume CEQA review responsibilities, accompanied by \$17 million in state grant funding for county staff and technology improvements, plus \$5 million in cultivator grants for site remediation and CEQA compliance. Between June 2023 and December 2024, the county expended these funds to rebuild CEQA review capacity, ultimately enabling the certification of an Environmental Impact Report in October 2024 that facilitated the transition of hundreds of provisional licenses to annual status.

Enforcement Structure and Jurisdictional Complexity

Cannabis enforcement in Mendocino County evolved significantly from tactical eradication to administrative compliance between 2013-2024. The County of Mendocino Marijuana Enforcement Team (COMMET) operated from 2013-2021 as a multi-agency task force receiving federal funding through the Domestic Cannabis Eradication/Suppression Program. During its peak operations from 2017-2021, COMMET conducted large-scale military-style operations utilizing helicopters, specialized vehicles, and partnerships with federal agencies including the DEA, U.S. Forest Service, and National Guard.

COMMET's largest documented operation was Operation Clean Sweep in July 2019, which served 28 search warrants across Covelo, Dos Rios, and Laytonville areas, eradicating 42,638 marijuana plants and documenting 603 environmental crimes. The unit's final major operations occurred in 2021-2022, including a July 2022 operation that eradicated 165,219 cannabis plants and seized nearly 6,000 pounds of processed cannabis.

Throughout its operational period, COMMET faced persistent allegations of corruption, extortion, and theft that undermined community trust and enforcement legitimacy. Cultivators reported demands for cash payments to reduce charges or avoid prosecution, creating what some described as a "pay-to-play" system within law enforcement. One unlicensed grower recalled paying \$60,000 in cash to law enforcement officials after a COMMET raid that seized 80 pounds of cannabis, in order to be charged with a misdemeanor for possessing just one pound rather than face felony prosecution for the full seizure. The corruption allegations extended beyond individual incidents to systematic federal litigation. In 2021, cannabis farmers Ann Marie Borges, Chris Gurr, and Will Knight, along with a former police officer, filed a civil lawsuit accusing multiple law enforcement entities including the Rohnert Park Police Department, the

Mendocino County District Attorney's Office, the Mendocino County Sheriff's Office, and the California Department of Fish and Wildlife of conspiracy to theft during raids and extortion.

Rather than formal disbandment, COMMET evolved into administrative enforcement focused on regulatory compliance as budget constraints and policy changes made tactical operations financially unsustainable. Helicopter fees of \$950 per hour and extensive overtime costs became prohibitive as cannabis tax revenue declined and regulatory compliance became the priority. The current enforcement structure emphasizes regional partnerships through the Mendocino Major Crimes Task Force (MMCTF) and coordination with state agencies through EPIC (Eradication and Prevention of Illicit Cannabis), which replaced the seasonal CAMP program in 2022.

Current enforcement operates primarily on a complaint-driven basis through fragmented systems lacking dedicated multi-agency coordination. Code enforcement has assumed primary responsibility for cannabis violations, working closely with the Environmental Health Department to address unlicensed operations through administrative rather than criminal processes. Environmental Health Director Marlena Dumule describes the enforcement challenges: "Fines and penalties were often not effective in deterring unlicensed producers... the challenges of implementing fines and penalties, including the lack of success in court and the return to illegal activities by offenders" necessitate "a more effective enforcement strategy that includes both law enforcement and code enforcement."

Sheriff's department capacity remains severely constrained, as one supervisor noted: "I think it's [unlicensed cultivation] running rampant still. And you know what I hear from the sheriff is that they don't have the capacity to go after some of the big grows that are cartel grows, whether they're from Mexico or Bulgaria or Romania or wherever."

Tribal Sovereignty and Jurisdictional Conflicts

Unlicensed cultivation on Tribal land where counties lack jurisdiction creates additional enforcement complexity, exemplified by the 2024 Round Valley Indian Reservation lawsuit against Mendocino County Sheriff Matthew Kendall and multiple jurisdictions for alleged violations of tribal sovereignty through cannabis raids conducted without tribal notification or coordination.

The lawsuit centers on a July 2024 two-day operation targeting 18 sites across the Round Valley Indian Reservation, affecting tribal members April James (48), Eunice Swearingen (86), and Steve Britton. According to the complaint, deputies destroyed cannabis plants, buildings, and personal property using tractors and armed force while heavily armed officers stood guard over children and elderly residents. Tribal officials assert that warrants failed to disclose that target sites were on reservation land and that no one from the Tribal Council or tribal police received advance notification. As tribal attorney David Dehnert stated publicly, "He [Kendall] has no

authority to enforce California regulatory law on the reservation, which is what they were doing."

The conflict illustrates broader jurisdictional disputes under Public Law 280, a 1953 federal statute that grants California authority to enforce criminal laws on tribal lands but excludes regulatory matters. This creates gray areas in cannabis enforcement where tribal governments assert regulatory authority over cannabis while state and local officials claim criminal jurisdiction.

Covelo: Case Study of an Enforcement Void

Covelo represents the most significant enforcement challenge in Mendocino County, combining Tribal Sovereignty issues with geographic remoteness and historical patterns of informal governance. Martin Milleck, owner of M+M Feed store and the de facto "grow store" in Covelo, along with longtime resident Corey Miller, provide insight into a community that has operated outside conventional legal frameworks for generations. As Miller explains, "Covelo has always been illegal because of the history of the genocide and the Indians here... Covelo was this backwater that was illegal, and the police hardly came here. And so it was a good place for it [illicit cannabis cultivation] to thrive."

Licensed cultivator Josh Artman, one of the first to obtain county permits in 2017, exemplifies the challenges even legal operators face in Covelo. Despite compliance efforts, Artman describes the fundamental inequity: "The licensed farmers are the first ones going out of business, and all the unlicensed farmers are pretty much still growing." As Artman noted about current market conditions, "I feel like I should get a trophy every day that I'm in business. The cost of cannabis is so low I'm literally being forced to be a family farm - I'm out there with my wife and kids farming."

Miller describes the community's resistance to formal regulation: "We don't take permits here, hardly for building department stuff. We don't do permits here... mostly we don't even take permits for anything." This resistance extends to cannabis cultivation, where unlicensed operations continue unabated despite intensified enforcement efforts. Local observers describe economic transformation from cannabis prosperity to market-driven decline, with Milleck noting sales declining "from about 3 million a year down to somewhere around just shy of a million a year."

Financial and Administrative Outcomes

The cannabis program's failure to generate anticipated revenue reveals the political economy driving regulatory dysfunction. County supervisors candidly acknowledged that "the county has spent more on the program than all of the revenue we had collected. So net loss for

something that we thought would be a revenue generator." This admission reflects how fiscal desperation in a poor county drove policy decisions.

Supervisors Williams and Gjerde described the economic context shaping their decisions. Williams noted that "there's no timber, there's no fish, there's no cannabis, there's really no exports. So this county is living on Social Security trickling down to everybody else." This economic reality created pressure to maximize cannabis tax revenue, leading to decisions that prioritized immediate income over regulatory competence.

Tax compliance proved systematically problematic, with 88% of licensees claiming zero production for reporting purposes and \$6.4 million in unpaid cannabis taxes outstanding. As Williams observed, cultivators with embossed receipts could tell law enforcement "look, I have an embossed receipt, I'm in the legal market" while avoiding actual tax obligations. These figures suggest widespread gray market participation among supposedly legal operators.

Licensed cultivator Howard Harris provided insight into this market integration: "The legal market and the illegal market are not separate. They are the same market... I think people who want to say there's a licensed market and an unlicensed market are just kind of saying that to themselves because it makes them feel better." Similarly, licensed cultivator Jed Davis noted that "I don't think there's anyone that's legal that is not doing both sides of the line."

The regulatory framework inadvertently enabled this gray market participation. The embossed receipt system allowed continued operation during application processing, effectively legitimizing unlicensed cultivation for extended periods while providing legal cover for operations that remained partially in black markets. According to county data, 878 embossed receipts were issued between 2017-2021, with 293 issued in 2017 alone, creating a large population of quasi-legal operators with minimal oversight or tax compliance requirements.

Unlicensed Cultivation Over Time

Pre-Legalization Cultivation Patterns (Pre-2016)

Cannabis cultivation in Mendocino County began with 1960s back-to-the-land migrants who integrated small-scale growing into rural subsistence lifestyles. Environmental consultant Chantal Simonpietri described these historical patterns where early cultivators "cultivated 30 years ago, they had professions, and they cultivated on the side, a small garden, let's say 25 plants, pure, like sun, grown outdoor, and they did it in order to pay for their children to go to college. It was done as like an economic augmenter." This approach facilitated community-based cultivation networks, with experienced growers mentoring newcomers and sharing resources across properties.

Over time, cultivation strategies became more sophisticated as growers developed risk management techniques under federal prohibition. Traditional approaches evolved into multiple 25-plant sites distributed across different parcels to remain under federal prosecution thresholds while maximizing production volume. As one licensed cultivator recalled, "Previously, the model was to get a bunch of different parcels, either through renting or purchasing, and put 25 plants on each parcel. Grow a lot of weed that way." This distribution strategy reflected both risk management and resource optimization, with cultivators minimizing exposure to catastrophic loss while accessing diverse environmental conditions and water sources. By 2015 it was not uncommon for someone to work as a trimmer (cannabis flower manicurist) one season, and be managing an entire farm the next.

Transition Period Dynamics (2016-2018)

The county's 2016 expansion to 99 plants under Chapter 9.31 brought previously concealed operations into quasi-legal status through registration systems while simultaneously enabling unlicensed operators to dramatically increase production with reduced enforcement risk. This period coincided with state legalization through Proposition 64, creating expectations for comprehensive regulatory frameworks. However, the county's delayed permit system implementation created a regulatory void - applications were only accepted during extremely limited windows (December 31, 2018, and again from April 1 to October 4, 2019), making it literally impossible for most cultivators to apply during the critical transition period.

Many cultivators observed peers attempting licensure only to encounter protracted delays and regulatory uncertainty during the brief application periods. This experience deterred additional permit applications, as potential applicants witnessed the challenges faced by early adopters. The county's "embossed receipt" system allowed continued operation during application processing, effectively legitimizing unlicensed cultivation for extended periods. According to county data, 878 embossed receipts were issued between 2017-2021, with 293 issued in 2017 alone.

Expansion Phase (2018-2020)

Contrary to policy intentions, unlicensed cultivation expanded during this period. Multiple factors contributed to this growth: regulatory uncertainty discouraged permit applications; market prices remained relatively profitable; and enforcement remained sporadic and ineffective. The state Department of Cannabis Control's former public engagement manager, previously Mendocino's cannabis director, observed that "what we've created in some arenas, Mendocino's one of them, is there's no incentive to be permitted, and there's no consequences to cultivate without a permit."

Environmental factors also influenced cultivation expansion during this period. Water availability became increasingly critical, with many operations investing in expensive

infrastructure or relocating to areas with reliable access. The rising costs of water tanks and water delivery services reflected the intensifying competition for water resources, with cultivators paying premium prices for trucked water as local sources became unreliable. Former licensed cultivator John Gentry described the financial burden: "I had to go and buy water... I drilled like two dry wells, and that didn't pan out... I was paying for water and it was a huge bill, like upwards of 40 grand a year." Climate change impacts, particularly drought conditions, forced adaptive strategies including greenhouse construction and irrigation system development. However, these adaptations often occurred outside regulatory oversight, creating environmental impacts that later complicated compliance efforts.

Licensed cultivators described the competitive disadvantage created by unlicensed operations during this period. As Josh Artman noted, "Nine out of ten farms in Mendocino County are unlicensed for every one that is" due in large part to the economic burden of compliance costs. This dynamic created perverse incentives where regulatory compliance became economically punitive rather than advantageous.

Market Collapse and Transformation (2020-2022)

The cannabis market collapse beginning in 2021-2022 fundamentally altered cultivation dynamics throughout the county. Prices declined from \$1,000-1,500 per pound to below \$300 per pound, making cultivation economically unsustainable for many operators regardless of legal status. Licensed cultivators, having invested in compliance infrastructure, demonstrated greater persistence but faced severe financial pressure. As one licensed grower stated, "2022 the price of cannabis was below the price of production... 2023 there was hardly anybody growing. And then as the price increased, there's more people."

This market-driven reduction proved more effective than regulatory or enforcement interventions in reducing unlicensed cultivation. A licensed cultivator observed, "The economy has been the best enforcer of illegal, black market, unlicensed grows - way better effective mechanism than what the county or state could ever do." The pandemic potentially contributed to market saturation through increased home cultivation during lockdowns. Garden supply retailers reported sales spikes in 2020-2021, suggesting expanded cultivation participation that later contributed to oversupply.

Recent Landscape (2022-2024)

Following the market collapse, cannabis cultivation in Mendocino County entered a period of economic consolidation and regulatory stabilization. The state's intervention through the Department of Cannabis Control in May 2023, providing \$17 million in assistance and assuming CEQA review responsibilities, represented a fundamental shift from local to state-managed cannabis regulation. In October 2024, the DCC certified an Environmental Impact

Report for Mendocino County, enabling streamlined transition from provisional to annual licenses for nearly 500 cultivators.

Despite state intervention, unlicensed cultivation persisted at substantial levels, with Sheriff's office estimates indicating approximately 200,000 unlicensed plants annually. However, the character of unlicensed operations shifted significantly during this period. Large-scale operations became increasingly associated with sophisticated criminal organizations, particularly in areas like Covelo where tribal sovereignty created enforcement voids. Geographic cultivation patterns continued shifting as operators migrated from concealed mountain locations to valley sites offering infrastructure advantages and regulatory compliance opportunities.

The economic changes became apparent across cannabis-dependent communities. Garden supply retailers experienced dramatic sales declines, with one reporting drops "from about 3 million a year down to somewhere around just shy of a million a year." Many longtime cultivators relocated to emerging markets in other states or abandoned cannabis cultivation entirely. Licensed operators faced continued challenges despite state assistance, with market prices remaining below production costs for many small-scale operations, forcing consolidation or exit from the industry. However, those who survived demonstrated greater resilience due to infrastructure investments and regulatory certainty.

Ethnographic Insights

Mendocino County's cannabis regulation experience offers several key insights that extend beyond local policy implementation to broader questions of political economy, class dynamics, and the challenges of formalizing informal economies.

- 8) **Market forces eclipse regulatory interventions.** The dramatic price collapse proved more effective at reducing unlicensed cultivation than years of enforcement efforts or regulatory programs. This market-driven contraction demonstrates how economic viability fundamentally determines cultivation patterns regardless of policy design. However, the collapse also accelerated consolidation toward operations with superior business acumen and capital resources while driving traditional cultivators from the industry entirely, potentially resulting in long-term losses of cultivation knowledge and community economic foundations.
- 9) **Institutional dysfunction emerges from political economy pressures rather than deliberate sabotage.** Mendocino's regulatory failures stemmed from fiscal desperation in a poor county where supervisors openly acknowledged spending more on cannabis administration than they collected in revenue. The begrudging implementation of Proposition 64 requirements by unprepared county government created conditions favoring expedient solutions over effective regulation. Environmental advocates' claims

of deliberate sabotage obscure the more complex reality of institutional incompetence driven by resource constraints and competing political pressures.

10) Regulatory compliance functions as class filter rather than universal pathway.

CEQA requirements and infrastructure compliance costs created natural selection mechanisms favoring cultivators with business skills, capital access, and strategic property selection over traditional farmers with cultivation expertise. Howard Harris's success story - strategic agricultural property purchase, scaling from 25 to 1,200 plants, and maintaining dual legal/illegal market access - exemplifies how business acumen trumped agricultural knowledge in determining regulatory success.

11) Administrative design choices have unintended distributive consequences. The ministerial permit system, chosen for administrative convenience, proved incompatible with state requirements and created a multi-year gray market legitimized through embossed receipts. This design inadvertently enabled widespread tax avoidance while providing legal cover for partially compliant operations, undermining both regulatory objectives and revenue generation.

12) Market integration challenges categorical boundaries. The persistent integration between licensed and unlicensed sectors, with 88% of legal operators reporting zero taxable production while maintaining gray market sales, demonstrates that formal regulatory categories may not correspond to actual economic organization. This integration reflects both the economic necessity for licensed operators to maintain unlicensed sales channels and the inadequacy of state distribution systems to serve rural cannabis markets effectively.

13) Territorial governance creates differential regulatory experiences. Tribal sovereignty conflicts, particularly in Covelo, create jurisdictional voids where sophisticated criminal organizations can operate beyond effective governmental oversight. These regulatory gaps, combined with geographic remoteness and historical resistance to outside authority, demonstrate how enforcement capacity varies dramatically across different territorial arrangements within the same regulatory framework.

Conclusion

Mendocino County's experience demonstrates that regulatory frameworks designed to facilitate informal-to-formal economic transitions can fail when administrative capacity, enforcement resources, and economic incentives remain misaligned. The county's ministerial permit system, while theoretically streamlined, created a regulatory void when incompatible with state requirements, effectively excluding most legacy cultivators from legal participation. Market forces proved more determinative than policy interventions, with price collapse achieving reductions in unlicensed cultivation that years of enforcement efforts could not accomplish.

The most significant barrier to regulatory success was the fundamental contradiction between stated goals of legacy cultivator inclusion and implementation mechanisms that made compliance economically prohibitive. Administrative instability, CEQA compliance crises, and enforcement dysfunction created conditions where unlicensed cultivation remained more attractive than legal participation for most operators. State intervention through the Department of Cannabis Control represented necessary but belated recognition of county-level regulatory failure.

Reducing unlicensed cultivation requires addressing underlying economic and administrative barriers rather than relying primarily on enforcement mechanisms. Evidence suggests that accessible regulatory pathways, technical assistance, and regulatory stability would better serve both environmental protection and industry transition goals than punitive approaches that maintain cultivator exclusion from legal frameworks. Mendocino County's experience indicates that successful cannabis regulation depends on economic viability of compliance, administrative competence in implementation, and enforcement strategies that build rather than undermine trust in regulatory systems.

Contributions to Report Findings

Objective 1 Assessing Unlicensed Production Amounts and Geography

Finding #1: In the years following legalization, unlicensed production showed an initial expansion, rapid retraction, then stabilization.

- Participants attributed the increase to severe administrative instability and repeated delays in the permitting process, including limited application windows that remained incomplete until April 2021.
- Many cultivators willing to seek licenses could not access them, leading to continued unlicensed production.
- The slow rollout and limited enforcement deterrence during early legalization encouraged expansion during this phase.
- When wholesale prices collapsed below \$300 per pound by 2020, ethnographic data suggested widespread economic exit, resulting in one of the sharpest declines in 2020–2022.
- By 2022–2024, unlicensed cultivation had dropped significantly, with participants describing a landscape of declining outdoor production and tighter regulatory visibility.

Finding #2: Cultivation moved from the hills to the flatlands and back again.

- Ethnographic data showed an early (2018–2020) migration from traditional mountain cultivation areas toward valleys and accessible agricultural zones, influenced by fire risk, insurance challenges, and proximity to infrastructure and markets.
- Many cultivators selected sites perceived as “easier to permit,” avoiding waterways and environmentally sensitive zones.

- From 2020–2022, CannaVision indicated declines in flatter areas, while ethnographic evidence documented both continued valley cultivation among financially stable producers and persistence in remote areas among those lacking alternatives.
- By 2022–2024, persistence in remote cultivation was concentrated among long-term legacy cultivators with established networks or limited livelihood options, while others consolidated near accessible, lower-cost valley sites.

Finding #4: Unlicensed cultivation generally migrated out of public lands because of lower consequences on private land.

- While not a major center of public land cultivation at the start of the study, Mendocino’s ethnographic data confirmed a similar directional trend: growers increasingly avoided public lands due to felony exposure and instead favored private parcels, especially in valleys and accessible hillsides.
- Cultivators described CDFW’s environmental enforcement as a deterrent in watersheds intersecting public holdings, which accelerated the shift to private rural parcels.
- By the third period (2022–2024), most unlicensed cultivation was concentrated on private land, often adjacent to or intertwined with permitted farms.

Finding #5: Transition from Outdoor to Mixed-Light Production.

- Ethnographic accounts pointed to multiple factors: wildfire smoke affecting outdoor quality, consumer preference for cleaner and more consistent flower, and the productivity benefits of greenhouse operations.
- Growers noted reduced concern about surveillance once operations were moved indoors or into hoop houses, aligning with local norms and compliance trends.

Objective 2 Identifying Factors Influencing the Observed Extent of Unlicensed Cultivation

Finding #1: Presence of licensed cultivation was the primary deterrent of unlicensed cultivation.

- Ethnographic accounts showed less spatial distinction between licensed and unlicensed operations, particularly in legacy cultivation zones where both coexisted.
- Early participants in the permit system shaped these mixed geographies, but environmental and land-use regulations (such as CEQA requirements) limited growers’ ability to relocate.
- Pro-licensure attitudes strengthened over time, especially as regulatory costs like cultivation caps and water compliance increased.
- Local code enforcement did not strongly link licensed and unlicensed oversight, resulting in weaker deterrent spillover effects than in other counties.

Finding #2: Bans Were Not a Consistent or Powerful Indicator of Growth or Decline in Unlicensed Cannabis Cultivation.

- Ethnographic accounts showed that Mendocino advanced its enforcement capacity by regularizing civil fines and incorporating agricultural guidance and best management practices.

- This framework allowed for more consistent handling of unlicensed activity by the 2022–24 period.
- Although geographic remoteness and complex permitting continued to present challenges, coordination between agencies improved overall outcomes compared to ban counties.

Finding #3: The Perceived Likelihood of Strong Enforcement Was an Initial Deterrent, but Became Less Important Over Time.

- Ethnographic evidence showed that cultivators adapted to enforcement by shifting toward greenhouses or smaller-scale operations.
- As enforcement became more predictable and civil enforcement mechanisms matured, cultivators adjusted rather than exited the market.
- The county’s mixed approach to enforcement and regulation helped moderate the disruptive effects of enforcement cycles observed elsewhere.

Finding #4: Over Time, Civil Policy and Civil Enforcement Efforts Became Key Drivers of Declines in Unlicensed Cultivation.

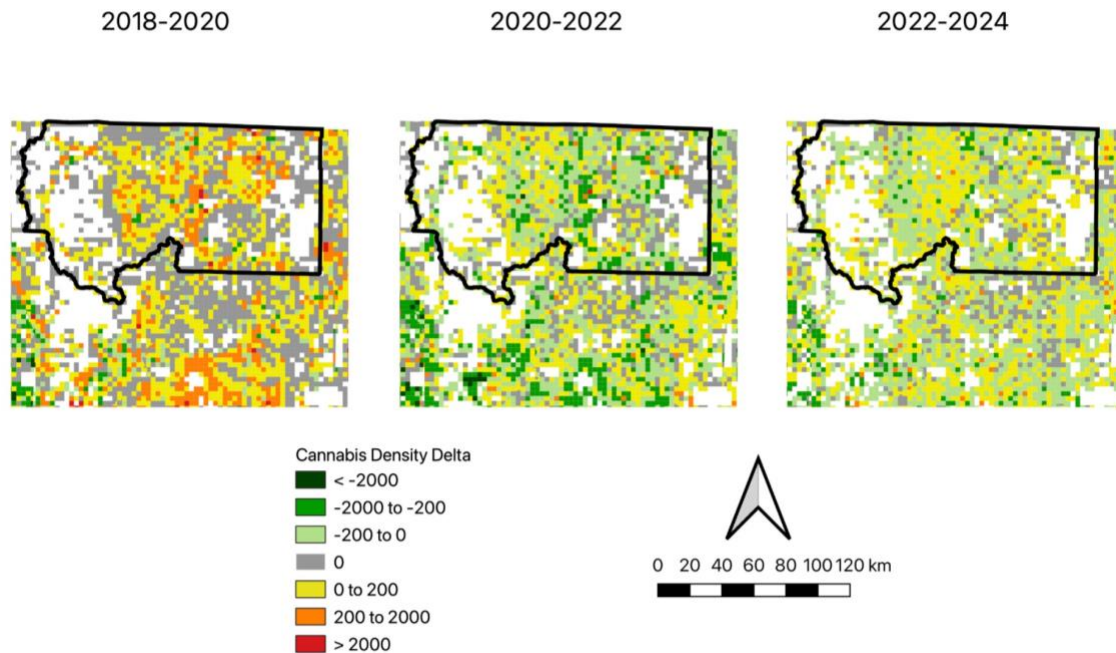
- Ethnographic evidence indicated that the threat of code enforcement and citation motivated cultivators to adopt best management practices even when not formally permitted.
- Early responses to water and environmental enforcement helped curtail unlicensed cultivation near streams from 2018–20.
- The county’s early adoption of provisional permits created a framework that both informed cultivators and normalized civil compliance expectations.
- By 2022–24, some rebound in cultivation was observed in remote and stream-dense areas, potentially linked to economic hardship and limited enforcement reach.

Finding #5: Troubles in Permitting Programs Prevented Many Cultivators from Becoming Licensed.

- Ethnographic findings indicated that Mendocino’s permitting process was frequently suspended or revised, resulting in long processing times and uncertainty for applicants.
- Changing environmental compliance standards and inconsistent communication from county offices undermined cultivator confidence in the program.
- Many cultivators described the system as unpredictable, noting that compliance steps completed under one version of the rules were later invalidated.
- Trade associations provided limited support but struggled to overcome administrative inconsistency and program delays.

SISKIYOU COUNTY: ETHNOGRAPHIC ANALYSIS

PREPARED BY: MARGIANA PETERSEN-ROCKNEY



- **Top-level summary**

Siskiyou County emerged as a pioneer in California's cannabis post-legalization landscape by implementing a forceful cultivation ban and developing innovative and aggressive enforcement strategies in attempts to reduce cannabis cultivation. The county's approach has become central to broader discussions about cannabis prohibition, enforcement practices, and the racial disparities they (re)produce.

Research combining extensive ethnographic data from 2017-2025, archival materials, and policy analysis demonstrates that the county's cannabis ban and related enforcement approaches have produced complex and contradictory outcomes, and have failed to drive reductions in unlicensed cannabis cultivation. Despite intensified enforcement since the 2017 cultivation ban, our quantitative analysis reveals that the amount of unlicensed cultivation has remained relatively steady from 2018-2024. As in the rest of California, unlicensed cultivation increased between 2018-2020 and then contracted slightly from 2020-2024, while remaining relatively constant between 2018 and 2024, which highlights that unlicensed cultivation has not so much declined as reorganized. This contraction, however, merely plateaued expansion and ethnographic research participants attributed this plateau to the cannabis market downturn, *not* to aggressive enforcement. Enforcement has only shifted the geography, organization and scale of

cultivation, often in negative or unintended ways. Paradoxically, intensive enforcement spurs a) the replacement of smaller-scale cultivators by larger-scale operators, b) the spread of cultivation across multiple parcels to avoid enforcement risk, and c) more intensive cultivation practices to grow harvests more quickly in the hopes of harvesting before a raid.

Innovative and targeted enforcement approaches, including water restrictions, have disproportionately impacted small-scale and socially marginalized growers, particularly Asian and Asian-American farmers. As documented in previous research, the county's enforcement-first approach is primarily motivated by efforts to preserve a particular vision of rural culture and "way of life" rather than consistent environmental concerns, as environmental protection justifications are applied unevenly across agricultural sectors (see Polson and Petersen-Rockney 2019; Getz, Petersen-Rockney, and Polson 2024). These bans have consumed substantial local resources (including numerous expensive civil rights lawsuits against the county that argue racial animus) while leveraging state agencies and powers for enforcement, often hindering rather than helping environmental and social protection agencies' ability to mitigate cultivation impacts. County officials and law enforcement emphasize illegal growing prevalence, while cultivators report facing increasing hostility despite a desire for pathways to legal markets and to comply with state regulations, suggesting the county's position on cannabis reflects broader anxieties about cultural and demographic change rather than environmental outcomes.

● **Research Summary**

The Siskiyou County case draws on previous ethnography data, including 38 days of fieldwork and over 55 ethnographic interactions and interviews conducted in 2022 and 2023 as part of DCC grant #65021. Additionally, in 2024, we conducted 10 person days of ethnographic fieldwork and in 2025, an additional six days, including 23 formal interviews and numerous informal observation events. Ethnographic participants included unlicensed cultivators, government officials and staff, and key informants like local business operators and medical cannabis advocates. This research included interviews with:

- Cannabis industry participants:
 - Small-scale cultivators, including both white and Hmong-American farmers
 - Medical cannabis advocates from Siskiyou Alternative Medicine
 - Cannabis entrepreneurs and support businesses (retail, water truck drivers, etc.)
- County officials:
 - Sheriff and law enforcement representatives
 - Board of Supervisors members
 - County code enforcement staff
 - Planning Department staff
- Other community members:
 - Rural subdivision residents
 - Anti-cannabis advocates

- Non-cannabis farmers and ranchers

Other major sources of information include:

- Siskiyou County planning code and ordinances (2015-2024)
- County Board of Supervisors meeting minutes
- Media coverage of cannabis-related events in Siskiyou
- Legal documents from court cases involving cannabis policy
- Sheriff's Office news releases and declarations

One challenge we encountered in Siskiyou County is that lead researchers have published findings from previous research on the region, leading some officials to resist further engagement. Additionally, with multiple active lawsuits against the county, government officials did not respond to requests for interviews and are now carefully managed by public relations staff.

● **County Background**

Siskiyou is a large, rural county in far-northern California with a relatively small population of approximately 44,000 residents and a population density of just seven people per square mile (compared to California's average of 250) (US Census Bureau, 2020). It is the fifth-largest county in California by land area. More than 60% of Siskiyou is comprised of state and federal public lands and nearly 80% of agricultural land is irrigated for alfalfa and pasture production (Cole and Medellin-Azuara 2021). The county's cultural economy is based primarily on agriculture, forestry, and tourism. Siskiyou is one of the most economically disadvantaged counties in California, with a poverty rate of 16.8% (compared to 12.2% statewide), significant unemployment (7.5%, placing it in the top quarter of California counties for unemployment), and a median household income of under \$50,000 per year, about half the average across the state (US Census Bureau, 2020). The population is predominantly white (74.2%) with small but historically significant Native American and Asian American communities (US Census Bureau, 2020). The county's annual budget is approximately \$115 million and its political makeup leans conservative, with voters favoring Republican candidates in national and state elections, though the county approved Proposition 64 in 2016 (Polson & Petersen-Rockney, 2019). Incorporated communities include Yreka (the county seat), and three incorporated towns that allow limited commercial cannabis activity: Mount Shasta, Weed, and Dunsmuir.

The county faces significant natural hazards, particularly wildfire risks that have intensified due to climate change (as illustrated by recent fire events like the 2021 Lava Fire). Drought conditions, along with extensive irrigated agriculture, have also placed increasing pressure on water resources (see Petersen-Rockney 2022a and 2022b). From the 2010s the geography of cannabis cultivation shifted from public lands to private lands, and remote forested, mountainous areas to Siskiyou's agricultural valleys alongside changes in the demographics of cannabis cultivators. As a result of these shifts, cannabis became increasingly visible and its cultivators vulnerable to enforcement, especially as a potential irrigated crop (see Polson and

Petersen-Rockney 2019; Lu, Dev, and Petersen-Rockney 2022; and Getz, Petersen-Rockney, and Polson 2024).

Enforcement efforts against cannabis cultivation on public lands date back to the 1980s CAMP (Campaign Against Marijuana Planting) operations. Small-scale medical marijuana cultivators, mostly white, had also operated in the county, primarily in the western mountainous region, for at least half a century with little enforcement intervention. As one county board supervisor put it in an interview, Siskiyou “has always had a hippie growing history, mom and pops kind of stuff that was kind of benign” and seemingly tolerated by the county government. In April 2015, Siskiyou County supervisors passed their first medical cannabis ordinance, which was permissive and informed by a two-year public listening process. This ordinance established cultivation regulations with property setbacks and plant limits based on parcel size, to be enforced by the Planning Division through an administrative process.

The county’s approach to cannabis cultivation, however, quickly shifted. In December 2015, the county tightened the medical cannabis allowance, banning outdoor cultivation. Despite medical advocate opposition, the Sheriff’s Office led numerous efforts to restrict medical cannabis cultivation in 2016, including publishing anti-cannabis reports, engaging in activity that led to a lawsuit alleging voter intimidation, encouraging the passage of several ordinances restricting medical cultivation allowances, and founding the Siskiyou Interagency Marijuana Investigation Team that enlisted the National Guard, CAL FIRE, California Department of Fish and Wildlife, California Highway Patrol, and other agencies in cannabis enforcement activities (see Polson and Petersen-Rockney 2019).

While county residents voted to approve Proposition 64 that November, the county leveraged newly granted local control capacities to place a moratorium on commercial cannabis activity, declare a state of emergency that enabled the county to access federal and state enforcement resources, and ban cultivation (see Polson and Petersen-Rockney 2019). The county’s 2017 declaration of emergency cited “over 2,000 private grows” and “nearly universal non-compliance” with cultivation regulations (Siskiyou County, 2017b). This non-compliance was predictable given the absence of any pathway to permitted markets under the county’s cultivation ban.

Numerous research articles (see Polson and Petersen-Rockney 2019; Lu, Dev, and Petersen-Rockney 2022; Getz, Petersen-Rockney, and Polson 2024; Dillis, Polson, and Petersen-Rockney 2024) and legal suits (e.g. see, *Lo v. County of Siskiyou*, Case no. 2:21-cv-00999-KJM-AC) note the in-migration of Asian and Asian-American farmers, many of them Hmong, as a significant factor in the county’s sudden shift in resources and governing capacity to what the county called the “out of control problem” (SCSO, 2016) that threatens “our way of life” (SCSO 2016) of cannabis cultivation.

In 2019, the county implemented a permanent prohibition of all commercial cannabis activity in unincorporated areas, as well as moratorium on industrial hemp cultivation. Yet cultivation continued to expand, prompting the county to innovate new strategies. A series of ordinances in 2020 and 2021 targeted water access for communities identified by the county as growing cannabis: making groundwater extraction for cultivating cannabis illegal; requiring administrative permits for groundwater extraction; and making transporting more than 100 gallons of water on certain county roads a misdemeanor (originally only applying to the roads surrounding the rural subdivisions). The county also filed lawsuits against non-cannabis farmers who sold water to residents in rural subdivisions reliant on trucked-in water where a majority of residents were Asian and Asian-American, and where the county located many cultivation sites through intensive surveillance (including drone use).

Additionally, in the summer of 2021, the Lava Fire burned through a third of one of the large rural subdivisions. Residents alleged that public services were slow to respond. Residents worked to contain the fire themselves, despite evacuation orders. During the fire, a Hmong man was shot and killed by authorities, leading to additional lawsuits and public trust erosion between the county and its growing Asian and Asian-American community. In response to the water restrictions and shooting, Hmong communities organized protests and several groups, including the ACLU of Northern California, filed civil rights lawsuits against the county alleging racial discrimination in enforcement. In 2021, a federal judge issued a preliminary injunction against the water transportation restriction and, in 2023 the county was forced to repeal the water ordinances following civil rights litigation.

In addition to targeting water access for communities the county identified as cannabis cultivators, the county also passed a series of ordinances during the early 2020s that adjusted the cannabis plant abatement process, including shifting responsibility of abatement to property owners, imposing new fines for cannabis plants, and increasing fines for unrelated code violations (e.g. unpermitted generator or shed) if cannabis plants were present on the property.

For a full list and citations of cannabis-related ordinances and resolutions, see our [Siskiyou County planning code summary](#).

- **Unlicensed Cultivation Over Time**

Historical Context: Pre-Proposition 64 Era

While specific data on the scale of unlicensed cultivation is limited (it is very difficult to quantitatively study something that is prohibited), the county has a long history of cannabis cultivation, particularly in the more remote, mountainous western region bordering Humboldt and Trinity Counties dating back to at least the 1960s. Cannabis cultivation expanded during the early medical cannabis era (1996-2016) when Proposition 215 provided limited legal protections for medical cannabis patients. This early cultivation was predominantly conducted by white and some Indigenous medical growers who operated without local cannabis regulation. Their

activities aligned with locally held values of property rights, independence, and limited government involvement. These early growers helped develop the expertise and cannabis genetics that form the foundation of today's cannabis industry.

During this period, some larger-scale cultivators grew on Siskiyou's remote public lands, creating potentially significant environmental impacts on streamflow, wildlife, and other environmental resources without regulatory oversight of cultivation practices.

Rapid Demographic and Policy Changes (2014-2017)

The landscape of cannabis cultivation in Siskiyou County changed dramatically in the mid-2010s. In 2014-2015, Hmong farmers began purchasing land in large rural subdivisions, particularly in the county's agricultural valleys. These subdivisions, created before California's 1974 Subdivision Map Act, contain over 1,000 small parcels (typically 1-3 acres) that sat mostly vacant until Hmong farmers began purchasing them in 2014 for as little as \$5,000-10,000 per parcel (Polson & Petersen-Rockney, 2019). Still today, these rural subdivisions lack basic infrastructure like municipal water, sewage, electricity, and paved roads. Many residents still live in temporary housing, such as RVs, and multiple participants reported waiting years for county permits to build permanent homes or build wells.

Many initial Hmong in-migrants to Siskiyou were refugees from the U.S. Secret War in Laos and veterans who had worked in difficult manual labor jobs in cities like Fresno or St. Paul. These rural parcels represented an affordable retirement opportunity. They sought to own property, return to agrarian roots, practice self-sufficiency by growing their own food and medicine, and live surrounded by community and near mountains that reminded them of their childhoods in Laos. While the marginal quality of this land made it challenging for conventional agriculture, it was adequate for small-scale cannabis cultivation, which many elders described using to treat various health conditions including anxiety, depression, arthritis, gout, and injuries from war and repetitive labor. Many Hmong and Hmong-American cultivators also described how cannabis was the only crop they could grow on their acre or two of marginal, dry, rocky land and earn enough money to buy groceries, pay property taxes, and put gas in their car. As one cultivator noted, "What else can we do on this rocky land? There is no other crop that will grow here and provide enough income to live." Along with cannabis, many Hmong-American growers maintain subsistence gardens of vegetables and medicinal herbs. Farmers interviewed reported a preference for organic growing methods when possible, though the challenges of farming on marginal land with limited water access and no pathway to legal cannabis markets make this difficult.

Demographic shifts as people of Hmong, and later Chinese, descent moved to the county, contributed to heightened and racialized tensions around cannabis cultivation. According to the sheriff's 2017 estimate, approximately 6,000 Hmong Americans had moved to Siskiyou since 2014, purchasing approximately 1,500 parcels and outnumbering non-cannabis farmers in the

county by a factor of more than two to one (St. John, 2017; SCSO, 2017a; Polson and Petersen-Rockney, 2019). Since the county began active cannabis enforcement in late 2015, enforcement activities have been concentrated on these rural subdivisions with Asian residents, particularly in the Mount Shasta Vista subdivision in the center of the county where an estimated 75% of the population is Hmong. County officials, particularly the Sheriff's Office, framed cannabis cultivation as primarily conducted by "outsiders" and as a threat that "burned through our county, causing irrefutable harm" to local culture, natural resources, and public safety (SCSO, 2016).

2018-2020: Cultivation Expands and Moves to Private Lands

According to our quantitative modeling, Siskiyou County saw an average increase, in line with other counties, in cannabis density during this period. Relative to results from other regions, mov

Following California's legalization of recreational cannabis, cultivation patterns in Siskiyou County, as across the state, underwent significant transformation. County officials noted that cannabis cultivation after Proposition 64 occurred primarily on private lands in the rural subdivisions, shifting from earlier geographies of mountainous, remote, public land cultivation. Relative to results from other regions of the state, the shifting geography of cultivation and its relationship to average slope was especially pronounced as cultivation decreased in the county's mountains and increased in the flatter center of the county where growers especially moved to rural subdivision parcels. This shift toward more accessible private properties in the county's valleys, though still on marginal lands unsuitable for conventional farming, brought cultivation closer to rural agricultural and residential areas while remaining relatively isolated on lands with poor soils, limited water access, and hilly terrain.

Despite Siskiyou County voters approving Proposition 64, the county banned commercial cultivation and made legal personal cultivation nearly impossible (see Polson and Petersen-Rockney 2019), creating the conditions where all cultivators in the county are unlicensed. Yet cultivation expanded, especially in poorer areas and fire-prone ecologies, which informants attributed to the relatively cheap land in Siskiyou, particularly in the dry, rural subdivisions. In response, enforcement approaches increased to include severe penalties (e.g. recent ordinances allow for immediate imposition of civil penalties of \$1,000 per day per violation, up to \$10,000 per day, see Siskiyou County Code § 10-14.100) and a complaint-driven system that allowed for "proactive action" when officers spotted violations. This system made Hmong farmers on small and densely packed subdivision plots particularly visible and vulnerable to enforcement, with some white residents even organizing self-described vigilante groups that patrolled subdivisions on horseback to report violations to law enforcement (Polson & Petersen-Rockney, 2019).

The height of the COVID-19 pandemic in 2020 drove significant expansion in cultivation across California, including in Siskiyou County. Multiple factors contributed to this growth:

stay-at-home orders may have increased cannabis consumption; economic uncertainty pushed more people toward cannabis cultivation as an income source; and many urban residents relocated to rural areas seeking more space and new opportunities. According to satellite imagery analysis and ethnographic data, cultivation sites in rural subdivisions like Mount Shasta Vista multiplied during this period. Increased cultivation brought economic growth to the region, which residents described as buffering the economic downturn many places experienced during the height of the pandemic. Residents reported booming local businesses and rising property values (e.g. subdivision parcels increased in value from \$10-\$20,000 to over \$200,000 during this time, see Getz, Petersen-Rockney, & Polson, 2024), which they attributed to the economic stimulus of cannabis cultivation and the thousands of Asian and Asian-American residents who were spending money in the economically marginalized region.

2020-2022: Expansion Reduces Amid Market Crash and Increased Enforcement

Beginning in late 2020, the cannabis market experienced a significant downturn that participants identified as the primary factor in slowing cultivation growth in Siskiyou County. However, despite this market contraction and intensified enforcement, cultivation in Siskiyou did not decline as dramatically as in some other California regions—as evidenced by both our quantitative and qualitative findings. Decreases in cultivation density were more pronounced in areas with higher building density and less tree cover, consistent with the heavily focused enforcement in the subdivisions through surveillance and raids.

Research participants attributed the relatively stable unlicensed cultivation to two primary factors. First, the county's intensive enforcement strategies paradoxically spurred adaptation in the form of more production. As enforcement intensified, cultivators responded by distributing gardens across multiple parcels to spread risk, adopting more intensive cultivation practices to harvest more quickly before potential raids, and increasingly moving cultivation into greenhouses and hoop houses to reduce visibility. What had begun as primarily older retirees growing on a small scale escalated, in direct response to intensified enforcement, to larger-scale unlicensed production.

Second, many Hmong and Hmong-American growers remained due to the stickiness of place and poverty. Initially attracted by inexpensive land, many had invested their limited life savings in their properties, some with hopes of eventually entering the legal market. The tight-knit communities established in the subdivisions also provided critical social infrastructure, especially for elders with limited English proficiency and agrarian backgrounds. With few economic alternatives and having already invested their resources in their land and communities, many could not afford to abandon their properties despite enforcement pressures.

The county's enforcement approach evolved during this period, particularly focusing on water access restrictions. Between 2020-2021, the county passed three ordinances: banning groundwater use for cannabis cultivation; requiring permits for water transportation between

parcels; and prohibiting water trucks carrying over 100 gallons on roads surrounding subdivisions with predominantly Asian American residents (Chang et al. v. County of Siskiyou, 2022). During the 2021 drought and Lava Fire, these restrictions severely impacted residents' access to water even for basic household needs, livestock care, and subsistence gardening (Getz, Petersen-Rockney, & Polson, 2024). Subdivision residents described about a third of their neighbors, those who could afford to, leaving the region during the summer of 2021 due to their inability to access water, and many described a sense that this was the county's goal: to drive Hmong residents out of the region. Yet cultivation did not stop, or even decline significantly—the cultivators who remained scaled up production in response to increased enforcement.

The Sheriff's Office increasingly emphasized environmental impacts, especially water use, in justifying enforcement, though these claims were contested. Portraying cannabis cultivation as environmentally polluting has been a key enforcement justification. However, research suggests that per-acre water use for cannabis is lower than many traditional crops grown in the region (Dillis, Petersen-Rockney, and Polson, 2019). Relative water use for cannabis cultivation is, as one alfalfa farmer phrased it, "a drop in the bucket" compared to water use for growing alfalfa in the county. One alfalfa farmer, who the county sued for selling water to subdivision residents, used about six million gallons of water each day to irrigate his alfalfa fields, while at most selling 350,000 gallons of water to subdivision residents daily, approximately 5% of his total water use. The county's water-focused enforcement strategy during this period, while creating significant hardship for residents, especially Asian and Asian Americans, has not eliminated cultivation.

2022-2024: Expansion Plateaus Amid Market Crash and Increased Enforcement

Our modeling results show that Siskiyou County experienced marginally more contraction in cannabis density than average across the state during this time period. The strongest reductions in cannabis density was observed in the flatter areas, according to our model. This can largely be understood in the context of these areas being the primary cannabis cultivation regions by this period – legacy growers who had historically cultivated in the hills had largely already scaled back their farms, stopped growing, or left the region by this period. The majority of cultivators who remained were in these flatter regions, in the rural subdivisions. Therefore, as the market continued to decline, wildfires and drought posed ecological challenges, and enforcement and water restrictions made life more difficult, the cultivators who left or scaled back their production during this period were primarily in those flatter regions. Simultaneously, our modeling data suggests that cultivation did actually increase overall in the more rugged and remote areas of the county, perhaps partly due to the intense enforcement focus on the smaller-scale cultivators in the subdivisions, creating opportunity for increased scale with reduced enforcement focus in the more remote regions of the county.

Unlicensed Cultivation and Policy Impacts

While precise data on unlicensed cultivation is inherently difficult to obtain, multiple sources provide insight into its scope and evolution in Siskiyou County. According to ethnographic data and satellite imagery analysis, cultivation in Siskiyou County has undergone several notable transformations since state legalization. Legacy cultivation shifted from the hills to the valleys with legalization. Initial cultivation patterns in the valley's rural subdivisions typically involved outdoor growing on single parcels, with most cultivators aiming to remain within what they believed were medical allowances (under 99 plants), and many reported provided enough income to meet their modest needs of daily life. As enforcement intensified, cultivation methods adapted accordingly, with a shift toward less visible growing methods, more intensive practices, and risk distribution across multiple sites.

By 2023, aerial imagery revealed that while some plots in the subdivisions stood empty due to the cannabis market crash, Lava Fires' damage, enforcement, and water restrictions, new patterns of land use and cannabis economies had emerged. The most significant impacts of enforcement appeared to be displacement and adaptation rather than elimination of cultivation activities, with smaller operations giving way to fewer but larger and better-capitalized operations.

The county's enforcement-first approach has produced several notable outcomes. First, it has driven a shift from smaller-scale cultivation toward larger operations with the resources to navigate or withstand enforcement pressure. Second, it has significantly impacted Asian and Asian American community, reproducing racial disparities well-documented in the War on Drugs. Third, the county has diverted its limited resources toward cannabis enforcement at the expense of other services and needs and its aggressive anti-cannabis action, and the racial disparity that has resulted, has generated significant litigation, creating additional financial strain on county resources.

Unlicensed cannabis cultivation has historically provided a livelihood for people pushed to the margins with few economic opportunities—which remains the case in rural, poor areas like Siskiyou, and especially for minoritized groups like Hmong ethnic minority refugees. While enforcement has shifted the landscape of cultivation, the underlying economic and social factors driving cannabis cultivation remain largely unaddressed by current policies. People continue to grow unlicensed cannabis not because enforcement is too limited or lenient, but primarily because they have few other economic options. This suggests that a more comprehensive approach considering economic development, community integration, and regulated cultivation may be necessary to effectively address unlicensed cultivation in the long term.

- **Discussion**

According to model data, between 2018 and 2020 cannabis density expanded, and between 2020 and 2024 cultivation growth decreased proportionate to that previous increased, leading to a plateau of overall cultivation (quant #s here). Because Siskiyou is a ban county, all

cultivation in unincorporated areas is unlicensed. The Siskiyou County Sheriff has a Marijuana Eradication Team. The Siskiyou Interagency Marijuana Investigation Team (SIMIT) and North State Marijuana Investigation Team (NSMIT) serve search warrants and conduct seizures of cannabis. While code enforcement officers accompanied law enforcement on raids, law enforcement was consistently led by both enforcement efforts and policy evolution. The Siskiyou Interagency Marijuana Investigation Team collaborates with state and federal agencies for aerial monitoring, and the county routinely uses drones for surveillance (a practice in legal question in other areas, such as Sonoma County). The Siskiyou County Sheriff's Office handles cannabis-related complaints, and the county operates specialized cannabis eradication teams, including SIMIT and NSMIT, to conduct raids and seizures. Cultivation sites are subject to immediate enforcement and civil fines start at \$1,000 per day and escalate to \$10,000 per day. See our [Siskiyou County planning code summary](#) for more details on cultivation penalties and ban enforcement.

Additional factors that our previous research on cannabis cultivation in Siskiyou County has found to be both quantitatively and qualitatively important include: cannabis is often excluded from areas with a large extent of non-cannabis agriculture and relegated to more marginal land for growing other crops and areas with low median income (Dillis et al. 2024).

When asked about cannabis geography trends identified in our quantitative analysis, informants in Siskiyou County articulated:

- Cannabis market crash: Cultivators identified the declining price of cannabis as the greatest explanatory factor in the slowed growth of cultivation after 2020. They also identified the county's enforcement approach as factor contributing to consolidation of the cannabis industry, especially after water restrictions and wildfires forced some growers to abandon their land.
- Wildfire and drought: These environmental concerns are increasing with climate change, and present an opportunity for local government officials to innovate new local land and water use policies that have produced racial disparities. Some informants, and several civil rights lawsuits, suggest racialized enforcement that goes beyond neutral application of regulations.
- Enforcement: Officials emphasized environmental damage, public safety threats, and the presence of "outsiders" and "cartels." Our ethnographic research on cannabis in Siskiyou County from 2018-2025 has revealed extremely limited evidence of organized crime cartels. Environmental protection has been a prominent justification for cannabis restrictions, with county officials citing concerns about water usage, pollution, and fire hazards. However, these environmental concerns have been inconsistently applied across agricultural sectors. For instance, while strict water use restrictions were imposed on areas with high concentrations of Hmong-American farmers, other agricultural water

users faced fewer restrictions. Additionally, growers described how the scale of cultivation increased as enforcement intensified.

- **Permitting and the licensed market:** Many cultivators reported a desire to comply with regulations and a goal of entering legal markets, a current impossibility for those located in Siskiyou County's unincorporated areas. Some expressed bewilderment at being treated as if they were criminals despite California's legalization of cannabis. As one cultivator stated during interviews, "We want to do the right thing, but they don't let us."
- **Does the current policy work?** While the ban and its enforcement has failed to reduce unlicensed cultivation, residents described cascading harms and impacts, socially and economically (see Polson, Petersen-Rockney, and Getz 2025). Not a single participant described the current policy regime as functioning well. For county officials and staff, they face an escalating scale of cultivation with few resources (made more limited by the drain of related civil rights lawsuits). For cultivators, there is no path to enter the legal cannabis market, simply by their location. For residents concerned with environmental and other impacts of cultivation, the opportunity to monitor cultivation practices, and build trust and compliance among cultivators has been missed by the county's neo-prohibitionist approach.

- **Findings**

Enforcement-Based Approach: Siskiyou County has pursued an enforcement-first approach to cannabis cultivation that blurs civil and criminal lines. Administrative infractions are readily escalated to criminal charges, and environmental regulations are selectively enforced against cannabis cultivators. This contradicts the civil regulatory framework envisioned by Proposition 64.

Environmental Justifications and Disparities: While environmental protection serves as a primary justification for cannabis restrictions, environmental concerns have been inconsistently applied across agricultural sectors. By pushing cannabis cultivation into more marginal and environmentally sensitive areas through enforcement actions, the county's policies may actually exacerbate the environmental impacts they aim to address. This creates a cycle where environmental harm narratives become self-fulfilling prophecies.

Racial and Ethnic Disparities: Asian and Asian-American farmers have been disproportionately impacted by cannabis enforcement, with their increased visibility in rural subdivisions making them particularly vulnerable to complaint-driven enforcement.

Economic Consequences: The county's approach has contributed to economic disparities in the cannabis industry, with well-resourced operators able to move to cannabis-friendly jurisdictions while small-scale cultivators face increasing barriers to participation in the legal market.

Cultural Underpinnings: Cannabis policy in Siskiyou reflects broader cultural anxieties about rural identity, demographic change, and resource control rather than purely evidence-based concerns about public health or safety. Cultural and social goals, along with economic necessity, are also factors that sustain cultivators' interests in remaining in Siskiyou, despite enforcement.

Scale of Unlicensed Cultivation: As enforcement efforts expanded in scope and intensity, cultivation methods adapted accordingly. Growers shifted cultivation into greenhouses and high tunnels to reduce visibility. They also adopted more intensive cultivation practices like increased fertilizer and mixed-light use in attempts to harvest sooner before potential raids. Some growers expanded their operations to multiple parcels to spread risk if one location was raided. What had begun as primarily older retirees growing on a small-scale for their own livelihood reproduction escalated, in direct response to enforcement, to larger-scale unlicensed production.

- **Conclusion**

Siskiyou County's approach to cannabis regulation represents a form of local resistance to state-level legalization through the implementation of increasingly restrictive bans and enforcement measures. Siskiyou's ban has not been effective at eliminating cannabis cultivation but has created significant social tensions, particularly along racial/ethnic lines, and has spurred an increase in consolidation and scale of unlicensed cultivation.

The case of Siskiyou County demonstrates how local control provisions in Proposition 64, while intended to allow for regional customization of cannabis policy, can enable forms of neo-prohibition that undermine the equity and environmental goals of legalization. The wide application of cultivation bans across the state has contributed to economic disparities in the cannabis industry, favoring well-capitalized firms that can establish operations in cannabis-friendly municipalities while marginalizing small-scale producers.

Reducing unlicensed cultivation likely requires addressing the underlying social, cultural, and economic dimensions of cannabis production rather than relying solely on enforcement. Evidence suggests, for example, that environmental protection goals would be better served through accessible regulatory pathways and technical assistance for cultivators rather than criminalizing approaches that push cultivation onto more marginal areas, incentivize more intensive practices, and reduce regulatory trust and oversight (Getz, Polson, and Petersen-Rockney, 2023). State-level oversight could help ensure that local policy implementation aligns with the broader intent of cannabis policy reform.

Contributions to Report Findings

Objective 1 Assessing Unlicensed Production Amounts and Geography

Finding #1: In the years following legalization, unlicensed production showed an initial expansion, rapid retraction, then stabilization.

- Ethnographic evidence revealed that despite a countywide cultivation ban, unlicensed cultivation initially increased in 2018–2020, especially in areas like Hornbrook and the Shasta Valley.
- Enforcement was localized and targeted toward previously known cultivation areas, but the overall trend was early growth.
- From 2020–2022, both ethnographic and CannaVision data showed above-median declines, indicating significant contraction.
- However, from 2022–2024, unlicensed cultivation increased again, leaving overall levels above those of 2018.
- Ethnographic participants linked the persistence of unlicensed cultivation to exclusionary licensing policies, limited legal pathways, and economic necessity among smallholders.

Finding #2: Cultivation moved from the hills to the flatlands and back again.

- Ethnographic data suggested that in 2018–2020, despite a formal cultivation ban, growers (particularly Hmong communities) expanded in flatter, semi-suburban subdivisions where land was inexpensive and relatively open.
- Many cultivators operated under the mistaken assumption that medical cannabis allowances still applied until 2019.
- Between 2020–2022, CannaVision indicated slower contraction in these flatter zones relative to hillier terrain.
- By 2022–2024, ethnographic evidence indicated limited movement back to rugged areas due to “stickiness of place” and continued affordability of subdivision parcels.
- Persistence in these areas reflected both economic constraints and the ability to grow in community clusters that offered security and shared infrastructure.

Finding #3: While participation in the unlicensed market was broad initially, increasingly the people left cultivating are those in tenuous socio-economic situations and attached to place for cultural-historical reasons.

- Ethnographic data identified Siskiyou as one of the most vivid examples of the intersection between socio-economic marginalization, ethnic/racial discrimination, and persistent unlicensed cultivation.
- Hmong and other ethnically marginalized growers, many of whom migrated seeking affordable land, settled in rural subdivisions such as *Shasta Vista* and other pre-1974 tracts characterized by small parcels (1-3 acres), lack of infrastructure, and low land costs.
- These subdivisions became critical nodes of persistence, fostering dense networks of mutual aid and information exchange despite ongoing harassment, discriminatory policies, and repeated enforcement actions.
- The “stickiness of place” was pronounced: residents remained due to sunk investments in land and infrastructure, a lack of alternative employment opportunities, and cultural and kinship bonds within tight-knit enclaves.

- Ethnographic accounts described how subdivision residents adapted to enforcement by coordinating cultivation schedules, pooling resources for water transport, and organizing community defense and warning systems.
- As broader market participation declined, Siskiyou’s unlicensed landscape became defined by concentrated, small-scale production within these subdivisions—communities where economic necessity, racialized exclusion, and social solidarity combined to sustain cultivation.

Finding #4: Unlicensed cultivation generally migrated out of public lands because of lower consequences on private land.

- Siskiyou County ethnographic data revealed similar patterns, with cultivators leaving public forest lands early in the legalization era.
- The felony-level consequences of public land cultivation were widely understood among growers, and enforcement pressure from both federal and county agencies effectively eliminated large-scale public land operations by 2020.
- The availability of cheap private parcels in rural subdivisions such as *Shasta Vista* provided a strong “pull” factor, enabling low-income cultivators (particularly Hmong and other marginalized residents) to continue operations under lower legal risk.
- Cultivators noted that even small fines or code violations were preferable to potential felony charges or asset forfeiture associated with public land cultivation.
- By 2022–2024, unlicensed activity in Siskiyou was almost entirely concentrated in these private subdivisions, where community networks and low entry costs made persistence feasible despite recurring enforcement actions.

Finding #5: Transition from Outdoor to Mixed-Light Production.

- Ethnographic data suggested that increased enforcement pressure, particularly through aerial detection, was a primary reason for abandoning outdoor production.
- Participants also emphasized the economic advantage of mixed-light systems, including the potential for more frequent harvests.

Finding #6: Unlicensed Cultivation Was Highly Sensitive to Major Fire Years.

- Ethnographic data described the 2021 *Lava Fire*, which burned through a third of one large rural subdivision.
- Residents alleged slow public service response and recounted working collectively to contain the fire.
- Approximately one-third of residents, mainly those with greater financial means, temporarily left the region during the summer of 2021.
- Despite these disruptions, cultivation activity reportedly did not cease or significantly decline, reflecting persistence among growers who lacked relocation options.

Objective 2 Identifying Factors Influencing the Observed Extent of Unlicensed Cultivation

Finding #1: Presence of licensed cultivation was the primary deterrent of unlicensed cultivation.

- Because cannabis cultivation remained prohibited, Siskiyou could not benefit from the deterrent effect of licensed farms.
- Ethnographic accounts indicated continued and shifting patterns of unlicensed activity, with cultivators operating without regulatory alternatives or proximity effects from licensed sites.

Finding #2: Bans Were Not a Consistent or Powerful Indicator of Growth or Decline in Unlicensed Cannabis Cultivation.

- Ethnographic data showed that Siskiyou's ban-dependent approach faced diminishing returns.
- Cultivators adapted by using more intensive growing methods, such as greenhouses, and expanding across multiple parcels to reduce exposure to enforcement.
- Limited fiscal resources further constrained the county's ability to maintain pressure on unlicensed cultivation.
- The persistence of unlicensed activity reflected both the absence of legal alternatives and the adaptability of growers to enforcement patterns.

Finding #3: The Perceived Likelihood of Strong Enforcement Was an Initial Deterrent, but Became Less Important Over Time.

- Ethnographic findings identified Siskiyou as a key example of enforcement-driven adaptation.
- Persistent law enforcement campaigns initially reduced visible cultivation but ultimately pushed growers into greenhouses and multiple dispersed parcels.
- Many cultivators, particularly from marginalized communities, remained because they had few alternatives and were economically dependent on cannabis.
- This "stickiness of place" effect reinforced the diminishing returns of strict enforcement.

Finding #4: Over Time, Civil Policy and Civil Enforcement Efforts Became Key Drivers of Declines in Unlicensed Cultivation.

- Ethnographic evidence suggested minimal civil enforcement capacity, with most efforts relying on traditional policing.
- Enforcement near streams was inconsistent, and little change was observed in cultivator behavior regarding water use.
- The county's limited regulatory toolkit hindered its ability to achieve the same reductions seen in jurisdictions with stronger civil programs.

Finding #5: Troubles in Permitting Programs Prevented Many Cultivators from Becoming Licensed.

- Ethnographic evidence showed that Siskiyou's ban on commercial cultivation prevented any licensing pathway for existing cultivators.
- Stringent limits on personal cultivation further restricted legal participation.

- Trade associations that had operated during the medical cannabis period were unable to continue under the ban.
- As a result, many residents who wished to continue growing had no option but to operate outside of the legal framework.

Finding #6: Cultivation Bans and Other Enforcement Policies Were Linked with Whack-a-Mole Dynamics of Unlicensed Cultivation.

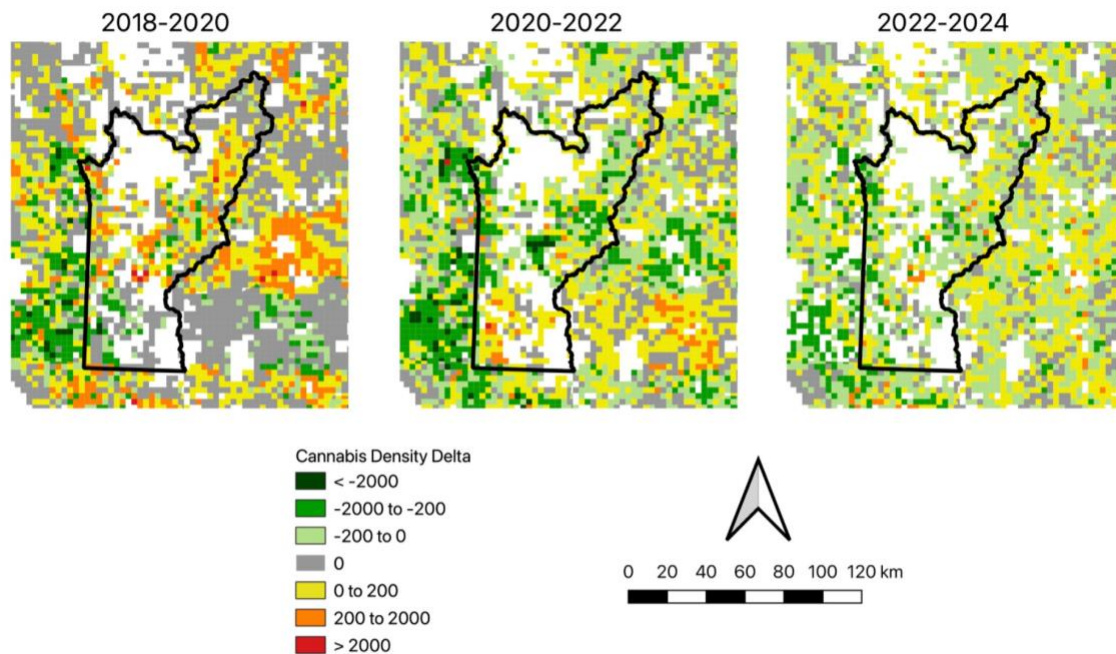
- Ethnographic evidence indicated a similar pattern of site mobility, particularly within unincorporated subdivisions such as Hornbrook.
- Cultivators often relocated within fixed residential clusters or across adjacent parcels where land was inexpensive and oversight limited.
- Enforcement actions prompted movement rather than cessation, especially where community norms or pro-cannabis associations provided informal protection.
- Anti-cannabis Property Owners Associations and targeted enforcement in some subdivisions reduced replanting, but broader displacement continued across the county.

Finding #7: Market Forces and Price Decline Were Major Factors in Siting Decisions.

- Ethnographic data described scattered, small-scale unlicensed activity persisting on low-value parcels even as overall cultivation declined.
- Growers relocated to cheaper lands where oversight was weaker, though reduced profitability and strong enforcement diminished total activity.
- Economic stress and lack of legal market access left many cultivators with limited livelihood alternatives, sustaining small operations despite low returns.

TRINITY COUNTY: ETHNOGRAPHIC ANALYSIS

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- **Top-level summary**

Trinity County, a rural region in California's Emerald Triangle, demonstrates the complex interplay of regulatory approaches, market forces, and community dynamics in cannabis cultivation. After recreational legalization in 2016, Trinity implemented a permit system capped at 530 licenses—a fraction of the estimated 4,000-6,000 cultivation sites, according to county officials. This cap, combined with a pivotal 2019 lawsuit settlement that required individual CEQA reviews for each farm, created substantial barriers for cultivators to enter the legal market. The two-year permitting freeze during the lawsuit, and the subsequent increased cost of the licensing process, along with the post-pandemic cannabis market crash, pushed many cultivators to either abandon cultivation or remain in the unlicensed market.

The county's cannabis landscape has been shaped by distinct communities over time: legacy cultivators, many of whom transitioned from timber to cannabis in the 1970s-1980s, and waves of more recent Bulgarian, Russian, Chinese, Central American, and, beginning in the late 2000s, Hmong farmers (who primarily settled in Trinity Pines/Post Mountain). While the market collapse caused many long-time growers to exit the industry, the Hmong community has largely persisted due to limited economic alternatives and strong social community ties. The Trinity County government has made notable efforts to support smaller-scale farms, including limiting permits to one per parcel, requiring residence on farms, restricting large-scale cultivation by

allowing only 15 Type 3 licenses (up to one acre), and reserving licenses for legacy growing regions like Hayfork.

Our spatial analysis shows an initial increase in unlicensed cultivation density between 2018-2020, followed by a decrease between 2020-2022, with the most significant reductions occurring near licensed farms, in flatter regions, and in areas with higher building density. That decrease trend continued between 2022-2024, especially in areas with groundwater present and in forested areas. While the county employs a multi-agency enforcement approach, stakeholders consistently identified the cannabis price collapse—not enforcement—as the primary driver of cultivation decline. Trinity County's experience highlights how well-intentioned regulations can create unintended barriers to legal market participation. This case also demonstrates that market forces, legal challenges, and permit program disruptions exert even more significant influence than enforcement actions in determining cultivation patterns.

- **Research Summary**

We conducted 16 interviews and 10 ethnographic fieldwork days in Trinity County in the summer and fall of 2024. Additionally, we draw on ethnographic fieldwork observations and interviews from previous research in Trinity County conducted in 2022. Interview participants include:

- Local government staff and officials, including enforcement and compliance officers, cannabis division staff, and agricultural commissioner staff
- Local residents, including medical cannabis advocates, cannabis consultants, and environmental organization staff
- Licensed and unlicensed cultivators, including both white and Hmong cultivators

In addition to ethnographic data, we draw on county policy and permitting documents.

- **County Background**

County Characteristics

According to the 2020 US Census, Trinity County has a population of just over 16,000 residents and a population density of about five people per square mile, making it one of the least populated and most rural counties in California. Trinity's residents are, on average, among the lowest-income in California—the median household income is just over \$40,000 per year and the poverty rate is over 22% (compared to 12.2% statewide). Trinity County has one of the smallest county budgets in California (approximately seventy-six million dollars per year, of which about four million is dedicated to law enforcement).

The local economy historically depended on timber, but after the industry's decline between the 1970s and 1990s, cannabis cultivation became a significant local economic driver.

Trinity County is approximately 85% public land, with only 15% of land area in private property. Just over 3% of the county's land is zoned for agriculture, and the minimal non-cannabis agriculture in the county is primarily beef cattle and wine grapes. Weaverville serves as the county seat and other significant communities include Lewiston, whose residents have largely opposed cannabis cultivation, and the legacy growing communities of Hayfork and Trinity Pines/Post Mountain.

Trinity County is majority non-Hispanic white (approximately 80%), while other groups may be under-reported in formal census data. Since the mid-2000s a significant influx of Hmong residents have moved to the county and are primarily concentrated in Hayfork and the Trinity Pines subdivision, which is home to significant permitted and unpermitted cannabis. According to county officials, approximately 1,000 Hmong families live in the Trinity Pines subdivision and cultivate cannabis,⁴³ as well as Eastern European communities, particularly people of Bulgarian descent.

Trinity County is geographically isolated and mountainous, with steep hillsides and dense forests. The county is prone to wildfires, with several major fires affecting the region in recent years, including the August Complex fire in 2020 that evacuated 3,400 people from Trinity Pines, which faces high fire risk due to its dense, dry pine forest landscape. The steep terrain of the Trinity Pines subdivision also raises erosion and water contamination concerns.

Cultivation History Summary

As part of the Emerald Triangle, Trinity County has been home to legacy cultivation for over half a century. While there have been large-scale public land grows noted in enforcement records for decades, most legacy cultivators grew on a small scale on either public or private land. After the collapse of the timber industry in the late 20th century, many former timber workers and their families turned to growing cannabis as an alternative source of income. In the late 1970s and early 1980s, legacy cultivators introduced new cannabis genetics and more organized cultivation methods and established distribution networks. The 1980s saw the beginning of enforcement with CAMP (Campaign Against Marijuana Planting), which pushed many growers to hide their operations deeper in the woods or innovate methods to avoid detection, often hiding their gardens among the natural vegetation in so-called “guerrilla grows.”

Trinity County was evenly split on Proposition 64, which passed in the county by only six votes (50.10% in favor). In 2016, Trinity County passed Resolution No. 2016-077, establishing principles for cannabis regulation that emphasized safety, environmental protection, and responsible cultivation practices. The county's first commercial cannabis ordinance (No. 315-823) was enacted in October 2017, which established an enrollment cap and zoning and property restrictions. County Code regarding commercial cannabis has been updated to clarify

⁴³ There are about 1,100 parcels in the Trinity Pines and an estimated Hmong population of about 1,000 families. See also; <https://www.nytimes.com/2017/06/03/us/hmong-marijuana-california.html>.

definitions, license caps, transportation issues (2018: Ordinances No. 315-829, 315-830, and 315-841), residency requirements, and limits on applications per parcel/person (2019: Ordinance No. 315-843). In 2020, an Urgency Ordinance (No. 1355) extended existing licenses and prohibited new ones pending a Transition Program. In 2020, the county also enacted environmental mitigation measures (Ordinance No. 315-849), and authorized new cultivation taxes (with the passage of Measure G). In 2021, the county also established temporary moratoriums on cultivation licenses in specific areas, including Lewiston and Rush Creek Estates where many residents were opposed to cannabis cultivation.

A pivotal disruption to Trinity County's cannabis program occurred when the Trinity Action Association (TAA) filed a lawsuit in 2019 challenging the county's compliance with the California Environmental Quality Act (CEQA). The county had initially published a Notice of Preparation for an Environmental Impact Report for its Commercial Cannabis Program in December 2018, held public scoping meetings in January 2019, and eventually certified a final programmatic Environmental Impact Report (FEIR) in December 2020 through Board Resolution No. 2020-103. However, TAA contended that the county was not properly implementing the transition program and environmental protections. The August 2020 lawsuit judgment effectively shut down the cannabis licensing program, and in the resulting settlement, Trinity County agreed to conduct individual CEQA reviews for each farm rather than using a programmatic approach.

The lawsuit had multiple negative impacts on the county government, community, and cultivators. The lawsuit shut down the county's permitting program for two years. Informants estimated that 25-50% of cultivators stopped growing or left the region during that time, many of whom had been in the process of entering the legal market. When the local permitting program restarted in 2022, there was a backlog of approximately 400 cultivators trying to navigate new requirements, and many lost the entire 2022 cultivation season due to permitting delays.⁴⁴ As the TAA lawsuit wound its way through the courts, many growers were placed in legal limbo. Since they had registered to cultivate, and invested considerable capital to do so, they were known to law enforcement, which also placed enforcement and compliance personnel in an awkward position of tolerating unlicensed activity or enforcing against cultivators stuck in limbo. Even after the settlement, the regulatory burdens created by the settlement substantially increased the cost and complexity of obtaining permits, with estimates from grower and consulting firms that cultivators must now spend approximately \$30,000 on consultants to complete the process. (In response to the lawsuit, the county created an "Appendix C checklist" that all applicants must complete with a qualified environmental professional from an approved list of consultants, substantially increasing costs.) The cost and difficulty of obtaining permits after the lawsuit

⁴⁴ A 2021 Court Order in the TAA case forced the county to stop issuing or reissuing any CCL until CEQA compliance is achieved. Numerous Trinity County farmers found themselves unable to operate legally through no fault of their own, and several filed legal action against the County (<https://www.trinitycounty.org/DocumentCenter/View/568/Report-JUR-2022-001-PDF>)

"created an incentive for not doing permitting because it's so difficult and expensive," as one county employee described. The lawsuit also cost the relatively poor county government considerably, and, as one Board Supervisor pointed out, the resulting individual CEQA process does not align with ecological science: "CEQA is done at the individual level, and the planning and mitigation is at the individual parcel scale, which is not how we manage environmental problems effectively—they need to be managed at a landscape scale."

Today, Trinity County has a permit cap of 530 cultivation licenses. Permit types are based on farm size and growing practices. Most of the permitted cultivators are small (10,000 sq. ft.), mostly outdoor or mixed light (greenhouses), and the County allows up to 15 Type 3 licenses in total (that allow up to one acre of outdoor cultivation). Additionally, only one permit may be obtained per parcel and there is a residency requirement, meaning that the parcel must have a permitted dwelling (Ordinance No. 315-823(3)(b) and Chapter 17.43.040(G)). As of summer 2024, Trinity County officials reported that they had issued approximately 300 commercial cannabis licenses out of the 530 cap since the program restarted after the CEQA lawsuit, and they still had a backlog of hundreds of hopeful license applicants.

Cannabis cultivation is treated as a land use issue, with local permitting, such as a "Commercial Cannabis Cultivation License" managed by the Planning and Building Department (Type 3 permits must also be approved by the Planning Commission). The permitting process includes an interview with the Planning and Building Department, site visits, a site plan of the entire parcel, and compliance with zoning and setback rules. The permitting process has been complicated by the CEQA requirements following the TAA lawsuit and cultivators must now complete an Appendix C checklist prepared by a qualified environmental professional, which, according to consultant firms and cultivators, has created a "green rush" for consultant groups and costs each cultivator approximately \$30,000 in consultant fees, according to consultant staff and growers.

To avoid conflicts with residents, like those involved with TAA, the county has made efforts to allow communities that do not want cannabis grown in their neighborhoods to "opt-out" of allowing cultivation. Upon petition request from local residents, the county approved two Urgency Zoning Ordinances that provide temporary moratoria on new commercial cannabis licenses in the communities of Lewiston (Ordinance No. 315-850 in 2021) and Rush Creek (Ordinance No. 315-845 in 2020). Allowing local communities that are opposed to cannabis to "opt-out" of allowing cultivation in their backyards has, according to interviewees, helped reduce community tension and broad-scale opposition to the licensing and permitting program.

The Cannabis Division is in the Planning and Building Department and has approximately eight full-time staff who handle compliance issues for license holders and applicants. While Trinity does not have a Marijuana Enforcement Team, the Sheriff's Department, along with multi-agency cooperation (including the State EPIC team, sheriff's offices from neighboring counties like Siskiyou and Humboldt, the State Water Resources

Control Board, the California National Guard, and the California Department of Fish and Wildlife CEP Team), leads enforcement against unpermitted cultivators. The county enacted a graduated fine system in August 2020: first violations incur fines up to \$1,000, second violations up to \$2,500, and third or subsequent violations up to \$5,000 (Chapter 8.90.080). Each day a violation continues constitutes a separate offense, with fines accruing interest at civil judgment rates (Trinity County Code Chapter 8.90.100).

Violations of cannabis ordinances are treated as public nuisances and subject to abatement procedures. The Board of Supervisors may order abatement after a public hearing with seven days' prior notice to property owners, who may file written protests. If the Board confirms a public nuisance exists, the Director of Public Works abates the nuisance, with costs becoming a property lien if unpaid (Trinity County Code Chapter 8.64.020-8.64.090). For immediate threats to public health or safety, the county may perform summary abatement without following standard procedures, recovering costs through property tax bills (Trinity County Code Chapter 17.43.080). Notably, property owners can be held responsible for violations whether or not they personally caused them, though officials must attempt to contact owners and provide reasonable time to cure violations caused by renters or lessees before commencing proceedings (Trinity County Code Chapter 8.90.060). Beyond monetary penalties, the county may withhold discretionary licenses, permits, or entitlements while penalties remain unpaid, creating additional compliance pressure.

For a full list and citations of cannabis-related ordinances and resolutions, see our [Trinity County planning code summary](#). Additionally, in 2025 the county was working on updating its General Plan and cannabis ordinances, with comprehensive amendments expected.

- **Unlicensed Cultivation Over Time**

Historical Development of Cannabis Cultivation in Trinity County

Trinity County's remote geography and favorable growing conditions have long made it an ideal location for cannabis cultivation. Historically, cultivation began primarily on public lands, with growers concealing operations from law enforcement. As one legacy grower explained, "If they find [cannabis] on forestland and they don't catch you in your patch, they just take it. No consequences. [If law enforcement] catches weed on your property, there are consequences."

During the 1970s-1980s, as the timber industry declined, more locals turned to cannabis for income. "Hayfork's economic collapse was mitigated by three forces: collaborative forest management, a local food movement, and the rise of the cannabis sector as an industrial boom after Proposition 215 passed in 1996. The rise of the cannabis sector provided some resilience" (Trinity County Cannabis Equity Assessment, 2023). The passage of Proposition 215 brought

some legitimacy to medical cannabis cultivation, though most cultivators still operated in gray areas of the law.

Cannabis eventually replaced logging as the economic backbone of the community. A local resident noted that cannabis provided such economic resilience that "the 2008 and 2009 U.S. market crash wasn't even felt here because cannabis provided such a cushion." This resident described cannabis as having been "a brain gain to this community," bringing new residents, skills, and economic activity to the rural county.

According to interviewees, a significant shift occurred from public land to private land cultivation, beginning in the late 2000s (although public land operations persist at reduced levels). This transition coincided with increased enforcement on public lands, reduced legal risk on private property under medical cannabis laws, and the in-migration of new cultivators who primarily farmed on small parcels of private land in the Trinity Pines rural subdivision.

Starting around 2008, Hmong farmers began settling in the Trinity Pines/Post Mountain area, initially migrating from agricultural backgrounds in California's Central Valley. By 2016, this migration had expanded to include Hmong families from other regions, such as Minnesota. Other ethnic groups also moved to the area to grow cannabis, including cultivators of Eastern European backgrounds, particularly Bulgarians. These demographic shifts dramatically transformed the local economy, with land prices skyrocketing "from a couple thousand to more than \$100,000 per acre at the peak of the market in 2016," according to residents.

Today, the Trinity Pines/Post Mountain area represents a concentration of cannabis cultivation, with approximately 1,000 Hmong families operating on about 1,100 parcels. Beyond cannabis, many Hmong residents contribute to the local food system by growing produce for farmers markets and grocery stores. While community integration continues to present challenges due to linguistic and cultural barriers, non-Hmong residents noted that "the Pines have become much more quiet and lawful since the Hmong moved in."

Recent years have seen significant economic contraction in the cannabis sector. As one resident observed, "now cannabis markets have declined just like the timber bust and the community is just as poor again... Now stores have closed, and people have left." Participants described the recent cannabis market downturn as among the most significant driver of reductions in cultivation. Many noted, however, that the loss of cultivators has been most severe among the legacy communities of "loggers and hippies." Due to the stickiness of place and poverty, many Hmong cultivators have persisted—many had invested their life savings in their land and have few other economically viable options in the region. Even with the market downturn, being able to own land and live in community remain important factors for staying in Trinity, and even at low market prices, cannabis still provides enough money to support basic needs like buying food and gas.

Unlicensed Cannabis Estimates and Explanations

Following recreational legalization, Trinity County saw significant fluctuations in unlicensed cultivation. Our spatial analysis indicates that between 2018-2020, the county experienced an increase in unlicensed cultivation of $1,097.95 \text{ m}^2/\text{km}^2$ —the second highest increase among permit counties. Unlike other focal counties, this increase was not reliably associated with predictors during this first analysis period. This trend reversed between 2020-2022, with a decrease of $698.28 \text{ m}^2/\text{km}^2$, resulting in a net increase of $399.67 \text{ m}^2/\text{km}^2$ over the 2018-2022 period. During this second period, the decrease was most pronounced in areas with higher building density, flatter terrain, groundwater, and near successfully permitted cultivators, aligning with qualitatively observed trends of legacy cultivators in the county's valleys being especially hard-hit by license volatility and market declines (and the cultivators who persisted trying to avoid conspicuous areas). From 2022-2024 the trend of unpermitted cannabis density decline continued, with the same predictors of unpermitted cultivators avoiding areas with more building, flatter terrain, groundwater, or permitted cultivators. Counterintuitively, forested areas were also predictive of unpermitted cultivation declines, perhaps due to the fact that cultivation by this point was so concentrated in the Trinity Pines area, this was the region where decreased cannabis density could be most observed.

Our spatial analysis revealed that the most significant decrease in unlicensed cultivation in Trinity occurred in proximity to licensed farms. Several ethnographic findings help explain this pattern. First, licensed operations attract regulatory attention, making nearby unlicensed farms more vulnerable to discovery during inspections or enforcement actions. Second, licensed farms are typically located in designated "green zones" where land commands premium prices, pricing out some unlicensed operators. Relatedly, as the legal market has developed, some previously unlicensed growers have relocated from non-permitted areas to green zones specifically to pursue licensing, reducing cultivation density in their former locations.

Trinity County continues to have a substantial unlicensed cannabis industry despite legalization efforts. When the county's cannabis program started in 2017, officials identified approximately 6,000 cultivation sites. The Trinity County Cannabis Equity Assessment prepared in 2022 estimated "4,000 unregulated actors in the county" (2023, p. 61). Several county officials and cannabis consultants estimated that in 2024 there were likely about 5,000 cultivation sites in the county, having "declined significantly due to market crashes rather than enforcement or policy changes," as one elected official stated. With only 530 possible permits available under county regulations, 2024 estimates suggest that nearly 90% of cultivation sites remain outside the regulated market. Unlicensed cultivators we interviewed expressed interest in entering the legal market, and a cannabis consultant described that "increased enforcement has spurred people who want to stay to pursue permitting and that now more people are open to pursuing permitting than a few years ago when most people preferred to be out of the public eye and off the radar." Yet several residents observed that once the cap of 530 CCLs was met in 2021, Trinity County

effectively began functioning like a ban county for the thousands of cultivators who could not obtain permits.

The size of unlicensed operations varies considerably. The Trinity Pines/Post Mountain rural subdivision has emerged as an epicenter of unlicensed cultivation. This subdivision contains approximately 1,100 parcels, most just 1-2 acres, with a high concentration of Hmong cultivators. Trinity Pines typically features smaller grows (under 99 plants) due to limited parcel sizes and intra-community norms wherein unlicensed cultivators try to stay under the radar and blend in with licensed farms. Hayfork, a historic cannabis-producing community, has seen a more significant reduction in cultivation, which participants primarily attribute to the exit of legacy cultivators from the industry due to expensive, onerous, and inconsistent permitting processes amidst low market prices. Larger unpermitted operations are often located in more remote areas with less oversight, including public lands where cultivation continues to a limited extent.

Several factors continue to create disincentives for entering the legal market. Some cultivators reported "bad experiences with the consultants and how the county rules are always changing and [Cannabis Division] staff is turning over." Most significantly, people noted that being "in process of permitting" makes cultivators vulnerable to enforcement—a dynamic that emerged during the 2020 and 2021 period of paused permitting, but that continues to a more limited extent in the present—because "once people get in the system the government has their information and it's easier to see and document those violations on permitted operations," as one county official described. A grower recollected how in 2017 and 2018 CDFW "targeted people who were in the program because those were the people they had information for, so it really disincentivized trying to come into the legal market because then you were recorded and a target." Another example often described by interviewees was when, in May 2023, Trinity sheriff's deputies, as part of a broader multi-agency enforcement effort, executed a search warrant for a DCC-licensed farm owned by a Hmong grower named Nhia Yang in the Trinity Pines, seizing over 16,000 plants, and fatally shooting the family's dog (Black, 2023). Enforcement actions seemingly targeting cultivators in the process of navigating legal market entry create a sense of distrust with the permit and licensing process, and interviewees described as driven by a culture of "the lawlessness of law enforcement."

The legal market itself presents significant challenges. One legacy grower described "the difficulty of selling to distributors in the permitted market now, and how there's no tracing of the product once it's sold into distribution." (As of January 2026, there are no Active Distributor licenses and only 10 Active Self-Transport licenses, according to the DCC's license search, creating a bottleneck for licensed cultivators who have to arrange transportation of their product.) Many permitted farmers noted that they often do not receive payment for their product. This legacy grower said, "Even the commodity price for corn is more transparent because you can't even find your product on dispensary shelves or see how much it's selling for or where it goes, so you can't negotiate at all like back in the day under medical."

The economic impact of the cannabis market crash has been severe. In 2023, some cultivators said they received just \$75/lb of cannabis, others said they were able to command \$500/lb, most said \$200/lb. Many cultivators noted that the market price of cannabis is no longer able to cover their costs of production, especially in the legal market where compliance costs and taxes remain significant. These economic pressures are forcing many cultivators to either upscale operations or exit the industry entirely. One experienced cultivator said, "Legalization caused farmers to get bigger." The market downturn, with no access to traditional business or farm credit, has had ripple effects beyond individual cultivators, as "people lose their property to foreclosures because they take predatory cash loans out at the beginning of the season and then can't pay them back." The loss of both permitted and unpermitted growers has also reduced county tax revenue as, for example, property values have declined alongside the cannabis market downturn.

While cultivators, county staff, and other residents universally noted the challenges facing both licensed and unlicensed cannabis farmers, Trinity is also home to several grower-led organizations that are trying to support cultivators. In 2018, Conscious Cannabis Resources worked "to help Hmong growers come into compliance," contacting over 400 growers in Trinity to "build bridges into the legal cannabis industry [and] help avoid discriminatory police enforcement against Hmong cannabis growers, which past years has been seen elsewhere in Northern California's cannabis belt." The Hmong Trinity Farmers Association and Trinity County Agricultural Alliance have also provided support to cultivators navigating the complex regulatory landscape.

Enforcement Effectiveness and Policy Impacts on Unlicensed Cultivation

Enforcement of cannabis regulations in Trinity County has been inconsistent with the starting, stopping, and starting again of the permit program. While cultivators in permit jurisdictions across the state frequently note low market prices and high costs of permitting as barriers to entering the legal market, one unique barrier that has emerged in Trinity is the perception that enforcement actions tend to target operations that are permitted or in the permitting process because they are easier to identify, especially by state agencies such as CDFW. Additionally, participants noted that cannabis enforcement responsibilities are spread across the Sheriff's Office (unlicensed cultivation) and Cannabis Division (licensed cultivation), lack of information and communication sharing can easily make mistakes when many cannabis farms look similar, whether licensed or unlicensed. Notable and consequential enforcement actions against permit-seekers have created significant fear and distrust of legal market entry, discouraging participation in the legal market.

CDFW has conducted significant and high-profile enforcement operations in the region, such as a June 2022 joint operation that "eradicated 84,150 illegal cannabis plants and destroyed more than 5,419 pounds of illegally processed cannabis" (CDFW, 2022). Despite these actions, many stakeholders believe enforcement has had limited impact on unlicensed cultivators

compared to economic factors. Some participants even questioned whether it was in the county's interest to reduce unlicensed cultivation. One former county employee said, "Trinity County did not want enforcement because it eliminates their tax base, even enforcement of unpermitted cultivators, decreases property values and property taxes and generally depresses the local economy which is so dependent on cultivation."

While participants agreed that policy impacts paled in comparison to market impacts in reducing unlicensed cultivation, the policy decision to cap licenses at 530 in an Emerald Triangle county with thousands of legacy growers did, in effect, function like a ban for the majority of cultivators. This restriction forces many to remain in the unlicensed market regardless of their willingness to comply with regulations. For those lucky enough to be on the list for a local permit, the individual CEQA review requirement following the TAA lawsuit poses a substantial financial and administrative barrier to legal market entry.

Trinity County's experience with regulation and enforcement does highlight several positive dynamics that other localities and the state could learn from.

A positive and supportive attitude from the county government

The county has attempted to support the cultivation community, especially legacy cultivators and new small-scale ethnic minority cultivators such as Hmong growers. Many of the county staff that we interviewed had personal experience in the cannabis industry, primarily in medical legacy cultivation, and a positive attitude towards cultivation. County staff seemed eager to find solutions and support struggling growers. For example, staff at the Cannabis Division kindly corrected us when we asked about "enforcement," saying that they are careful to use the term "compliance" in an effort to de-stigmatize growers.

With limited capacity, the county worked hard to leverage resources in support of growers, especially to help them enter the legal market. In 2022, for example, the county received a \$3.3 million dollar grant from the state to facilitate permitting, and in 2023, the Board of Supervisors awarded the Cannabis Division \$500,000 in grant funding along with a matching \$500,000 loan to keep the program going. A local consulting firm similarly received a grant from the CDFW to help offset CEQA compliance costs for approximately 100 "equity" growers. More than 70 minority growers had benefited from this program as of the summer of 2024, many of them Hmong, according to consultants.

With the goal to "make use of existing disturbance, bring illegal operations into the legal market, and recognize and honor legacy cultivators," as one official described, the county required that at least thirty licenses be issued to properties within the Trinity County Waterworks District #1 in Hayfork, a historical cannabis-producing region. After significant turnover in county staff, especially during and immediately following the permit program disruption from 2020-2022, officials seemed to adopt a more supportive approach to licensed cultivators, according to interviews.

Protections for small farms and outdoor cultivation

Local license allocations, structures, and associated fees in the county aims to prioritize and protect smaller-scale cultivators, particularly those who grow outdoors (for example, there are only 15 Type 3, up to one acre of outdoor cultivation, licenses allowed in the county). Residents generally appreciate this small-farm protection built into the license structure, as evidenced by the 2023 proposed amendments to allow permits of up to four acres that was not approved.

Similarly, the county requires a legal dwelling on cultivation parcels and allows only one license per parcel (to discourage “stacking”). Some cultivators noted the challenges the residency requirement poses – particularly in the Trinity Pines where infrastructure remains limited, and some people cannot afford to build a legal dwelling (living instead in RVs). Yet the residency requirement is extremely effective in supporting smaller, family-scale farms and local community by reducing concentration and consolidation (which is a general trend in the industry).

Zoning flexibility for community self-determination

Trinity County has also designed some flexibility into local policy that, in the context of a culture of supporting smaller-scale growers, is appreciated. Notably, the county has made efforts to grandfather-in legacy cultivators who may be on parcels that do not meet current zoning requirements, such as those in timber production or rural residential zones. Additionally, applicants who need a temporary exemption from the on-site residence requirement can obtain a Director’s Use Permit while they build a permitted home; if their parcel does not meet setback requirements (350 feet from a neighboring dwelling), they can pursue a variance. In the process of updating the county General Plan in 2024, officials made efforts to engage potentially effected communities, particularly in the Trinity Pines subdivision where parcels are small and close together. One county official described ideas to ensure that “the subdivision parcels will not be disqualified [from cannabis licensing] because they are mostly about two acres and there are many dwellings that would not allow setbacks.”

This locally flexible approach extended understanding to communities that did not want cannabis cultivation too. The creation of opt-out zones in 2020 and 2021 was highly contentious at the time, but participants reflected that opt-out zones have reduced overall opposition to cannabis by allowing those communities to limit cultivation.

Opportunities for education

Some of the most promising approaches to reducing the negative impacts of unlicensed cultivation have focused on education rather than punishment. Compliance officers give cultivators seven days to correct issues before imposing fines, demonstrating a preference for bringing operations into compliance rather than punitive measures. The Agricultural

Commissioner offers pesticide training workshops for both permitted and unpermitted growers "so they know what to spray and how to handle them safely and use protective gear," according to county Agricultural Commissioner staff.

Environmental regulations, particularly regarding water usage and pesticide application, have influenced cultivation practices. Environmental organization staff noted they "rarely see carbofuran, but what they see more often is pesticides that are OK to use on other kinds of agriculture, just not cannabis." When these issues are observed, cultivators are required to attend pesticide training through the Agricultural Commissioners office. Water monitoring requirements for wells and ponds, along with CDFW's authority to impose moratoriums on licensing in impacted watersheds, have the potential to shift the geography of cultivation away from the most environmentally sensitive areas and reduce negative impacts.

In summary, Trinity County, like every other jurisdiction in California, has engaged in its own experiment in regulating and enforcing around cannabis. Some efforts have spurred great problems, others have helped mitigate concerns. Yet despite the various policy interventions, stakeholders consistently identified market factors as having the most significant impact on reducing cultivation. This economic reality has forced cultivators to either scale up operations or exit the industry entirely, a dynamic that has reshaped Trinity County's cannabis landscape more profoundly than any enforcement action or regulatory requirement.

● Discussion

According to model data, unlicensed cultivation increased between 2018 and 2022 and decreased during the 2020-2022 period, as we observed in many places across California. This pattern aligns well with stakeholder observations about a post-legalization "green rush" followed by contraction due to market forces and regulatory challenges, with Trinity experiencing the second-highest increase among permit counties during the initial period.

Trinity County does not maintain a dedicated cannabis enforcement task force, instead relying on multi-agency collaboration between the Sheriff's Office, CDFW, EPIC, and the Cannabis Division's compliance staff. The county primarily employs a complaint-based approach supplemented by CDFW operations that utilize satellite imagery and aerial surveillance to target larger operations, particularly those causing environmental damage. This fragmented approach, with the Sheriff responsible for unpermitted grows and the Cannabis Division handling permitted operations, has created coordination problems where legal operations are sometimes erroneously targeted.

Informants almost unanimously identified market factors as a significant driver of decreasing cultivation. The dramatic fall in cannabis prices has made both licensed and unlicensed operations economically nonviable for many. Natural disasters, particularly wildfires, have compounded these challenges, with the 2020 August Complex fire evacuating 3,400 people from Trinity Pines and smoke damage causing up to "50% crop loss" for some cultivators. These

events have pushed growers to adapt cultivation practices, including using hoop houses and growing later-maturing strains.

Trinity Pines/Post Mountain presents unique challenges due to its density (1,100 small parcels with high Hmong concentration) and limited infrastructure. The county is considering an overlay zone in the updated General Plan to accommodate these circumstances, while also working to balance the sometimes-conflicting interests of different communities through practices like "grandfathering in" legacy operations and establishing opt-out zones where most residents oppose cultivation.

The effectiveness of enforcement has been limited by several factors, including selective targeting of operations that include those in the process of obtaining licenses, resource constraints, concerns about economic impacts, and damaged community relations from high-profile enforcement incidents. Educational approaches, such as the Agricultural Commissioner's pesticide training workshops for both permitted and unpermitted growers, appear more effective at improving cultivation practices than punitive measures. However, even the most thoughtful regulatory and enforcement approaches appear to be less significant in reducing unlicensed cultivation than market forces.

- **Findings**

Trinity County's experience with cannabis regulation and enforcement offers several key insights:

- **Market forces eclipse enforcement.** The dramatic cannabis price collapse holds greater explanatory power for reductions in unlicensed cultivation than enforcement actions or regulatory measures. Yet the price drop, driven by a crisis of overproduction across the state, also increased the scale of cultivations as growers tried to adapt by growing more cannabis to maintain economic viability, or exited the industry, with potentially long-term losses of legacy knowledge, genetics, and rural economic vitality.
- **Regulatory barriers create unintended consequences.** The 530 license cap combined with costly requirements has effectively locked most cultivators out of the legal market, creating a de facto prohibition for the estimated 90% of cultivators who cannot obtain permits. This has perpetuated unlicensed cultivation despite many growers' willingness to participate in the legal market.
- **High-profile and intensive enforcement can backfire.** Trinity's enforcement experience demonstrates how targeting growers attempting to enter the legal market (because they are easier to identify) creates powerful disincentives for compliance.
- **Community-tailored approaches show promise.** Policies that accommodate diverse community needs—such as grandfathering legacy operations, creating opt-out zones for

cannabis-opposed communities, and considering overlay zones for unique areas like Trinity Pines—can reduce overall opposition while supporting existing cultivators. Similarly, educational outreach and opportunities to fix compliance issues appears more effective than punitive measures at improving cultivation practices.

- **Demographic shifts reshape cultivation patterns.** While market pressures have forced many legacy growers to exit the industry, Hmong cultivators in Trinity Pines have largely persisted due to limited economic alternatives, substantial investments in land, and strong community ties. This persistence has created both challenges and opportunities for regulation and community integration. Several stakeholder groups demonstrated particularly good visibility into the unlicensed market. Legacy cultivators possess deep historical knowledge; environmental organizations work directly with cultivators on remediation; consulting companies assist cultivators navigating the permit process; compliance and enforcement agencies conduct monitoring and surveillance; and community leaders in areas like Trinity Pines understand local cultivation practices, particularly within diverse and shifting communities.
- Trinity County's experience ultimately suggests that well-designed, flexible regulatory approaches that assess and accommodate different community needs and provide realistic pathways to compliance will be more effective than enforcement-heavy strategies. However, market realities will likely continue to be the primary driver of cultivation patterns regardless of policy design.
- **Conclusion**

Trinity County's experience demonstrates that a permit system alone is insufficient to curb unlicensed cultivation when structural barriers prevent widespread participation in the legal market. With only 530 permits available for an estimated 4,000-6,000 cultivation sites, approximately 90% of growers could not legally participate regardless of their willingness to comply. This permit cap, combined with costly CEQA requirements and regulatory uncertainty from often-changing requirements, effectively created a de facto prohibition for most cultivators. Even when permits are theoretically available, a system that makes legal market entry prohibitively expensive or administratively burdensome will perpetuate unlicensed activity, particularly when market pressures already strain economic viability.

The most effective approaches in Trinity County have focused on education, compliance assistance, and community-tailored flexibility rather than punitive enforcement. Conversely, enforcement actions that target cultivators attempting to enter the legal market create powerful disincentives for compliance. Trinity County's experience suggests that enforcement should be precisely targeted at the most environmentally damaging operations and coordinated between agencies to avoid undermining trust in regulatory systems. However, even the most thoughtful enforcement strategy will likely have minimal impact compared to market forces in determining

cultivation patterns. As cannabis prices continue to fluctuate and regulatory frameworks evolve, policies that provide realistic pathways to compliance for small-scale cultivators, particularly those from legacy and minority communities, will be essential for transitioning more cultivators into the legal market.

Contributions to Report Findings

Objective 1: Assessing Unlicensed Production Amounts and Geography

Finding #1: In the years following legalization, unlicensed production showed an initial expansion, rapid retraction, then stabilization.

- Ethnographic data showed minimal growth in unlicensed cultivation during 2018–2020.
- The county’s early implementation of a permitting program in 2018, coupled with local residency requirements and remote geography, limited expansion during the initial period.
- Ethnographic accounts noted that by 2022–2024, unlicensed cultivation had declined well below 2018 levels, consistent with broader market and regulatory contraction.
- Local enforcement and the visibility of licensed operations made unlicensed grows easier to identify, contributing to reductions.
- Remote southwestern areas, historically strong in legacy cultivation, were among those experiencing localized declines.

Finding #2: Cultivation moved from the hills to the flatlands and back again.

- Ethnographic evidence closely mirrored the broader CannaVision trend: during 2018–2020, growers left public forest lands and relocated to private agricultural areas that were easier to permit.
- This move reflected early environmental enforcement actions and permitting rules that discouraged cultivation in hills and near sensitive habitats.
- From 2020–2022, ethnographic data suggested cultivators sought to avoid conspicuous, flat areas near permitted farms due to increased inspections and enforcement; declines were greatest near high-density permitted zones.
- By 2022–2024, cultivation increasingly concentrated in remote areas such as the Trinity Pines subdivision, driven by affordability, weak land markets, and a lack of alternative livelihoods.
- Ethnographic data indicated that those who remained were primarily low-income cultivators or marginalized groups (including Hmong growers), for whom remaining in remote enclaves was economically and socially viable.

Finding #3: While participation in the unlicensed market was broad initially, increasingly the people left cultivating are those in tenuous socio-economic situations and attached to place for cultural-historical reasons.

- Ethnographic data from Trinity highlighted a similar dynamic of persistence among socially and economically marginalized groups, often in remote or semi-remote areas like *Hayfork* and *Trinity Pines*.
- The decline in overall cultivation after 2020 was steep, but many smallholders remained—particularly those with limited livelihood alternatives or those whose social worlds were deeply rooted in these rural communities.
- Subdivisions in Trinity, like those in Siskiyou, became “centers of production” where concentration rather than dispersion characterized the unlicensed landscape. This density, while increasing visibility to enforcement, also facilitated mutual support networks and resource sharing that made persistence possible.
- Ethnographic accounts described strong “stickiness of place” due to decades-long community formation around cannabis livelihoods and shared histories of marginalization and distrust of outside authorities.
- Cultural attachments to cannabis cultivation as a way of life, combined with the lack of affordable exit options, meant that older and poorer residents often persisted, while more mobile and financially flexible cultivators exited or sought permitted avenues.
- The subdivision setting created what one respondent described as “almost suburban” conditions in a rural environment, enabling constant communication, informal surveillance, and community protection mechanisms that offset the vulnerability of individual growers.

Finding #4: Unlicensed cultivation generally migrated out of public lands because of lower consequences on private land.

- Trinity County ethnographic data reflected a decisive migration from public forest lands to private holdings over the 2018–2020 period.
- Cultivators described the dual pressures of federal enforcement and new local environmental regulations as major push factors.
- Enforcement by both the U.S. Forest Service and the California Department of Fish and Wildlife (CDFW) was cited as particularly aggressive in the early legalization period, when public lands remained a key enforcement focus.
- The “pull” toward private land was equally significant: private subdivision parcels such as those in Trinity Pines offered affordable alternatives and opportunities for long-term investment, especially for smallholders who could not access formal licenses.
- By 2020–2022, cultivation on public lands had declined to isolated instances, and by 2022–2024, most unlicensed activity occurred on private lands within or adjacent to established residential or agricultural zones.
- Ethnographic accounts underscored that this migration was both an economic adaptation and a legal risk management strategy.

Finding #5: Transition from Outdoor to Mixed-Light Production.

- Ethnographic data indicated that wildfire smoke was a key factor driving a move from outdoor to mixed-light cultivation.

- Growers also cited the potential for more harvest cycles and higher-quality product as additional motivations for greenhouse transitions.

Finding #6: Unlicensed Cultivation Was Highly Sensitive to Major Fire Years.

- Ethnographic data documented major disruption from the 2020 *August Complex Fire*, which forced evacuation of roughly 3,400 residents from the Trinity Pines area and caused up to 50% crop loss.
- Rather than abandoning the area, cultivators reportedly adapted practices by installing hoop houses and adopting later-maturing strains that could be planted after fire events.
- These accounts suggest that fire catalyzed adaptation rather than geographic relocation.

Objective 2 Identifying Factors Influencing the Observed Extent of Unlicensed Cultivation

Finding #1: Presence of licensed cultivation was the primary deterrent of unlicensed cultivation.

- Ethnographic evidence aligned closely with the broader finding: proximity to licensed farms increased visibility and oversight, prompting unlicensed growers to relocate to more remote areas.
- Licensed cultivators reported greater regulatory attention, and unlicensed growers avoided these zones to minimize enforcement risk.
- Despite this deterrence effect, Trinity’s rugged geography and reliance on cannabis as a primary livelihood sustained unlicensed activity in isolated regions.

Finding #2: Bans Were Not a Consistent or Powerful Indicator of Growth or Decline in Unlicensed Cannabis Cultivation.

- Ethnographic data highlighted Trinity’s shift from reactive enforcement to corrective and educational strategies, including temporary abatement periods for cultivators.
- These measures reduced unlicensed cultivation while maintaining community engagement.
- Trinity’s experience illustrated the benefits of a functioning permit system in contrast to enforcement-only approaches.

Finding #3: The Perceived Likelihood of Strong Enforcement Was an Initial Deterrent, but Became Less Important Over Time.

- Ethnographic accounts noted that enforcement triggered adaptive responses, including relocation of cultivation to more isolated areas and transitions toward covered or greenhouse production.
- Legacy growers who were deeply invested in land and community remained despite enforcement risks.
- The county’s reliance on education and abatement programs over time helped reduce tension between enforcement and cultivator compliance.

Finding #4: Over Time, Civil Policy and Civil Enforcement Efforts Became Key Drivers of Declines in Unlicensed Cultivation.

- Ethnographic data showed that Trinity’s abatement and education-based enforcement strategies contributed to a steady decline in unlicensed cultivation.
- Farmers learned to anticipate enforcement and comply voluntarily, adapting their practices to align with civil codes.
- Communication networks among cultivators spread awareness of which actions triggered enforcement, reinforcing collective compliance norms.
- Water enforcement had early impacts (2020–22), but by 2022–24, economic constraints led some growers back to stream-adjacent lands.

Finding #5: Troubles in Permitting Programs Prevented Many Cultivators from Becoming Licensed.

- Ethnographic data described that Trinity’s permitting system was disrupted by the TAA lawsuit between 2019 and 2022, halting approvals and leaving many cultivators unable to proceed.
- A county-imposed permit cap effectively functioned as a ban, preventing new applicants from entering the legal market.
- Many cultivators who had begun the licensing process abandoned it during the suspension period and reverted to unlicensed operations.
- Trade associations attempted to advocate for policy reform but were constrained by limited county resources and unclear administrative processes.

Finding #6: Cultivation Bans and Other Enforcement Policies Were Linked with Whack-a-Mole Dynamics of Unlicensed Cultivation.

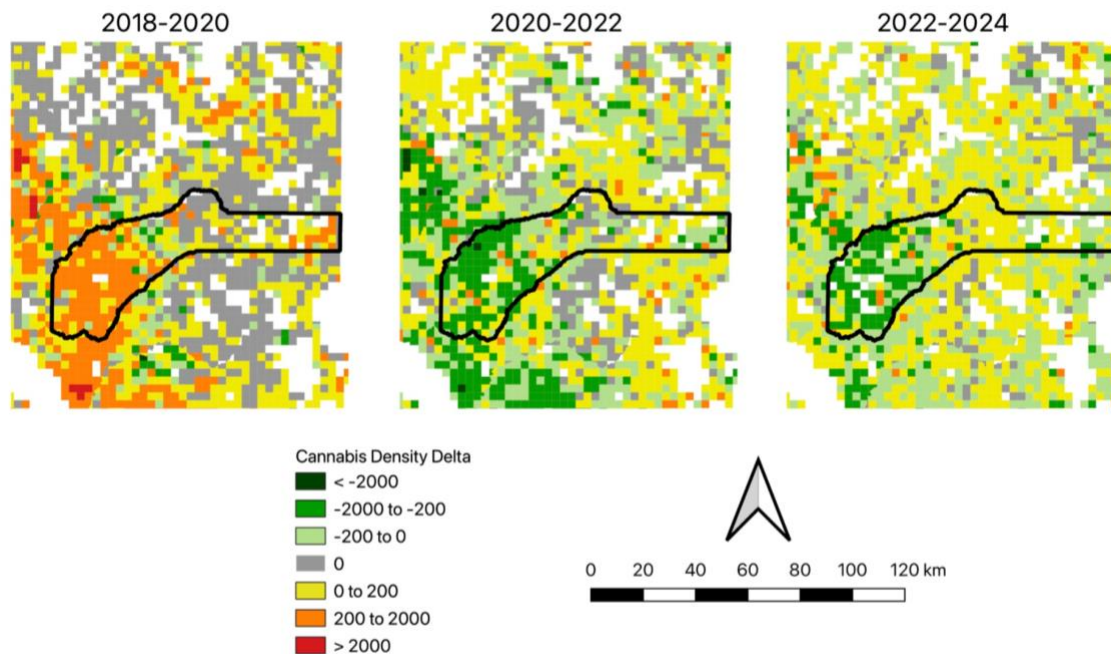
- Ethnographic data described persistent relocation of unlicensed cultivation within and between subdivisions such as Trinity Pines and The Ridge.
- Cultivators frequently moved to cheaper parcels or operated within social networks that shared access to remote lands.
- Local Property Owners Associations and community organizations were influential in shaping these patterns, with some actively supporting cultivation and others discouraging it.
- Despite strong enforcement pressure, cultivation persisted through movement rather than reduction.
- Economic decline and reduced profitability by 2024 appeared to slow this cycle, as some cultivators exited the industry entirely.

Finding #7: Market Forces and Price Decline Were Major Factors in Siting Decisions.

- Ethnographic data showed that the market downturn exacerbated economic distress among cultivators who already faced limited regulatory options.
- Many growers reduced staff, scaled down to personal gardens, or left the market entirely by 2023.
- Some continued cultivating in small quantities for subsistence or household income, relying on low-cost operations and community resource sharing.

NEVADA COUNTY: ETHNOGRAPHIC ANALYSIS

PREPARED BY: MICHAEL POLSON



Research Overview

Research by Dr. Michael Polson in Nevada County consisted of interviews with 16 people, including: 10 growers (1 personal, 2 former, 2 unlicensed, 5 licensed); 1 farmworker (small, licensed farm); 2 cannabis cultivation advocates; and 3 planning officials (including code enforcement officers). Research also included several observations of: 1) a neighborhood gathering of farmworkers and licensed cultivators; 2) a public meeting involving the planning commission, planning officials, pro-cannabis advocates, and an environmental advocate; and 3) a social gathering of current and former cannabis cultivators. This research was conducted in Fall 2024.

Research in 2024 was supplemented by extensive interviews by Dr. Polson (with Dr. Ann Laudati) in Nevada County (approximately 35 interviews, 19 recorded and transcribed, 13 actively used in this research). For this study, we drew on interviews with 2 environmental advocates, 9 growers (3 unlicensed, 1 former, 5 licensed), a local resident and business owner, and 1 consultant. That research entailed numerous observations, including a medical cannabis giveaway, a gathering of legal cannabis farmworkers, and local cultural events attended by growers and workers.

Secondary sources included census materials, county policy archives, news sources on local topics, CannaVision mapping material, a report by Dr. Dominic Corva on Nevada County's

cannabis policy history and social equity considerations, and articles by Dr. Sara Keene on the area's cannabis politics and socio-economic dynamics.

Nevada County Background

Nevada County is located in the Sierra Nevada range, extending from the foothills through the mountainous Tahoe National Forest to the border with Nevada. It is among the smallest 25% of California counties, 30% of its land is public, and a third of its population lives in its major incorporated cities (Grass Valley, Nevada City, Truckee). Its diverse geography is drained by several rivers, nourishing vineyards, orchards, and farms producing fruits, vegetables and livestock. Mining and forestry economically developed and ecologically impacted Nevada County from its early days, though mining had virtually disappeared by the 1950s. Since the 1970s, the county has become a destination for exurban migration. The population quadrupled between 1970 and 2001 as farmland was converted into residential uses (residential land use increased from 30% of private county lands to 70% between 1970 and 2001, and agricultural land use declined in tandem). Service sector employment displaced natural resource jobs, but by 2000, the largest source of income came not from wages but from dividends, interest, rent, and transfer payments (like pensions), a hallmark of exurban residential formation (Walker & Fortmann 2003).

The population (of 102,000) is concentrated in the western county, within and near Grass Valley and Nevada City, the county seat. Whites (non-Hispanic) constitute 83% of the population (over twice the state average), HispanicsHispanic/LatinosLatino were 11% (vs. 25% state average), and 4% were multiracial. Nevada County ranks 33rd (of 58) in population density. The median resident age is 50 years old, nearly 13 years older than state averages. The county's voters are primarily Democratic, though 33% are Republican. While Nevada County has a lower poverty rate than the California average (11% vs. 19%), over half the population makes less than 300% of the poverty line. Half of local wage earnings come from government, construction, and healthcare, with a median income of \$78.4k (below California averages). The county's top agricultural product in value is cattle, though only 8% of county land is zoned for agriculture. Cannabis is now the county's second most valuable agricultural product. The county's budget is \$222m. Higher income people are concentrated in the western edge of the county and in Truckee in the east. Significantly fewer people have full-time work than state averages (53% vs. 63%; US Census 2024). Median property prices were \$532.5k for 2024 (Hamilton 2025), up from \$418k in 2020 (largely due to a Covid boom in 2021) but still lower than state averages (\$861k).

History of Cannabis Policy and Market

Cultivation Sector Grows Since 1970s: Cannabis cultivation has been practiced in Nevada County since at least the 1970s, when back-to-the-land migrants harnessed cannabis to support small-scale rural livelihoods and vibrant “off-grid” communities (Keene 2017). These

communities, cultivators included, were historically concentrated in an area of northwest Nevada County along several ridges, most famously the San Juan Ridge, or “The Ridge,” for short. These communities recuperated lands devastated by resource extraction industries, built community institutions, and, unique to Nevada, fostered an organic and natural foods movement that had impacts well beyond county lines (Corva 2020). Conflict between pro-cannabis “hippies” and “straights” arose and persisted as Nevada County shifted toward a service sector economy, catering to the needs of wealthier, older in-migrants. Cannabis provided a more stable means of sustaining livelihoods in a period of stagnant livelihoods, growth of low wage service jobs, and increasing living costs as “amenity migrants” settled in Nevada (Keene 2017; for instance, home values increased 795% between 1970 and 1990 and another 129% between 1990 and 2000). Many people, not just countercultural migrants, found sustainable rural livelihoods in cannabis, which became a major pillar of Nevada’s local economy (Keene 2017), particularly for postindustrial workers and local youth with few other income opportunities (Corva 2020). Nevada also became a destination for growers seeking to escape high-enforcement areas of the Emerald Triangle in the 1990s (Corva 2020).

County Grapples with Medical Cannabis: Though Nevada County cultivators experienced targeted, periodic enforcement, cultivation generally operated below the radar, first attracting a 1990s wave of cultivators displaced by enforcement in the Emerald Triangle and another wave in the late 2000s by a diversity of growers who sought areas with lower enforcement, wanted to grow medical cannabis, and/or sought a livelihood after being laid off in the mortgage-based crisis (Corva 2020). The county’s DA developed guidelines for medical cultivation in 2000 and revised them in 2007 to appease law enforcement demands. However, after a grow was discovered near a school in 2011, the expressly anti-cannabis Sheriff, backed by vocal Homeowners Associations, led an effort to craft and pass new, strict zoning ordinances against cultivation. The resulting county approach was one of nuisance abatement to protect a narrowed definition of “community,” that excluded cannabis cultivators and patients (Keene 2017). The new restrictive ordinance provoked cannabis activists to propose a voter ballot, led by Americans for Safe Access. The ballot was rejected by voters in 2014 but was critical in organizing the medical marijuana community (Keene 2017). In 2016, after aggressive and sometimes-scandalous enforcement of the county ordinance, the Sheriff and Board of Supervisors doubled down on the restrictive ordinance by proposing a ballot to ban outdoor cultivation entirely. This move, however, provoked local backlash and voters roundly rejected the ban by 60%. Around this time, voters approved Proposition 64 with 53% of the vote.

County Permits Cannabis: Supervisors reacted to this turn in public opinion by expunging cannabis-related criminal records (597 convictions) and establishing a cannabis permitting program, which Corva (2020) notes “created the smallest scale permits in the state” and created “the State’s first decriminalized code enforcement regime.” The program was designed through facilitated community/stakeholder meetings (a Community Advisory Group), which issued recommendations in early 2018. In October 2018, the county passed a pre-

authorization of temporary permits so that cultivators could obtain temporary state licenses. In November, county voters authorized (by 75% vote) a tax on cannabis businesses (based on gross receipts with a minimum tax due regardless of income). Though a draft ordinance for local permitting was approved in May 2018, the ordinance was not officially passed until 2019, after an environmental review was conducted. Key stipulations in the resulting program restricted cultivation to parcels over five acres and in certain forest resource and agricultural zones. Skirting conflict with vocal HOAs, the county excluded cultivation from ag-residential zones. Garden sizes were initially limited to 10,000 square feet, and permits needed to be renewed annually. The county required growers to obtain a land use permit and an Annual Cannabis Permit to cultivate. Nevada County also required cultivators to have a residence on the cultivation property. On one hand, this could raise costs if no residence was present (since one would have to be built) or an existing residence was unpermitted (and would require a permit). On the other hand, the residence requirement fostered a farming system where owner-operators lived on site, rather than operating absentee commercial farms with no residents. (Sites could have non-residential ag structures or small storage structures that could be exempted from permitting if not used for cannabis.). The county allows a maximum of three cultivation permits per person or entity. The ordinance also indicated investment across more than 8 firms was disallowed, though we are unaware of any monitoring of this stipulation.

Discontented, the Sheriff and HOAs led an early effort to undermine this regulatory scheme by alleging it ran afoul of CEQA stipulations. In response, the county delayed the roll-out of the permit program while it conducted a Programmatic Environmental Impact Review (PEIR), which was approved in mid-2019. Though the delay dismayed cultivators, its passage proved beneficial, as counties *without* PEIRs experienced significant delays, regulatory turmoil, and lawsuits, all while burdening cultivators with individual compliance requirements and significant costs that delayed, if not foiled, permit acquisition (Biber et al, 2023).

The Cannabis Policy and Compliance Division (CCD) of the Community Development Agency (CDA, comprised of six departments, including building, planning, and environmental health) leads cannabis regulation. As of Fall 2024, CDA had conducted 1542 inspections and 904 enforcement cases, resulting in 315 abatements, 87 citations, and 426 cases deemed unfounded. While the licensed industry is concentrated in the west and south of the county, the majority of enforcement cases have been in District 5, ranging over park land and the eastern edge of the county around Truckee. The rest of the cases are concentrated in the two districts (2 and 4) where licensed cannabis is concentrated. As of 2025, 290 permits had been approved by Nevada County and 172 remained active, the vast majority for outdoor and mixed-light operations, owned by mostly Nevada County residents, and located in mostly agricultural zones. In its first few years, Nevada County was the quickest of all California counties to get from application submission to permit granting (143 day average or 7.6 months; Biber et al, 2023).

Permitting Challenges & Policy Reform: As noted statewide (Bodwitch et al 2021) and true in Nevada, high costs of compliance – particularly road infrastructure, consultants, and

building permitting – were major impediments for farmers seeking a permit. Another impediment was the presence of a minimum tax (regardless of income), a challenge for farms that struggled to turn profits even in better years (2019-20). Another major cost, as with all counties, was employees, who not only required wages and non-wage supports (e.g. worker compensation) but also triggered a requirement to upgrade farms to commercial standards that affected everything from building standards to disability access to road width to fire safety regulations. Many could avoid this cost by assuming all the labor themselves or by hiring under the table. A similar challenge arose with processing structures: they were required to rise to commercial standards and thus carried significant costs to permit. Some surreptitiously processed cannabis off-site to avoid these costs. Given the totality of these many costs and challenges, many cultivators chose to remain unpermitted. Some, however, were categorically excluded through zoning designations or parcel sizes. Others were technically eligible but faced ecological conditions (e.g. steep slopes, surface water) that would make permitting expensive if not impossible.

A Grand Jury issued a report in 2021 criticizing the permitting program. On one hand, the report recommended lowering barriers to make permits accessible. They estimated the current costs of permitting and compliance ranged between \$85k and \$300k. The result: of the estimated 3500 cultivation sites in the county, only 2-3% were in the permitting process (our calculations place this closer to 5%), with the large remainder either unable or unwilling to attain permits. The county has since taken significant, continuous steps to make permitting more feasible, including revisions to parking, restroom, and septic requirements, permitting exemptions for some structures, expediting of building and grading permits, streamlined applications, provisioning of pre-application staff consultations, and the creation of online permit interfaces. Though county cannabis permits apply to the entire parcel (not just the cultivation area), these modifications helped to exempt and adapt land use regulations for easier compliance.

On the other hand, the Grand Jury urged renewal of enforcement efforts, thus tightening the relative lenience Nevada County had granted to cannabis cultivators in the transitional period to legalization. Cannabis compliance officials, early on, were largely responsive to public complaints, rather than proactively seeking enforcement opportunities themselves. Law enforcement, with new leadership and an exhaustion with cannabis-related conflict at the expense of other enforcement concerns, had backed away from enforcement in the first years of regulation. (The new Sheriff did conduct a targeted raid in 2019, early in her tenure, perhaps to telegraph enforcement priorities, consisting of a 2-day operation that seized 5200 plants and issued 48 citations from the Water Board and Fish & Wildlife, 60 county code violations, and investigated 48 counts of felony cannabis cultivation (NCSO 2019).)

A new agreement in 2022 between the CDA and the Sheriff coordinated efforts, delegated responsibilities across agencies, and signalled an overall tightening of enforcement strategies. According to interviews with officials, this led to increased activity by law enforcement to identify and enforce against unlicensed cultivation sites, particularly large and

environmentally impactful sites. To signify this shift, the Sheriff conducted several operations in August 2022, targeting large grows with environmental violations (NCSO). A similar focus on large, environmentally deleterious grows continued in 2023 and 2024 against sites with a range of 4500 to 15,239 plants and numerous environmental violations. CDA incorporated the use of drones to aid investigations, allowing them to see past fencelines and public rights of way, as needed. The drones were intended for the use of identifying unlicensed cannabis cultivation but if cultivation was present, the drones could also be used to document further code violations (e.g. unpermitted grading). CDA explained that they only use drones in circumscribed cases, where other methods of investigation were limited and complaints were present. They state that their use differs from other counties, which use drones and satellites to proactively search for cannabis. CDA notably moved toward “pro-active” nuisance identification in 2022/23 as part of an effort to discourage unlicensed production and ease inter-neighbor conflicts that would often boomerang back to licensed cultivators. CDA availed themselves of the ability to eliminate abatement periods and impose fines immediately, though they did not increase fines as recommended by the Grand Jury. CDA was able to levy fines of \$1k per day not only for cannabis cultivation but for violations *related* to cultivation (e.g. electrical, waste disposal). (Other fines could be levied on the property that were not related to cultivation but they would carry standard fines defined in CA Govt Code § 25132(c).) The county initially placed a \$25k annual fine limit for cannabis-related violations but lifted this maximum in 2022.

The above modifications were taken prior to the wholesale price declines in the Winter of 2020-21. Since then, the county has continuously adjusted as farmers are squeezed by low prices and high costs for maintaining licenses. In 2023, they reformed the permitting process, with aims of making it more user friendly, and made allowances for on-farm sales in the county, a first in the state. They changed local cultivation tax methodologies, shifting from gross receipts (which were hard to collect) to a square footage tax (from \$10/square foot to \$.16-\$.32/square foot – a 97% reduction), which is the lowest of any county in California. This tax reform also eliminated a minimum tax per site. Further, the county allowed farmers to expand their cultivation area, to a maximum of 30k square feet, so long as they had three contiguous parcels of 20+ acres each. The county modified parking, setbacks and permitting processes for these aggregated plots. This allowed farmers to attain economies of scale at a time of declining costs. Initially, this stipulation required that a living structure be present on each parcel, but this resulted in cultivators erecting unnecessary structures on parcels with correlated costs and environmental impacts. The structure requirement was subsequently eliminated. In 2024, the Supervisors continued reforms by allowing indoor cultivation in industrial zones, allowing cannabis events, and requiring microbusinesses selling cannabis on their farm to only sell local products.

In 2023 and again in 2025, Nevada County received Cannabis Equity Grants Program funds (a total of \$1.25m) to support licensed cultivators in meeting expensive compliance standards. The grants are meant to promote social equity and repair the harms of the War on Drugs. Several farmers reported that the assistance was appreciated but by the time it was issued

to social equity applicants, the per farm amount was lower than originally expected. As of 2023, legal cannabis contributed \$10m to the local economy – a return to levels seen in 2020-21 after a 40% dip in 2022 to \$6m.

Around the time of legalization, the Nevada County Cannabis Alliance (NCCA) formed, promoting an approach to regulation that balanced smallholder livelihoods with environmental sustainability, often based in values descended from the countercultural, local organic food, and medical marijuana movements. They were and continue to be a key force in shaping county regulations. Notable among their achievements have been the support and mentorship programs (e.g. the Get Legit program) they have provided to farmers to navigate licensure and to maintain operation. By many accounts, they have fostered a sense of supportive community. Also notable is the activity of the South Yuba Conservation League (SYRCL), specifically their decade-long program Growing Green, that helped to educate farmers on environmentally conscious cultivation practices and build shared ethics around environmental protection, regardless of license status.

Cultivation Geographies over Time

Cultivation Pre-2018: As explored above, Nevada County has a history of (unlicensed) cultivation dating back to at least the 1970s. Interviewees report a significant growth in cultivation from 2007-2015 resulting in a boom in medical cultivation, economic refugees from the mortgage crisis, and those migrating from other areas of more intensive enforcement. Growers generally adhered to county limits up to 99 plants. Cultivation on smaller, rural residential lands, led to animosity between growers and residents (which still echoed in 2024, when Homeowner Associations (HOAs) lobbied for restrictions on cannabis cultivation). Though stricter regulations and enforcement began in 2011, interviewees reported that it was not until 2015-2018 that cultivation began to destabilize locally – a decline they attribute not to enforcement but to price destabilization in the lead-up to legalization in 2017.

A study conducted in 2017, just prior to legalization, estimated that the county had approximately 3250 parcels with cannabis, comprising approximately 303 acres of cultivated area. Of this acreage, 91% was clearly active and 1% abandoned; 20% was mixed light with the remainder outdoor. Over 55% of cultivated parcels were located in District 4, encompassing the county's western edge, including the San Juan Ridge, with 17% in District 1, in and around Nevada City, another 12% in District 2, in mostly ag/ranch land south of Grass Valley and 12% in District 5 in the immediate Grass Valley area. Plots with cultivation had an average of 16% slope and about 279 acres (of 303) was on land that was environmentally low risk (i.e. lower slope). About 171 acres of cultivation (56% of total acreage) was more than 400 feet from public waterways (the standard setback for the county under later permitting rules). Notably, about 203 acres (2/3rds) identified were on AG zone land even prior to county permitting, with 66 further

acres (about 20%) located on Forest Resource (FR) land – these two designations were where local permits allowed cannabis, meaning that about 12% of cultivators would have been zoned out of future permitting regulations, which only allowed cultivation on FR and AG zoned land. Cultivation outside AG and FR zones (about 10%) was on residential ag (RA) that was excluded from permitting. . These findings, albeit done with different methodologies than those employed in this study, provide a unique insight into cultivation prior to legalization and the timeline for this study.

Licensed Market Snapshot: According to the DCC License Search, Nevada County received 318 applications for cultivation since 2019, with 172 licenses currently active, 118 licenses expired, and 13 surrendered. The number of licenses peaked in 2022 with 201 active licenses (29 farms have stopped operating since then), though 2021 notched the greatest number of permits issued. Of all permits granted, 75% are in District 4 that spans the western edge of the county from the mountainous areas of the San Juan Ridge down to the agricultural areas around Rough and Ready (CDA 2025). The bulk of the remaining licenses are in the agricultural areas of District 2, south of Grass Valley. These two areas contain much of the Forest Resource and Ag zones where cultivation is permitted. Nearly all licenses are outdoor or mixed light. In 2023, the county had approximately 32 acres under cultivation. The crop value of that acreage dropped precipitously between 2021 and 2022 with a rebound in 2023 to about \$10m, an amount that dwarfs all other forms of county agriculture, excluding livestock (SYRCL 2024). In 2020, legal cannabis' value was 1/3rd of the total ag/resource economy, but by 2023, its share had fallen to about 20% as cannabis prices fell and the value of other ag rose. Also between 2022-23, the number of mixed light licenses surpassed outdoor licenses.

2018-2020: According to Cannavision analysis, during the first time period (2018-2020) Nevada County saw above average increases in cannabis density (1.5-2x that of the overall average). In fact, it had the single largest increase of cannabis density of any county in that period, the majority of which was mixed-light (not outdoor) growth. Nevada County ranked 22nd of 30 in enforcement at this point, which would match the overall trend of low enforcement reputation leading to higher cannabis densities during the first time period. Growth was documented of both outdoor and mixed light cultivation, though mixed light accounted for approximately 60% of growth of cultivation in that period. Of the county model variables, only proportion retired seemed to have an effect on cannabis density; though the effect was dramatic. There was almost no increase of cultivation in cells at the high end of “proportion retired” (35%). As we explore below, we believe the largest factor contributing to this was the requirement that cannabis be removed from Ag-Residential lands, where many retirees were congregated. At the more youthful end, the increase in cannabis density was three times the overall average increase.

2020-2022: In the second time period (2020-2022), Nevada County saw an above average decrease in cannabis density, thus tracking with general decline of cannabis density during this period. Nevada County fell from 1st largest increase to one of the 8th largest decrease

in the second period. *All* of this decline was attributable to declines in outdoor production – mixed light cultivation actually *grew* minimally in this period. Like most other counties, decline was most prominent in cells with a licensed cannabis farm. Indeed, proximity of a licensed farm was the only significant predictor of change in this period – unlicensed cultivation moved away from licensed cultivation in this period.

2022-2024: During the third time period (2022-2024), Nevada County experienced a well above average continued decrease in cultivation density, 3/4ths of which was from declines in outdoor production. Indeed, Nevada notched the largest decrease of cultivation of all 30 counties examined – it fell from the 1st largest increase in 2018-2020 to largest decrease by 2024. This may be traced to ongoing attrition of smaller cultivators amidst low wholesale prices as well as enhanced law and code enforcement efforts, as discussed below. Interestingly, cannabis density decrease was once again associated with the proportion of the population beyond retirement age, although this time the younger cells saw the most dramatic decreases in cultivation density. This could be just a correction from the first time period, though ethnographic evidence explained below indicates that younger people were also actively seeking non-cannabis livelihoods and shrinking the size of existing gardens. Again, the presence of a licensed farm continued to be associated with above average decreases in cannabis density.

Findings/Results

Nevada County underwent California's largest growth in unlicensed cultivation density in 2018-2020 and the largest retraction in 2022-24. Nevada County evidenced the most growth and retraction of any of the 30 counties we studied in Cannavision.

Nevada County unlicensed cultivators largely shifted toward mixed-light cultivation. Mixed light cultivation grew faster than outdoor cultivation in 2018-20. Mixed light cultivation continued to grow from 2020-22, even though the county saw an overall and significant decrease in cultivation generally. From 2022-24, 75% of decreases in cultivation were outdoor sites.

Unpermitted cultivation peaked in 2017 and 2020 and has declined since. Growers credit market decline as the reason for decline. Cultivation peaked between 2016-17, when over 3000 cultivation sites were detected in a commissioned study (see above). A 2017-18 price dip cued some (unpermitted) farmers to stop cultivating, though most held on, encouraged by the defeat of a cultivation ban and the convening of a Community Advisory Group to formulate regulations. Cannavision analysis detected that cultivation was thriving by 2020, when prices spiked amidst early Covid days.

Price declines in 2021-23 pushed licensed and unlicensed cultivators alike out of business. One nursery licensee, who supplied 50 regional permitted farms in 2020 only had 12 clients by 2022. Ethnographic research in 2022 reflected significant struggles among unlicensed (and licensed) cultivators as prices dove below the cost of production. By the time of fieldwork in 2024, most unlicensed cultivators had either left cultivation behind completely or downsized

to personal gardens (or slightly above) with large plants that could provide a supplemental income with minimal investment. One local official remarked that perennial unlicensed cultivation sites had largely stopped by 2024 and cultivation was generally subsiding. This decline from 2020-2024 accords with Cannavision data, showing large decreases in unlicensed cultivation across both periods.

Repeatedly, cultivators referenced market conditions – not threat of enforcement – as the reason they stopped cultivating. As discussed below, cultivators adapted to enforcement conditions, but there was only so many adaptations one could make to low wholesale costs. One could find cheaper land, expand scale, find cheaper labor and agricultural inputs, etc., but by 2022 and 2024 few other modifications – especially for outdoor cultivators – were possible.

Before 2020, unlicensed cultivation followed licensed cultivation toward flatter agricultural land where they could “hide in plain sight.” Nevada’s cultivation scene reorganized geographically prior to 2020. The most notable shift, relayed by county officials, growers, and Cannavision data alike, was that cultivation migrated from forested, mountainous areas into more traditional agricultural lands with more gradual slopes, less stream density, and less tree cover. One official estimated that 75% of cultivation in mountainous areas has disappeared since 2016, a rate they believed was quicker than flatter agricultural lands.

Under medical cannabis rules, migration to ag lands occurred in the late 2000s and more rapidly in the 2010s, when cultivation became ubiquitous. A 2017 study showed that 2/3rds of cultivation was already occurring on ag-zoned land at that time. When permitting programs were established, licensed cultivators found it easier to permit farms in agriculturally-zoned areas. Farmers cited: fewer trees reduced fire risk and eliminated the need to submit tree removal plans; lower stream density meant less setbacks; lower slopes meant less road grading costs; county ag exemptions for buildings with non-cannabis uses facilitated compliance; lower elevation meant warmer weather and longer growing seasons; and ag sites were generally closer to supply stores, friends, and family. With flatter geography, ag lands could allow cultivators to maximize their square footage. Used primarily for livestock grazing, ag land was also relatively affordable. The move to ag lands has helped to integrate cannabis into the county’s farming system: one cannabis-producing family, who have been in non-cannabis agriculture for four generations in Nevada County, derived meaning from their continued stewardship of local agricultural lands.

Unlicensed cultivators initially found it possible to “hide in plain sight” among licensed cultivators, in lower-elevation ag lands. The lightly sloping foothill topography was hilly enough to reduce visibility from roadways and neighbors, thus enabling some growers more ease of operation. Cultivating on ag lands was also less onerous – access to roads, supplies, labor, and social life made life easier (compared to traditional, remote sites). As long as unlicensed cultivators were careful to avoid nuisances that would bring complaints, neighbors generally did not investigate whether growers were licensed or unlicensed. Licensed cultivators were not generally prone to reporting unlicensed grows nearby (though county officials reported some

instances of licensees reporting unpermitted grows). Finally, unlicensed growers found that less stream density and forest cover drew less enforcement attention and less risk of fines, particularly from SWRCB and CDFW (see below).

After 2020, unlicensed cultivation moved away from licensed sites partly because of shifts in inspection practices and county policy. Cannavision modeling shows that after 2020, licensed and unlicensed cultivation diverged. Cultivation decreased faster around areas with licensed farms. Two reasons became apparent. First, after county reforms in 2022, code enforcement became more proactive in identifying unlicensed grows on ag lands, particularly while on permit inspections at licensed farms, where grows not normally visible from public roads might be detected on the relatively open landscape. This meant that the county did not rely solely on complaints but could effectively become complainants themselves, thereby initiating investigations when they saw fit. Usage of drones, though limited by county accounts, enhanced the capacity to detect suspected cultivation. Notably, of the top 7 counties where cannabis declined in 2022-24, only Nevada had a low enforcement reputation (i.e. high enforcement rank), suggesting that the county's efforts to discourage unlicensed cultivation were uniquely effective.

After 2020, unlicensed cultivation moved away from licensed sites partly because of persistence of unlicensed cultivation in harder-to-permit mountainous areas. Divergence between licensed and unlicensed cultivation can be explained by the persistence of cultivation in relatively limited permits granted in hillier, harder-to-permit, traditional cultivation areas. Hill slopes and tree and stream density made it likely permit-seeking cultivators would need to seek special permits, inspections and approvals, often with significant environmental mitigations. This added significant cost and time to permit acquisition. Setback requirements for streams meant finding a permissible cultivation site was a challenge. Requirements to remediate prior cultivation sites and permit self-built structures posed significant challenges to would-be permittees. The county also limited permits to Forest Resource land, thus categorically excluding farmers in other zones (e.g. Timber Processing Zones) from seeking permits. If permitted or seeking a permit, other challenges loomed, including a shorter growing season, logistical challenges due to remoteness, and the significant amounts of capital required to navigate all of these factors. Permittees who stayed in the mountainous areas generally remained at smaller scales due to physical, environmental and regulatory constraints. In short, permitting was harder in legacy cultivation areas, leading many to avoid licensure altogether.

Cultivators in these legacy areas tended to be older and lacked administrative capacity or skills required to navigate permitting. Some observed a cultural resistance among some unlicensed farmers to permitting at any scale, which some viewed as “selling out” or cooptation by “the Man.” However, proponents of this view also acknowledge that unlicensed cultivators were often categorically excluded from permitting by zoning or the characteristics of their land or materially excluded by lack of capital to seek a permit. Remaining unlicensed cultivation was generally split between: (a) small gardens of unlicensed cottage growers in rural residential areas and (b) large, remote grows. Small unpermitted gardens were usually maintained because

residents had few other ways of making a livelihood – either their land was not usable for other purposes or they were unable to attain and maintain off-site work for numerous reasons, including advanced age. Large remote grows persisted, at least until recently, on cheap land where enforcement may be more likely (because of scale and environmental impact) but financial investment was minimal.

Though people persisted away from licensed cultivation sites, overall unlicensed cultivation was declining. In other words, grows near permitted sites declined less fast in 2020-22 and even grew a small amount from 2022-24. As new farms were not generally opening after 2020, it is not that farmers moved to areas far away from permitted sites, but rather, that unlicensed farms were *persisting* in areas (declining less fast) in areas further from permittees.

Unlicensed cultivation initially moved away from areas with retirees because of cannabis zoning rules, but later unlicensed cultivation declined more significantly among younger populations seeking livelihoods. Though cultivation generally moved toward flatter agricultural lands (see above), it was initially driven away from areas with higher numbers of retirees. In Cannavision this trend was strongest in 2018-2020, which correlates to the exclusion of licensed cannabis from Ag-Residential zones, where retirees were largely concentrated. A 2017 study showed that 10% of existing cultivation occurred in those zones prior to permitting. County regulations empowered residents to complain against cultivating neighbors and the lack of licensed farms also eliminated the possibility of “hiding in plain sight” among permittees.

By 2022-24, however, unlicensed cultivation decreased *slowest* in areas with more retirees. We trace this, on one hand, to persistent cultivation among older residents in remote, legacy cultivation areas with few other livelihood options or alternative land uses. Indeed, it is likely that the average age of these legacy areas was actually increasing as younger commercial growers left, thus making persistence among older populations more significant. On the other hand, in 2022-24 unlicensed cultivation was decreasing *fastest* among working-age residents. This corresponds to numerous interviews with former cultivators, who stopped cultivating after the post-2021 price-decline.

Small, unlicensed legacy cultivators, especially among older growers, persisted primarily because of few alternative options. Small, legacy cultivators persisted for several reasons. Reasons included cultural resistance to licensure but were also rooted in the infeasibility of permitting on their parcels, either because of zoning disqualification or environmental or physical features that rendered permitting impossible or financially infeasible. In our sample, these persistent growers were often approaching or beyond retirement age, lacked transferrable skills for other jobs or permitting processes, and their land had few other livelihood uses. They were “growing to eat.” Increasing enforcement against this population would destabilize the community by taking away growers’ ability to make a (meager) living and result in negative consequences on the community and environment, residents speculated. One grower reported that his neighbors were living on the edge of poverty, lacking cars and running water. Concern

over making an income overrode the ability to estimate risk – people were not worried about enforcement when economic pressures were high. One official noted that high rates of land ownership among this group correlated with better stewardship practices, thus limiting the urgency for corrective enforcement. A local advocate also observed that if enforcement led to abandonment or foreclosure, properties would become a county liability. This said, growers felt “stuck” with their properties – their value had declined with cannabis and were not suitable for other kinds of profitable land uses. Some worried that these growers would become more desperate, which could have negative effects on the environment and community as growers sought to make up for declining profits by increasing scale, using cheaper inputs (e.g. pesticides), exploited labor, or growing closer to environmentally sensitive areas.

Some larger-scale, unlicensed cultivation persisted in remote areas with cheap land, where investment could be kept minimal as enforcement risk increased. Commercial unlicensed growers sought to grow by utilizing unique spatial-economic strategies. Some sought to grow *large scale in remote areas* with minimal investment. These sites could attract law enforcement because of land features – lack of residential structure or road; many streams and steep hillsides; grows in open, deforested clearances – but these cultivators gambled that they would escape detection or that only a few of several sites might be busted. This cultivation took place on cheap land with few other marketable land uses. Commonly, this kind of cultivation would be done by lessees of land owned by opaque LLCs and would be subject to enforcement on an annual basis – each time with new, unwitting cultivators hoping to get lucky (but set up for failure). These LLC sites were known among officials as perennial sites of enforcement. These commercial cultivators were often labeled as “cartel” by respondents, though we find it equally likely that they were simply ethnic, immigrant, or poor, perhaps with fewer language skills or legal literacy, thus making them easy prey for distant, shady property owners.

Some larger-scale unlicensed cultivation adopted siting methods to increase scale by growing on multiple properties over broader territories. Well-informed commercial cultivators adapted to enforcement and permitting conditions by spreading *smaller cultivation sites across numerous parcels*. These growers reported efforts to blend in with permitted farms (e.g. having a permitted residential structure on site) and avoid enforcement trip wires (e.g. gardens too close to streams). Some concentrated sites in one particular area, which minimized travel time and logistical costs but increased the risk of cascading enforcement, where one bust would lead to several busted nearby sites. One grower described this as “walking into a casino and putting it all on green.” A second strategy was to spread these sites over the county, which increased travel time and logistical costs, but reduced enforcement risks. Because cultivators multiplied sites to maximize square footage, it is likely that there are significantly fewer unlicensed farmers than there are unlicensed sites.

Regardless of whether they grew in scattered or clustered formation, these growers approached cultivation as a long term career strategy that required going “all in” (unlike personal-scale cultivators). They expected less returns on investment (treating it “like any other

commodity,” as one grower put it) but through efficient operations and expanded scale could achieve sustainable profits that rivaled if not exceeded other livelihood options in the region. One grower said his decision-making is first about costs – land, labor, inputs, improvements, maintenance – and, second, about trust in his partners and operational team. Leases were generally preferable to ownership, so cultivators could keep mobile. As prices decrease, one grower noted that cultivation on cheaper, marginal and remote land becomes enticing – if you stand an equal chance of getting plants eradicated on all kinds of land, why not “try your luck” on larger scale, remote growing? Conversely, unlicensed farmers (like one respondent) might choose to invest in licensed cultivation sites (perhaps as an operator, lessee or unnamed investor) to spread around market and enforcement risk.

Some licensed cultivators found that their farm’s viability depended on selling to the unlicensed market, as is common industry practice. Licensed operators found it financially necessary to utilize the unlicensed market to keep their business solvent amidst low wholesale prices, compliance costs, regulatory restrictions, and limited to no credit access. One grower, whose garden was limited to 5k square feet because of their parcel size, found it difficult to afford road modifications, water permitting, and consulting fees to become licensed, putting pressure on her to sell unlicensed. Even this, however, was not profitable – brokers were swamped with offers from licensed and unlicensed product and prices hovered below the cost of production. This farmer now runs a guest house at her home to supplement her permitted site. Another permitted farmer found himself in debt to friends and family after trying to meet commercial standards for his property in order to process cannabis on-site and build a required house on his site amidst Covid-era inflation. He is now delinquent on taxes, cannot afford workers, visits the food bank frequently, and sells his product on the unlicensed market not because he gets better prices but because it is administratively simpler and, after he was cheated by two licensed distributors on payments, more secure. A third operator (who “leases” from a license holder) considered halting cultivation when she grew her largest crop ever and could not make a profit. She hires informal workers to avoid compliance costs and sells on the unlicensed market after negative experiences with distributors and to account for lack of liquidity and credit in running her licensed farm. As a new mother, she became licensed to avoid the insecurities of unlicensed market risk. She now wishes she stayed unlicensed and maintained a small side garden. Another farmer, reliant on the unlicensed market to stay viable, calls his license a “legal beard” to sell on the unlicensed market. He notes that his product retrieves lower market prices because he cannot afford to grow indoors – greenhouse production would require major property upgrades. He now sells product as cheap “biomass” for processed cannabis products. Finally, farmers report utilizing under-the-table workers to process their product because commercial-level site modifications required to employ workers were exorbitant.

Relatively supportive permitting policies fostered legal market participation and a unique cultivation landscape based on small farms run by local residents. Though some county officials and social groups were resistant to cannabis cultivation in the 2010s, the push for an outdoor cultivation ban in 2016 incited organized opposition by patients and medical cultivators and led to a turn in public opinion. The ban was defeated, Prop 64 passed in the county, and county officials (gradually but notably) turned supportive. Pockets of resistance remained, however, leading to demands for a PEIR to ensure that environmental issues were fully addressed. Though this delayed the local permitting program, it ultimately simplified the path forward for a first wave of initial applications.

Size restrictions on cultivation permits (initially 10k square feet) and requirements for on-site residences encouraged small farms and cultivation by residents. Regulations encouraged land ownership by requiring significant land improvements. Ownership can subsequently encourage stewardship of land, especially to the degree regulations require it. Size caps made the county less desirable for “county shopping” firms seeking to maximize scale, although after the protracted delays and failures of permitting programs in places like Mendocino, Nevada County did experience a second wave of small farmers seeking quality of life, the value placed on small farming, and an easier path to permitting after 2020. Many of these farmers did not succeed in the legal market but have subsequently stayed in the county for quality of life.

Policies that supported parity between cannabis and agriculture were helpful in simplifying regulation and supporting farmers. The initial policy design was onerous for many applicants, particularly requirements around roads and accessory structures, but ongoing advocacy by Nevada County Cannabis Alliance and their local farmer membership pushed the county to reform their permitting program to support farmers through the licensing process, particularly after the price crash of 2021. Reforms included reduction and streamlining of administrative requirements; reductions of setbacks; tax reduction; modest increase of allowed farm size; and the granting of a transition period to bring buildings up to code as needed. When these reforms posed problems the county made further modifications, as it did when it eliminated an expensive and environmentally impactful requirement for on-site residences to be present when cultivators sought to expand cultivation to adjacent parcels. The throughline for these reforms, as expressed by local advocates, was a demand to achieve parity between general agriculture and cannabis cultivation. This demand generally and increasingly won over support among officials and opened subsequent doors to reform, including the 2024 approval of expanded cannabis event permits, the requirement to carry local products by microbusinesses, the defeat of cannabis “exclusionary zones,” and the removal of some pre-conditions for obtaining a permit.

Nevada permitted about 10% of pre-existing cannabis cultivation acreage and 5% of pre-existing parcels. Though Nevada County’s regulations were successful in supporting smaller, locally-owned farms, they did not attract most pre-existing cultivation into licensure. A 2017 study estimated approximately 303 acres of cultivation existed before regulations. The county permitted approximately 32 acres, or less than 10% of pre-existing acreage. The 2017 study also

detected cannabis on 3250 parcels, while the permitting program issued 318 permits, of which 172 existed in early 2025. In other words, the equivalent of approximately 5% of pre-existing parcels are currently permitted. Though the county has made important regulatory reforms to support permitted farmers, farmers continue to experience difficulties including: the cost and availability of fire insurance, which increasingly necessitates outright ownership of a property to avoid insurance requirements; significant costs related to hiring workers and doing on-site processing; and navigation of competing requirements of county and state agencies.

County regulatory reforms aimed to reduce harms from unlicensed cultivation and educate violators on compliance. To address unlicensed cultivation, the sheriff and planning departments inked MOUs in 2022 to implement a system of inter-agency communication and referral to address persistent unlicensed cultivation. This resulted in an informal division of labor – the sheriff’s office pursued large, environmentally-impactful sites, often in more remote locations requiring aerial detection, while planning and code enforcement would respond to complaints about unlicensed cultivation, largely in more residential and less remote areas. Law enforcement, which had backed away from dedicating limited enforcement funds to unlicensed cannabis from 2019-2022, switched gears after 2022 to focus on more remote regions. They telegraphed priorities to cultivators that they would undergo enforcement if they were large and near environmentally sensitive features, like streams. Law enforcement consistently enforced against particular parcels, where cultivation occurred perennially. These parcels were largely owned by LLCs, usually from out of state, that leased to unwitting would-be cultivators. The county responded to these properties by placing “notices of violation” on the ownership deed, making it difficult and expensive for those LLCs to sell the property without rectifying prior violations. By 2024, they had seen a cultivation decline even on these persistent sites.

Code enforcement was authorized to use a more proactive stance in detection and inspection, including the use of drones to substantiate complaints and the initiation of investigations by county officials who spotted cannabis cultivation sites in the course of their duties. Code enforcement acquired discretionary powers to impose fines immediately without abatement periods, apply fines in unique ways if unpermitted cannabis was present, and hold property owners responsible for violations. In its first year, the intensified abatement, fine and enforcement system shut down numerous “repeat offender” sites, who were taking advantage of the county’s prior 5-day abatement period. By 2024 only a few dozen abatements were issued.

Code enforcement used its discretion to work with violators to bring them into compliance. One official emphasized that they have “no duty to enforce” written into county rules, allowing them to utilize discretion in addressing violations, something they avail themselves of often. Nevada stands out in their efforts to treat cannabis like other land use violations, to be dealt with in ways proportional to the risk it poses to public health and welfare, rather than as intrinsically bad land use, worthy of exceptional punishment.

Unlicensed cultivators adapted operations to shifting enforcement practices. Unlicensed growers reported concern over legal and economic consequences resulting from specific growing practices. They understood that *presence of waterways and steeper hill slopes* could make them targets of enforcement by state environmental agencies and local sheriffs. One grower worries about how his environmental practices “would read in the newspaper” if his site was busted, suggesting a concern for social perceptions.

Growers also noted an aversion to *large grows*, which were prioritized by enforcement. One grower tracks the size of busted grows. His fear increased as the plant count decreased. One year, the last bust of the season was 80 plants and one of his sites was 75, putting him next in line for enforcement, he imagined. If cultivators decided to go big, it was wise to do it on cheap land that required little investment and was far from neighbors. A bust, then, would be less likely to occur and less financially devastating so long as one “didn’t bet more than [they] could afford to lose.”

As they had under medical, unlicensed growers maintained an emphasis on *concealing gardens* and limiting visibility, particularly from public right of ways. The launch of the permitting program incentivized unlicensed growers to move into *greenhouses or “light-dep” plastic tarps* after 2016 and this pressure increased as market conditions deteriorated (mixed light cannabis yielded more and was valued higher). Moves to mixed light cultivation limited the powers of civil enforcement to identify cannabis and acquire warrants. One grower repeated a mantra to “keep it clean” to avoid getting complaints from neighbors, to appear orderly from the air (particularly after aerial surveillance increased in 2022) and to evade additional fines if code enforcement comes. For similar reasons, growers avoided cultivation in rural residential zones, where detection was more possible and complaints by neighbors would increase the likelihood of enforcement. To further avoid consequences of enforcement, growers sought autoflower strains and implemented light deprivation (“light dep”) practices to shorten time to harvest and avoid late-season cultivation when enforcement is more common.

Finally, savvy growers reported efforts to mimic licensed cultivation sites to avoid obvious trip-wires for enforcement. For instance, one grower cultivated only on sites with residential structures to blend in with licensed sites. Distance to streams, growing in allowed zones, storing pesticides properly were also measures taken to blend in with permitted grows.

The decline of unlicensed cultivation deepens poverty and insecurity. Many never-licensed cultivators dropped out of cultivation. They depended on cultivation as a livelihood and struggled to find new occupations. Some succeeded in transitioning to other jobs, like one grower who became a commercial truck driver, though many found themselves unemployed, underemployed, depressed, or otherwise destabilized. One former grower traveled hours for a job as a security guard, several tried to market their contracting and construction skills in a saturated market, others tried to launch tenuous entrepreneurial efforts. Respondents sought charity food boxes, worked as an informal housecleaner, moved away or in with family, or turned to drugs.

One became a minimum-wage day laborer on a cannabis farm, a tough pill to swallow for a former cultivator who used to gross several hundred thousand a year and was now making just above minimum wage. Another grower of 30 years, who grows personal plants to manage an autoimmune disease, now works highway maintenance, trying to pay off (and retain) a property they bought at the cannabis market peak. Another farmer of 25 years, a pillar in the growing community, sold his property and left, after failing to find local employment. The property, which he has been stewarding and improving for 15 years in order to convert it into an organic berry farm, was meant to be his children's inheritance but he now must find another way to build a "nest egg" to pass on. He is grateful, though, that he has his property to cash out – many of his unlicensed friends leased properties and, when their cash reserves disappeared, they were assetless and rendered mobile and desperate. As people drop out of cannabis cultivation, a looming question emerges about whether they seek new livelihoods through their land through more environmentally impactful activities, like logging, subdivisions, etc. One elderly neighbor of a licensed farmer, for instance, stopped cultivating and turned to renting out trailers on their property, which attracted methamphetamine users and dealers, led to several confrontations and attempted robberies of surrounding properties, and a decline in community dynamics.

For residents that stopped cultivating, personal-size gardens sometimes provided a side income and hobby. Cultivators that stopped cultivating turned to personal-size gardens (i.e. 6 plants).

This was common after the 2021 price collapse, as growers exited commercial production. These growers sought to transition to other livelihoods but continued growing large outdoor plants for supplemental income and personal consumption. A common refrain was that personal grows would "pay a few bills" with the limited income from these plants. "Weed pays like a hobby," or a "side hustle," one grower explained. Financial investment was low and growers focused on maximizing yields on each individual plant. One personal/unlicensed cultivator intended to become licensed in Nevada County after moving from the North Coast but remained unlicensed because of falling prices. He now grows large plants at or slightly above the personal limit. He sells cannabis on the side to improve his property (e.g. implement "fire safe" practices) while maintaining other jobs. Some personal-scale cultivators may be drawn back into scaled-up unlicensed production if prices rise again, though many were exhausted by market extremes and sought to minimize the role of cannabis cultivation in their household livelihood strategy.

Cultural and quality of life factors retain former growers in Nevada County for now. Many former farmers reported a desire to stay in the county because of its cultural and social dynamics. This cultural magnetism drew growers to Nevada County in various moments – in the '70s back-to-landers found autonomy, community, and a vibrant, intellectual culture; in the 2000s, cultivator-patients and caregivers grew a community-minded, health-oriented culture; and in the 2010s, before and after legalization, the county became a destination for growers who valued a cultivation landscape based on small farms and a rural culture unavailable in more sparsely populated places. One former grower described Nevada as "almost suburban" in its density of population, allowing for a feeling of robust neighborhood to emerge. With much of the county's

development owed to cannabis, it was this legacy culture that led many to desire to remain – even as property prices increased and good-paying jobs dwindled in the wake of cannabis.

Some, however, stayed reluctantly. They were stuck with properties that had declined in value with little other use besides cannabis cultivation. Also, people expressed sadness when they refer to what Nevada County history. People shared a sense of distress when people refer to the hardships of livelihood loss and the search not only for new occupations but new sources of meaning. As one former grower said, “no one knows where they’re going” and everyone’s trying to “reinvent themselves.” Another, at a “decompression” party, said: “the party is over.”

Finally, market pressures reduced the capacity for cultivators to reproduce a locally-supportive culture. Licensed and unlicensed farmers expressed a desire to maintain local values of sustainability, interdependence, and small-farm culture, though market conditions degraded their ability to do so. For instance, bonds between workers and owner-cultivators on two unlicensed farms deteriorated as wages declined, perks disappeared, and automation replaced labor. Similarly, providing for patients, which linked cultivators with the community, became administratively difficult, thus severing many farmers from a key source of purpose and connection.

Local cultivator organizations can shape regulation, support farmers, defuse conflict, and promote shared values. The local cannabis cultivator organization, Nevada County Cannabis Alliance (NCCA), has been a crucial voice in articulating, defending, and sustaining the historic values created by cannabis farmers under prohibition. They fought for and won policies instituting small farmers as the basis of the cultivation sector. They advocated for and won support for small, craft production and unique opportunities for local producers to access local markets, along with special opportunities to support cannabis patients. They built community among farmers through mentorship and support programs. They built bridges with environmentalists, most notably SYRCL (South Yuba River Conservation League) to educate farmers (licensed and unlicensed) on environmentally-aware farming practices. NCCA and local farmers pushed the county to eliminate unnecessary processes and costs from the permitting programs, like onerous parking requirements. Their advocacy helped reframe cannabis regulation as a means of valuing and supporting small farm agriculture, rather than fighting nuisances or preventing crime. This has led to the normalization of cannabis cultivation in county life. As they prepare a future agenda – like making on-site processing more feasible – they defend victories won, as with a 2024 proposal to allow non-cannabis landowners to form exclusionary zoning that would have prohibited cultivation for future owners.

Conclusion

Nevada County demonstrates how cultivation grew and declined in California, especially for outdoor cultivation. It supports findings that market conditions were critical to reductions in unlicensed cultivation. Overall, proximity to licensed sites was the most consistent factor in

unlicensed declines. This is due both to inspection and permitting practices that can identify and remediate nearby cultivation as well as persistence of cultivation in more remote areas.

Cultivators generally adapted to shifting enforcement conditions, though civil enforcement practices became more effective over time (including original success through zoning policies, which pushed cultivation out of ag-residential areas). Age was a key indicator of unlicensed cultivation – it declined in areas with retirees and later declined in areas with younger people. This reflects the efficacy of zoning policies (which moved cultivation out of areas with high densities of retirees), underscores the importance of market conditions (as younger cultivators left cultivation behind), and the enduring persistence of older growers with few other livelihood options or land uses. Populations that are not able to transition to other livelihoods cling to cultivation, while others are able to utilize personal gardens to supply their own flower or create a side income. Looking forward, declines in cultivation may produce insecurity among residents. That said, significant social and political organization continues to build a more equitable permitting system and the cultural legacy of cultivators continues to fuel county life.

Contributions to Report Findings

Objective 1 Assessing Unlicensed Production Amounts and Geography

Finding #1: In the years following legalization, unlicensed production showed an initial expansion, rapid retraction, then stabilization.

- Ethnographic data indicated the largest increase in unlicensed cultivation from 2018–2020 among the case study counties.
- Growers were attracted by the county’s proximity to markets, relatively lenient enforcement environment, and a community culture supportive of smallholder farming.
- Participants described relocating from more remote cultivation regions in search of better quality of life and perceived local acceptance of cannabis cultivation.
- The county’s permitting program was delayed until 2019, and by that time, discouragement among cultivators about the permitting process was already widespread.
- Many participants reported initially moving to Nevada in hopes of obtaining licenses but later abandoning the process as barriers and delays mounted.
- Law enforcement deprioritized costly cannabis enforcement, a factor ethnographic data suggested influenced cultivators’ decisions to remain unlicensed.
- By 2022–2024, both CannaVision and ethnographic data indicated significant declines in unlicensed cultivation, with the county shifting toward stabilization and reduced overall levels.

Finding #2: Cultivation moved from the hills to the flatlands and back again.

- CannaVision data and ethnographic evidence both indicated a clear movement from mountainous legacy areas toward flatter, more accessible lands between 2018 and 2020.

- Ethnographic data suggested this shift was motivated by expectations of future permitting, a desire to blend in with licensed operations, and a perception of lower enforcement risk in flatter areas.
- County permitting rules made cultivation in steep or environmentally sensitive terrain difficult, reinforcing the trend toward open lands.
- From 2020 to 2022, CannaVision showed overall decline in cultivation, but ethnographic accounts described slower declines in remote eastern and central areas where permitting was impractical or impermissible.
- Ethnographic data also suggested that limited economic opportunities and aging cultivator populations contributed to persistence in remote areas through 2024.
- By 2022–2024, affordability pressures and reduced viable land uses encouraged continued cultivation in marginal, remote zones even as flatter areas declined.

Finding #3: While participation in the unlicensed market was broad initially, increasingly the people left cultivating are those in tenuous socio-economic situations and attached to place for cultural-historical reasons.

- Ethnographic data indicated that by 2022–24, older cultivators were disproportionately represented among those continuing unlicensed cultivation. Quantitative data from CannaVision supported this observation, showing a positive correlation between older age demographics and the persistence or even expansion of cultivation in this period.
- Older growers described limited mobility and an unwillingness to abandon land they had worked for decades, particularly as local land values in legacy cultivation areas declined. For many, cannabis represented the only remaining profitable land use.
- Ethnographic interviews revealed that older residents often expressed deep attachment to their land and communities- values rooted in the homesteading and back-to-the-land movements of the 1970s-80s. They cited lifestyle, familiarity, and identity as key reasons for staying, even as profitability waned.
- Younger cultivators, by contrast, were more likely to exit the unlicensed market between 2020 and 2024, seeking alternative livelihoods or downsizing to personal or supplemental gardens. Some shifted toward cannabis-related side businesses or lower-risk subsistence production.
- Ethnographic data also documented exploitative arrangements in which socio-economically distressed individuals, including migrants and renters, leased land from absentee or out-of-state LLCs. These renters were frequently raided by enforcement agencies, as properties were well known to authorities, illustrating how predatory land practices targeted vulnerable cultivators.
- Communities like *The Ridge* exemplified how social networks and shared histories of trust fostered mutual aid among older and lower-income residents. Despite enforcement pressures, these networks provided early warning systems, shared resources, and informal credit that sustained unlicensed activity.

Finding #4: Unlicensed cultivation generally migrated out of public lands because of lower consequences on private land.

- Ethnographic data and interviews with local officials indicated that by 2022–2024, public land cultivation in Nevada County had diminished to near zero.
- A county enforcement officer reported that federal enforcement and the risk of felony charges made public lands untenable for all but the most desperate or uninformed growers.
- Cultivators emphasized that growing on private land offered both lower legal exposure and the perception of greater legitimacy, even when unlicensed.
- Some of the early movement (2018–2020) off public lands coincided with efforts by would-be licensees to secure parcels that could be legally permitted in the future, although many of those efforts ultimately stalled.
- Ethnographic data suggested that the county’s combination of rising social acceptability of cannabis and declining profitability on the black market meant that remaining cultivators concentrated on small, privately held rural parcels rather than risk public land operations.

Finding #5: Transition from Outdoor to Mixed-Light Production.

- Ethnographic data showed that enforcement threats and price incentives jointly motivated the shift to mixed-light operations.
- Cultivators described greenhouses as both a practical and regulatory shield against identification.

Objective 2 Identifying Factors Influencing the Observed Extent of Unlicensed Cultivation

Finding #1: Presence of licensed cultivation was the primary deterrent of unlicensed cultivation.

- Ethnographic data indicated a marked divergence between licensed and unlicensed cultivators, driven by population density, community complaints, and heightened enforcement.
- Over time, pro-licensure social norms strengthened as licensed growers invested in compliance, including environmental measures such as groundwater payments.
- Civil inspections and code enforcement at licensed sites often led to the identification and closure of nearby unlicensed operations.
- Licensed cultivators tended to remain on their properties despite market fluctuations, while unlicensed growers were more transient, relocating frequently to cheaper, less regulated areas.

Finding #2: Bans Were Not a Consistent or Powerful Indicator of Growth or Decline in Unlicensed Cannabis Cultivation.

- Ethnographic data indicated that Nevada developed increasingly sophisticated enforcement tools, including proactive drone monitoring and coordinated civil enforcement programs.

- These approaches reduced unlicensed cultivation without relying on a ban.
- The county's regulatory and enforcement revamp between 2022 and 2024 reflected improved integration of oversight and education for cultivators.

Finding #3: The Perceived Likelihood of Strong Enforcement Was an Initial Deterrent, but Became Less Important Over Time.

- Ethnographic data indicated that Nevada attracted growers between 2018 and 2020 due to its reputation for being welcoming to small cultivators and for its perceived shift toward tolerant sheriff enforcement.
- Early perceptions of leniency encouraged migration from more restrictive counties such as Yuba and El Dorado.
- Over time, consistent enforcement criteria allowed cultivators to predict and adapt their siting decisions more effectively.
- Some growers relocated to higher, more remote, and environmentally sensitive areas to reduce costs and avoid oversight, even as overall enforcement visibility increased.
- The persistence of cultivation in these marginal zones reflected both economic pressures and long-term investments in land and livelihood.

Finding #4: Over Time, Civil Policy and Civil Enforcement Efforts Became Key Drivers of Declines in Unlicensed Cultivation.

- Ethnographic data suggested that Nevada's civil enforcement efforts became significantly more structured by 2022–23, after initial regulatory flux.
- The county's program emphasized education, discretion, and in-person inspection, using drones primarily as a last resort.
- Cultivators reported that consistent enforcement criteria and communication about environmental expectations (for example, stream proximity and nuisance violations) encouraged compliance and relocation away from sensitive areas.
- Civil enforcement was supported by community norms and public awareness of environmental impacts, which strengthened over time.
- Some unlicensed cultivators adapted by operating in more remote or stream-dense zones due to economic pressures, despite awareness of environmental regulations.

Finding #5: Troubles in Permitting Programs Prevented Many Cultivators from Becoming Licensed.

- Ethnographic evidence showed that Nevada's permitting program emphasized inclusion of small farms and maintained open communication with cultivators.
- Approximately ten percent of cultivators pursued licensure, aided by regulatory easing and temporary tax reductions that allowed them to remain viable.
- Strong involvement from a local cultivator association facilitated cooperation and policy refinement throughout the process.
- The program's stability helped prevent widespread reversion to unlicensed activity.

Finding #6: Cultivation Bans and Other Enforcement Policies Were Linked with Whack-a-Mole Dynamics of Unlicensed Cultivation.

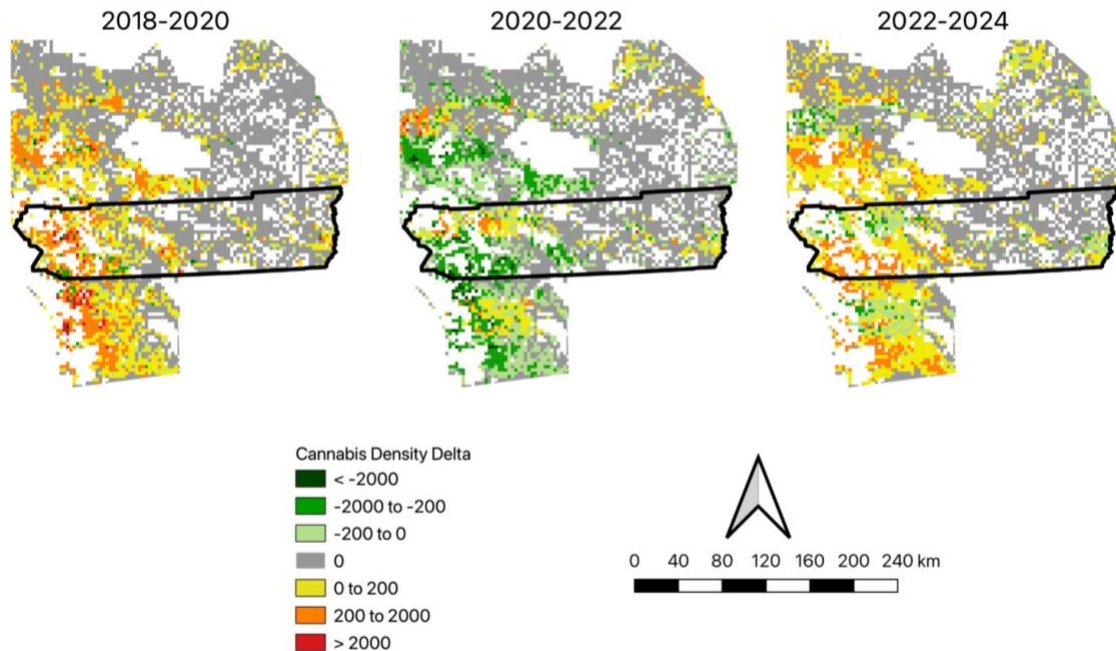
- Ethnographic data suggested that unlicensed cultivators relocated to remote, low-cost lands with minimal competing uses during the early years of enforcement.
- Some properties, often owned by limited liability companies, repeatedly appeared in enforcement records, indicating ongoing reoccupation after abatements.
- By 2024, the frequency of relocations had declined as market downturns and economic constraints reduced incentives for continued movement.
- Counties with permit programs, such as Nevada, showed greater site stability and fewer relocations compared to ban jurisdictions.

Finding #7: Market Forces and Price Decline Were Major Factors in Siting Decisions.

- Ethnographic evidence showed that declining prices prompted cultivators to seek cheaper, more remote sites, particularly in central and eastern parts of the county.
- Several interviewees reported consolidating multiple small sites under single operators, suggesting fewer cultivators managing dispersed properties.
- The downturn in market value coincided with visible contraction in the overall cultivation footprint, followed by stabilization in remote areas between 2022 and 2024.
- Older cultivators were more likely to continue operations than younger growers, who exited the market or transitioned to personal gardens.

RIVERSIDE COUNTY: ETHNOGRAPHIC ANALYSIS

PREPARED BY: MICHAEL POLSON



Research Summary & Methods

Dr. Michael Polson conducted in-person interview and ethnographic research in Fall 2024 and Summer 2025. He interviewed 3 grow store owners, 2 county officials, 3 city officials, 5 licensed growers, and 1 former unlicensed grower. He visited three licensed cultivation facilities and two centers of unlicensed cultivation. He supplemented this with prior research conducted in 2022 under DCC Grant # 65306, which included interviews with 4 officials, 2 unlicensed growers, and 7 local advocates for and against cannabis. Polson supplemented this research with policy studies conducted by Joanna Hossack and social-demographic backgrounds by undergraduate research assistants.

Background on Riverside County

Southern California's Riverside county spans from the Eastern border with Arizona to western border with Orange County. It is enclosed by San Bernardino County to the north and Imperial and San Diego counties to the south. The diverse geography, including deserts, mountains, and fertile agricultural valleys, lends itself to a wide range of economic, social and environmental dynamics. The county encompasses 7,209 square miles, is home to 2.4 million people, making it California's [4th most populous county](#), most of whom are concentrated in

Riverside and Moreno Valley. It has a median household income of 90,527 (just below state average of \$95.5k), median home price of [\\$597,000](#) in 2024, and a poverty rate of 11.3% (below state average of 12%). As of 2020, the county is 48.3% Hispanic or Latino, 32.6% Non-Hispanic White, 7% Asian, 6% Black, and 16.3% multiracial ([Riverside County, California - Census Bureau Profile, n.d.](#)). Political affiliation skews Democratic, with less than a third of registered voters being republican ([32.3%](#)). The 2024 approved budget was \$9.4 billion, with the three largest expenditures being the Department of Public Social Service (\$1.4 billion expenditure), RCRMC (Riverside County Regional Medical Center, including University Health Services, \$1.26 billion), and the Sheriff's Department (\$1.02 billion) ([County of Riverside, California, n.d.](#)). Proposition 64 was approved by 52.90% of voters. About 84% of Riverside County is publicly owned, largely due to Bureau of Land Management land and Joshua Tree National Park in the East, with US Forest Service and Department of Defense land making up significant portions as well ([Robinson, 2021](#)).

The economic history of Riverside County is defined by citrus agriculture, starting with the Washington Navel Orange, and continuing with lemons and grapefruit through the early 20th century. Economic diversification came as a result of World War 2 defense spending and continued with service sector industries like retail, social services, education, health care, recreation and tourism, and entertainment ([History | Agricultural Commissioner Riverside County, n.d.](#)). Currently the largest proportion of workers – 26% – are employed in educational services, health care, and social assistance; followed by 11.8% in professional, scientific, management, and administrative and waste management services; 11.6% in retail trade; 10.6% in arts, entertainment, recreation, and accommodation and food services, and less than 10% each in construction; manufacturing; transportation and warehousing; and public administration in descending order.

History of Cannabis Policy & Market

Early Policy & Market History: Cannabis commerce has a storied history in southern California, centering on the cross-border movement of people and plants (Adler & Adler 1993; Gieringer 1999; Maguire 2015). The contemporary history of cannabis cultivation in Riverside County begins in the mid to late 1980s, when northern California growers, targeted by eradication programs, innovated methods to grow cannabis indoors. As one person remembers, southern California seasonal farmworkers on these grows learned these skills and brought them south. Indoor cultivation adapted well to the Inland Empire, where underutilized warehouses, industrial spaces and residential tracts abounded amidst deindustrialization. An artisanal indoor cultivation scene developed in the region by the early 1990s as growers refined horticultural practices and honed potent, fragrant, crystallized and dense strains that would shape consumer markets for decades to come. In 1996, this indoor scene was buoyed by medical cannabis laws and the legal gray space that enabled cultivation and communication about cannabis in medical registers. From 1996 to 2010 a gray-market, cottage industry around medical cannabis emerged as cultivators provided for patients (Getz et al 2024), who organized to protect patient rights and

ensure access through groups like the Marijuana Anti-Prohibition Project and local chapters of Americans for Safe Access.

County government responded primarily through enforcement and, like many localities, by failing to pass any regulatory measures. In this period, raids of cannabis cultivation sites were conducted from the desert towns of Rancho Mirage and Desert Hot Springs to the cities of the San Bernardino Valley, like Riverside and Eastvale, to the exurban communities of southwest Riverside, like Hemet and Temecula. In 2004, SB420 codified protections for patients and required counties to engage with cannabis regulation in minimal ways, namely through medical ID cards. Riverside County rejected this state ID mandate by joining a lawsuit, which it subsequently lost.

Since deployment of law enforcement against medical cannabis became complicated under SB420, the county turned to land use regulations. Building on a temporary moratorium, Riverside banned medical cannabis distribution in 2006. Shortly after, the City of Riverside also banned dispensaries by declaring any federally illegal activity (including cultivation) a nuisance, thereby subjecting it to local land use powers. Subsequent litigation (*City of Riverside vs. Inland Empire Health & Wellness*) established the statewide ability of localities to declare cannabis a nuisance and regulate or ban them accordingly. Between 2006 and 2015, the city reportedly shut down 118 dispensaries. (Even by 2015 city voters rejected regulations allowing dispensaries.) The county, in 2010, considered regulations for cannabis but halted action when court decisions questioned the regulatory powers of localities and posed liability risks for county policymakers and personnel. In 2011, the county filed a lawsuit to close an estimated 36 dispensaries in unincorporated areas. With medical cannabis now firmly a matter of local regulatory authority, numerous cities banned medical cannabis, including Hemet, Moreno Valley, Rancho Mirage, Temecula, Murrieta, San Jacinto, Corona, Banning, Calimesa, Indio, Indian Wells, Banning, Menifee, and Norco. Many, however, passed no rules at all. Initially, Palm Springs was the only city that allowed and regulated dispensaries. In 2015, Riverside county expanded their ban to include all cultivation and mobile delivery services in unincorporated areas, while also affirming limited patient allowances to cultivate up to 24 medical cannabis plants on a property (with some setbacks and requirements around visibility, registration and security) through [Ordinance 925](#).

In 2015, the Riverside sheriff agency made an effort to enforce the newly-authorized and explicit ban on cultivation. They conducted approximately 500 raids, netting approximately 30,000 plants that summer. Yet, this enforcement effort was an exception, according to many observers, who saw the sheriff as generally “hands off.” Despite county regulations, the sheriff was reticent to enforce against cannabis because medical rules made enforcement legally complex and difficult to gain convictions. (In the absence of sustained enforcement, one party took vigilante actions against cannabis when it hired a private security company to raid a woman’s property with a helicopter and armed guards. The woman had turned to cannabis when her avocado farm stopped being profitable.)

County Turns Toward Permitting Cannabis: In 2017, the county began to grapple with cannabis regulation more comprehensively, when supervisors authorized a working group to craft a county permitting program. Supervisors at the time admitted that enforcement-only efforts to stymie cannabis commerce were not working. On December 23, 2018, the county established a permitting process and regulations for commercial cannabis activities through [Ordinance No. 348.4898](#) ([Cannabis | Planning Department Riverside County, 2023](#)). The ordinance regulated medical and commercial cannabis cultivation (and a panoply of other commercial activities like manufacturing and distribution) and retained an exception for medical patients and their primary caregivers growing up to 24 plants on a residential parcel ([ORDINANCE NO. 925, n.d.](#)). Outdoor cannabis was explicitly prohibited. Indoor cultivation was allowed in industrial, commercial and agriculture zones, while mixed-light cultivation was only allowed in agriculture zones. Cannabis was explicitly denied Right-to-Farm protections assumed by other farmers. Cultivation was capped at one acre on any single parcel. Conditional use permits (CUPs) were required of commercial cannabis activities and applicants were required to obtain a state license prior to operating ([Cannabis | Planning Department Riverside County, 2023](#)). Among other features the ordinance would: a) establish a scoring system to approve applicants; b) forego special cannabis taxes (and voter ballots) for a “[Development Agreement](#)” for things like street maintenance, law enforcement, and other services; c) charge a “public benefit fee” on each square foot utilized; d) collect regular county sales taxes (as with any business); e) issue 10-year conditional use permits (requiring site-specific approvals) for \$6k; and f) encourage applicants (through scoring criteria) to demonstrate benefit to the surrounding community. In enacting this ordinance, Riverside County joined five early-starter cities that established permitting programs by 2017: Coachella, Cathedral City, Desert Hot Springs, Palm Springs and Perris. Later, Jurupa Valley, Banning, San Jacinto, and Moreno Valley, among others, would establish permitting programs.

It is notable that at the time of fieldwork, only one farm had become operational on unincorporated lands, while a few others had either been permitted but failed to open or applied but never made it through the CUP process. Interviewees conveyed that the major impediments to permitting for cultivators are: expense of acquiring and operating on ag-zoned land, which were generally large parcels, in non-legacy areas, and did not have right-to-farm protections; more permissive permitting processes in cities that made unincorporated county less desirable; the large costs of development agreements; stringent requirements on everything from parking to waste water management to odor control; and zoning exclusions that disallowed cannabis growers in legacy areas from seeking permits.

Law Enforcement and Code Enforcement Approaches to Unlicensed Cultivation: In the period before the permitting program was established, other county agencies took initiative in attempting to control unlicensed cultivation. A pioneering lieutenant in the Hemet substation, frustrated with relative inaction from the sheriff’s department, little funding from the county, and concern from a group of residents in the Anza Valley area, began to reorganize deputy time and responsibilities to conduct weekly cannabis raids. These raids, dubbed “Marijuana Mondays,”

were organized to occur without new resources. Balancing these raids with non-cannabis cases, he meticulously counted arrests and cannabis seizures to defend himself from the “scrutiny” he got from superiors. Momentum built and at its height, he was part of a 900 officer eradication operation in his substation area, targeting cannabis. In 2018, this lieutenant, Chad Bianco, leveraged this eradication program and an anti-cannabis platform to win election as county Sheriff.

Sheriff Bianco, a self-described constitutional sheriff (believing that sheriffs are the supreme authority in given jurisdictions), is one of several sheriffs around the state that have intensified cannabis operations since legalization. He describes this as a “generational shift” that is more hands-on, less libertarian, and includes sheriffs in Siskiyou, San Bernardino, and elsewhere. The sheriff prioritizes large cultivation sites but will respond to and prioritize complaints (a claim by officials that some residents refute). Marijuana Mondays expanded to THC Tuesdays, Weed Wednesdays, etc., as he intensified cannabis enforcement by rotating operations across 10 stations, adding detective bureaus, utilizing asset forfeiture processes, and enlisting local, state (e.g. CDFW) and federal agencies that helped to get more legal “teeth” to achieve prosecutions. To win felonies he focused not on cannabis but on the “major felonies attached to it,” like contamination, poisons and other environmental crimes. In 2022, California’s Department of Justice also joined enforcement efforts with the new EPIC program (Eradication and Prevention of Illicit Cannabis); in 2024 it eradicated 136.5k plants in Riverside across 79 sites, the most of any county in the state. The Unified Cannabis Enforcement Task Force (UCETF) also conducted raids in Riverside. Their intensive enforcement became a model for San Bernardino, several people noted. Ironically, San Bernardino needed to implement this model because Riverside’s enforcement campaign of 2017-20 pushed cultivators into the High Desert areas of San Bernardino and LA.

The planning department developed a different strategy. The Cannabis Regulation Task Force (CRTF) formed in 2018, led by the county planning agency in collaboration with dozens of municipalities throughout the county. Through an inter-jurisdiction civil code enforcement effort, they aimed to shut down unauthorized cannabis sites in incorporated and unincorporated areas alike. The CRTF typically issued cease and desist orders with a 7-day response time, followed by an abatement order, mostly centering on nuisance and compliance violations. By avoiding investigations into environmental crimes, which require significant analysis and reporting, they could quickly escalate cases to win permanent injunction against cultivators with significant fines. They prided themselves on not being punitive (unless appropriate), offering fair hearings, and focusing on cultivator education. In some cases, CRTF could send cases to the District Attorney, who would decide whether civil or criminal charges might result. By partnering with the DA, CRTF was able to muster investigation resources when needed and trace money upwards to find “the key players” directing operations. Investigations cut the operations off at the root, preventing their continued operation. CRTF operated under a “broken window” theories of enforcement, which focused on “quality of life” violations, trusting that it would have

“ripple effects” in communities that would change social norms. CRTF was most responsive to residential complaints, seeking to resolve flagrant issues first. It also “tried to get [legal operators] to tell on one another,” thus breaking forms of solidarity that had thrived under prohibition. CRTF was reportedly successful in addressing certain unlicensed dispensaries and cultivation. Activity declined in the early 2020s as municipalities resolved the problem of grow houses and unlicensed dispensaries, thus threatening CRTF’s budget allocations.

CRTF and Sheriff-led enforcement arose parallel to the establishment of the county permitting program. In some ways, code and law enforcement substituted for the lack of success of county permitting – in the absence of a viable path to county licensure, cultivators attempted to continue operations, opening themselves up to enforcement. This said, code enforcement, policing, litigation, and county permitting formed a multidisciplinary approach to cannabis, with varied logics, that could see, address, and follow up on different aspects of cannabis cultivation. This wrap-around model of enforcement and redress was later replicated in San Bernardino (Getz et al 2024), proving to be effective in transforming (if not eliminating) cultivation.

Cultivation Geographies Over Time

Pre-2018: As mentioned above, during the 1990s and 2000s the Inland Empire became a center of small-scale indoor cultivation, refining techniques that came to shape the cultivation sector and cannabis market generally. Cultivation was concentrated in a deindustrializing landscape of empty warehouses and periodically emptied residential areas. Space was more available and cheaper than Los Angeles but proximity to the LA market and major interstates heading eastward were a boon for the cannabis industry (as it was generally for the logistics and warehousing industry located in the region; Getz et al 2024). Indoor cultivation in the urban Inland Empire area remained significant until rising rents and drops in wholesale cannabis prices in the early 2020s reduced profit margins. Lower rents in areas like Anza Valley and the High Desert of San Bernardino and LA county drew some cultivators to cultivate outdoors, while cheaper indoor sites were prospected in Coachella Valley, to the east of Riverside Valley.

With relatively light and irregular enforcement from 2013-2017, outdoor cultivation emerged in two significant areas of Riverside County: suburban and exurban population-dense areas; and remote, mountainous regions. First, smaller cannabis gardens popped up throughout suburban and exurban backyards (easily in the hundreds if not thousands, according to one official), particularly after the county approved 24 medical plants per parcel in 2015. In the county’s southwest, Mead Valley became informally known as “Weed Valley,” numerous grow shops opened, and a localized boom in property prices occurred. In poorer, unincorporated areas, cannabis “was in people’s front yards, and people didn’t care,” one official recalls. This official alleged that locals often grew cannabis on consignment for buyers. Sometimes a grower might rent a person’s property for significant sums to set up and tend a garden. Many growers, though, were independent micro-entrepreneurs vending to gray market dispensaries, like one grower we spoke with. During this period before 2018, one official recalls that his constituents underwent a

“cultural shift,” as patients “came out” about their use. More explicit advocacy by groups like the Brownie Mary Democratic Club helped to normalize the plant. When state voters legalized cannabis in 2016 (including a majority of Riverside voters at 53%), one person noted, many residents across suburban, exurban and rural areas began to grow beyond the county limit of 24 – often up to 99 plants (below a federal threshold for escalated consequences).

Prior to 2018, outdoor cultivation also appeared in more remote, mountainous areas of Riverside, particularly in the triangular area of Sage-Aguanga-Anza. The relative proximity to Los Angeles and San Diego markets, cheap land markets, and low levels of county enforcement attracted cultivators. As discussed below, this migration put cultivators at loggerheads with local residents, who were largely retirees or lower income, who valued the landscape amenities the area had to offer. Cultural and ethnic tensions rose and conflicts over land use codes escalated, but by 2018, enough cultivators were present to form a cultivator’s advocacy organization that was focused on winning inclusion into county permitting programs. Both outdoor, backyard, suburban cultivation and remote outdoor cultivation in the Anza Valley area have subsequently declined due to enforcement efforts described above and, moreover, declines in cannabis profitability. It is possible cultivation also grew before 2018 in desert areas (particularly indoor) in Coachella Valley as well as the county’s far eastern edge.

2018-2020: Riverside, like almost every county, showed an increase in cultivation density from 2018-2020 (slightly above average in Riverside). Almost all of the increase during this period (98%) came from a growth in mixed light cultivation. Three county model variables were determined to have an effect on where unlicensed cultivation occurred: building density, the presence of hemp, and the presence of public land. All three variables matched the overall trend, although the effect of building density was rather small (cultivation occurred more near areas with greater building density). The presence of hemp had a large positive effect, as did the absence of public land (i.e. cultivation was more likely to be near hemp sites and away from public land). Movement away from areas with public lands and towards more building-dense areas suggests that cultivation was becoming more open and proximate to population centers. Paradoxically, Riverside county had a high enforcement reputation rank, yet it showed above average increases in cannabis density. The general trend among counties was the opposite (i.e. cultivation moved away from areas with more robust enforcement reputations). There were modest and substantial increases in the Aguanga-Sage-Anza area, a few parts of Coachella Valley, and desert areas along the I-10 toward the Arizona border. Unlicensed cultivation did not grow in all areas, however: maps of cultivation density declines and increases show some sharp declines in urban and suburban areas in Moreno Valley, particularly along the I-15.

2020-22: Like most counties, cultivation decreased in the second time period and retreated into more concealed areas. The recession from conspicuous growing was captured by four significant variables in the county model: building density, proportion planted, presence of hemp, and presence of public land. Cultivation *decreased most* in areas with higher building density, more traditional agriculture, in the presence of hemp farms, and in areas not bordering

public land. Of all these variables, the effect of seeking out public/private land boundaries was the most significant. Growers remained cultivating at greater rates in areas that bordered public lands. Mapping of cultivation indicates that declines were most significant in rural and suburban areas in the county's southwest, including Aguanga-Sage-Anza areas and Coachella Valley. Modest growth was detected around City of Riverside, Perris, and in the hillier areas near the Banning-San Jacinto stretch of the San Gorgonio Pass on I-10 (to the east of Riverside Valley). About 80% of the decline in cultivation came from mixed light cultivation, with outdoor cultivation accounting for the remainder.

2022-24: Riverside cultivation grew in the third period at the 4th highest rate in the state. Notably, virtually all of this increase was in areas far from licensed farms – cultivation near licensed sites actually decreased substantially. This accords with statewide trends. About 75% of the increase in cultivation comes from mixed light, with 25% increase due to outdoor. Unlicensed cultivation moved back toward areas where it had vacated in the prior period, namely areas with higher building densities, more traditional ag, and where hemp was present. This was thus a reversal of the prior period, though each of these variables indicated relatively small effects. Mapping of cultivation detects modest growth throughout the county's southwest suburban and rural areas, including the Aguanga-Sage-Anza areas and places like Menifee, Temecula and Murrieta along I-15 and I-215, while decreases were noted from Mead Valley and City of Riverside out to the San Gorgonio Pass.

Findings

An expensive, stringent permitting program with multiple conditions made licensed cultivation infeasible, especially for pre-existing cultivators. Three years after Riverside established its cultivation permit program, only one farm had become operational. Several others had either applied and failed to obtain a CUP or gotten through the process but failed to open. Respondents criticized the program for its expensive development agreements and fees. One supervisor described these as a “pay to play” scheme that excluded smaller operators. Another official believed policymakers were overly interested in getting “their cut of the pie” – of making money. County officials had shown disdain for people they regarded as “stoners” and “potheads,” he says, but when “guys in suits” and with money arrived, the county began to listen. This official considered this to be a positive development: “I think we in government had to kind of understand and comprehend that this was going to become a *legitimate* business and we needed to get our arms around it and begin to figure out what were going to be the advantages and disadvantages.” This statement confirms some cultivator's intimations that regulations were designed to serve those with money, rather than the public at large. One respondent connected to this to the lack of a county social equity program – repairing drug war harms and supporting affected communities was not part of the county's vision.

Another factor in the county's failure to establish successful cultivation licensing was a delay in establishment of regulations and approval of applications, which did not pass until 2019.

Supervisors got caught in the “minutiae” of regulation, one official reflects. Which zones? Could felons grow? What size parcels? How many permits to grant? How should applications be scored? When the program was created, an initial rush to apply occurred but then most applications and granted permits “just sat there.” “In the meantime, the world’s moving on,” this official says. By the time the county permitted the first cultivation site, the market was in decline and farmers were leery of onerous regulations. This is reflected in county permitting amounts: the Board envisioned issuing up to 50 cultivator and 19 dispensary permits, just in the first wave of approvals. By 2024, only 1 cultivation site and 6 dispensaries had opened.

The Conditional Use Permit (CUP) process delayed the application process significantly. Community opposition foiled business plans, as it did with the first cultivation application. Though the cultivator had issues, “the community lost their minds” over the application, which was agriculturally zoned but surrounded by upper-income residential areas. The person that finally received a cultivation permit was notably a wealthier resident in a poorer community, who encountered little opposition. (Fieldwork from other projects [Getz et al 2024; Moiseeva 2024] has shown that cannabis firms often target poorer, marginal communities to locate their business, since community leaders are more easily controlled and their populations less engaged.)

These delays and barriers made transition to licensure financially and administratively impossible for the vast majority of growers, or “average Joes.” An unsuccessful permitting program, one observer argued, likely led many back to the unlicensed market or to other jurisdictions where they could cultivate legally and with fewer barriers.

Restrictive zoning and a ban on outdoor cultivation excluded most pre-existing cultivators, thus fomenting a problem of unlicensed cultivation. Most farmers never applied for a permit because of overly-strict zoning requirements, according to an official involved with designing the permit program and numerous cultivators. The county restricted cultivation to agricultural and industrial zones. The exclusion of rural ag (RA) and rural residential (RR) land from cultivation permitting was a de facto ban on most rural, outdoor growers, who lived in these zones. This restrictive zoning excluded nearly all legacy cultivators, particularly those who had less wealth, could not relocate, and could not afford to build and permit indoor structures. Their parcels (often on RR or RA land) were suited for small-scale cultivation but their inclusion in county policy was opposed by vocal community groups and their allies in law enforcement agencies, who targeted those rural areas. *Exclusionary zoning, then, structurally ensured that broad swaths of existing growers could never enter licensure and unlicensed cultivation would persist.*

Further, most ag-zoned sites were large parcels ranging from 20 to several hundred acres. Existing farmers on ag land exhibited little interest in transitioning to cannabis. But to the county, the prospect of limiting cultivation to large agricultural sites was alluring: it was easier to regulate a few, large agricultural operations than thousands of small ones, according to one

official. (Few sought permits on industrial lands – despite numerous industrial zoned warehouse areas suitable for indoor cultivation, cannabis-friendly municipalities lured all indoor production to their locales.)

County policy also disallowed outdoor cultivation. One official says he “would have made it easier to grow outdoors” but this policy option was overridden by fears about security and water use. Notably, the water concerns were overestimated – cannabis cultivators were already subject to stringent water rules to obtain state licenses and they use a fraction of the water amount estimated in county debates (especially when compared with other local crops like avocados) (Dillis et al 2023). Security issues were conflated with fears over the unlicensed market – that criminal poachers would invade farms, destroy habitats, threaten neighbors, attract crime, etc. A regulated market would account for these dangers through regulation.

County ban on outdoor cultivation likely drove a move toward mixed-light cultivation. From 2018-20 almost all growth in cultivation density was from mixed-light cultivation. Mixed light dropped from 2020-22, along with all cultivation, but then accounted for 75% of cannabis density growth from 2022-24. The growth of mixed light is likely a product of county rules that ban outdoor cultivation. Any outdoor cultivation is, even for personal use, is banned. Therefore outdoor plants are a clear marker of violation and can attract enforcement.

Growers sought permits in incorporated cities with easier permitting terms. Growers could just as easily locate in one of Riverside’s many cities that established permits early, had fewer costs, and more friendly, efficient permitting processes. Cities like Perris and Desert Hot Springs benefited from the county’s slow rollout, becoming destinations for cannabis firms. This is borne out in license numbers: of 119 active licenses in 2025 only 1 is in unincorporated county lands.

Cities in Riverside will likely see sustained cultivation sectors, as cultivators flee Los Angeles for proximate, more affordable sites. Two licensed growers report moving to Riverside County cities (Perris and Desert Hot Springs) from Los Angeles. Pull factors include more capacity to grow electrical and water usage, lower energy costs, easier and responsive administrative processes for cannabis permits, more reliable labor markets, the ability to obtain larger spaces for expanded cultivation, and, in the last few years of firm failure, bargains on site leases and equipment and improvements left by previous tenants. Push factors included high taxes, licensing caps, and administrative barriers and delays.

Places like Mead Valley or Anza Valley, in unincorporated county, have been bypassed by this municipal growth because of a non-functional county permitting system. Mead Valley (like Anza) is “back to being poor,” one operator says. Even informal markets, called “seshes,” have dried up in places outside of more populous Riverside and San Bernardino urban areas, and the ones that are left are often “dumping grounds” for legal products that expired or cannot otherwise be sold. Though seshes used to sell lower-cost product, legal dispensaries now are competitive on prices as massive oversupply lowers costs. With complaint-driven enforcement a

big factor in suburban and urban places, one grower noticed a migration to more sparsely-populated desert areas in the desert, like Twenty-Nine Palms, where he lives and grows. Others just gave up altogether or moved out of the area for states like Oklahoma. For many of the people moving far away, cannabis is only a specific articulation of a broader crisis of affordability, where people's ability to earn money does not match escalating housing costs.

Riverside County ignored calls by growers for accessible regulations, thus ensuring that legacy growers would be sitting targets for enforcement agencies . Since the early 2000s, a legacy cultivation community had settled around Anza Valley. The area saw a cultivation boom in the early 2010s after the recession (and a High Times article heralding local growing). Prior to 2017, most grew 99 plants, though large gardens on contiguous parcels owned by the same person, might be up to 1k plants. Large gardens were 5k, a knowledgeable grower said, challenging sheriff estimates of 10-50k as typical. Growers typically grossed \$60k in an area with a median of \$37k. Hmong and other Asian growers increased in numbers and mostly "kept to themselves," though one sat on the growers council as a liaison.

Some residents revolted against this influx by forming an anti-cultivation community watch in 2016. This drew the attention of future-Sheriff Chad Bianco and his Marijuana Monday efforts, many of which targeted the Anza region (his substation was close by in Hemet). Growers experienced "constant" flyovers and enforcement over the next several years. Growers perceived busts as a "flex," as with one operation involving helicopters, dump trucks, a staging area, and numerous officers. One grower reported deputies and CDFW officers driving 60 or 70 on a dirt road "as if they were the Mexican mafia," only to "bash in [someone's] gate and...swarm the property as if they're catching [a] serial killer...It's like: they're growing fucking weed, man."

In response – and in preparation for debates on county regulations in 2017-18 – growers organized a farmer's organization that held town halls and grower events and raised money and awareness for things like food bank drives. The growers organization took several actions to build support. They commissioned a water study to look at water table recharge, finding that 3,000 growers (the estimate at the time) growing at moderate scales, would not impact the recharge of the water table. They organized a community board, comprised of pro, anti, and undecided residents about cannabis. The board produced a 30 page report on the history of local cannabis cultivation and what policy solutions existed. This included a grower survey demonstrating interest in legal participation if they were protected from enforcement. Their long-term hope was to establish a designation of origin that valued local climate and geophysical conditions, which would create a pathway for local economic development and create a "farmers market" cannabis culture. To get there, they needed the county to: a) allow outdoor cultivation; and b) approve Rural Residential and Rural Agriculture zones for cultivation.

The county rejected both of these proposals, "wiped their ass" with the report (in the words of one grower) and acted on a report by the planning commission, which never visited the area to hear from residents. Farmers in the Anza-Aguanga-Sage region were categorically

excluded through zoning laws while expensive requirements and an outdoor ban excluded farmers as a matter of fact. As a result of being excluded from regulations, growers persisted in business as usual.

This population of rural cultivators became a perennial target of enforcement agencies, including both Planning and the Sheriff's office. Statistics of busts and abatements should be read with this in mind – if small-scale, legacy cultivators had been included in county permitting, they would not be sitting ducks for enforcement and the ballooning of enforcement statistics. Further, tensions between cannabis growers and local residents may have been addressed and resolved through regulations, rather than life-altering enforcement.

Since the cannabis price crash, the “old heads” are gone, sick and poor people have given up growing for fear of losing their properties, and destitution has reassumed its role in this low-income area. “A lot of farmers don't know any other way of life. I know even young farmers that have been growing since they were 18, and now they're zoned out...there are no job opportunities for them.” Residents were stuck – they had “spent their life savings buying [a] property...knowing this is where I can farm. And you can't just expect them to buy a million dollar property just to grow weed.” One grower observes, “the people who were willing to do [it right] were the ones that got the door shut in their face.” To make consistent money, a small grower would have to quintuple their crop size and footprint on relatively small 5- or 10-acre parcels that constitute most of Anza Valley. This scale would make them an enforcement mark but, more importantly, “nobody had the infrastructure to go bigger.” Indoor cultivation in Anza never took off, because it was not profitable for most growers to make the necessary investments.

Rural residents had substantial quality of life concerns, yet struggled with the benefits cultivation brought to a depressed community. Since Anza cultivation played an outsized role in county perceptions of unlicensed cultivation, it is worthwhile to explore its intricacies and what it reveals about cultivation. Public attention on cultivation in the area began in 2016, with a community meeting organized by a community group in Anza Valley where law enforcement and officials fielded complaints from residents.

In a focus group we conducted of members in a residential community watch program, many of these complaints were repeated – vagrants, fears of robbery, restrictions on movement of people and horses over private property, and water issues (namely that “legitimate residents” had built wells that were drying up, ostensibly because of cannabis growers). Many had moved to the area to “enjoy the outdoors, smell the fresh clean air” – they “wanted to breathe” after years of living off the I-15 or I-215 and living their lives inside. Cannabis smells, they said, polluted this pure air and symbolically disrupted their lifestyle hopes. Land use patterns shifted as makeshift housing was erected, vacant land developed, fences were built, shade cloth hung, easements closed, U-Haul trucks picked up loads in the night, and generators were fired up. Cannabis growing became noticeable to them after the 2008 mortgage crisis and properties were

bought by growers, marking a shift away from meth production (and related property crimes). Cheap land and water were the main draws, along with the moderate climate.

Ironically, the influx of growers shrunk property supply and inflated property prices, benefiting non-cannabis residents. Some residents did not have to sell to cash in – many accepted significant sums of money to lease parts of their property to growers. These payments were an important source of income for locals on fixed incomes or SSI. It could also work out badly for owners – growers might lease land but abandon it after a bust, leaving the landlord to pay fines and remediation costs. Realtors (along with well drillers and hardware and horticulture stores) also consistently made money off land deals, leading the focus group to reflect on how they were implicated in the growth of cannabis, even if indirectly. When enforcement pushed cannabis indoors, however, many houses were blighted, leaving landlords with large bills. One resident reports that nearly 90 properties in the area were for sale, signalling an area being vacated quickly, and 20 had uninhabitable residences. The exit of many growers also increased vacancies and home prices declined.

Residents traced their ire at cannabis to a more general sense of neglect in the county, as a result of being a relatively poor, remote community burdened with the status of being “habitat land,” that limited development and land use in the name of resource stewardship. One resident called the area a “sacrifice zone” for the greater county and region to provide ecological services, like those in the Endangered Species Act. Though they disliked these restrictions, they were angry that unlicensed cultivators flouted rules they had to follow. Some expressed sympathy for growers who could not become permitted because of restrictive rules, but nonetheless believed growers should relocate if they wanted to grow. They knew cannabis could provide local economic development, but it did not match with local norms (as they define it). In a state of arrested development, amidst environmental and land use restrictions, they saw cannabis *enforcement* as a way of garnering attention and resources from the county, especially when cannabis was named as an environmental threat.

Ultimately, the demand for enforcement should be seen as a desire for more resources and attention from the county. Cannabis enforcement provided a mechanism to gain those resources and attention.

Cultural and racial animus played an enduring role in justifying more stringent enforcement approaches. One of the reasons Anza area residents believed enforcement was necessary was because growers did not fit with local cultural norms, as they perceived them. By way of explanation, residents would often appeal to ethnic and racial tropes to explain this irreconcilable difference. One woman, who rode her horse across property lines (and would report unlicensed gardens) was stopped by a “Mexican” person with a rifle. Over the years, she noted a shift from “moms and school bus” traffic to “Asian people in their Toyotas,” commuting from other areas into Anza Valley. While realtors had to be “colorblind,” one resident (a realtor) reported that she got around this by only working on referrals. She wouldn’t explicitly reject

Hispanic and Asian buyers but she would only work with people recommended in her (mostly white) clientele list. She continued that she “refused to sell out my community to this scourge,” even if this meant a declining real estate business.

Residents, who were white or Hispanic citizens, consistently noted the ethnicity of growers, but were careful to register these as empirical observations rather than racist sentiments. One person expressed discomfort when empirics became judgment: “I don’t want to feel this way and judge you this way, but you see it and you’re like, yeah, [it’s true.” She continued, “all of us don’t feel like we are prejudiced...especially by your skin color or nationality.” Ethnic markers were consistently implied, however, in discussions over the threat of “cartels,” which law enforcement told them were present, and the decline of a “wholesome community” and “country life” with a “small town atmosphere” where grandchildren could visit. Whose children and who constitutes “community” was left unremarked. Physical fences, shade cloths, and monitored property lines were manifestations, or markers, of the linguistic and cultural barriers that separated white residents from ethnic residents.

Residents were open to outsiders and non-white people, so long as they assimilated slowly, but the influx of growers created an “alien nation overnight.” Residents interpreted growers’ actions as “disrespect” and would have been fine if the growers had come in “quiet, clean, respectful.” The racial-ethnic division became self-reinforcing as residents complained about growers and growers retreated further from local life, leading one woman to allege that they “don’t help in any way in the community,” like paying for shared roads. This woman, however, was finally able to talk with her neighbors, after a conflict over a loose dog, finding they both had children in the military and were US citizens. She chalks their growing and flouting of norms as cultural ignorance: “they don’t understand what they’re doing is wrong.”

Enforcement agencies built upon these racial and citizenship sentiments to justify ongoing enforcement. The sheriff’s department asserts that cultivation is cartel driven, though few local cases have traced this connection and this information derives from federal investigations. Enforcement agents in neighboring San Bernardino do not believe cartels are present in any appreciable way (though domestic gangs are). One recent case did find cannabis being shipped on a container, hidden in furniture, destined for China, and was traced back to 15 residential cultivation sites in Eastvale, on the county’s western edge. Other cases have tracked cannabis to and from other states like Minnesota, Michigan, and Wisconsin, largely through southeast Asian circuits. While people of color and immigrants may participate in the unlicensed cannabis market, this is often attributed to “organized” and “criminal” activity rather than to exclusion from formal, legal economic systems and systems of cultural-ethnic support, as research has found elsewhere (Getz et al 2024).

Though the cannabis rush was subsiding by 2020 in Anza, a massacre of seven people (likely gang related) at a cannabis farm in Aguanga led to an intensified public focus on cannabis, violence, and ethnicity and contributed to the sustained policing of the Anza area. All

victims were of Laotian descent living in makeshift dwellings and tending 1000+ plants. This incited further enforcement responses, that some described as overly-aggressive and performative. For instance, in 2023, a veteran and cannabis grower sued the county for “shock and awe” raids that involved 100 armed officers, an armored vehicle and helicopter (Lotshaw 2023). The grow, however, was on sovereign Cahuilla tribal land and was permitted by the tribe. The grower had told the sheriff’s department of his site, fearing a mistaken raid. The sheriff’s department raided the site anyhow. Though officials, cultivators and residents in the Anza area report a steady decline in cannabis cultivation since 2020, the sheriff’s department continues eradication efforts coupled with an aggressive PR campaign heralding their effects on cartels, human/labor trafficking, and environmental destruction to outlets like NBC Nightly News. One deputy noted, that “while I’m seeing a decline in the overall marijuana that’s out there, there has been no decline in our enforcement. If anything, it has increased.”

Code enforcement efforts were effective at discouraging smaller-scale residential outdoor and mixed light cultivation in suburban and urban areas, though some growers have adapted and continue. Cannabis Regulation Task Force (CRTF) was a multijurisdictional code enforcement effort that largely responded to complaints and was therefore more active in populated areas. In a year-long foray (2018-19), Cannabis Regulation Task Force (CRTF) shut down numerous dispensaries in Riverside’s southwestern 1st District, especially in Harupa Valley, Temecula, Perris and Lake Elsinore. They “almost worked [them]selves out of a job with dispensaries” by shutting them down.

As with dispensaries, CRTF was successful in shutting down backyard cultivation sites. Most backyard growers were casual, opportunistic growers, cultivating for extra cash, expecting low risks of enforcement. They were not eager to pay fines or civil processes and CRTF found success with abatement orders. Some moved indoors, especially for smaller gardens for personal or medical use, though some maintained greenhouses or simply stopped cultivating.

Several people noted a decline in full-blown residential “grow houses” – houses entirely dedicated to indoor cultivation – as neighbors became attuned to telltale signs, leases tightened, and electric and water bills were utilized to establish clear evidence trails of cultivation for prosecutors. One supervisor’s aide says that by 2022 they were not receiving any constituent complaints for residential area cultivation, an account that squares with cultivator narratives and the experience of grow store owners that have seen a dramatic decline in sales to small-scale home growers, who had been a pillar of their revenue stream. Commercial-scale illicit cultivation in warehouses has likely persisted, though numerous respondents, including an indoor permitted operator and two grow store owners, observe that no *new* cultivators are setting up large indoor grows and many existing cultivators left the region or the sector altogether.

A trend toward “own-grows” has started in some county areas – people are getting lights for basements or greenhouses for their backyard, aiming to produce quality product for themselves, their families and friends. Some grow for side income, though finding a market

outlet is a challenge. Mixed light greenhouses are most popular, since electricity costs are too expensive. For many cash-strapped users, producing their own is a way to save money by avoiding expensive retail costs. Grow stores still serve as an educational hub for these hobby growers but people want “a recipe” to ensure efficient growing. There is little artisanal interest or experimentation.

Law enforcement was effective at stopping rural cultivation but code enforcement was perceived to be more effective in the long run at ensuring cultivation did not continue. Rural cultivation – particularly in the Anza-Aguanga-Sage region – was a key target of Riverside’s sheriff from 2017 onward. This region was likely the largest concentration of outdoor/mixed light cultivation in unincorporated areas. As the lieutenant-then-sheriff escalated enforcement from 2017-2019, one deputy recalls “it was harder to find a parcel that did not have marijuana on it than it was to find one with it.” The grows were mostly outdoor, hidden under thinned out manzanita and red shank canopies, and often yielded relatively large plant numbers (i.e. 1-20k) during busts. By 2022, the Sheriff noted that most grows were “down and dismantled” and he was “amazed at the lack of growth.” His program “made a huge difference,” and he was proud he had done it without new budget allocations. He had reallocated existing positions and resources to cannabis, as with one deputy in Hemet who, in 2022, spent 100% of his time on cannabis and supervised a team of eight. In his station, they aimed to “hit” one grow a day, equaling 250 in 2022. Despite his efforts, he estimates there are still 3500 grows in the Anza Valley area alone. The sheriff argues more resources (beyond his half billion dollar budget) would allow him to address these grows by quadrupling the size of his enforcement team.

After 2018, growers initially moved to more building-dense areas on private land and, as enforcement escalated and the county banned outdoor cultivation, they moved to greenhouses to evade detection. One official remarks that 2019 was “the last year things were out of control.” The remaining grows are often on repeat sites where absentee landlords (usually LLCs) repetitively lease land to naive growers. “Almost every grow” the county busts has been busted before and there seems to be “no deterrent” for the remaining sites, says one officer. By 2022, the maximum size of individual grows had decreased from 50k plants max to 10k and often much smaller. Of the growers left, many are stopping because of low prices or are stuck with withering product, according to a deputy and a local advocate.

At first, local residents sought law enforcement assistance to shut down these cultivation sites but they came to see that code enforcement was more effective in keeping cultivation at bay. CRTF became increasingly important in pushing cultivation out of Anza Valley, as it became more hidden and residents became more skilled at reporting small land use violations. In 2020-21 CRTF sent hundred of letters to non-compliant cultivators. This foray, an official estimated, addressed 800 grows. Residents became frustrated over time with sheriff-led raids that would leave behind blighted, trashed properties and wild dogs. Police warrants were harder to obtain for indoor operations but residents found civil warrants from CRTF and Planning were more effective than the sheriff at identifying and addressing indoor cultivation. While the sheriff

reported responsiveness to citizen complaints, local residents saw more proactive engagement by CRTF/Planning. Code enforcement actively solicited complaints and gave residents a sense of being listened to. This led to some abuses as some residents reported any code violation (fences, trailers, etc) out of a sense of revenge – “anything to make [growers’] lives difficult because they’ve made our lives [difficult].” One person backed away from vindictive reporting, saying that it was “impacting negatively my quality of life,” as it made her focus on only negative things.

CRTF proponents continue to argue that the investigative partnership with the DA combined with the administrative tools of code enforcement is the best combination for more permanently shutting down sites and transforming local landscapes. One official contrasts CRTF’s approach with criminal enforcement, arguing that civil enforcement “takes the morality out of” policy, by reframing cannabis not as a crime but as a land use issue. They argued law enforcement alone was not sufficient, appropriate, or even effective – sites would be raided only to emerge again later, without ongoing monitoring that civil enforcement practices enable. Civil liability and fines were a “better way of enforcing the law” because “it has more effects” on violators and holds “a lot more sting.” Ultimately, CRTF aimed not to punish but to “protect the legal market” by “taking out unfair competition” and “unfair business practices” of illegal market actors against legal market actors. While there is a role for law enforcement, they argued, it is just one tool among many to address unlicensed cultivation.

Despite a reputation for stringent enforcement, cultivation grew from 2018-20 and 22-24, suggesting that other factors were more important than enforcement in whether cultivation occurred. Though Riverside has a high enforcement reputation, they showed significant growth in cultivation for two of three periods. While the first period was not particularly remarkable, the latter period (2022-24) was significant in that Riverside – despite years of intensive enforcement – saw the 4th largest increase in cultivation of 30 counties. Notably, in 2024, Riverside County had the most plants eradicated of any county in the state. The only other counties that had high enforcement reputation that saw increases in cultivation from 2022-24 were Kern and San Bernardino, both counties that are more proximate to Los Angeles consumer markets, east-bound highways, and some cheaper land.

Hemp permitting first led to nearby increased unlicensed cultivation, but that effect reversed as inspections and enforcement increased. Though the county banned hemp in 2018, the county approved a Hemp Activities Ordinance in 2020 establishing a permit program, including setback, energy, and water requirements. Of approximately 150 permits granted, 100 were in the Anza Valley. A permit was only \$50 (compared to hundreds of thousands for a permitted cultivation site). This initially led to a boom in cannabis masquerading as hemp on hemp-permitted farms and led to unlicensed cannabis farmers pretending as if they had a hemp permit. This boom reached its height in 2020-21 but by 2022 the county (particularly Planning and CRTF) had responded with robust inspection and abatement processes.

Hemp operations posed problems for Planning, the DA and Sheriff. One deputy reported nervousness about raiding licensed hemp farms because of lawsuits. Since hemp is treated as a different crop from cannabis, officials have to be diligent in proving non-compliance to avoid lawsuits and lengthy appeals for wrongful eradication or license revocation. The sheriff now cross-checks hemp permit parcels before raiding cannabis sites. Planning's CRTF partnered with the Agricultural Commission to review existing permittees and found on test warrants that growers were consistently over THC limits. By 2022, authorities responded by shutting down 80% of hemp farms and many farms on adjoining land. One farm had 4000 cannabis plants (not low THC cannabis) in 15 greenhouses. Another had 34k plants in 130 greenhouses and was not compliant with reporting requirements or THC content. Some growers without hemp permits attempted to blend in with neighboring hemp farms by posting "No THC" signs. In 2022, supervisors tightened restrictions on hemp sites, including odor control and water inspections. The process is now so tight that even established farmers report trouble entering the system.

By 2022-24, the largest decrease in cultivation was near other permitted farms. In line with state trends, cultivation declined most quickly near other permitted sites (including sites in incorporated cities). This effect was significant – when permitted sites were present, unlicensed cultivation decreased drastically but when permitted sites were not present, cultivation actually increased in greater quantity. The overall increase of cultivation was entirely due to cultivation increases far from permitted sites.

During observations in 2024, officials, grow store owners and cultivators alike believed cannabis cultivation was in decline (despite Cannavision's detection of a moderate increase). Grow store operators along the 215 in southwestern, suburban Riverside county reported that local cultivators had largely disappeared. These grow stores depended on unlicensed and small personal and medical gardens and were struggling to survive as these growers disappeared. On a Wednesday afternoon visit, the owner reported that lines would normally have been out the door but there was not one customer in sight. Now most growers try to sell their equipment *back* to grow stores or online. Another grow store near Perris and Mead Valley displays an entire section of the store that is used grow equipment (e.g. ducting, generators, pumps, water tanks) they have bought back from growers leaving the industry. This store is stuck with stock of expensive inputs and supplies and only low-cost items are moving, reflecting a tightening profit margin for growers. Very few people place large orders, suggesting warehouse grows are declining, and bigger equipment is only ordered by current operators – no new cultivators are setting up. Even the grow store more proximate to Anza Valley had shut down, despite Anza being the "last place" left with unlicensed cultivation of significance.

It is likely, then, that the bulk of growers had disappeared, especially in population-dense areas in the county's southwest and Coachella Valley. Despite lower number of grows, it is possible a few large outdoor and mixed-light cultivation sites produced an overall increase in Cannavision detection (e.g. in 2025 an 800-acre cultivation site was raided in eastern Coachella Valley).

Building density, proximity to public land, and agricultural land variables indicated a move toward more open, populated land (2018-20), a move away from these areas as enforcement was implemented (2020-22), and a modest movement back to these areas in 2022-24.

Movement to more dense areas away from public land made sense in 2018-20 as growers sought to grow in more amenable, less distant areas. In 2020-22 enforcement by the Sheriff and CRTF was at its height and pushed growers back into more remote locales (less building density, closer to public land, further from ag land). (During this period, overall cultivation decline, but cultivation declined much slower in remote areas.) In 2022-24, there was a slight movement back again toward areas with more building density and with agriculture.

Conclusion

Riverside County demonstrates how restrictive permitting programs can end up creating a problem of unlicensed cultivation among excluded growers. Stringent programs also preclude benefits for firms and communities, as cultivation prospers in some places (e.g. cities) and not in others (e.g. rural areas of Anza, Aguanga and Sage). Subsequent appeals to law enforcement might be effective in stopping cultivation immediately but are not effective in the long term (i.e. by 2022-24 cultivation was increasing in this historically enforcement-intensive county). Code enforcement measures can address cultivation over a longer period but they are best-suited for populated areas, where complaints are more likely, and they can produce antagonisms – especially along racial and ethnic lines – within communities instead of creating greater understanding or compromise. Further, cannabis enforcement of whatever type does not solve perennial problems of residents, namely the sense that they are underserved and underinvested. Riverside shows that targeted enforcement interventions, like those against hemp-proximate cultivation, can be effective. Similarly, permitting terms (like bans on outdoor cultivation) can also shape unlicensed cultivation. Overall, Riverside demonstrates the value of permitting cannabis, as proximity to permitted sites became the number one indicator of reductions in unlicensed cultivation.

Contributions to Report Findings

Objective 1 Assessing Unlicensed Production Amounts and Geography

Finding #1: In the years following legalization, unlicensed production showed an initial expansion, rapid retraction, then stabilization.

- Ethnographic data identified early localized increases in unlicensed cultivation from 2018–2020, particularly in the Anza Valley and parts of Temecula.
- These increases occurred despite strict zoning prohibitions that excluded rural residential areas from cultivation.

- The county permitted only one farm in its first several years, and participants described widespread exclusion of legacy cultivators due to high costs and restrictive criteria.
- From 2020–2022, unlicensed cultivation declined under intensified enforcement, particularly in suburban and accessible rural areas.
- By 2022–2024, ethnographic data indicated renewed increases, especially in areas with affordable land and easy market access (e.g., Perris, Mead Valley).
- Participants attributed the rebound to economic factors, including land affordability and proximity to major consumer markets and transport corridors.

Finding #2: Cultivation moved from the hills to the flatlands and back again.

- Ethnographic data revealed that between 2018–2020, both suburban and rural growers moved toward flatter private lands in the Perris/Mead Valley area and eastern Coachella Valley.
- Many new cultivators hoped to gain permits or blend into licensed hemp and agricultural operations, though zoning restrictions ultimately excluded most.
- From 2020–2022, ethnographic data recorded movement away from hemp-permitted and agricultural zones due to heightened civil enforcement and code inspections; some growers relocated toward more remote public lands to avoid neighbors and regulators.
- By 2022–2024, CannaVision suggested modest re-expansion into flatter areas, which ethnographic participants attributed to cheap desert land, reduced enforcement intensity, and proximity to large Southern California markets.
- Licensed market transfer data showed the region’s centrality in the state’s cannabis logistics network, supporting the inference that unlicensed cultivation benefited from market proximity and transportation access.

Finding #3: While participation in the unlicensed market was broad initially, increasingly the people left cultivating are those in tenuous socio-economic situations and attached to place for cultural-historical reasons.

- Ethnographic accounts portrayed Riverside’s unlicensed landscape as more fragmented and socio-economically diverse than that of northern counties, reflecting its large geographic span and proximity to major population centers.
- By 2022–24, persistence in the unlicensed market was largely tied to affordability and land access in the desert and exurban zones of eastern Riverside, where cheap parcels enabled marginalized or semi-formal cultivators to continue small-scale production.
- Though less defined by tight community cohesion than in northern cases, some rural enclaves nonetheless developed local support networks and informal economies around cultivation.
- Economic precarity was the primary driver of persistence: for many residents, cannabis remained a stopgap livelihood in areas with few employment opportunities, rather than a continuation of legacy cultural identity.

- Ethnographic data also indicated that some predatory leasing and lending practices were present here, particularly in lower-income and migrant-dominated zones, though less pronounced than in the north.

Finding #4: Unlicensed cultivation generally migrated out of public lands because of lower consequences on private land.

- Ethnographic data documented a clear shift out of public lands (particularly near Anza and the San Bernardino National Forest boundary) during the early legalization years, driven by coordinated federal and county enforcement.
- Public land cultivation had once been common in these upland areas, but by 2020, most activity had moved to private or quasi-private holdings in exurban zones such as Perris, Mead Valley, and parts of eastern Coachella Valley.
- Later in the study period (2022–2024), some cultivators entered into informal or semi-formal partnerships on tribal lands, which offered unique jurisdictional protections and were perceived as safer from county enforcement.
- The ethnographic record suggests these shifts were driven by both “push” and “pull” dynamics—heighted enforcement on federal lands combined with economic opportunity and jurisdictional complexity on tribal and private lands.

Finding #5: Transition from Outdoor to Mixed-Light Production.

- Ethnographic data highlighted that suburban and desert growing conditions made mixed-light cultivation more viable than outdoor growing.
- Enforcement concerns and local policy prohibitions against outdoor cultivation encouraged growers to adopt greenhouses to appear compliant with “mixed-light only” regulations.

Objective 2 Identifying Factors Influencing the Observed Extent of Unlicensed Cultivation

Finding #1: Presence of licensed cultivation was the primary deterrent of unlicensed cultivation.

- Although few cultivation licenses were issued, unlicensed cultivation near licensed farms declined, underscoring the localized deterrent effect.
- In suburban and densely populated areas, communities became more aware of cannabis regulations, exerting social pressure against illegal operations.
- Licensed farms were typically large-scale, capitalized enterprises, while unlicensed growers dispersed into rural or lower-cost regions.
- Ethnographic data suggested limited overlap or interaction between licensed and unlicensed groups, reflecting distinct social and economic strata.

Finding #2: Bans Were Not a Consistent or Powerful Indicator of Growth or Decline in Unlicensed Cannabis Cultivation.

- Riverside functioned as a de facto ban county due to restrictive zoning and high barriers to entry for permitting.

- Ethnographic evidence described reliance on intensive law enforcement operations that initially reduced cultivation but were unsustainable over time.
- Following major enforcement efforts, unlicensed cultivation rebounded during 2022–24.
- The lack of an effective permitting framework prevented lasting deterrence or integration of cultivators into the legal system.

Finding #3: The Perceived Likelihood of Strong Enforcement Was an Initial Deterrent, but Became Less Important Over Time.

- Ethnographic data revealed that early enforcement efforts in areas such as the Anza Valley caused some cultivators to leave or relocate to less visible, rural regions.
- Despite an initial deterrent effect, by 2022–24 unlicensed cultivation rebounded, particularly in desert and mountain areas.
- Strict enforcement fostered consolidation of more organized operations and displacement of smaller, less-resourced growers.
- The county’s dependence on law enforcement, rather than civil or regulatory tools, produced short-term gains but no sustained reductions in unlicensed activity.

Finding #4: Over Time, Civil Policy and Civil Enforcement Efforts Became Key Drivers of Declines in Unlicensed Cultivation.

- Ethnographic data described an early, strong civil enforcement program targeting unlicensed cannabis near hemp operations from 2020–22, leading to widespread abatements.
- Enforcement around hemp farms was especially effective in this period, reducing unlicensed activity in those zones.
- Civil enforcement became less consistent by 2022–24 as programs were defunded and neglected, while law enforcement efforts remained reactive and unpredictable.
- Cultivators relocated to remote desert and mountain regions, where enforcement costs were higher and oversight was limited.
- Code enforcement was found to produce more enduring abatements than policing due to its broader set of regulatory tools.

Finding #5: Troubles in Permitting Programs Prevented Many Cultivators from Becoming Licensed.

- Ethnographic data described Riverside’s program as heavily constrained by financial and procedural barriers that excluded most small or legacy operators.
- High fees, stringent zoning, and protracted environmental review made entry into the legal system impractical for most cultivators.
- Some municipalities within the county offered more accessible alternatives, drawing away many potential county applicants.
- As a result, the majority of cultivators remained unlicensed or relocated to other jurisdictions with lower administrative burdens.

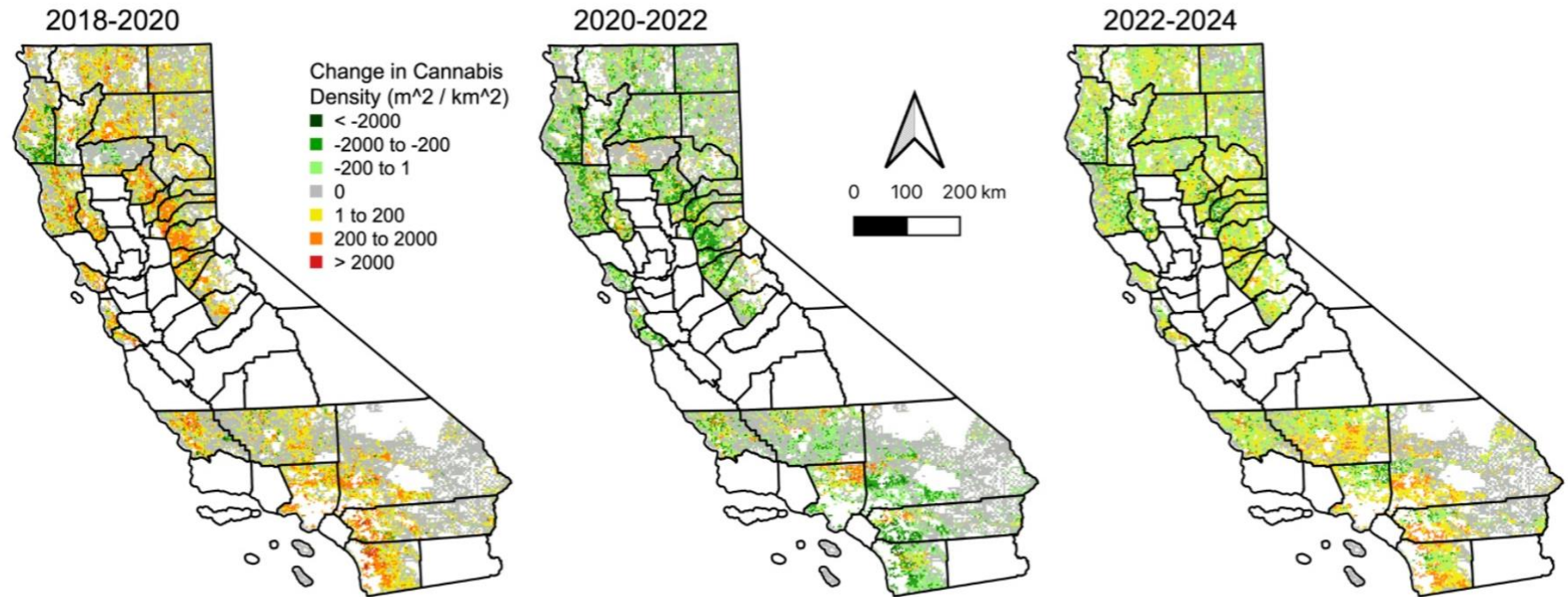
Finding #6: Cultivation Bans and Other Enforcement Policies Were Linked with Whack-a-Mole Dynamics of Unlicensed Cultivation.

- Ethnographic findings described both spatial movement and site repetition in unlicensed cultivation.
- Some growers re-established operations on previously enforced sites, especially in remote desert or mountain regions, indicating that enforcement did not create lasting deterrence.
- In suburban or densely populated areas, enforcement outcomes were more final, likely due to greater visibility and neighborhood scrutiny.
- The proximity of urban markets and transportation corridors may have contributed to the persistence of cultivation despite economic downturns.

Finding #7: Market Forces and Price Decline Were Major Factors in Siting Decisions.

- Ethnographic data indicated that cultivators increasingly relocated to lower-cost eastern desert areas after 2021 as prices declined.
- Some respondents described returning to previously used sites in remote zones to minimize costs despite higher enforcement risks.
- A modest rebound in unlicensed cultivation was observed in higher-value areas of southwestern Riverside, likely due to proximity to consumer markets and established infrastructure.
- Economic stress and enforcement penalties jointly influenced decisions to conceal or downscale operations, including a shift toward mixed-light systems to reduce visibility and crop loss risk.

APPENDIX 7: SPATIOTEMPORAL MAPS OF CULTIVATION TRENDS



APPENDIX 8: COMPOSITE INDEX SCORES AND ENVIRONMENTAL ANALYSIS

County	PropWatersheds Critical	CritWatershed Rank	Undeveloped proportion	Undeveloped Rank	StreamNet Density	StreamNet Rank	Composite Rank
Mendocino	0.91964286	2	84.8287767	21	4.86E-07	10	11
Humboldt	0.73469388	7	81.3159784	25	5.71E-07	4	12
Tehama	0.61797753	8	91.5232416	16	3.02E-07	21	15
Sierra	0	41	97.6859738	4	6.72E-07	1	15.333333
Trinity	0.08791209	30	94.9060229	10	5.30E-07	6	15.333333
Alpine	0	41	98.5872881	2	5.43E-07	5	16
Santa Cruz	0.91666667	3	57.8880395	42	5.77E-07	3	16
Sonoma	0.90909091	4	73.875733	29	3.60E-07	16	16.333333
Tuolumne	0.01492537	38	96.9286358	5	5.06E-07	9	17.333333
Shasta	0.26446281	24	92.5531516	15	3.41E-07	18	19

Nevada	0.03333333	36	93.3305812	13	4.09E-07	11	20
Placer	0.17391304	27	79.6971785	26	5.13E-07	8	20.333333 33
Plumas	0	41	95.6203937	8	3.91E-07	12	20.333333 33
Del Norte	0.05128205	33	76.1172645	27	6.72E-07	2	20.666666 67
Lake	0.06666667	31	88.0226149	20	3.74E-07	13	21.333333 33
El Dorado	0	41	91.1063778	18	5.16E-07	7	22
Mariposa	0	41	98.1187705	3	2.70E-07	22	22
Napa	0.38095238	16	82.3277847	23	2.21E-07	27	22
Marin	0.80769231	6	53.5777556	45	3.48E-07	17	22.666666 67
Calaveras	0.02777778	37	95.1506811	9	2.55E-07	24	23.333333 33
Mono	0	41	95.6847739	7	2.55E-07	23	23.666666 67
San Mateo	0.86666667	5	41.7544378	51	3.62E-07	15	23.666666 67

Amador	0	41	93.6773374	12	3.06E-07	19	24
Santa Clara	0.5	11	70.9217807	33	2.05E-07	29	24.333333
Siskiyou	0	41	90.560436	19	3.67E-07	14	24.666667
Monterey	0.54081633	10	73.87251	30	1.19E-07	36	25.333333
Butte	0.2826087	22	66.4727527	37	3.04E-07	20	26.333333
San Luis Obispo	0.40625	13	81.8717369	24	7.54E-08	44	27
San Benito	0.34146342	17	92.7524013	14	4.71E-08	51	27.333333
Ventura	0.43396226	12	68.1610797	36	1.24E-07	35	27.666667
Santa Barbara	0.38636364	14	64.6245848	39	1.19E-07	37	30
Modoc	0	41	91.4843163	17	1.35E-07	33	30.333333
Inyo	0	41	99.0371167	1	4.93E-08	50	30.666667
Lassen	0	41	94.9035241	11	9.78E-08	40	30.666667

Solano	0.33333333	18	44.0072519	50	2.06E-07	28	32
Glenn	0.2	26	62.2635119	40	1.45E-07	32	32.66666 67
Yuba	0.33333333	18	64.8648383	38	8.42E-08	42	32.66666 67
Tulare	0	41	70.7532386	34	2.51E-07	25	33.33333 33
Madera	0	41	69.0686602	35	2.35E-07	26	34
Alameda	0.2173913	25	55.5725054	44	1.28E-07	34	34.33333 33
San Bernardin o	0	41	95.9538228	6	9.80E-09	57	34.66666 67
Sacramen to	0.38461539	15	33.3165615	53	1.07E-07	38	35.33333 33
Contra Costa	0.3	21	46.9480296	47	1.05E-07	39	35.66666 67
San Joaquin	0.61538462	9	19.5839433	55	8.09E-08	43	35.66666 67
Sutter	1	1	12.8474228	57	5.12E-08	49	35.66666 67
Colusa	0.03703704	34	49.9524691	46	1.81E-07	31	37

Fresno	0	41	59.3530882	41	2.03E-07	30	37.33333 33
San Diego	0.0078125	39	75.7184225	28	5.52E-08	48	38.33333 33
Riverside	0.00534759	40	84.2739892	22	2.62E-08	54	38.66666 67
Stanislaus	0.275	23	46.7938079	48	7.44E-08	45	38.66666 67
Merced	0.05769231	32	46.4490696	49	9.30E-08	41	40.66666 67
Imperial	0	41	72.9904264	31	3.03E-08	53	41.66666 67
Los Angeles	0.03539823	35	56.0480804	43	5.54E-08	47	41.66666 67
Yolo	0.0952381	29	34.4782865	52	5.96E-08	46	42.33333 33
Kern	0	41	72.8102033	32	2.06E-08	55	42.66666 67
San Francisco	0.33333333	18	1.6786859	58	3.41E-09	58	44.66666 67
Orange	0.13636364	28	32.8737624	54	1.14E-08	56	46
Kings	0	41	19.1767607	56	4.15E-08	52	49.66666 67

APPENDIX 9: CENTERS OF PRODUCTION: CANNABIS CULTIVATION METHODOLOGY AND LAND USE CHANGE IN FOUR CALIFORNIA CANNABIS GROWING HOTSPOTS

Key Conclusions

- **Methodological Transformation:** A profound shift from outdoor cultivation (87% in 2016) to greenhouse structures (79% by 2022) occurred across all four study regions (Post Mountain (Trinity); Rancho Sequoia (Humboldt); Shasta Vista (Siskiyou); Covelo (Mendocino)), regardless of regulatory environment.
- **Regional Variation:** The transition occurred at different rates and scales, with Shasta Vista and Covelo exhibiting the most rapid and extensive greenhouse expansion, Post Mountain showing steady growth, and Rancho Sequoia maintaining the smallest greenhouse footprint.
- **Policy Factors:** Both ban counties (Siskiyou) and permit counties (Mendocino, Trinity, Humboldt) experienced similar methodological transformations, suggesting market forces may be more influential than specific policy approaches.
- **Environmental Implications:** The shift toward greenhouse cultivation represents a complex environmental trade-off, with increased energy consumption compared to outdoor cultivation and greater potential impacts on biodiversity through habitat disruption and ecological alteration.

Summary

This appendix presents a comprehensive analysis of cannabis cultivation methodology changes across four key growing regions in Northern California from 2016 to 2022. Using Machine Learning (ML) object detection modeling and spatial analysis, we documented a thorough transition from predominantly outdoor cultivation to greenhouse-based production across all study regions. The research reveals both common trends and regional variations in how cannabis cultivation has evolved in response to market forces, enforcement, and policy frameworks.

The four regions studied, Shasta Vista (Siskiyou County), Rancho Sequoia (Humboldt County), Post Mountain (Trinity County), and Covelo (Mendocino County) represent diverse regulatory environments, including both ban counties and permit counties. Each county government implemented distinct regulatory frameworks with varying degrees of enforcement intensity, cultivation limitations, and compliance requirements, resulting in markedly different legal environments for cannabis producers. Despite these policy differences, all regions displayed a similar methodological shift toward greenhouse cultivation, though at varying paces and scales. By 2022, greenhouse structures had become the dominant cultivation methodology (79% of all sites) across all four regions, representing a complete inversion from 2016 when outdoor cultivation comprised 87% of sites.

This spatial and temporal analysis provides insights into how cannabis cultivation has adapted to California's post-legalization landscape, with implications for land use planning, environmental management, and policy development in regions where cannabis production represents a significant economic activity.

Background

2.1 Cannabis Regulation in California

California's cannabis regulatory landscape underwent significant transformation following the passage of Proposition 64 in 2016, which legalized adult-use cannabis and established a comprehensive statewide regulatory framework. However, the proposition also affirmed local control, allowing counties to either permit commercial cannabis activities or implement bans. This created a patchwork of regulatory approaches across the state, with some counties establishing permit programs while others enacted complete prohibitions.

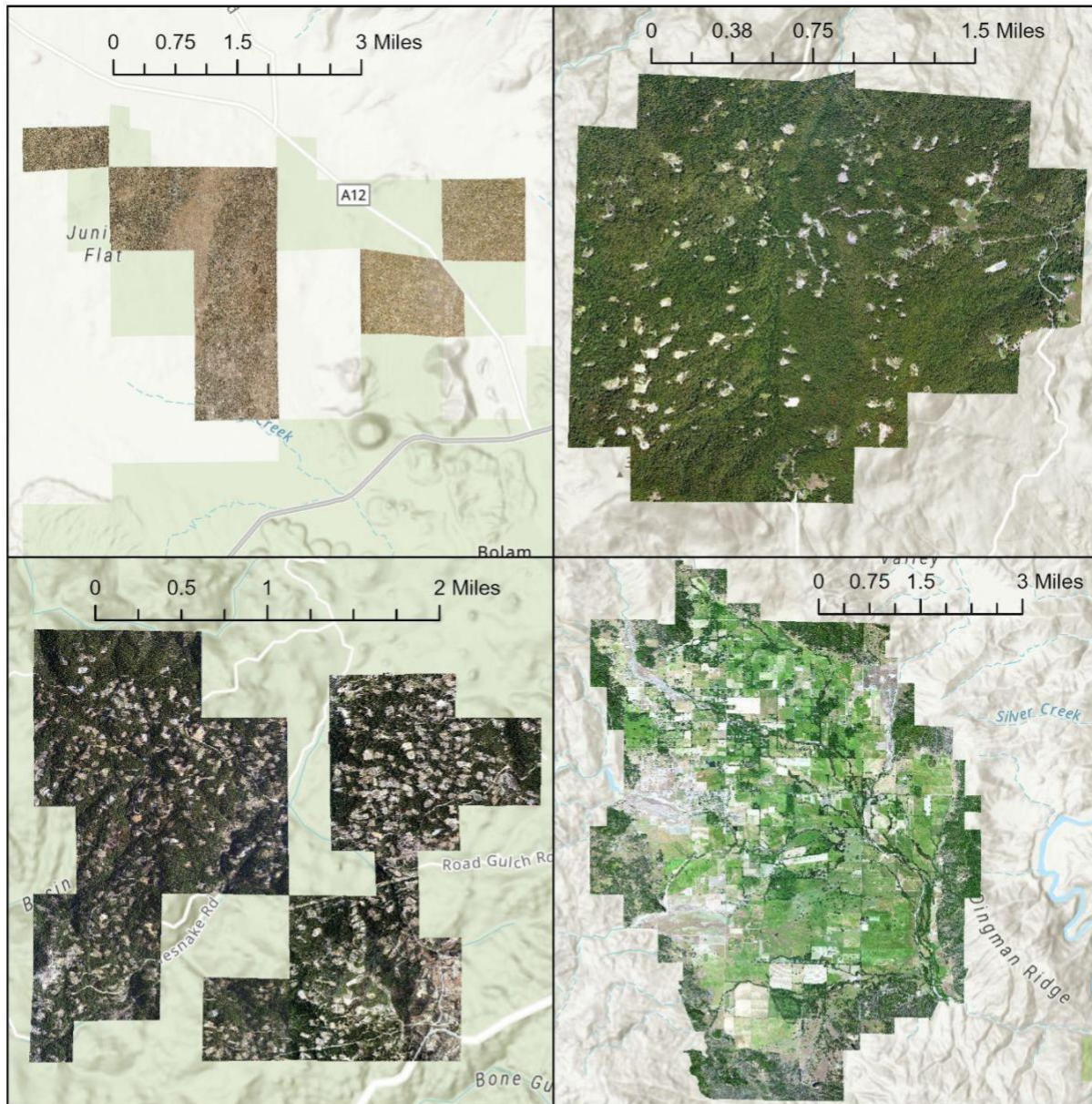
As documented in the main report, these different regulatory approaches have produced varied outcomes. Permit counties have created pathways to legal market participation but often with significant barriers including high costs, onerous or complicated application processes, and permit caps that limit market access. Ban counties have focused on enforcement approaches but have faced challenges in effectively eliminating unlicensed cultivation, exhibiting a 'whack-a-mole' pattern (whackamolarity) where enforcement in one area simply shifts cultivation activity elsewhere, ultimately driving adaptation in cultivation practices and locations.

2.2 Study Regions Overview and Characteristics



Map showing the four cannabis 'Centers of Production' study regions (highlighted in red) across Northern California counties. The study areas are distributed throughout the region known as the 'Emerald Triangle' and nearby counties, including sites in Siskiyou County (northeast), Trinity County (northwest), Humboldt County (west coast), and Mendocino County (southwest).

The four regions selected for this study represent diverse regulatory environments, geographic conditions, and cultivation histories (Map 1). Each region has unique characteristics that influence cannabis cultivation practices and adaptation.



Aerial imagery of the four California cannabis cultivation regions studied in 2022: Shasta Vista (top left), characterized by arid open terrain with a grid-like subdivision pattern in Siskiyou County; Rancho Sequoia (top right), showing heavily forested mountainous terrain in Humboldt County; Post Mountain (bottom left), displaying forested mountainous landscape in Trinity County with visible clearings; and Covelo (bottom right), featuring a mix of agricultural valley land and surrounding forested areas in Mendocino County.

- Shasta Vista - Located in a ban county (Siskiyou County) with aggressive enforcement, characterized by arid, open terrain and a well defined rural subdivision.

Shasta Vista is situated in northeastern Siskiyou County near the Oregon border, characterized by arid, open terrain with sparse vegetation. The area consists primarily of rural subdivisions with small parcel sizes (typically 2.5-5 acres), limited natural water resources, and no municipal water systems. The elevation ranges from approximately 2,500 to 3,500 feet, creating a high desert environment with challenging growing conditions.

The regulatory environment is defined by Siskiyou County's prohibitionist approach, which banned cannabis cultivation in 2017. The area has been subject to aggressive enforcement including water delivery restrictions, targeted ordinances, and multi-agency enforcement operations; with civil penalties including \$5,000 per plant fines. The region has been the focus of numerous legal challenges regarding enforcement approaches, particularly concerning water access restrictions.

Community demographics in Shasta Vista underwent significant transformation beginning in the mid-2010s with an influx of Hmong American farmers (Getz et al. 2024), with an estimated 6,000 Hmong Americans moving to the area since 2014, purchasing approximately 1,500 parcels in rural subdivisions. The area has limited infrastructure, including unpaved roads and no municipal services, making development challenging and increasing vulnerability to environmental stressors.

- Rancho Sequoia - Situated in a permit county (Humboldt County) with a well-established historical cannabis culture, characterized by heavily forested, mountainous terrain.

Rancho Sequoia is located in southern Humboldt County near Garberville, characterized by heavily forested, mountainous terrain with steep slopes. The area gained notoriety as the setting for the salacious Netflix documentary 'Murder Mountain,' which contributes to an unfortunate reputation that overshadows the broader community dynamics. The area is remote with limited access via winding rural roads, making transportation challenging but providing natural seclusion. Natural water resources are abundant, but seasonal through numerous streams and springs. The elevation ranges from approximately 1,200 to 3,000 feet, creating microclimates that influence cultivation practices.

The regulatory environment reflects Humboldt County's status as one of California's earliest adopters of commercial cannabis permitting. The county implemented a permitting program designed to incorporate existing "legacy" cultivators, with pathways for both pre-existing and new operations. County ordinances allow for both outdoor and mixed-light cultivation, acknowledging the diversity of cultivation practices in the region.

The community represents a multi-generational cannabis cultivation community dating back to the "back-to-the-land" movement of the 1960s-70s. The area maintains a strong cannabis culture and identity as part of the "Emerald Triangle," with cultivation knowledge passed through generations. The population has remained relatively stable with limited recent demographic changes, with homesteads typically situated on larger parcels (10+ acres) scattered throughout the forested landscape.

- Post Mountain - Located in a permit county (Trinity County) with a cap on total licenses, characterized by forested mountainous terrain and a mixed community of legacy cultivators and more recent settlers.

Post Mountain is situated in southern Trinity County near Hayfork, characterized by forested mountainous terrain with mixed coniferous forest. The study area boundaries align with the Post Mountain Public Utilities District (PUD), which almost perfectly captures a significant cannabis cultivation hotspot, providing a naturally defined study region. The area is moderately remote with seasonal access challenges, particularly during winter months when snow and ice can limit transportation. Multiple seasonal streams and water sources traverse the region, though many diminish significantly during dry summer months. The elevation ranges from approximately 2,000 to 5,000 feet.

The regulatory environment is shaped by Trinity County's permit program, which established a cap of 530 licenses, a fraction of the currently estimated 4,000-6,000 cultivation sites in the county. County ordinances were designed to support small-scale resident cultivators, with requirements that cultivators reside on their properties. The regulatory environment experienced significant disruption during 2020-2022 due to litigation challenging the county's CEQA environmental review process.

The community represents a mix of legacy cultivators and more recent settlers, including a significant Hmong American community concentrated in the Trinity Pines subdivision, with approximately 1,000 Hmong families operating on about 1,100 parcels. Development density in some areas has raised concerns about wildfire vulnerability, particularly following several major fires that threatened the region during the study period.

- Covelo - Positioned in a permit county (Mendocino County) with evolving regulations, characterized by a mix of agricultural and forested landscapes.

Covelo is located in northeastern Mendocino County in Round Valley, characterized by a mix of agricultural valley, oak woodlands and surrounding forested mountains. The area is relatively accessible via state highways compared to other study regions. Multiple water sources are available including the Eel Rivers and its tributaries, and a high water table for well developments. The elevation ranges from approximately 1,400 feet in the valley to 3,000+ feet in surrounding areas, creating diverse growing environments.

The regulatory environment reflects Mendocino County's evolving approach to cannabis permitting, with multiple iterations of cannabis permitting programs established in 2017, followed by significant revisions in 2019 and 2023. This created regulatory uncertainty due to changing requirements and department transfers. Until recent changes, cultivation was limited to 10,000 square feet per parcel, creating constraints on operation scale.

The community represents a diverse agricultural setting with both multi-generational residents and newer arrivals. The area has a significant tribal presence with the Round Valley Indian Tribes reservation, adding cultural and governance complexity to land use issues. Though remote from urban centers, Covelo maintains a cohesive community with defined geographic boundaries created by the surrounding mountains.

Together, these regions provide a representative sample of the diverse conditions under which cannabis is cultivated in Northern California, enabling comparative analysis of how different factors influence cultivation practices. Each of these locations has a well-documented history of cannabis cultivation dating back decades before the passage of Proposition 64, serving as established cultivation hotspots with distinctive local characteristics. This fine-scale examination of these locales over time provides valuable insights into the broader transformations occurring across California's cannabis landscape.

Methods

3.1 Data Collection

This study utilized custom made object detection machine learning models applied to publicly available National Agriculture Imagery Program (NAIP) aerial imagery to identify and quantify cannabis cultivation sites across the four study regions. The NAIP imagery was accessed through the USGS Earth Explorer open source platform, providing high-resolution (60 cm) data for the years 2016, 2018, 2020, and 2022, enabling consistent temporal analysis across all locations.

The four study regions were selected based on their historical significance as established cannabis production centers and their divergent post-legalization regulatory approaches. Each site represents a distinct "center of exception" where cannabis cultivation has persisted for years, if not decades, despite formal prohibition, creating deeply embedded cultivation communities with unique geographical and social characteristics.

Study areas were precisely defined using county parcel data that encompassed the targeted subdivisions in Shasta Vista, Rancho Sequoia, and Post Mountain, while the Covelo study area was defined to include the flat valley portion of Round Valley. NAIP images were downloaded, mosaiced, and clipped to the exact study site boundaries for all four time periods to ensure consistent spatial analysis.

3.2 Machine Learning Object Detection

Cannabis cultivation sites were identified using a custom-trained Region-based Convolutional Neural Network (RCNN) model developed with ArcGIS Pro version 3.4's Deep Learning toolset. The model was specifically trained to recognize two distinct cultivation methodologies: Outdoor Cultivation (OD) - open-air cultivation with plants directly exposed to the environment, and Greenhouse Structures (GH) - cultivation under transparent or semi-transparent structures, including both permanent greenhouses and temporary hoop houses.



Compare: ML detection results from Post Mountain in 2022, showing the RCNN model's ability to identify outdoor cultivation sites (purple overlays) across the forested landscape. The left panel displays the raw NAIP aerial imagery with visible clearings and cultivation areas, while the right panel shows the model's detection outputs.

The model was trained using verified cannabis cultivation sites from regulatory data and ground-truthed locations from previous studies in Covelo, Mendocino County, and Siskiyou County. Training samples included cultivation sites across different terrain types, seasons, and development stages to ensure robust detection capabilities. The model achieved an End-to-end Mean Detection Score (EMD) of 0.71, indicating reasonably strong performance for this specialized detection task.

3.3 Spatial Analysis

Following object detection, we conducted spatial analysis to quantify: total number of greenhouse structures and outdoor cultivation sites in each region for each time period, change in

cultivation methodology over time (2016-2018, 2018-2020, 2020-2022), spatial distribution of cultivation sites in relation to environmental features, and other spatial trends.

To ensure validity, we did a manual review of a random sample of 10% of detected sites to verify accuracy, filtering of false positives based on size, shape, and context parameters, and consistency checks across temporal datasets to identify and address anomalies. Through this manual verification process, we determined the overall accuracy of our classification to be approximately 78%, suitable for this comparative analysis.

3.4 Limitations

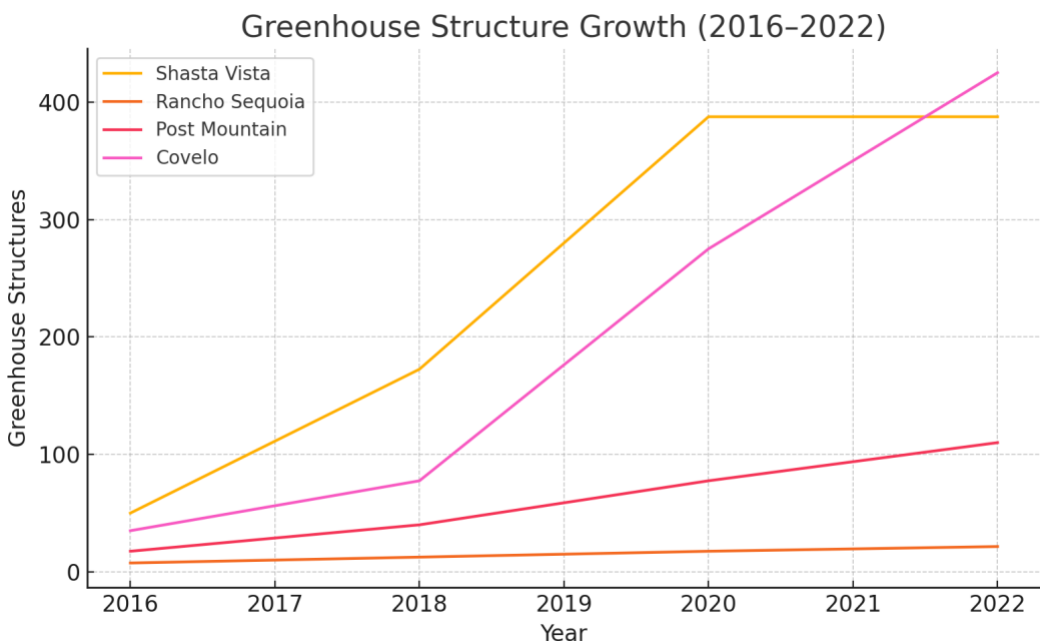
The methods employed have several limitations that should be acknowledged: NAIP imagery is collected during daylight hours in summer months, the 2018 imagery in particular was collected rather early (early June) and may have missed seasonal operations. Resolution limitations prevent identification of very small cultivation sites (< 10 sq meters) and cloud cover and shadows in mountainous areas may obscure some sites. The model may occasionally misidentify similar structures (e.g., non-cannabis greenhouses). Licensed and unlicensed cultivation cannot be distinguished from imagery alone. Despite these limitations, the consistent methodology applied across all study regions and time periods enables valid comparative analysis of land use trends and patterns.

Findings

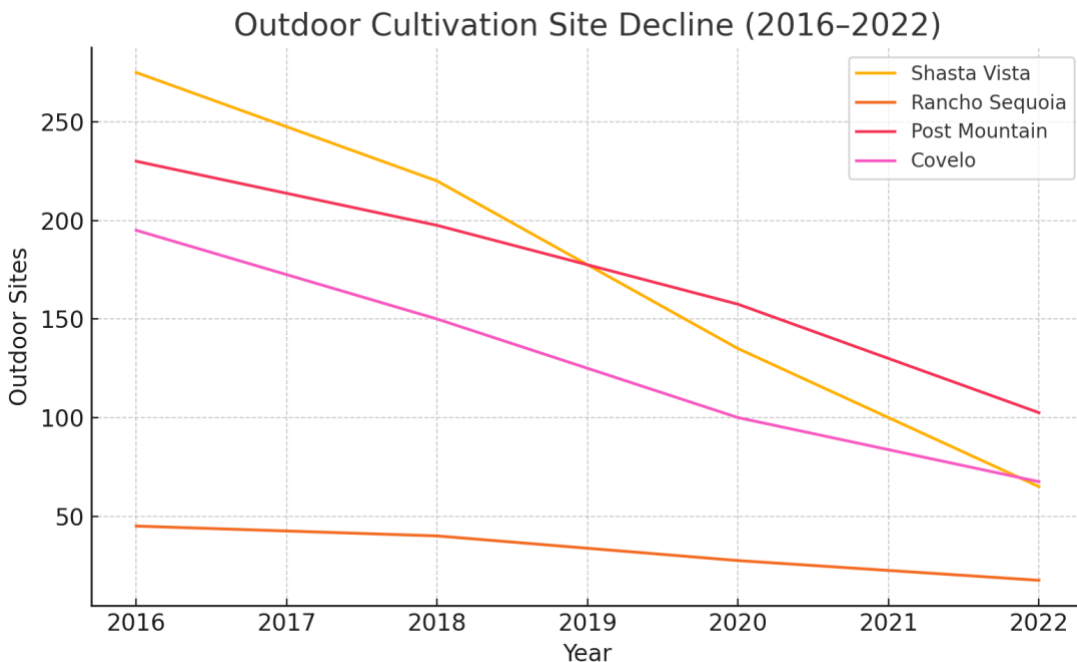
4.1 Overall Trends Across All Four Locations

The data reveals a dramatic transformation in cannabis cultivation methodology across all four study regions between 2016 and 2022. Greenhouse structures increased from approximately 113 sites in 2016 to 949 sites by 2022, representing an extraordinary 8.4-fold expansion over the six-year period. This growth occurred in three distinct phases: an initial 168% increase from 2016 to 2018 (reaching 303 structures), followed by another 150% increase from 2018 to 2020 (reaching

757 structures), and a final more modest 25% increase from 2020 to 2022.



Concurrent with this greenhouse expansion, outdoor cultivation sites experienced a steady decline. From an initial count of approximately 751 outdoor sites in 2016, numbers dropped by about 18% by 2018 (to 612 sites), followed by a further 31% reduction by 2020 (to 421 sites), and finally another 39% decrease by 2022 (to 256 sites). This represents a cumulative 66% reduction in outdoor cultivation sites over the study period.



When examining overall cultivation activity (combined greenhouse and outdoor operations), the total number of cultivation sites actually increased by approximately 40% between 2016 and 2022. From an initial count of 864 total sites in 2016 (predominantly outdoor), the number rose slightly to 915 sites by 2018, then increased more substantially to 1,178 sites by 2020, before stabilizing at 1,205 sites in 2022 (now predominantly greenhouse).

This pattern reveals a profound methodological shift in how cannabis is cultivated. In 2016, greenhouse structures represented just 13% of all cultivation sites, with outdoor cultivation dominating at 87%. By 2018, greenhouses had increased to 33% of sites, with outdoor declining to 67%. The balance shifted decisively by 2020, with greenhouses comprising 64% of sites compared to outdoor's 36%. By 2022, the transformation was nearly complete, with greenhouses representing 79% of all cultivation sites and outdoor operations reduced to just 21%.

4.2 Shasta Vista (Siskiyou County)

From 2016 to 2020, greenhouse structures in this region increased dramatically from approximately 52 to 388, representing more than a 7-fold expansion in just four years. This growth occurred in two distinct waves: first increasing 3.3 times between 2016 and 2018 (to 172 structures), then increasing 2.3 times again by 2020. Between 2020 and 2022, greenhouse numbers stabilized, showing only a 1% increase to 392.

Outdoor cultivation in Shasta Vista followed a steady downward trajectory throughout the study period. Beginning with approximately 278 outdoor sites in 2016, numbers declined by about 20% by 2018 (to 223 sites), then fell more dramatically by 40% between 2018 and 2020 (to 134 sites), and finally plummeted by another 50% by 2022 (to 67 sites). This pattern suggests accelerating abandonment of outdoor cultivation methods in this region.

What makes Shasta Vista particularly noteworthy is that this dramatic shift in cultivation methodology occurred despite Siskiyou County's prohibitionist approach to cannabis, including aggressive enforcement measures, water delivery restrictions, and substantial civil penalties. By 2022, Shasta Vista had the second-highest concentration of greenhouse structures among the four study regions, demonstrating that methodological adaptation occurs even under hostile regulatory conditions. The region's arid, open terrain appears to have facilitated this rapid greenhouse expansion, providing suitable conditions for structure development despite regulatory challenges.

4.3 Rancho Sequoia (Humboldt County)

Greenhouse structures increased incrementally from approximately 8 in 2016 to 22 by 2022, representing growth but at a far more measured pace than other regions. This expansion occurred gradually over the study period, with a 63% increase from 2016 to 2018 (to 13 structures), a 38% increase from 2018 to 2020 (to 18 structures), and a 22% increase from 2020 to 2022.

Outdoor cultivation in Rancho Sequoia also declined more moderately than in other regions. From an initial count of approximately 46 outdoor sites in 2016, numbers decreased slightly to 39 by 2018 (a 15% decrease), then continued a steady decline to 27 by 2020 (a 31% decrease from 2018) and finally to 18 by 2022 (a 33% decrease from 2020). This represents a cumulative reduction of about 61% over six years, comparable to percentage decreases in other regions but from a much smaller initial base.

What makes Rancho Sequoia's pattern particularly interesting is that it occurred in Humboldt County, which implemented one of California's earliest and most accommodating commercial cannabis permitting programs. Despite this relatively permissive regulatory environment, Rancho Sequoia showed limited cultivation expansion and the slowest methodological transition. This suggests that factors beyond regulatory approach significantly influence cultivation patterns, with the region's heavily forested, mountainous terrain likely imposing natural constraints on large-scale development. The cultural attachment to traditional cultivation practices in this historic cannabis-producing region may also have contributed to the more measured pace of change.

4.4 Post Mountain (Trinity County)

Greenhouse structures increased from approximately 17 in 2016 to 112 by 2022, representing a 6.6-fold expansion over six years. This growth occurred in a remarkably consistent pattern: increasing 129% between 2016 and 2018 (to 39 structures), increasing 100% between 2018 and 2020 (to 78 structures), and increasing by another 44% between 2020 and 2022.

Outdoor cultivation in Post Mountain declined throughout the study period but retained a stronger presence than in other regions. From approximately 231 outdoor sites in 2016, numbers decreased by about 15% by 2018 (to 197 sites), followed by another 20% reduction by 2020 (to 158 sites), and finally a 35% decrease by 2022 (to 103 sites). By 2022, Post Mountain maintained the highest proportion of outdoor cultivation among the four regions.

The more measured pace of methodological transition in Post Mountain likely reflects multiple factors. Trinity County's permit program, which established a cap of 530 licenses for an estimated 4,000-6,000 cultivation sites, created limited legal market access and regulatory uncertainty, especially after litigation during 2020-2022 disrupted the permitting process. Additionally, the region's mountainous, heavily forested terrain presents natural constraints to large-scale greenhouse development. The mixed community composition, including both legacy cultivators and more recent settlers, may also contribute to the diverse cultivation approaches observed in this region.

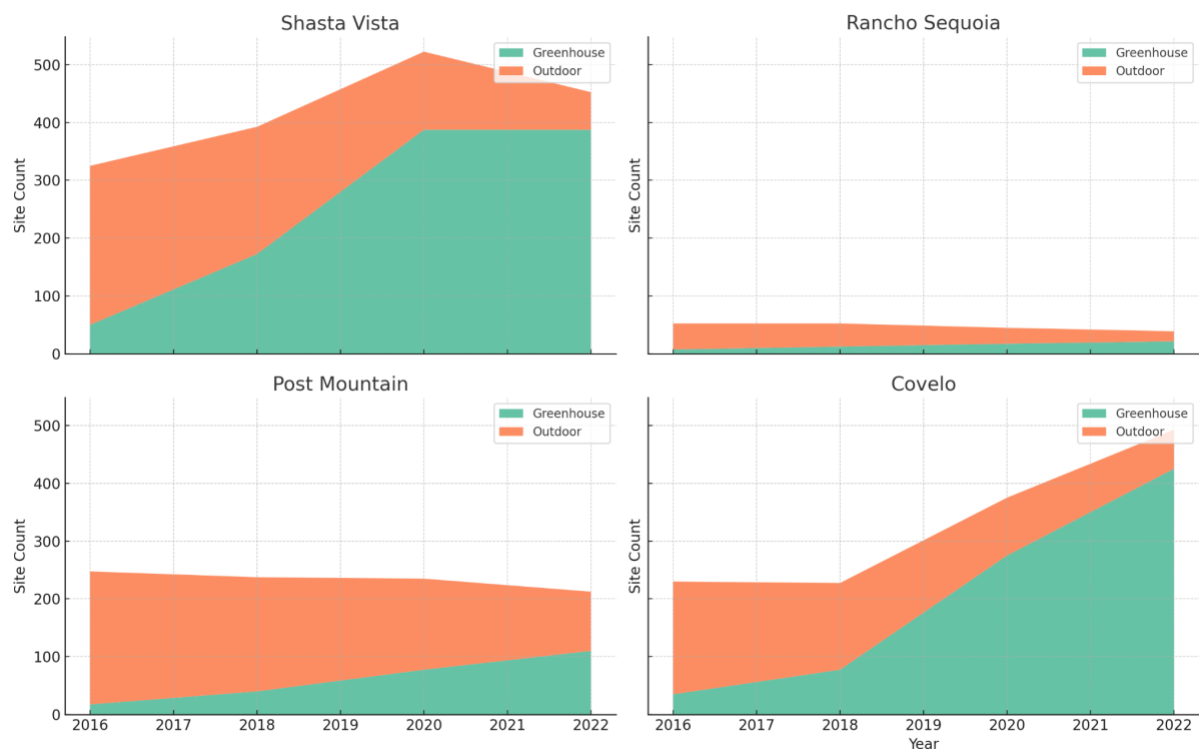
4.5 Covelo (Mendocino County)

Covelo demonstrated the most dramatic expansion of greenhouse structures among all study regions, increasing from approximately 36 in 2016 to 423 by 2022, a remarkable 11.8-fold increase over six years. This growth followed a distinctive pattern: increasing 119% between 2016 and 2018 (to 79 structures), followed by an explosive 246% increase between 2018 and 2020 (to 273 structures), and another 55% expansion by 2022.

Outdoor cultivation in Covelo declined steadily throughout the study period. From approximately 196 outdoor sites in 2016, numbers decreased by about 22% by 2018 (to 153 sites), followed by a more substantial 33% reduction by 2020 (to 102 sites), and another 33% decrease by 2022 (to 68 sites). This represents a cumulative 65% reduction in outdoor sites over the study period.

By 2022, Covelo had emerged as the largest cultivation center among the four regions, with its greenhouse count exceeding that of Shasta Vista. This explosive growth occurred during a period when Mendocino County implemented multiple iterations of cannabis permitting programs, with significant revisions in 2017, 2019, and 2023. The distinct valley geography of Round Valley, where Covelo is located, with its far flung locale and local culture of lawlessness, may have facilitated this concentration of cultivation activity in a relatively defined area.

Cannabis Cultivation Method Trends by Region (2016–2022)



Discussion

5.1 Centers of Exception: Cannabis as Economic and Community Cornerstone

The four study regions represent what might be termed "centers of exception" within California's broader agricultural and regulatory landscape. Unlike most agricultural regions where conventional crops predominate, these areas have long been characterized by cannabis cultivation as a cornerstone of both economic development and community identity (Cite Micahel, Margiana, Van). This exceptionalism predates legalization, with cannabis serving as an economic lifeline following the decline of traditional industries like timber, particularly evident in the North Coast regions (Rancho Sequoia, Post Mountain, and Covelo).

In Humboldt County's Rancho Sequoia, cannabis cultivation emerged from the "back-to-the-land" movement of the 1960s-70s, evolving over generations into a defining feature of the local culture and economy. Similarly, Trinity County's Post Mountain developed a cannabis-dependent economy after the collapse of the timber industry, with cultivation providing critical economic resilience that buffered these communities against broader economic downturns. As one Trinity County resident noted in our broader study, "the 2008 and 2009 U.S. market crash wasn't even felt here because cannabis provided such a cushion."

The exceptional nature of these communities has made them simultaneously targets for regulatory intervention and challenging to integrate into conventional regulatory frameworks. Ban counties like Siskiyou have characterized these areas as problematic "outlaw" regions requiring aggressive enforcement, while permit counties have struggled to design regulatory systems that acknowledge the centrality of cannabis to these communities while bringing cultivation into compliance with broader agricultural and environmental standards.

5.2 Market Evolution and Methodological Adaptation

The shift from outdoor cultivation to greenhouse structures reflects broader evolution in the cannabis marketplace. As consumer preferences have increasingly favored consistent, high-potency, visually appealing cannabis products, cultivators have adapted their production methods accordingly. Greenhouse structures allow for greater control over growing conditions, more consistent product quality, and multiple harvests per year, all competitive advantages in an increasingly saturated market.

This methodological adaptation represents a sophisticated response to changing market conditions. As wholesale cannabis prices declined from reported highs of \$1,500-2,000 per pound in 2016 to lows of \$300-500 per pound by 2022, cultivators needed to increase efficiency and productivity to maintain economic viability. Greenhouse production offers the ability to control the amount of natural sunlight, provides year-round cultivation cycles instead of the single annual harvest typical of outdoor operations, potentially tripling or quadrupling annual yield from the same cultivation footprint.

The timing of the most dramatic greenhouse expansion (2018-2020) coincides with a period when California's licensed market was developing and wholesale prices remained relatively high.

The slower expansion from 2020-2022 likely reflects market saturation and declining profit margins, making further infrastructure investment less economically viable.

5.3 Energy Use and Biodiversity Implications

The dramatic shift toward greenhouse cultivation raises important considerations regarding energy consumption and environmental impact. As noted by energy researcher Evan Mills in his work on cannabis energy use (Mills, 2012; Mills et al., 2022), greenhouse cultivation typically requires significantly more energy than traditional outdoor methods but substantially less than full indoor production. According to Mills' estimates, greenhouse cultivation typically consumes about 25-30% of the energy required for comparable indoor operations.

Beyond energy considerations, recent research by Parker-Shames et al. (2022) has found that greenhouse cannabis farms have greater impacts on aquatic and terrestrial biodiversity than outdoor cultivation sites. Their study, examining the spatial overlap of small-scale cannabis farms with biodiversity in Northern California, found that greenhouse structures create more significant habitat disruption, alter water flow patterns, and produce more concentrated environmental impacts than traditional outdoor cultivation. The permanent infrastructure associated with greenhouse cultivation creates longer-term ecological impacts compared to seasonal outdoor operations, particularly in environmentally sensitive areas.

The methodological shift observed in this study, from almost entirely outdoor cultivation (87% in 2016) to predominantly greenhouse (79% in 2022), therefore represents not only a significant increase in energy intensity but potentially greater impacts on local biodiversity in these regions. In areas like Post Mountain and Shasta Vista, where greenhouses have expanded in previously undeveloped areas, these biodiversity impacts may be particularly pronounced and have long term environmental implications.

5.4 Policy Implications Across Regulatory Environments

One of the most striking findings from this analysis is the similar methodological transformation observed across both ban counties (Siskiyou) and permit counties (Mendocino, Trinity, Humboldt). This finding strengthens the suggestion that binary policy approaches may be less influential than assumed in shaping cultivation practices. Cannabis cultivators adapt to regulatory environments rather than simply complying or ceasing operations.

This convergence of outcomes across diverse regulatory approaches suggests that effective cannabis policy should focus less on whether to permit or ban cultivation and more on how to guide inevitable adaptation toward environmentally sustainable, economically viable, and socially beneficial practices. Rather than treating cannabis cultivation as either a criminal activity to be eliminated or a conventional agricultural crop to be regulated, policies might more

effectively acknowledge the exceptional nature of these communities while channeling market-driven methodological evolution in beneficial directions.

Conclusion

The comprehensive analysis of cannabis cultivation across four Northern California regions from 2016 to 2022 reveals a dramatic transformation in production methodology that transcends regulatory approaches and geographic boundaries. This transformation from predominantly outdoor cultivation to greenhouse-based production represents a fundamental restructuring of cannabis agriculture in the post-legalization era.

The data demonstrates that cannabis cultivation underwent a complete methodological revolution between 2016 and 2022, with greenhouse structures increasing from 13% to 79% of all cultivation sites across the four study regions. This shift occurred regardless of whether regions were located in counties with bans or permitting programs, suggesting that market forces and environmental factors may be more influential than specific regulatory approaches in shaping cultivation practices. Cultivators in all regions adapted their methods in response to broader pressures and opportunities, regardless of the local regulatory framework.

Geographic and landscape characteristics significantly influenced these development patterns. Regions with flatter, more accessible terrain like Covelo's mixed agricultural valley and Shasta Vista's arid subdivisions supported larger-scale greenhouse operations. In contrast, heavily forested, mountainous areas like Rancho Sequoia and Post Mountain presented natural constraints to extensive development, resulting in more modest greenhouse expansion.

The evolution of cultivation methodology likely represents adaptation to changing market conditions, including increasing competition, declining wholesale prices, and the need for efficiency improvements. Greenhouse structures offer multiple harvests per year, better quality control, and increased yield per square foot, advantages that became increasingly important as California's cannabis market matured and wholesale prices declined.

The overall pattern suggests a consolidation trend within the cannabis industry, with fewer but larger and more technologically advanced operations replacing numerous smaller outdoor cultivation sites. This parallels trends observed in conventional agriculture but is occurring at an accelerated pace within cannabis cultivation.

These key findings contribute to a more nuanced understanding of how cannabis cultivation has evolved in California's post-legalization landscape. Rather than simply expanding or contracting in response to regulatory frameworks, the cannabis industry has fundamentally transformed its production methodology, with implications for environmental management, regulatory approaches, and market development.

This research suggests that effective cannabis policy should focus less on binary approaches (permit vs. ban) and more on guiding the inevitable adaptation of cultivation practices toward environmentally sustainable, economically viable, and socially responsible outcomes. By understanding and acknowledging the powerful market and environmental forces shaping cultivation practices, policymakers can develop more effective approaches to cannabis regulation that work with rather than against these underlying trends.

APPENDIX 10: DELTAS OF CANNABIS DENSITIES BY COUNTY

The average change in sample cells within a county for each time period, with distinctions for outdoor and mixed-light cultivation specifically. Units are m² of cannabis per km².

County	mean_18.20_0_Outdoor	mean_18.20_ML	mean_20.22	mean_20.22_Outdoor	mean_20.22_ML	mean_22.24	mean_22.24_Outdoor	mean_22.24_ML	
San Diego	301.39	70.63	230.96	-297.83	-89.80	-207.82	131.71	29.49	102.44
Humboldt	-134.06	-45.89	49.22	-280.66	-50.69	-53.41	-81.12	-7.36	-10.46
El Dorado	230.42	81.03	149.39	-234.71	-141.56	-92.25	2.93	-14.02	17.86
Santa Cruz	193.08	35.77	169.13	-231.19	-97.43	-96.60	67.68	6.36	84.17
Marin	319.60	25.18	294.42	-230.44	-21.64	-208.81	9.16	-2.67	11.82
Butte	277.70	123.23	154.47	-212.21	-222.82	10.61	-29.35	-53.66	24.31
Calaveras	48.85	38.65	67.01	-206.57	-67.70	-29.73	-36.68	8.89	45.21
Mendocino	156.99	48.45	149.90	-198.86	-134.50	-13.21	-76.56	-30.04	-3.46
Los Angeles	355.55	30.82	324.73	-184.85	-17.81	-166.75	80.09	12.54	67.84
San Mateo	340.81	45.71	305.17	-182.16	8.31	-180.40	3.07	-8.84	22.10
Nevada	284.27	124.98	178.38	-180.62	-144.68	9.36	-141.72	-73.99	-24.81
Amador	244.98	112.34	132.64	-176.93	-98.30	-78.63	39.03	-4.97	44.01
Riverside	144.81	1.50	144.52	-157.79	-44.74	-109.90	52.81	17.21	37.42
Yuba	166.06	69.87	96.19	-150.13	-152.74	2.62	-12.47	-17.46	4.99

Lake	176.32	63.98	176.39	-140.53	-49.13	20.62	-112.18	-35.81	-28.95
Trinity	9.83	-2.32	48.18	-126.35	-54.71	-27.98	-51.17	-9.90	-13.40
Overall	106.92	29.29	88.59	-108.06	-45.43	-47.23	8.98	-1.70	18.77
Placer	169.43	68.63	100.81	-93.05	-63.98	-29.06	-20.96	-13.17	-7.79
San Luis Obispo	95.55	68.03	33.22	-85.11	-60.00	-15.87	3.14	-4.45	13.18
Shasta	126.81	71.46	55.35	-81.70	-67.14	-14.56	-8.07	-8.18	0.11
San Bernardino	66.90	5.75	61.37	-73.92	-17.44	-56.24	35.71	9.89	26.06
Siskiyou	82.26	44.58	37.68	-52.42	-45.33	-7.09	-14.67	-12.10	-2.57
Modoc	44.41	29.07	15.33	-31.32	-17.55	-13.77	-5.44	-8.69	3.26
Del Norte	54.76	7.44	47.32	-31.27	-5.34	-25.92	-6.45	-0.68	-5.76
Mariposa	92.47	44.01	48.46	-27.81	-17.73	-10.07	-11.07	-8.93	-2.14
Kern	41.13	8.04	33.67	-27.63	-10.09	-16.62	37.57	11.00	27.49
Sierra	19.50	9.03	10.48	-13.77	-11.72	-2.06	-2.90	-6.31	3.41
Lassen	39.47	24.54	14.93	-12.28	-10.75	-1.53	-4.03	-4.00	-0.03
Tuolumne	66.44	24.42	42.02	-2.74	-4.46	1.72	6.32	-14.34	20.66
Plumas	47.13	29.60	17.53	-2.69	-3.36	0.84	4.56	-0.46	5.20
Tehama	1.75	-3.09	4.83	7.90	-9.01	16.91	-4.36	-6.28	2.05

**APPENDIX 11: ESTIMATES OF LICENSED CULTIVATED HECTARES BY
COUNTY**

County	2019	2020	2021	2022	2023	2024
Alameda	3.43	5.29	6.57	10.76	10.41	11.9
Calaveras	0.02	14.09	29.61	39.4	39.95	36.58
Colusa	0.2	0.39	0.99	1.24	0.78	0.83
Contra Costa	0.65	0.84	0.99	2.59	2.55	3.8
Del Norte	0.2	0.2	0.2	0.25	0.3	0.09
El Dorado	0	0	0.09	0.09	0.41	0.5
Fresno	0.19	0.96	42.47	42.86	31.05	22.96
Humboldt	154.19	198.96	228.65	225.91	207.56	185.79
Imperial	0	0.09	0.09	0.09	0.19	0.19
Inyo	0	4.27	5.57	5.3	5.81	5.2
Kern	0.79	2	2.76	4.02	3.55	3.52
Kings	0	0	22.85	22.85	19.88	19.88

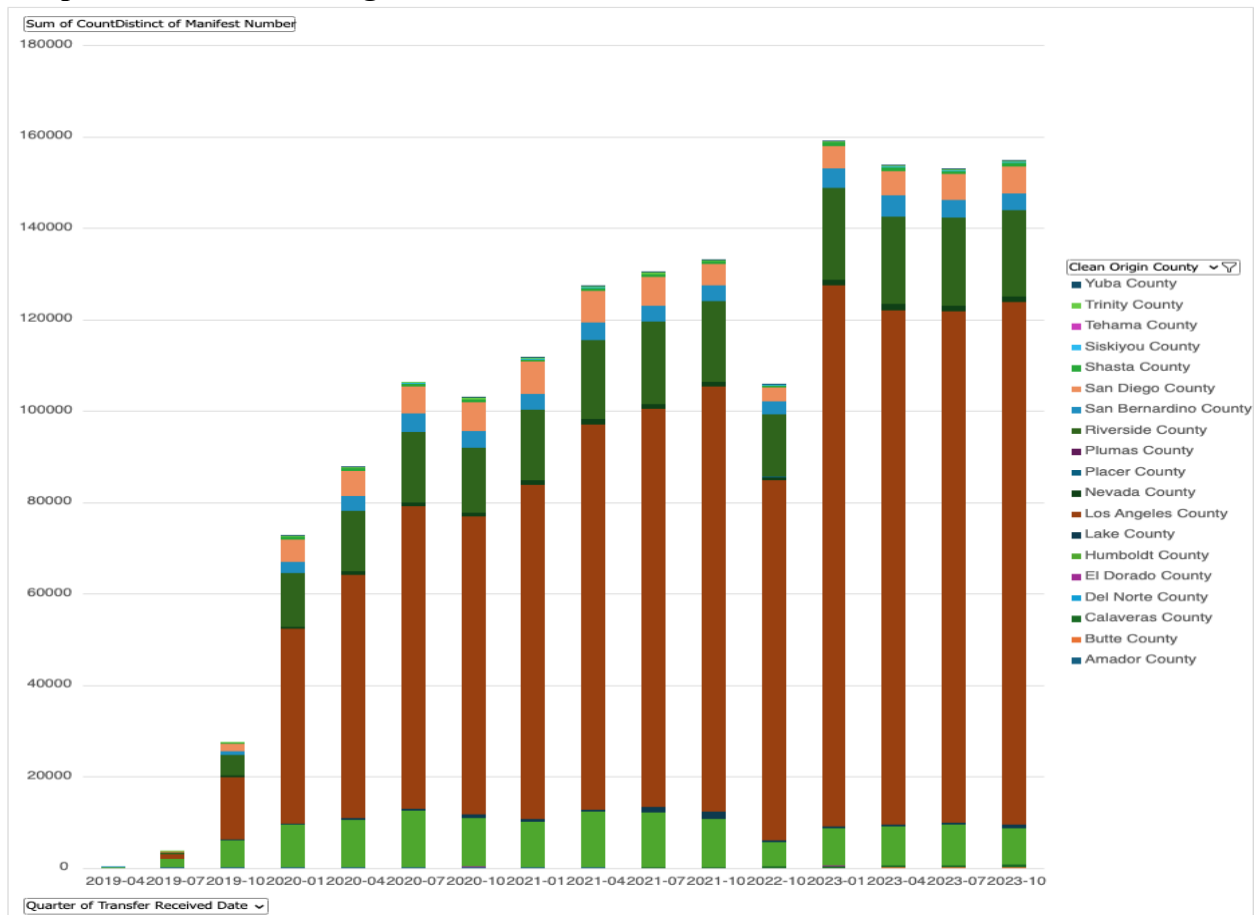
Lake	11.84	48.32	128.87	135.58	71.88	57.07
Los Angeles	13.01	21.01	23.19	29.34	29.93	26.67
Marin	0	0	0	0	0.02	0.02
Mendocino	38.44	59.81	62.66	61.85	51.02	41.3
Merced	0	0	0	0.5	0.64	0.94
Mono	0.59	0.66	0.66	0.66	0.14	0.14
Monterey	36.69	41.74	46.8	43.3	36.2	30.78
Nevada	4.61	8.65	13.37	16.29	14.45	16.4
Orange	0.2	0.41	0.94	1.44	1.86	1.61
Riverside	6.32	9.28	14.85	18.08	18.36	15.83
Sacramento	4.58	7.11	7.9	9.94	10.11	10.82
San Benito	0.37	0.37	0.78	0.5	0.59	0.59
San Bernardino	4.55	6.91	9.59	11.81	13.31	12.42
San Diego	0.39	1.05	1.14	1.06	1.06	0.87
San Francisco	0.79	0.98	1.07	1.07	0.84	0.74

San Joaquin	0	0	0.09	0.39	0.59	0.59
San Luis Obispo	7.06	8.97	13.03	14.04	11.64	12.5
San Mateo	0.48	1.08	1.08	1.08	1.08	1.37
Santa Barbara	143.5	182.75	217.42	281.21	254.87	165.05
Santa Clara	0.94	0.94	0.94	0.9	0.9	0.85
Santa Cruz	5.31	12.64	25.54	26.38	22.47	21.9
Shasta	0.62	0.72	0.97	1.01	1.18	1.58
Siskiyou	0.05	0.05	0.05	0.05	0	0
Solano	0	0.09	0.09	0.12	0.12	0.12
Sonoma	10.9	17.23	21.69	21.77	17.49	11.51
Stanislaus	0.67	1.51	1.7	2.42	2.12	2.14
Trinity	18.85	35.89	40.44	41.14	36.2	36.06
Tulare	1.17	1.17	1.17	1.22	1.22	0.86
Ventura	0	0	0	15.28	16.05	18.1
Yolo	19.99	23.42	21.36	20.64	15.3	13.06

APPENDIX 12: LICENSE DATA ANALYSIS OF TRANSFERS/MANIFESTS

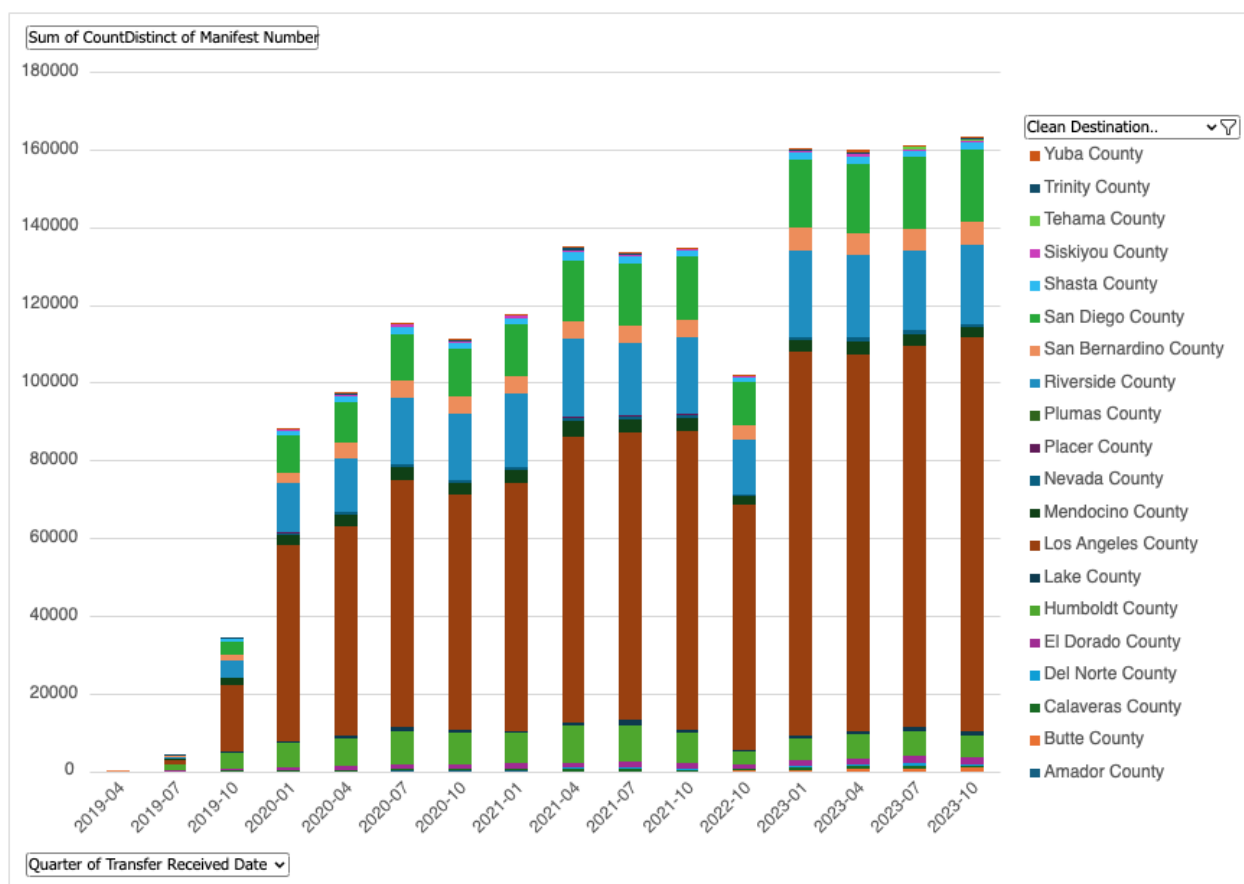
We calculated the number of manifests originating from and heading to 19 counties of interest for the study period. During the study period, 1.67M manifests were created at their counties of origin. Among these 19 counties, most manifests originated in Los Angeles County which accounted for 67% of the total manifests. This is not surprising given that manifests cover both cannabis flower and manufactured products. When considering counties with high levels of cultivation, Humboldt County accounted for 8% of the manifests, and Mendocino County only accounted for 3% of the total manifests. After Los Angeles County, Riverside County had the second highest number of manifests with 13%. Of the 19 counties, Tehama County had the fewest manifests with only 10 during the study period. Except for a dip in October 2022, the number of manifests for each county steadily rose during the study period. This could be capturing a data issue, as, prior to October 2022, the majority of transfers had null values for both origin and destination county. A stacked bar graph representing the number of manifests by county can be seen in Graph 9.

Graph 9: Manifests of Origin for Counties of Interest



We also looked at the number of manifests for the 19 counties of interest by destination. That is, how many manifests were sent to each county over the study period. There were 1.71M manifests received during the study period, slightly more than were reported being sent. As with the county of origin, the county of destination was most often Los Angeles, which accounted for 58% of the manifests received. Riverside County was again second with 14% of the manifests received. San Diego County was third with 11% of the manifests. Plumas County received the fewest with 4, although they sent 219. Humboldt County received 8% of the manifests, and Mendocino County 3%, making the number received on par with the number sent from those counties. Like sent manifests, the number of manifests received steadily grew over time except for the dip in October of 2022. You can view a stacked bar graph of the number of manifests received over time by county in Graph 10.

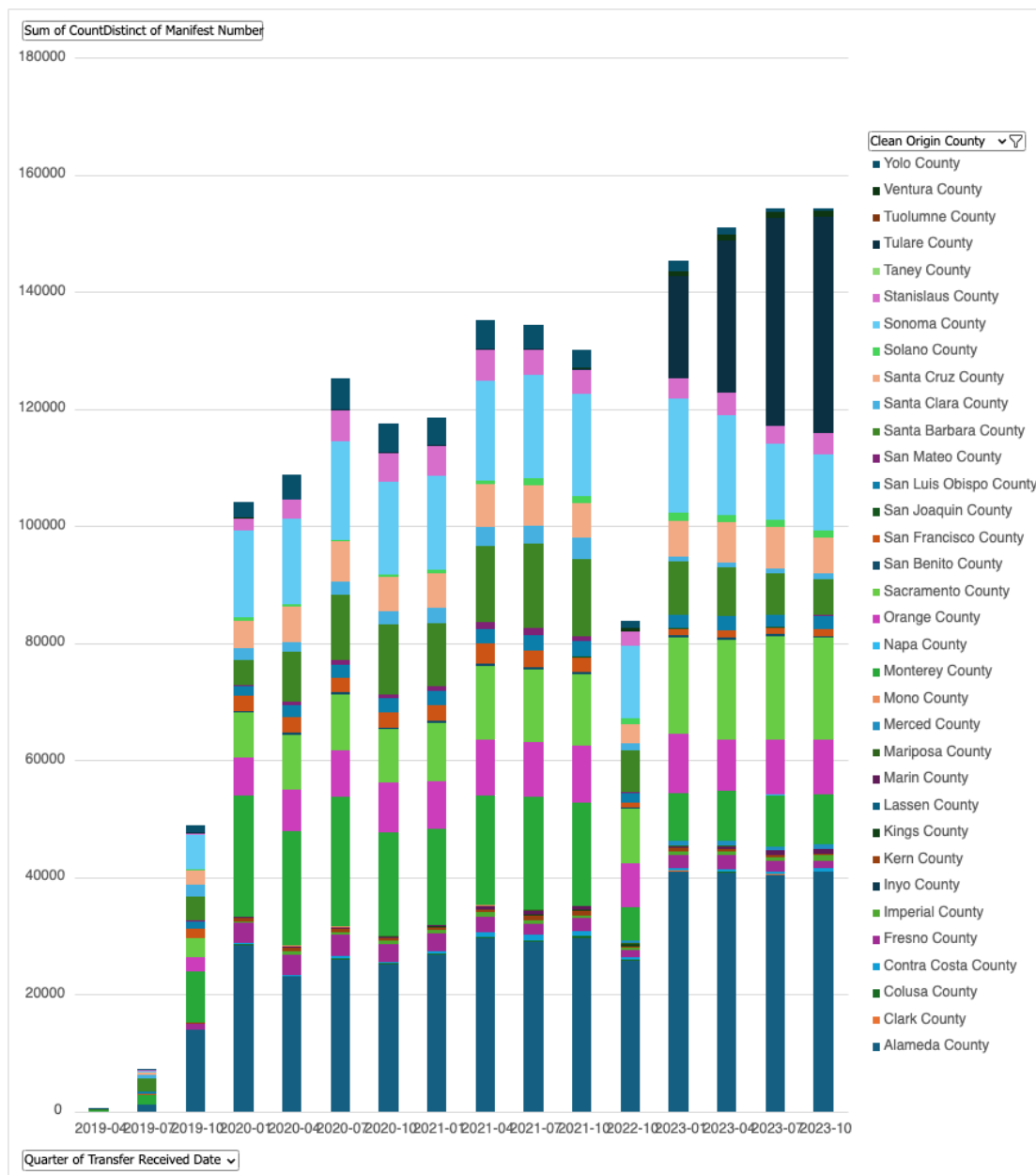
Graph 10: Manifests of Destination for Counties of Interest



All Other Counties

Among the counties not included in the interest list, there were a total of 1.76M manifests generated during the study period. The highest number was in Alameda County (421K), the lowest in Lassen County (6). See Graph 11 for a stacked bar graph representing the share of manifests created by county over time.

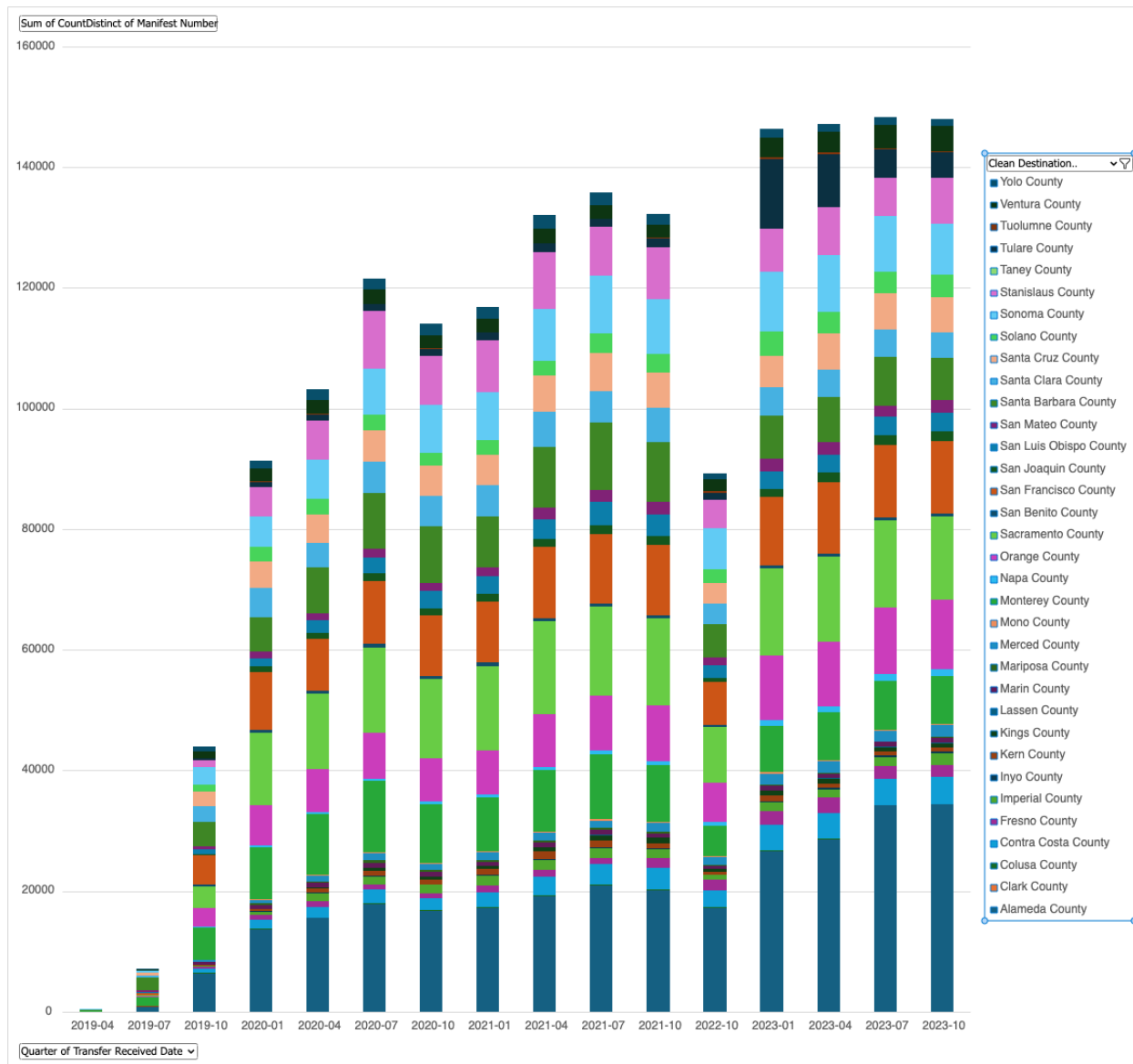
Graph 11: Manifests of Origin for All Other Counties



When looking at the data on the number of manifests received by counties not on the interest list, we see some notable differences. There was a total of 1.68M manifests created in these counties during the study period. Like the origin of the manifests, Alameda County led the way with 289K. However, while Lassen County produced the smallest number of manifests with 6, they received 558. The county with the lowest number of manifests received was Taney County with 13. Taney County generated 15 manifests. The difference in manifests generated and received in Lassen County implies that while they restrict cultivation and manufacturing, they allow for retail. This is the case as commercial cultivation and manufacturing is not allowed there, whereas

cannabis retail operations are. See Graph 12 for a stacked bar graph representing the share of manifests received by county over time.

Graph 12: Manifests of Destination for All Other Counties



The transfer data analyzed shows that flower itself plays only a small role in the amount of products shipped throughout the state. The top flower producing counties account for a very small percentage of the overall manifests for both origin and destination. Counties of origin can be looked at as the producing counties, while the counties of destination are those with retail outlets. The highest number of manifests for both origin and destination came from areas of the state with higher levels of overall industry, and with denser populations. This shows that cannabis products, like other commodities, are more often produced in and sold in areas with the greatest level of industry and the highest populations. It also differentiates cannabis from

agriculture, where production often happens in areas with less industry and people. The high volume of manufactured cannabis products in the supply chain has overshadowed the raw flower as the driver of both production and retail.

APPENDIX 13: DATA SECURITY (IDENTITY & QUALITATIVE RESEARCH)

Data Security: The complete confidentiality of data transmitted over the internet cannot be guaranteed. However, UC Berkeley's Google Drive on G Suite for Education system has a firewall and heightened security appropriate for the level of data sensitivity (Level P3). We aimed to ensure that no information identifying individuals will be made known by keeping notes in a locked container that will be hidden at a site only known to ourselves (Sluka 1995, Adler & Adler 1993) and by assigning a code that will be associated with and unique to each individual/farm. The code key for identifying informants on notes, audio files, and transcripts will be stored separately from the data-- on a written code key kept under lock and key, accessible only to the researchers. The coded data will be kept on a password-protected laptop, which will be kept in a secure place. The files themselves will also be encrypted and password-protected. No names associated with any data (including audio recordings of interviews, which we will ensure do not contain names during the transcription process). Any notebooks used during interviews will be kept locked, and secured by our researchers. De-identified anonymous data will be stored indefinitely for future research. The identities of the participants will remain undisclosed. The code key will be destroyed after a period of 5 years, thus severing all connection with identifiers.

To minimize potential risks to researchers and subjects, we did the following. We verbally emphasized that participation is voluntary (Crewe 2006; O'Brien and Bates 2003) and periodically interjected reminders of our position as researchers and accountability to the informant (Kovats-Bernat 2002). We assured participants that they may terminate or retract interviews at any time. We maintained individual informed consent (Maher 1997, Schensul et al. 1999); avoided inquiries into or recording of specific names and identifying details regarding alleged or actual unregulated activity and periodically asked informants to be cognizant of divulging such information (Angel-Ajani 2004; Fitzgerald & Hamilton 1999); required that, when meeting for interviews, the meeting place is neutral and not sensitive, the informant is not likely to be recognized, and the interview will not be overheard by others in the proximity (Belousov 2007); and asked the informant to decide where we will meet. We did not ask informants to identify themselves on audio and we de-identified any potential identifiers (names, places, etc.) during the transcription process so written files will be effectively anonymized. There was no penalty for choosing not to participate in an interview, an observation/shadowing exercise, a mapping exercise, or any other research related activity. Original audio files (which contain potential identifiers) were destroyed after transcription and secure file backup. Only the project researchers know subjects' identities and we alone have access to coded identification and information. Our research team personally transcribed or accessed the coded identification and information. Our research team personally transcribed or supervised transcription of interviews by authorized project workers. Interviews were de-identified during transcription, meaning that all identifiable place names and names of people were altered or deleted. The code that correlates to the informant is kept in a code key in a secure document. All documents from

which identification might be made (transcripts, audio files, field notes, etc) are kept in an encrypted folder on a password secured computer.

We conducted interviews, as needed, through HIPAA-compliant Berkeley-licensed Zoom, did not record or retain video data, and expeditiously downloaded transcript data and erased them online (if possible). Data transfer between researchers occurred through secure mechanisms (e.g. FTPs, thumb drives, direct download from recording devices). We did not email any files with sensitive, identifying data. In our correspondence with informants, we did not expose any compromising information, such as whether an individual cultivates cannabis.

We implemented these security measures to address the most vulnerable informants in our participant pool, namely unlicensed cannabis cultivators. The security procedures we detail are necessary because there are consequences for unlicensed cultivation. We take these potential consequences very seriously and our data security protocol is designed to meet the needs of our most vulnerable/at-risk informants. It is the case that unlicensed cultivators could be fined or have administrative actions taken against them for growing cannabis unlicensed by state or local agents. For under 6 plants the penalty may be an infraction (like a parking ticket) while over 6 plants can be charged as a misdemeanor, with possible jail time for egregious offenses. Further, while licensed cultivators are legal in California, the federal government still prohibits cannabis, even if federal enforcement is exceedingly rare and, in regard to medical cannabis in California and other states that have passed medical cannabis laws, is specifically prohibited by the federal government. Indeed, the past 12 years have seen a radical lessening not only of penalties for cannabis cultivation but also actual enforcement of cultivation laws and prosecution of cultivation cases at local, state and federal levels. Because of the potential consequences, we aim to expeditiously secure data, meet with cultivators in non-public venues as possible, avoid mention of cultivation in any correspondence, and any record we make with identifiable information will be kept under lock and key or in an encrypted file.