Planning for Marijuana

The Cannabis Conundrum

Jeremy Németh and Eric Ross

Problem, research strategy, and findings: Twenty-three states and Washington, DC, have legalized medical marijuana, raising difficult land use questions for planners regarding allowable locations, buffering from sensitive uses, and distribution of facilities. We know little about how local jurisdictions regulate medical marijuana dispensary (MMD) location and operation and how equitably different regulatory models distribute these facilities. We begin with an overview of MMD impacts related to crime, property values, and quality of life. We then review emerging local regulation of MMDs with a particular emphasis on land use controls, and find that most authorities regulate MMD location like they do other locally unwanted land uses (LULUs) such as sex-oriented businesses and liquor stores. Given a history of siting LULUs in less-affluent neighborhoods and communities of color, we conduct a case study of Denver and show that four common regulatory models concentrate land that permits MMDs in socioeconomically disadvantaged tracts and areas with high proportions of persons of color.
Takeaway for practice: Local planners are often caught unprepared for the land use implications of medical marijuana legalization. This outline of common land use regulatory models and a replicable analytical model help practitioners develop ordinances that square with their own communities' goals, values, and attributes.
Keywords: environmental justice, medical marijuana, NIMBY, nuisance uses, zoning

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Medical marijuana is legal in 23 states and the District of Columbia, and recreational marijuana is now legal in Washington and Colorado (National Organization for the Reform of Marijana Laws [NORML], 2014).[1] The proliferation of new medical marijuana dispensaries (MMDs) raises difficult land use questions for local planners regarding where MMDs are permitted to locate ("suitable land"), distancing from sensitive uses, equitable distribution of facilities, and potential preemption of local zoning by state law (Salkin & Kansler, 2011). Planners are also faced with regulating new recreational marijuana dispensaries (RMDs) in Colorado cities such as Boulder, Denver, Fort Collins, and Breckenridge, although RMD land use regulations are virtually identical to those for MMDs (Colorado Municipal League, 2014).

We ask two important questions in this study: 1) How do local jurisdictions regulate how and where MMDs operate, and 2) how equitably do common marijuana land use models distribute these facilities, which we define as each tract receiving its fair share of suitable land based on its total land area? To answer these questions, we begin with a brief overview of MMD impacts on crime, property values, and quality of life. Next, we review emerging local regulation of MMDs with a particular emphasis on land use controls. We find that most authorities control where MMDs locate as they do other locally unwanted land uses (LULUs) such as sex-oriented businesses, halfway houses, and liquor stores. Given a history of concentrating LULUs in less-affluent neighborhoods and communities of color, we conduct a case study of Denver and show that four popular regulatory models tend to concentrate suitable land in severely socioeconomically disadvantaged (SED) tracts and areas with high proportions of African American, Hispanic, Asian, and Native American (AHANA) residents (Mitchell, 2012). Our analytical model is replicable and can help practicing planners determine which components of various medical marijuana land use strategies align with their communities' needs and desires.

Background

Experts have valued the medical marijuana market at $1.7 billion and expect that number to double by 2016 (See Change Strategies LLC, 2011). Colorado has more than 130,000 registered patients—up from 7,000 in 2008—and Oakland's (CA) Harborside Health Center clinic alone counts 110,000 registered patients (Pugh, 2011; Roberts, 2013). Los Angeles once contained more than 800 MMDs, although recent estimates put the current number at 472. Denver's 220 licensed dispensaries outnumber Starbucks outlets in the city (Kendall, 2012; Osher, 2011).[2] Nonetheless, marijuana remains illegal at the federal level, violating the Controlled Substances Act (CSA). The federal government's influence on state legalization regimes has played an important role in shaping what types of regulations are levied at the state and local level (Kamin, 2012).

The industry's staggering growth has not come without controversy. Although support for medical marijuana legalization continues to increase, even among conservatives, "not in my backyard" (NIMBY) responses to MMD sitings persist in places such as Washington, DC (Opfer, 2013), New Jersey (Farley, 2012), and Los Angeles (Kudler, 2014; Walker, 2013), all of which approved legalization ballot measures by high margins. A recent poll showed that 73% of adults support making medical marijuana legal, but 44% would be "somewhat or very concerned if a dispensary opened near their home" (Pew Research, 2010). Even as 80% of Californians support medical marijuana (Greenberg Quinlan Rosner Research, 2012), only 55 towns and counties have developed MMD ordinances and 213 localities have banned medical marijuana altogether, many due to pressure from concerned residents (Americans for Safe Access, 2013). In Massachusetts, one-third of communities have imposed a moratorium on medical marijuana sales and facilities (outright bans are illegal), highlighted by intense NIMBY debates in Boston, Springfield, Westfield, and six Cape Cod towns (Crossley, 2014; Metzger, 2013; Vennochi, 2014). In 2013, a spirited debate occurred over the perceived "dumping" of MMDs and cultivation facilities in the District of Columbia's Ward 5, a neighborhood with an already disproportionate share of strip clubs and trash transfer facilities, where 77% of residents are African American and 26% of children live below the poverty line (Bevilacqua, 2013; DCist, 2013; NeighborhoodInfo DC, 2012).

MMDs are prototypical LULUs, or facilities that provide some recognized public benefit, even though virtually no one wants them in their neighborhood (Popper, 1981). Yet, the fervor of the NIMBY response to MMDs is alarming given the lack of empirical evidence on the actual impacts of MMDs, a fact we can attribute to the industry still being in its infancy. Still, several reports show that NIMBY residents fear that new MMDs will threaten their quality of life, raise crime rates, and reduce property values (Ingold, 2010; Ingold & Lofholm, 2011; Tilton, 2009). Quality of life concerns include fear of increased loitering, drug dealers, marijuana smoking outside MMDs, noxious odors, gang activity, exposure to minors, accidental poisonings, and sale of drugs other than marijuana, as well as increased automobile traffic, accidents, and arrests for driving under the influence of marijuana (Bailey & Reiterman, 2008; Thurstone, Lieberman, & Schmiege, 2011). Affected residents also fear increased crime around MMDs (Ingold, 2010). However, the only two peer-reviewed studies on MMD impacts—both cross-sectional in design—find no significant association between dispensary density and local crime in several California cities. The more recent study shows that crime rates around Sacramento MMDs decreased when certain security measures were present (Freisthler, Kepple, Sims, & Martin, 2013; Kepple & Freisthler, 2012). Researchers have yet to examine how MMDs affect property values, given the lack of sufficient time to study such effects as well as the general difficulty in isolating the impact of individual facilities on local property values. Nevertheless, an important concern of developers and business organizations is the potential loss of revenue and trade from commercial businesses who do not want to locate in the immediate vicinity of an MMD (Steckler, 2006; Tilton, 2009).

Although not the topic of this study, we do question whether MMDs should be considered LULUs since localities collect millions in sales taxes as well as application and licensing fees from MMD operation. Moreover, lease rates for MMDs and cultivation centers can be 50% to 75% higher than traditional retail (N. Arbalaez, personal communication, August 10, 2013). Neighborhood impacts can also be quite positive: Oakland City Councilwoman Rebecca Kaplan credits medical marijuana businesses with helping revitalize the Uptown neighborhood, an area that only recently was replete with vacant, boarded-up buildings (Kaiser, 2011). Indeed, growth in MMD facilities is not relegated to liberal communities for these reasons: Sean Paige (R-Colorado Springs) defended his conservative community's decision to allow MMDs as an attempt to attract local entrepreneurs: "We're a pro-business community…. Like a lot of cities, we're hurting for sales tax revenue, so there's no question that we benefit" from an industry that creates jobs and stimulates real estate activity and ancillary services (quoted in Kaiser, 2011, p. 13).

We set out to understand how localities regulate MMDs. For several reasons, we focus particularly on the

geography of dispensaries. First, land use is squarely the purview of urban and regional planners, and we believe planners should take the lead in developing such regulations. Second, we know that concerned citizens and regulators often agree on the need for stringent licensing and operation controls as a way to limit real or perceived externalities, but controversy most often ensues when it comes to determining the location of suitable land for MMDs, or any other LULU for that matter (Salkin & Kansler, 2011). Third, planners and other regulators have a long history of siting LULUs, or suitable land for LULUs, in communities of color and areas of concentrated poverty (Commission for Racial Justice, 1987; Maantay, 2001; Ritzdorf, 1997; Silver, 1997).We examine whether this pattern holds true for MMDs through an analysis of existing regulations for MMDs and case examples.

Regulating MMDs

Once residents vote to legalize medical marijuana, state regulators develop a broad regulatory framework to control the drug's production, distribution, and consumption. Some states become the primary regulating body, whereas others pass on regulatory power—particularly time, place, and manner restrictions—to local authorities. In nearly all cases, state statutes do not require municipalities to make production and sale of medical marijuana legal within their municipal limits, although some require municipalities to either develop licensing regulations or ban facilities outright (Salkin & Kansler, 2010). Local authorities are then charged with controlling land use and operation of facilities as well as enforcing local licensing requirements. We focus much of this study at the local level, both because conflict most frequently occurs over facility location and operation and because planners should be at least partly responsible for developing and enforcing local regulations.

States and localities control potential impacts from MMDs through a combination of licensing, operation, and land use restrictions, all of which aim to protect the health, safety, and welfare of host communities. These categories are not mutually exclusive; for example, compliance with operation requirements is often a condition of licensure. Here we briefly identify some common licensing and operation regulations, and then focus the balance of the study on how land use regulations are used to control where MMDs can locate.

Licensing

Many states have a dual-licensing scheme for MMDs similar to that for liquor stores. In Colorado, for example,

MMD licensees are required to obtain their local license before applying for a state license (Allen, 2010). Municipalities can draft a local licensing ordinance that may be more stringent than the requirements of the state statute, which often includes additional restrictions on land use and operation. Most licensing applications ask proprietors to provide proof of responsible practice as well as floor and security plans. Some municipalities, such as Los Angeles and the District of Columbia, use licensing to limit the total number of dispensaries the city can host. Others, such as Oakland, try to achieve the same ends by requiring strict background checks on business owners and operators to determine "moral or financial fitness," such as evidence of criminal records or bankruptcy history. Licensing fees are often used to offset some of the costs of industry regulation.

Operation

Operation restrictions govern the day-to-day operations of an MMD. The main intent of these approaches is to limit feared secondary impacts of MMDs, especially crime, underage use, or diversion to the "black market" (Kamin, 2012). Table 1 provides an overview of operation restrictions from states and localities with legal medical marijuana adapted from Freisthler et al. (2013). These jurisdictions demonstrate a broad range of regulatory approaches.

Some argue that operational restrictions can be more flexible and enforceable than zoning standards, especially when an industry is in its infancy and actual local impacts are unclear or unknown (Kaiser, 2011; P. Park, personal communication, April 1, 2013). Don Elliott (2008) agrees that the best way to control noise, loitering, or design is "to enforce…[operational] ordinances rather than to prohibit uses that may or may not create those impacts" (p. 143). Again, regulating MMDs based on performance is difficult since so little empirical evidence exists on facility impacts; few cities have hosted MMDs long enough to provide the experience necessary for before/after studies.

Land Use

Land use regulations for MMDs can be divided into three subcategories: zoning restrictions, proximity buffers, and density controls. Table 2 is also adapted from Freisthler et al. (2013) and displays a variety of MMD land use regulations from the same jurisdictions listed in Table 1. Note the minimal use of zoning restrictions and extensive use of buffers from sensitive uses, such as schools, residential areas, childcare, rehabilitation centers, churches, and parks.

States leave zoning to local jurisdictions, which most often prohibit MMDs in residential or mixed-use districts

Table 1. Operation restrictions by state and locality.

	Security Measures								Operations		
	Alarm system	Security cameras	Signage required	Secured entrance	Security guard	Outdoor lighting	Safe for storage	Security plan	No onsite use	Limited hours	Sq. ft. limit
States											
Arizona	×								×		
Colorado	×					×	×		×	×	
Delaware	×							×			
Maine				×							
New Jersey								×			
New Mexico	×							×			
Rhode Island	×			×							
Vermont	×			×							
Localities											
Ann Arbor	×	×					×		×	×	×
Denver	×	×		×	×					×	
Los Angeles	×	×	×	×		×	×		×	×	
Phoenix											
Sacramento	×	×	×	×	×	×	×		×	×	×
Washington, DC	×		×			×	×		×	×	×

Note: See applicable laws and statutes in this article's endnotes.
Source: Adapted from Freisthler, et al., 2013. With kind permission from Springer Science and Business Media.

but allow them in commercial districts. Some localities also keep medical marijuana out of residential districts by prohibiting dispensing of medical marijuana as a home occupation or as an accessory use to another home occupation (Salkin & Kansler, 2010). In terms of proximity buffers (provisions about which may be included in zoning codes), most states require MMDs to locate a minimum distance away from schools, but this is where state control over land use decisions usually ends. Table 2 shows that cities and counties may require proximity buffers between MMDs and residential districts, rehabilitation centers, churches, childcare centers, schools, parks, cinemas, and even other MMDs. The intent of these buffering measures is to separate MMDs and their clientele from sensitive uses and prevent any de facto districting of MMDs resulting from dense concentrations (Elliott, 2008). Finally, states and localities may use density controls to either cap the total number of MMDs outright or base the number on population distribution.

Table 3 illustrates how LULUs can fit into one or more categories: environmental, human services, or nuisance/vice (Cooper, Kelly, & McCleary, 2008; Gaber & Takahashi, 1998; Sandman, 1986; Schively, 2007). Although by definition MMDs fall into the human service category because they provide a legal drug to licensed patients, in practice they are regulated most closely to liquor stores and other nuisance/vice uses. To allocate suitable land for MMDs, communities around the country are adopting the same zoning restrictions that prohibit any businesses selling alcohol, pornography, firearms, and fast food from locating in residential or even mixed-use neighborhoods (Ashe, Jernigan, Kline, & Galaz, 2003; Holder et al., 2000; Salkin & Kansler, 2011). For example, local jurisdictions are applying the same proximity buffers used to separate sex-oriented businesses from residential areas and senstive uses such as schools, parks, and playgrounds (Cooper et al., 2008; Holder et al., 2000; Kelly, 1999). They are also employing density controls commonly used to control bar and liquor store density, most often the spacing between such facilities (Gorman, Speer, Gruenwald, & Labouvie, 2001; Gruenewald & Remer, 2006).

One of the long-standing critiques of land use regulations for LULUs is that they tend to concentrate unwanted facilities in marginalized communities with high percentages of low-income residents and persons of color, either directly by zoning suitable land in such neighborhoods, or indirectly because affluent neighborhoods have more power to exclude offensive uses from their neighborhoods (Boone, Buckley, Grove, & Sister, 2009; Commission for Racial Justice, 1987; Schively, 2007; Sze, 2006).

Table 2. Location restrictions by state and locality.

	Zoning		Buffers[b]				Density controls	
	Permitted[a]	Prohibited	Schools	Residential areas	Other MMDs	Other sensitive facilities	Per population	Total number
States								
Arizona			500				1 per 10 pharmacies	
Colorado			1,000					
Delaware								Per jurisdiction
Maine			500					Per jurisdiction
New Jersey								Per jurisdiction
New Mexico			300					
Rhode Island			500					Per jurisdiction
Vermont			1,000					Per jurisdiction
Localities								
Ann Arbor	Downtown Campus Industrial PUD		1,000					
Denver		Residential	1,000		1,000	1,000 childcare 1,000 rehab center		
Los Angeles			1,320	250	1,000	500 churches 1,320 parks	Per population	
Phoenix	Commercial		1,320	Not adjacent	5,280	1,000 childcare 1,000 churches 1,000 libraries 1,000 parks 1,000 rehab center		
Sacramento	Commercial Industrial		1,000	300	1,000	600 childcare 600 church 600 rehab center 600 cinema 600 tobacco store		Cap at moratorium
Washington, DC		Residential	300			300 rec centers		5 to 8 in entire city

Note: See applicable laws and statutes in this article's endnotes.
a. Includes special use and conditional use permits.
b. Distance in feet.
Source: Adapted from Freisthler et al., 2013. With kind permission from Springer Science and Business Media.

For example, we know from studies of Baltimore, Boston, Washington, DC, and Philadelphia that liquor stores—perhaps the closest land use regulatory parallel to MMDs—are concentrated heavily in each city's poorest neighborhoods, which also house the highest proportions of non-White residents (Jones-Webb & Karriker-Jaffe, 2013; Jones-Webb et al., 2008; LaVeist & Wallace, 2000; Shimotsu et al., 2012).

The question therefore is: If MMD regulation shares similarities with the regulation of other nuisance LULUs, are resulting allowable land use distributions also similar?

In other words, what are the equity implications—intended or not—of current regulatory approaches for zoning MMDs? We consider an equitable distribution approach in which each census tract receives its fair share of suitable land based on its total land area; conversely, an inequitable distribution would mean that some tracts contain a disproportionately high or low percentage of suitable land. Here we outline a spatial–analytical approach that communities can adopt and adapt to help answer this question, and then test this approach in our own Denver case study.

Table 3. LULU categories.

Category	Examples	Most common concerns
Environmental	Incinerators Landfills Recycling centers Power plants Freeways	Physical health Environmental quality Property values
Human services	Rehab centers Homeless shelters AIDS clinics Soup kitchens Correctional facilities	Crime Safety Property values Neighborhood image
Nuisance/vice	Bars/nightclubs Casinos Fast food restaurants Gun shops Liquor stores Massage parlors Sex-oriented businesses Tattoo parlors	Crime Property values

Distributing Suitable Land for MMDs: An Approach and Case Example

Case Selection

We examine how several different MMD land use models would change the amount of suitable land in one city (Denver) for two reasons. First, the selection of exist-ing models, or "suites" of regulations, mimics the type of analysis that most localities would undertake in confronting a similar decision (P. Park, personal communication, April 1, 2013). Second, we control for geography and socioeconomic status across locations by using one city. We chose Denver as our base map because of its available and complete GIS data, our familiarity with the city and subsequent interpretation of the results, and the fact that the city is at the national forefront of medical marijuana legislation.

To select models for comparison, we sought examples that on initial review appeared to differ most significantly in the intensity of zoning and proximity restrictions, especially since density controls are quite rare. This would help us determine which form of regulation was more explanatory in resulting MMD distributions. Table 4 shows that we sought localities that vary with regard to geography, total land area, and population density. Finally, we selected cities with readily accessible municipal ordinances and zoning definitions.

The total land area for our study is approximately 71,901 acres; however, we chose to omit rights-of-way, parks, and open space and use developable land as the basis for our land area calculations. We also eliminate from our study area the Denver International Airport tract in northeast Denver due to the large size of this area (approximately 27,000 acres) and very low population (approximately 1,165 persons). The resulting total developable land is 50,789 acres.

Table 4. Model cities.

City	Land area	Population (2010)	Population density	Zoning restrictions	Proximity restrictions
Ann Arbor (City-Data, 2012a)	27.7 sq. mi.	113,934	4,219/sq. mi.	Permitted in downtown (D), commercial (C), industrial (M), or planned unit development (PUD) districts	Prohibited within 1,000 feet of elementary or secondary schools
Denver (City-Data, 2012b)	154.9 sq. mi.	600,158	3,874/sq. mi.	Prohibited in residential and MS-2 zones	Prohibited within 1,000 feet of schools, childcare centers, and drug rehab centers
Los Angeles (City-Data, 2012c)	502.6 sq. mi.	3,792,621	8,092/sq. mi.	Prohibited in residential; no more than 70 collectives distributed based on community plan area population	Prohibited within 1,000 feet of schools, public parks, public libraries, religious institutions, childcare facilities, youth centers, drug rehab centers, or any other medical marijuana collectives; adjacent to any residential
Phoenix (City-Data, 2012d)	517.9 sq. mi.	1,445,362	3,071/sq. mi.	permitted in commercial (C-2, C-3), industrial (A-1, A-2); prohibited in residential	Prohibited within 1 mile of medical marijuana centers, 250 feet of residential, 1,320 feet of parks, schools, and community buildings, 500 feet of churches

Suitable Land Analysis Methods

In this analysis we do not examine developable land where MMDs are actually located, but instead where they are permitted to locate. This isolates the impact of local land use regulations without introducing facility location variables such as local labor markets or lease rates. Our first step was to map suitable land under each regulatory model. Importantly, we only mapped suitable land based on the zoning and proximity restrictions, omitting density controls that a municipality might use. We also omitted the regulation that would buffer MMDs from other MMDs because our hypothetical analysis is intended to provide guidance to planners prior to the implementation of medical marijuana regulations and subsequent siting of MMDs.

We conducted a three-step process to determine total suitable land under each regulatory model. First, we mapped suitable land for MMDs by applying only that model's zoning regulations (Municode 2012a, 2012b, 2014; City of Phoenix Planning and Development Department, 2010). Second, we mapped unsuitable land applying only that model's proximity buffers. Third, we subtracted the unsuitable land prohibited by proximity buffers from the suitable land (based on zoning), resulting in a "total suitable land" calculation for each model.

To map suitable land based on zoning regulations, we used parcel data from the City and County of Denver, which includes an "actual zoning" attribution for each parcel. This allowed us to easily identify prohibited zones (typically residential zones) and permitted zones (typically commercial and industrial). An acknowledged weakness of our model is the generalization across cities of zoning categories such as residential, commercial, or industrial: one city's definition of "light commercial" or "heavy industrial" may vary from another's. Therefore, we used the general zoning descriptions from the Denver parcel data to approximate similar zone categories.

To map suitable land based on proximity buffers, we used land use descriptions from the parcel data that included schools, parks, churches, and other sensitive uses. For those uses not available in the parcel data (e.g., childcare facilities, drug rehabilitation centers), we acquired locations from the Denver Public Schools and Colorado Coalition for the Homeless and geocoded these by address, achieving high match rates (approximately 90%; Colorado Coalition for the Homeless, 2014; Denver Public Schools, 2014). Ideally, these points would be joined to parcels; unfortunately, most of the geolocations were not rooftop locations, so we measured proximity buffers from the geolocated point rather than from parcel edges as specified by some of the municipal codes.

Los Angeles has an additional density restriction limiting the total number of medical marijuana businesses; as Table 2 shows, other cities such as Washington, DC, have similar constraints. However, the number of MMDs allowed is still subject to suitable land allocations, which is the focus of our study.

Demographic and Socioeconomic Analysis Methods

We downloaded all census tract geographic boundaries and City and County of Denver boundary, parcels, parks, streets, and zoning from the City and County of Denver Open Data Catalog in shapefile format (City and County of Denver, 2012). We acquired Decennial Census 2010 and American Community Survey (ACS) 2006–2010 demographic data from the U.S. Census American FactFinder and National Historic GIS sites (National Historical Geographic Information System, 2012; U.S. Census, 2014). These data were joined to census geographies using census tract identification numbers.

To understand the types of neighborhoods where these facilities were allowed to locate, we collected and analyzed census data on two subcategories within the city's 143 census tracts: AHANA and SED populations. The first category identifies a minority presence (less than 50%) of residents who identify themselves as non-Hispanic White only. We use the inverse term, AHANA, for such tracts. The second identifies significantly distressed populations using a composite index of area-based indicators that includes three constructs and eight variables that together measure SED by comparing observed data with Denver averages (Diez Roux et al., 2001; Krieger, Waterman, Chen, Rehkopf, & Subramian, 2004). Tracts that meet all thresholds listed in the third column of Table 5 are considered SED tracts. We used this index because we believe it to be a more robust measure of disadvantage than singular measures such as income, education, or home values.[3]

Impact of Land Use Regulations on Suitable Land Distribution

Our analysis shows the models we assessed lead to land variability: The land use regulations in these four cities vary highly in resulting permissiveness. We array these regulatory models three different ways to help practitioners understand conceptually how zoning restrictions and proximity buffers interact to produce more or less permissive suitable land distributions. Figure 1 maps the distribution of suitable land under each model; Table 6 displays the percentage of suitable land under each model and its

Table 5. SED index.

Construct	Variables	Local measure (national)	Census product
Income/wealth	Median household income	Below Denver median of $45,501 ($51,915)	ACS selected economic characteristics
	Percentage of persons below poverty	Greater than Denver average of 19.2% (13.8%)	ACS selected economic characteristics
	Median value of owner-occupied housing units	Below Denver median of $240,900 ($188,400)	ACS selected housing characteristics
	Percentage of housing units that are owner occupied	Below Denver average of 52.5% (66.6%)	ACS selected housing characteristics
Education	Percentage of adults 25 years and older who have completed high school	Below Denver average of 84% (85%)	ACS selected social characteristics
	Percentage of adults 25 years and older who have completed college	Below Denver average of 40.1% (27.9%)	ACS selected social characteristics
Occupation/ employment	Percentage of persons 16 years and older in executive, managerial, or professional occupations	Below Denver average of 40.4% (37%)	ACS selected economic characteristics
	Percentage employed	Below Denver average of 91.2% (90.4%)	ACS selected economic characteristics

Source: Reprinted from *Annals of Epidemiology*, Vol. 11, No. 6, A. V. Diez Roux et al., "Area Characteristics and Individual-Level Socioeconomic Position Indicators in Three Population-Based Epidemiologic Studies," pp. 395–405, Copyright 2001, with permission from Elsevier.
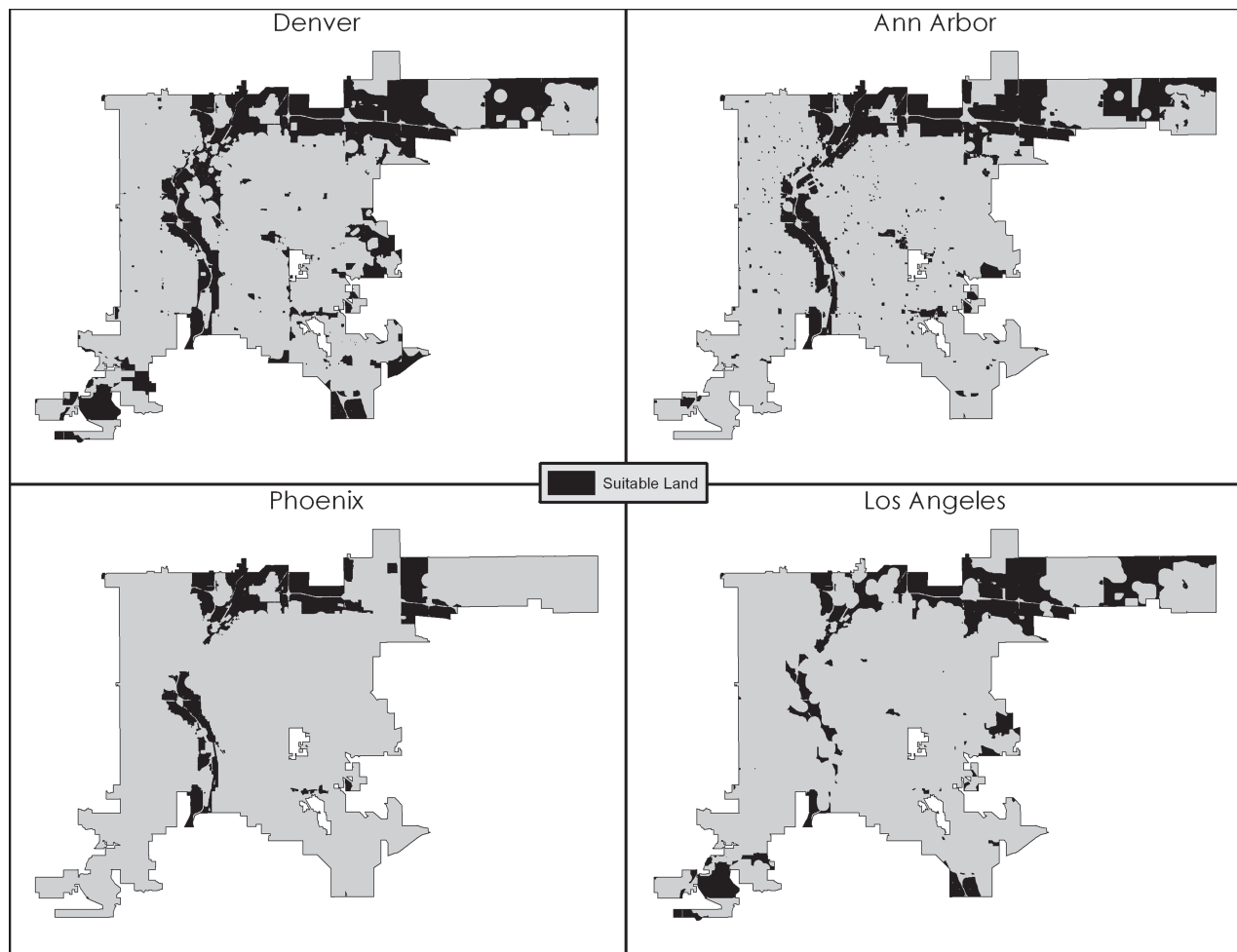

Figure 1. Suitable land distribution by each model.

Table 6. Suitable land in all tracts and permissiveness by model.

Zoning restrictions			
	Acres in all tracts	Percentage in all tracts	Permissiveness rank
Los Angeles	21,074	41%	1
Denver	20,970	41%	2
Ann Arbor	12,001	24%	3
Phoenix	7,227	14%	4
Proximity restrictions			
	Acres in all tracts	Percentage in all tracts	Permissiveness rank
Ann Arbor	44,079	87%	1
Denver	30,824	61%	2
Phoenix	15,075	30%	3
Los Angeles	9,827	19%	4
Zoning + proximity restrictions			
	Acres in all Tracts	Percentage in all Tracts	Permissiveness Rank
Denver	16,031	32%	1
Ann Arbor	11,390	22%	2
Los Angeles	9,827	19%	3
Phoenix	6,249	12%	4

Note: Total land area based on parcels excluding right-of-way and Denver International Airport tract = 50,888 acres.

Figure 2. Zoning and proximity model matrix: Permissiveness by percentage of suitable land in each model.

"rank" of relative permissiveness. Figure 2 shows our placement of the four models into quadrants based on the percentage of suitable land after applying zoning restrictions or proximity buffers.

We can characterize the impact of these models in several ways given these distributions. If we just apply a model's zoning restrictions, the Denver and Los Angeles models are the most permissive, whereas Phoenix is the most restrictive. Ann Arbor's proximity buffers are the most permissive, and Los Angeles' buffers are the most restrictive. When combining zoning restrictions and proximity buffers, the Denver model is the most permissive, whereas the Phoenix model is the least.

Having identified the majority AHANA and SED tracts, we then calculated suitable land in those tracts to show any difference in the percentage of suitable land between AHANA and non-AHANA, or SED and non-SED, tracts. Table 7 displays these percentages as well as an "equitability rank" based on the difference between each model: smaller differences in percentage of suitable land are *more equitable* (1) and larger differences are *less equitable* (4).

Table 7 shows that in 10 of 12 model and regulation combinations, there is a higher percentage of suitable land
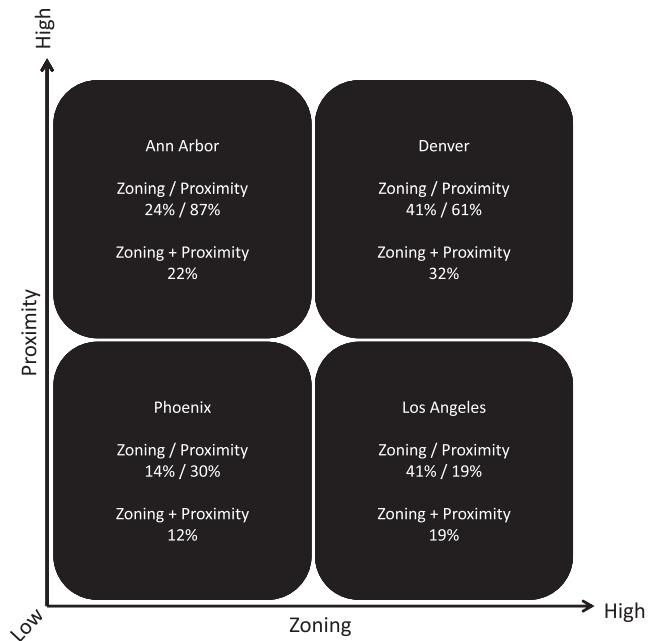
in AHANA tracts. Ann Arbor exhibits the largest differences across the three categories: zoning restrictions alone, proximity buffers alone, and zoning restrictions and proximity buffers together. Overall, the largest disparities exist in the zoning restrictions category where all observed differences are statistically significant.[4]

Differences in percentages of suitable land in SED versus non-SED tracts are quite stark. Phoenix is the least permissive across the board; again, the largest disparities exist in the zoning restrictions category. All differences in the SED analysis are significant. If we look only at the impact of zoning restrictions on distribution equitability across AHANA and SED categories, we note that the most permissive models (Denver and Los Angeles) produce the most equitable distributions of MMDs in AHANA and SED tracts. Conversely, the restrictive zoning in the Phoenix model puts that model at or near the bottom in equitability.

If we examine just proximity buffers, Ann Arbor is the most permissive in terms of suitable land, but it produces the least equitable distribution in AHANA versus non-AHANA tracts. Yet, it is the most equitable in terms of distribution in SED versus non-SED tracts. Importantly, however, the differences in percentage of suitable land in these different tracts are very small across the board when proximity buffers are applied in isolation, except in the case of the Phoenix model's distribution in SED and non-SED tracts.

When we combine zoning restrictions and proximity buffers, the Phoenix model, which occupies the low

Table 7. Suitable land distributions by total acres and percentage of developable land.

	Zoning restrictions in African American, Hispanic, Asian and Native American (AHANA) tracts					
	Acres in AHANA tracts	Percentage in AHANA tracts	Acres in other tracts	Percentage in other tracts	Additional percentage in AHANA tracts	Equitability rank
Denver	8,952	44.0%	12,018	39.3%	4.7%*	1
Los Angeles	9,001	44.3%	12,073	39.5%	4.8%*	2
Phoenix	4,521	22.2%	2,706	8.9%	13.4%**	3
Ann Arbor	6,851	33.7%	5,150	16.9%	16.8%**	4
	Proximity restrictions in AHANA tracts					
	Acres in AHANA tracts	Percentage in AHANA tracts	Acres in other tracts	Percentage in other tracts	Additional percentage in AHANA tracts	Equitability rank
Los Angeles	4,049	19.9%	5,778	18.9%	1.0%	1
Denver	12,000	59.0%	18,824	61.6%	−2.6%**	2
Phoenix	6,579	32.4%	8,496	27.8%	4.6%	3
Ann Arbor	16,932	83.3%	27,147	88.8%	−5.6%**	4
	Zoning + proximity restrictions in AHANA tracts					
	Acres in AHANA tracts	Percentage in AHANA tracts	Acres in other tracts	Percentage in other tracts	Additional percentage in AHANA tracts	Equitability rank
Los Angeles	4,049	19.9%	5,778	18.9%	1.0%	1
Denver	7,065	34.7%	8,966	29.3%	5.4%	2
Phoenix	3,849	18.9%	2,400	7.9%	11.1%**	3
Ann Arbor	6,450	31.7%	4,940	16.2%	15.6%**	4

Note: Total land that allows MMDs = 20,332 acres in AHANA tracts; 30,556 acres in others

$*p < .10, **p < .05, ***p < .01.$

	Zoning restrictions in socioeconomically disadvantaged (SED) tracts					
	Acres in SED tracts	Percentage in SED tracts	Acres in other tracts	Percentage in other tracts	Additional percentage in SED tracts	Equitability rank
Los Angeles	4,414	56.9%	16,660	38.6%	18.3%***	1
Denver	4,400	56.7%	16,570	38.4%	19.3%***	2
Ann Arbor	3,649	47.0%	8,352	19.4%	27.7%**	3
Phoenix	3,598	46.4%	3,629	8.4%	38.0%***	4
	Proximity restrictions in SED tracts					
	Acres in SED tracts	Percentage in SED tracts	Acres in other tracts	Percentage in other tracts	Additional percentage in SED tracts	Equitability rank
Ann Arbor	6,673	86.0%	37,406	86.7%	−0.7%***	1
Denver	5,034	64.9%	25,790	59.8%	5.1%***	2
Los Angeles	2,048	26.4%	7,779	18.0%	8.4%**	3
Phoenix	3,431	44.2%	11,644	27.0%	17.2%**	4
	Zoning + proximity restrictions in SED tracts					
	Acres in SED tracts	Percentage in SED tracts	Acres in other tracts	Percentage in other tracts	Additional percentage in SED tracts	Equitability rank
Los Angeles	2,048	26.4%	7,779	18.0%	8.4%**	1
Denver	3,577	46.1%	12,454	28.9%	17.2%**	2
Ann Arbor	3,556	45.8%	7,834	18.2%	27.7%**	3
Phoenix	3,189	41.1%	3,060	7.1%	34.0%**	4

Note: Total land that allows MMDs = 7,756 acres in SED tracts; 43,132 acres in others.
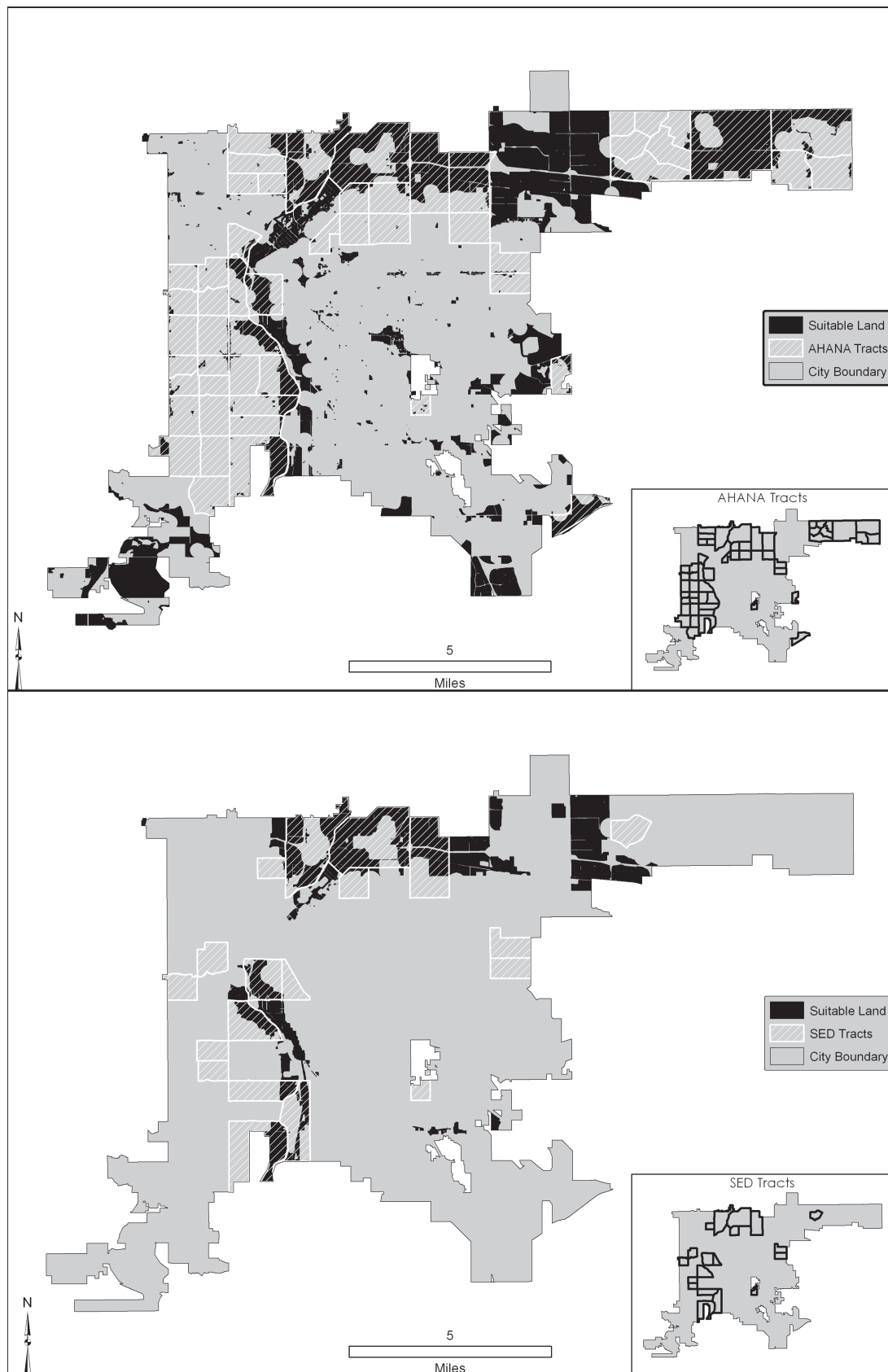
$*p < .10, **p < .05, ***p < .01.$

Figure 3. Suitable land distribution in African American, Hispanic, Asian, and Native American (AHANA) tracts under the Denver model (top) and socioeconomically disadvantaged (SED) tracts under the Phoenix model (bottom).

zoning/low proximity permissiveness quadrant in Figure 2, produces the least-equitable MMD distribution. The second-worst performer in terms of equitability is Ann Arbor, which occupies the low zoning/high proximity permissiveness quadrant. In sum, the common feature of these two less-equitable models is the high restrictiveness of their zoning regulations.

It is also important for planners to visualize precisely where suitable land is located in different neighborhoods to understand better which specific neighborhoods or corridors have more or less suitable land. Figure 3 shows two selected overlays that demonstrate strong spatial relationships between suitable land and AHANA and SED tracts. Both maps show distinct linear patterns of suitable land running north–south along U.S. Interstate 25 and east–west along U.S. Interstate 70. These two overlays also expose the strong correlations between race and class in Denver: All but two AHANA tracts are also SED tracts.

The preceding analysis indicates that, when applied in Denver, all four regulatory models result in a higher proportion of suitable land for MMDs located in SED tracts and tracts with a majority of AHANA residents. This does not mean that MMDs will necessarily locate in higher concentrations in SED and AHANA tracts, especially since the majority of Denver's developable land area is in non-SED and non-AHANA tracts. But our analysis demonstrates that some of the most common models of zoning regulations and proximity buffers tend to produce higher percentages of suitable land in these areas. Given that most would people prefer not to live near these facilities, planners must recognize the potential equity implications of these land use policies.

Our central aim in this study is to outline emerging land use regulations for medical marijuana and demonstrate a replicable spatial–analytical model for analyzing the potential equity implications of local land use decisions. While our results are specific to the Denver case and might have been different if we had conducted our analysis in another city or applied different regulatory models, it is worth noting some general takeaways for practitioners:

1) Instead of adopting off-the-shelf regulatory models that already exist for other nuisance or human service LULUs, communities looking to distribute MMDs more equitably should consider conducting similar analyses in their own communities while taking a more detailed "stepwise" look at which zoning restrictions and proximity buffers might be behind any resulting distribution inequities. Such an analysis could entail adding individual regulations until a desired balance is achieved. In our case study, for example, the Ann Arbor and Phoenix models produce

much larger percentages of suitable land in SED tracts than in non-SED tracts, and these are the only two models to explicitly permit MMDs in all commercial zones. We might attribute some of this imbalance to that fact that, in Denver at least, the richest and Whitest neighborhoods are residential only with very few embedded commercial districts.

2) The literature on environmental privilege shows that more affluent (i.e., non-SED) tracts contain more public amenities and institutions such as schools, parks, community centers, churches, and childcare facilities (Pulido, 2000; Wolch, Wilson, & Fehrenbach, 2005). We initially hypothesized that proximity buffers intended to distance MMDs from such sensitive uses would push MMDs out of non-SED neighborhoods. In fact, we found that while proximity buffers do contribute to some inequity, it is not nearly as important in producing inequitable outcomes as zoning restrictions.

3) Although we spend very little time discussing how communities develop medical marijuana land use policies, it is worth noting that many of these processes—especially at the state level—are top-down, expert-driven legislative processes by appointed boards with little contribution from planning staff.[5] Planners must be at the table to conduct analyses such as those presented here, processes that carefully evaluate the potential equity impacts of MMD land use policies on the most marginalized neighborhoods. Without such careful analyses, we are likely to continue allocating suitable land at higher proportions in heavily disadvantaged neighborhoods with high percentages of persons of color.

Conclusion

This is one of the first scholarly studies to provide a detailed overview of emerging regulation of MMDs and the potential equity implications of varying regulatory regimes. First, we outline current information on potential and perceived MMD impacts and the predominant regulatory strategies used by U.S. communities. Second, we provide a straightforward analytical approach to help planners and policymakers determine whether to adopt or adapt certain land use regulations in a manner that fits best with their own communities' goals and attributes. Third, we apply this framework in a Denver-based case study and find that each land use model results in different but overall higher concentrations of suitable land in SED tracts and tracts with a majority of AHANA residents. Restricting MMDs to certain zoning districts tends to explain more of the discrepancies than proximity buffers. We hypothesize that this pattern

might hold in other localities and suggest that planners conduct a similarly fine-grained analysis when their communities have legalized medical or recreational marijuana.

As we learn more about actual MMD impacts, we hope to engage with residents of affected localities to understand whether, indeed, MMDs remain LULUs. To better understand why such businesses locate where they do, we will continue interviewing dispensary proprietors as well as examining lease rates, property values, and other potential explanatory factors. Scaling up this study to consider the land use and policy implications of medical marijuana across the state would also allow us to answer even more questions: Do some localities that permit MMDs have such stringent land use or permitting requirements that they force MMDs to neighboring towns? Will proprietors begin to concentrate in jurisdictions with more lax standards? What does this all mean for local tax dollars, labor markets, and the state's economic landscape?

Planners and policymakers in states that permit the dispensing of medical marijuana would do well to develop responses to these questions and others posed in this article. As legalization efforts increase across the country, many planners will be faced with these issues.

Notes

1. All listed codes and statutes related to this study:

States

Name	Act, ordinance, or code	Statute	Year
Arizona	*Arizona medical marijuana act*	Ariz. Rev. Stat. § 36-2806.01	2010
Delaware	*Delaware medical marijuana act*	Title 16, Del. Health and Safety Food and Drugs, Chapter 46A	2011
Maine	*An act to amend the Maine medical marijuana act*	Maine L.D. 1811§ 1–51	2010
New Jersey	*New Jersey compassionate use medical marijuana act*	P.L. No. 2009, c.307	2010
New Mexico	*The Lynn and Erin compassionate use act*	N.M. Stat. § 26-2B	2010
Rhode Island	*The Edward O. Hawkins and Thomas C. Slater medical marijuana act*	Chapter 016, H 5359 Substitute A, R.I. Gen. Laws.	2009
Vermont	*An act relating to registering four nonprofit organizations to dispense marijuana for symptom relief*	Vermont S.B. 17	2011

Localities

Name	Act, ordinance, or code	Year
Ann Arbor, MI	Ordinance no. ORD-10-37	2010
Denver, CO	Council bill no. 34	2010
Los Angeles, CA	Ordinance no. 181069	2010
Phoenix, AZ	Ordinance G-5573	2010
Sacramento, CA	Ordinance 2009-033	2009
	Ordinance 2009-037	2010
	Ordinance 2009-038	2010
Seattle, WA	Ordinance no. 123661	2011
Washington, DC	Council of the District of Columbia, Bill 18-62W2	2010

2. Note that we focus on dispensaries versus cultivation centers, as the latter are almost always permitted only in light or heavy industrial districts far from NIMBY residents and surrounded by more objectively noxious land uses.

3. We use a composite index found commonly in public health and epidemiological studies for several reasons. First, the index is a better proxy than single-variable measures such as poverty level, education level, and unemployment for individual-level indicators of socioeconomic status and allo ws the researcher to make more confident assertions when attributing area-level data to all persons within that geography (Diez Roux et al., 2001). Diez Roux et al. (2001) show that the variables that comprise the index are correlated in the 0.5 to 0.8 range. Second, all variables are publicly available and can be collected easily from more the more up-to-date ACS estimates. Third, the index is useful in determining significant socioeconomic distress, since an area is only considered SED if it falls below the threshold for all variables in the index. Fourth, the index is particularly appropriate in a study such as ours in which we aim to make binary distinctions about a certain geography's characteristics (i.e., SED or non-SED).

4. With regard to significance tests in Table 7, since we calculated these differences for every census tract in Denver, the resulting percentage difference is an actual difference. Nonetheless, we did conduct a two-tailed t test for each observed difference and found that the difference in means is significant in 8 of 12 cases in the AHANA analysis (the other four cases fell just outside the .10 probability range) and in all 12 cases in the SED analysis (Table 7). Had we conducted a one-tailed test, all observed differences would be very statistically significant.

5. Rachel Allen, attorney with the Colorado Municipal League, states "staff planners are rarely at the table when developing land use regulations for medical and recreational marijuana. These discussions are typically held between lawyers and councils with little input from planning and development" (R. Allen, personal communication, 2014). Colorado's medical marijuana laws were developed by a workgroup of 32 people comprising "district attorneys, law enforcement agencies and individuals already selling marijuana" (Scott, 2012). The task force and working groups charged with developing regulations for recreational marijuana consisted of 85 total members, only two of which were planners (including one of the authors of this article; Amendment 64 Task Force, 2013).

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