Estimating the Impact of Cannabis Production on Rural Land Prices in Humboldt County, CA[1]

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Abstract

Amenity values, development potential, commodity prices and productive capacity largely determine rural land prices. For rural lands used in timber and agricultural production, capacity and expected future commodity prices play primary roles. For rural lands that are used as second homes or recreational properties, amenities—such as being near lakes or having scenic views—drive pricing. Here, we examine the impact of cannabis production on rural property values in Humboldt County, California, the largest cannabis producing county in the country and also home to both productive and recreational rural lands. We hypothesize that lands that are best for cannabis production will be impacted by two competing forces. On one hand, areas with high cannabis capacity should have higher prices if potential returns to growing cannabis are highest in these areas. On the other, these areas may have social disamentities that provide downward pressure on property values (e.g., higher levels of crime, transient workers, etc.). Using a hedonic model that accounts for land's productive capacity as well as the presence of potential disamenties, we find the density of cannabis production has a positive relationship with property prices. Our results suggest that a doubling of the median existing cannabis density in a watershed is associated with a 3 to 4 percent increase in the sales price of undeveloped land in Humboldt County.

Keywords: amenity value, hedonic models, illegal markets, marijuana

Introduction

Over the last half century many rural areas in the United States have undergone broad social and cultural transformations. Behind much of these changes lies a shift in land use (Radeloff et al. 2005). Many rural lands which once were used for resource use and extraction, are now primarily used for tourism and second home ownership (Brown et al. 2005). Such shifts have not only impacted local communities, but land markets as well.

The prices for productive and recreational lands are determined by different economic forces. For timber and ranching lands, land prices are based on the productive capacity of the land (either in terms of timber production or livestock) and expectations of future returns to management (Conrad 2010). For recreational properties, land prices are largely driven by amenity values such as hunting and fishing opportunities, scenic values, and wildlife viewing (Smith et al. 2002). Likewise, there is strong evidence that disamenities, such as crime or degraded environments, negatively impact these amenity based properties (Boggess et al. 2014).

Cannabis production is an increasingly important rural land use in many parts of the country. Now legal as either medicine or for recreational purposes in over 30 states, cannabis production is a multi-billion dollar industry and much of the production takes place in rural areas where traditional natural resource uses mingle with the new wave of economic activities (Arcview Market Research 2014). Economic theory suggests that cannabis production may have competing impacts on property prices. On one hand, properties that are well-suited, either socially or biophysically, to production should experience increased property prices based on the potential for high future returns. At the same time, these properties may be less attractive to buyers who see the potential cannabis production on

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neighboring parcels as a disamenity, which can lower the amenity value of a parcel or cause land owners to invest in ameliorative actions. Given these competing forces, whether cannabis production increases or decreases property prices remains an empirical question.

We examine the impact of cannabis production on property values in Humboldt County, California, one of the largest cannabis production regions in the country, and likely the world. Combining a dataset of over 3,000 arm's length property transactions with data on the location of cannabis farms, we identify the impacts of cannabis production using a hedonic pricing model. The results of our empirical investigation suggest that areas that are best suited for cannabis production have statistically significant higher prices than similar parcels in parts of the county that do not produce cannabis.

Methods

Study Area

Our study area consists of 54 randomly selected watersheds in Humboldt County that are representative of the area as a whole (see Butsic and Brenner 2016, for comparative statistics). Humboldt County is located in northern California (fig. 1) along the Pacific Coast and is considered the leading cannabis producing county in the United States, if the not world. The county is heavily forested with a mix of coniferous and hardwood forest, with pockets of open rangeland. Timber production contributes about $72 million in direct sales to sawmills, secondary manufacturing, and biomass energy plants that generate additional value added products (Humboldt County 2015). The harvesting and processing of wood has historically been a major center of economic activity. Due to the steep terrain and poor soils, traditional agriculture is limited to a relatively small area of the county. Livestock, dairy, and nursery production are the largest agricultural sectors ($76, $61, $41 million dollars in sales in 2014) and make up over 95 percent of all agricultural production by value. In comparison, the wholesale value of cannabis production is likely over $300 million, although no official figures exists (Butsic and Brenner 2016).

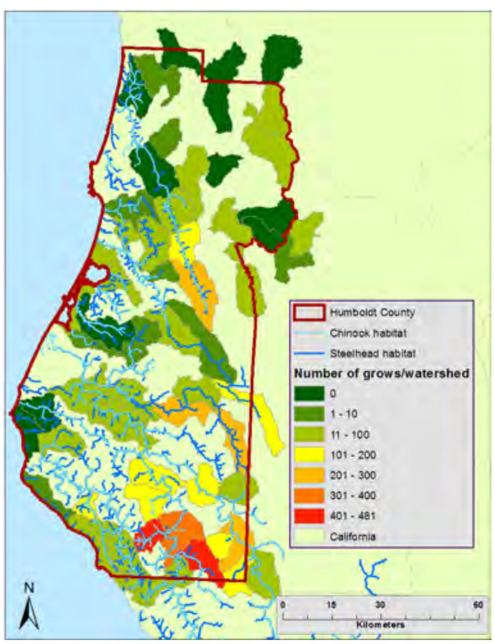

Figure 1—Humboldt County and number of grows per watershed.

Second home ownership and tourism is an increasing important part of the Humboldt County economy. Located about 4 hours north of the Bay Area, and comprised of scenic terrain and ample coastline, Humboldt County is an attractive area for outdoor enthusiasts. Redwoods State Park and parts of Six Rivers National Forest are well known for their spectacular old growth forest and attract nearly three-quarters of a million visitors a year. These visitors spend nearly $3.2 billion dollars a year, making tourism one of Humboldt County's leading industries.

Cannabis Production

Cannabis can be legally cultivated in California for medicinal purposes, although the federal government still considers cannabis an illegal Schedule I drug (McGreevy 2015). Producers must be documented care givers and can supply their crop either to individuals who have physician approval to use cannabis or to dispensaries, which can sell cannabis to patients. Under the Obama administration, federal law enforcement agencies have not strongly enforced federal cannabis laws nationally, although there is precedent for federal actions on dispensaries and growers (Zilversimt 2016). Federal law typically enforces a 5 year prison sentence for cultivation sites larger than 99 plants, hence anecdotal evidence suggests that many farmers stay under that number in case of federal intervention (California Normal 2016). Currently, there is no organized program in California to track cannabis cultivation siting, production, or sales, even in the legal market. New laws passed in 2015 aim to establish such a system by 2018 (McGreevy 2015).

There is little documentation of actual practices of cannabis production in the scientific literature (Carah et al. 2015). Nevertheless, researchers have anecdotally observed several tendencies of cannabis production that are relevant to our modeling exercise. First, production takes place both outdoors and in greenhouses. Outdoor production is reliant on natural sunlight and plants are typically grown in groups or individually in raised beds. Greenhouse production allows for light to be diminished with shades or enhanced with artificial light. The manipulation of light allows growers to precisely control flowering, which gives greater control over production in terms of both the schedule and the amount produced. Finally, for most agricultural crops, soil quality is a driver of crop choice. In Humboldt County, poor-quality agricultural soil covers nearly 90 percent of the county. Therefore, many growers import soil and amendments for both outdoor and greenhouse grows. While there is no documentation of how much soil is imported, various local businesses supply soil in large quantities (e.g., www.humboldtnutrients.com, www.royalgoldcoco.com).

Past land use analysis have shown that cannabis production is clustered at the watershed scale, with some watersheds having high levels of production and others no production at all (Butsic and Brenner 2016). Cannabis production is more prevalent in the south and east of the county. Most production takes place in remote areas of the county, and many of these areas are not suited for traditional agricultural production.

Disamenities from cannabis production may reduce property values. Many cultivation sites are located off the grid, and thus rely on generators for power. Many Humboldt County landowners have complained about the constant humming in remote areas of the county caused by these generators (Stansberry 2016b). Also many growers use artificial lights to increase yield, and these lights can lead to light pollution that may be unattractive to rural residents (Stansberry 2016a). And overall, there may be an unease for some potential landowners about purchasing property near cannabis cultivation, both for cultural reasons and because cannabis cultivation is still federally illegal.

Data

Our primary dataset of property sales was purchased from Core Logic and contains over 3000 arm's length transactions. We developed this dataset from a larger list of sales, by limiting our analysis to properties where at least 90 percent of the property price was the value of the land. We limited our dataset in this way because we were not able to obtain detailed information on improvements, such as the size of a structure, number of bathrooms, or number of bedrooms. We also limited our data temporally to sales that took place from 2000 to 2015.

In order to identify what features of the property impacted sales price, we merged the sales data with a host of spatial variables. For each parcel we calculated: the percent of the property in coniferous forest, the percent in hardwood forest, the percent in mixed forest, percent in agriculture, and percent in barren land; the distance to the nearest town of at least 10,000 people, the size of the parcel in acres, the distance to the ocean, latitude, and distance from nearest paved road. In addition we calculated the percent of the parcel with slope over 30 percent, and percent of the parcel with a southern aspect.

Because cannabis is often produced on imported soils and takes little land to grow, many variables typically used to explain agricultural productivity may not fully account for whether an area is actually well suited for cannabis production. Therefore, to quantify if a parcel is well suited for cannabis production, we identified the density of cannabis plants in each of the 54 watersheds. To do this, we used the dataset developed by Butsic and Brenner (2016). Cannabis density in a watershed acts as a proxy for overall suitability of a watershed for cannabis production.

Estimating the Hedonic Model

In order to identify the impacts of cannabis production on property prices, we employ a hedonic pricing model (Rosen 1974). The intuition behind the hedonic model is that a piece of property is comprised of various attributes that contribute differently to the overall price of the property. Often, these attributes are grouped as structural, locational, neighborhood, and environmental characteristics (Champ et al. 2003). By including these parcel characteristics in a regression framework, we can identify the contribution of each to the overall price. In our specific case we estimate the hedonic model of property i in watershed w sold in year t as:

$$\ln{(price)}_{itw} = B_1 + \beta eco_{iw} + \phi property_{iw} + \theta distance_{iw} + \Phi zone_{iw} + \Gamma cannabis_{w} + \rho_t + e_{iw}$$

We take the natural log of price in order to limit the impact of high priced properties that may be outliers in the data. Where eco represents a vector of variables pertaining to the ecological characteristics of each parcel (percent of property with slope over 30 percent, percent of each land cover class in the parcel, percent of property with a south facing aspect slope), $property$ a vector of characteristics pertaining to the features of the property (acres, acres^2, assessed value of improvements), $zone$ a vector with the zoning classification of each parcel (including having a timber harvest plan within the past 15 years), $distance$ is the distance to various important features (town, stream, road and ocean), and $cannabis$ is the number of cannabis plants per acre in the watershed where the property is located.

Results

Results of the model suggest that higher intensity cannabis production is positively associated with land prices. In the sample that includes all properties larger than 1 acre (0.4 ha), price per acre increased by 24 percent for a one plant per acre (0.4 ha) increase in cannabis density (table 1). For the sample of properties greater than 2 and 20 acres (0.81 and 8.1 ha), the corresponding price per acre increases are 27 and 25 percent, respectively. The coefficient estimates are significant at the 5 percent level using heteroscedasticity robust standard errors. With the exception of the 1 acre (0.4 ha) sample, the results are significant at the 10 percent level when calculated with robust standard errors clustered at the watershed level (table 2).

To better interpret the coefficient estimates, note that a one plant per acre (0.4 ha) increase would be an extraordinarily large expansion in cannabis cultivation. To put the results in perspective, the median watershed in our sample has a plant per acre (0.4 ha) density of 0.14. If cannabis density doubled from that number, our results imply a concomitant property price per acre(0.4 ha) increase of 3.4 percent in the sample of all properties larger than 1 acre (0.4 ha).

Table 1: Hedonic estimates with robust SEs

	Parcels > 1 acre	Parcels > 2 acres	Parcels > 20 acres
Cannabis plants per acre (watershed)	0.242	0.273	0.245
	(0.108)**	(0.107)**	(0.117)**
Assessed improvements ($1000s)	0.025	0.024	0.021
	(0.004)***	(0.004)***	(0.003)***
Parcel size (acres)	-0.006	-0.006	-0.004
	(0.001)***	(0.001)***	(0.001)***
Acres^2	0.000	0.000	0.000
	(0.000)***	(0.000)***	(0.000)***
% slope > 30%	-0.271	-0.250	-0.224
	(0.182)	(0.186)	(0.201)
% mixed forest	-0.150	-0.084	0.005
	(0.144)	(0.148)	(0.181)
% hardwood	-0.171	-0.199	-0.038
	(0.184)	(0.198)	(0.219)
% shrub	0.391	-0.026	-0.503
	(0.454)	(0.347)	(0.630)
% coniferous	0.301	0.267	0.091
	(0.140)**	(0.145)*	(0.194)
% barren	0.094	-0.129	-0.097
	(0.256)	(0.276)	(0.397)
Ln (distance to road)	-0.141	-0.041	0.010
	(0.095)	(0.092)	(0.097)
Distance to stream (KMs)	-0.013	0.019	0.071
	(0.055)	(0.057)	(0.104)
% facing south	0.105	-0.008	0.074
	(0.130)	(0.131)	(0.157)
THP in last 15 years	0.059	0.123	0.222
	(0.108)	(0.106)	(0.113)**
Ag exclusive zone	-0.759	-0.507	-0.033
	(0.117)***	(0.114)***	(0.127)
Ag zone	0.096	0.410	0.400
	(0.126)	(0.133)***	(0.293)
TPZ	-0.886	-0.613	-0.014
	(0.131)***	(0.128)***	(0.131)
Forest/rec zone	-0.798	-0.458	0.224
	(0.125)***	(0.125)***	(0.134)*
City	0.202	0.063	-0.517
	(0.161)	(0.180)	(0.273)*
Unzoned	0.632	0.569	0.190
	(0.103)***	(0.115)***	(0.172)
Distance to ocean (100 KMs)	-1.700	-1.731	-2.025
	(0.330)***	(0.334)***	(0.369)***
ykm	-0.001	-0.001	-0.002
	(0.001)	(0.001)	(0.002)
Distance to a city (100 KMs)	-0.323	-0.384	-0.417
	(0.083)***	(0.085)***	(0.094)***
R^2	0.52	0.51	0.41
N	1,422	1,229	751

Dependent variable is recorded per acre sales price. Robust standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 2: Hedonic estimates with clustered SEs

	Parcels > 1 acre	Parcels > 2 acres	Parcels > 20 acres
Cannabis plants per acre (watershed)	0.242	0.273	0.245
	(0.225)	(0.178)	(0.130)*
Assessed improvements ($1000s)	0.025	0.024	0.021
	(0.003)***	(0.004)***	(0.003)***
Parcel size (acres)	-0.006	-0.006	-0.004
	(0.001)***	(0.001)***	(0.000)***
Acres^2	0.000	0.000	0.000
	(0.000)***	(0.000)***	(0.000)***
% slope > 30%	-0.271	-0.250	-0.224
	(0.224)	(0.200)	(0.218)
% mixed forest	-0.150	-0.084	0.005
	(0.185)	(0.121)	(0.125)
% hardwood	-0.171	-0.199	-0.038
	(0.227)	(0.178)	(0.207)
% shrub	0.391	-0.026	-0.503
	(0.403)	(0.301)	(0.613)
% coniferous	0.301	0.267	0.091
	(0.198)	(0.161)	(0.179)
% barren	0.094	-0.129	-0.097
	(0.237)	(0.143)	(0.205)
Ln (distance to road)	-0.141	-0.041	0.010
	(0.133)	(0.117)	(0.115)
Distance to stream (KMs)	-0.013	0.019	0.071
	(0.057)	(0.039)	(0.068)
% facing south	0.105	-0.008	0.074
	(0.150)	(0.142)	(0.165)
THP in last 15 years	0.059	0.123	0.222
	(0.115)	(0.104)	(0.112)*
Ag exclusive zone	-0.759	-0.507	-0.033
	(0.166)***	(0.131)***	(0.114)
Ag zone	0.096	0.410	0.400
	(0.192)	(0.156)**	(0.197)**
TPZ	-0.886	-0.613	-0.014
	(0.223)***	(0.187)***	(0.132)
Forest/rec zone	-0.798	-0.458	0.224
	(0.242)***	(0.203)**	(0.160)
City	0.202	0.063	-0.517
	(0.156)	(0.135)	(0.189)***
Unzoned	0.632	0.569	0.190
	(0.138)***	(0.132)***	(0.172)
Distance to ocean (100 KMs)	-1.700	-1.731	-2.025
	(0.500)***	(0.436)***	(0.361)***
ykm	-0.001	-0.001	-0.002
	(0.002)	(0.002)	(0.001)
Distance to a city (100 KMs)	-0.323	-0.384	-0.417
	(0.129)**	(0.097)***	(0.080)***
R^2	0.52	0.51	0.41
N	1,422	1,229	751

Dependent variable is recorded per acre sales price. Robust standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$; *** $p < 0.01$.

Non-cannabis characteristics also influence the sales price of the properties in our data set. Higher proportion of coniferous forest cover increases the property value, while barren and other forms of forest cover are associated with lower sales prices. However, estimates of the impact of different forest cover types on sales price are marginally significant overall, and vary with the parcel size cutoff of the sample. For example, the positive and significant impact of coniferous forest cover is diminished greatly when looking at parcel sizes over 20 acres (8.1 ha). Indeed, the difference in the magnitude of forest type coefficients is small in the larger parcel sample more generally.

Similarly, the impact of zoning variables varies by the parcel size cutoff. In the samples that includes parcels less than 20 acres (8.1 ha), prices for property in ag-exclusive, forest/recreational or timber production zones (TPZ) are much lower than other zoning classifications. However, those effects are moderated when looking only at the sample with larger properties. Likewise, no price difference is found for a property with a history of a timber harvest plan (THP) in the smaller parcel sample, but a THP is associated with a 21 percent price per acre increase in the sample restricted to properties greater than 20 acres (8.1ha). These differences likely reflect the fact that smaller parcels are undesirable for production (either timber or agricultural) purposes, so smaller parcels with these zoning restrictions likely carry higher conversion costs to residential development (and hence fetch lower prices).

Properties further inland and further from cities are significantly less valuable. However, distance to a stream and latitude does not significantly affect price, all else constant. While properties further from a known road are significantly less valuable in the sample that includes properties less than 20 acres (8.1 ha), no effect is found in the large property sample. That difference may reflect the existence of privately constructed and maintained dirt roads that exist on large properties in more remote areas that are not visible in our dataset.

Discussion

Changes in rural economies have large impact on land prices for different land uses. Here, we investigate the impact of an expanding and economically important land use: cannabis production. Using Humboldt County as our case study, we used the hedonic method to estimate the impact of cannabis grows on property prices. Our findings suggest that the increases in productive capacity of land brought about by cannabis production outweigh the negative disamenity impacts of cannabis production and that cannabis has a positive and statistically significant impact on property prices in our study area.

The past decade has seen significant changes to state and local policy towards cannabis, and the next decade will likely bring further transitions to the regulatory framework surrounding its production and consumption. In California, a 2016 ballet initiative regarding recreational legalization has prompted considerable discussion of the future role of cannabis in the state’s economy. While much of the policy debate has centered on potential tax revenue from retail level sales, our research highlighted potential secondary economic impacts on the rural economy.

Despite our results, we are unable to definitively claim our estimated positive relationship between cannabis production and property prices is causal. If there are unobserved factors driving both property prices and the location of cannabis farms, the relationship estimated here may be biased upwards. Further, we also cannot determine whether the positive influence of cannabis on property values stems directly from the higher potential productive value of this activity, or indirectly from higher local incomes due to the crop. Further planned projects will attempt to remedy these issues by identifying exogenous sources of variation in cannabis farm location and property prices.

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