Counting and Mapping Community Supported Agriculture (CSA) in the United States and California: Contributions from Critical Cartography/GIS

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Abstract

Using a critical cartography/GIS approach and multiple data sets on community supported agriculture (CSA), this paper addresses two questions. First, how accurate was the 2007 United States Census of Agriculture's counting of CSAs? Second, where are CSAs concentrated and how does their distribution compare with that of farming generally and population distribution? I argue that significant overcounting of CSAs in the census occurred largely because of a lack of shared meanings of terms. Examination of discrepancies between data sets at the county level in California points to higher CSA overcounting in counties with many farms and lower overcounting in counties with many CSAs. This overcounting matters as critical geographers and others increasingly seek to take stock of and contribute to alternative agrifood movements. As for distribution, multi-scale maps and a CSA density indicator reveal the continued existence of high levels of CSAs in New England and the Pacific Northwest and low levels in

the South. Further data collection and analysis efforts should focus on (1) improving census questions for the next CSA count, including adding a definition of CSA and asking whether farmers coordinate the CSA or contribute to a joint CSA; and (2) conducting further geographical analyses on CSA vis-à-vis contributing causes behind low and high concentrations and areas of fast and slow growth.

When you cannot measure it, when you cannot express it in numbers, your knowledge is of a meagre and unsatisfactory kind.

— Lord Kelvin

When you can measure it, when you can express it in numbers, your knowledge is still of a meagre and unsatisfactory kind.

— Jacob Viner (Berelson and Steiner, 1964, cited in Sayer, 1992, 175)

Should there be just one map? Should not the viewer be given several maps ... ?

— Mark Monmonier (1996, 146)

Community supported agriculture: background and conflicting data

At a time when much national attention focuses on food scares, global warming, and a recession, many people express a desire for different socio-environmental arrangements based on a sense of belonging, environmental conservation, and the prioritization of values other than short-term profit creation (McKibben, 2007; Patel, 2010). Community supported agriculture (CSA) — an arrangement in which consumers invest in a farming operation and receive shares of produce, usually weekly[2] — answers many of these concerns.

Growth of CSA has been rapid in the US (Table 1). Almost 25 years after two CSA farms started the movement in the US in 1986 (McFadden, 2004), LocalHarvest, an organization that connects consumers and farmers, counts 2,932 CSA farms in mid-2009 and has observed a dramatic increase in the number of new CSAs (Figure 1). In contrast to the LocalHarvest count, the CSA website of the

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[2] Lyson (2004) identifies four CSA types. With *farmer-directed CSAs*, members are "subscribers" and have minimal involvement in the farm's workings. In *consumer-directed CSAs*, customers have decision-making power since they seek out a farmer to grow produce for them. *Farmer-coordinated CSAs* involve two or more farmers producing different items. *Farmer-consumer cooperative CSAs* jointly buy land and equipment and share decision making.

Table 1: Estimates of CSA numbers in the United States, 1986-2009

	1986	1996	2004	2007[a]	2009[a]
Number of CSAs	1[b] - 2[c]	635[d]	1,700[c]	12,549[e]	1,304[f] - 2,932[g]

[a] The considerable discrepancy between 2007 and 2009 data is one foci of this paper.
[b] Roosevelt, 2003
[c] McFadden, 2004
[d] Bio-Dynamic Farming and Gardening Association, 1997, cited in Wells et al., 1999, 39
[e] NASS, 2009b, 606
[f] Robyn Van En Center, 2009
[g] LocalHarvest, 2009

U.S. Department of Agriculture (2009) notes: "Data collected in 2007 by the U.S. Department of Agriculture indicates that 12,549 farms in the United States reported marketing products through a community supported agriculture (CSA) arrangement." There is thus a wide discrepancy between CSA counts by LocalHarvest — 2,932 — and the agricultural census — 12,549. The census count will likely be widely cited because many see it as *the* definitive number, so I want to critically evaluate it here. Before doing so, it is important to introduce the context of agrifood localism and CSA.

Among social scientists, agrifood localism generates celebration and critique. Relocalization forms the backbone of a socially re-imbedded "civic agriculture" (Lyson, 2004) reconnecting urban and rural residents in mutually beneficial relationships (Tegtmeier and Duffy, 2005). Others warn of defensive and reactionary agrifood localism (DuPuis and Goodman, 2005; Qazi and Selfa, 2005;

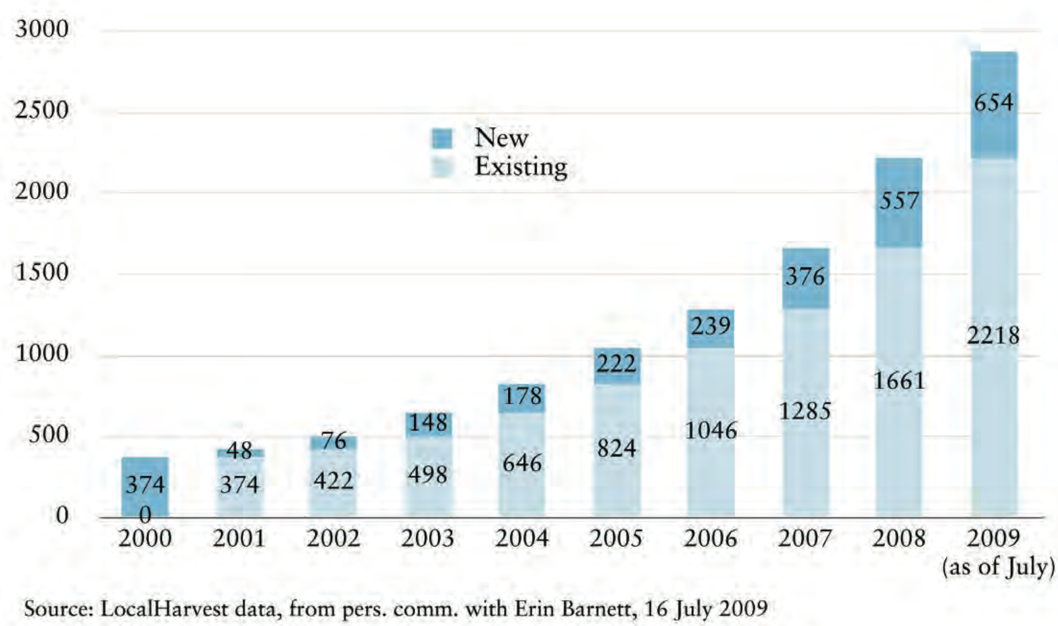

Figure 1: CSA operations listed on the LocalHarvest website, by year, 2000-2009

Winter, 2003). Race/ethnicity, class, and gender vis-à-vis alternative food movements are only ignored at the peril of exclusion (Allen, 1999; Guthman, 2008; Slocum, 2007). Critique of CSA also involves charges of elitism (DeLind, 1999), although elitism is not an intrinsic feature of CSA (Andreatta et al., 2008). At the farm level, while direct marketing generally allows for higher profits (Brown and Miller, 2008), CSA creates burdens, including learning the plethora of skills involved and the challenges of maintaining membership (Cone and Myhre, 2000), the fuel costs, driving, and time involved in direct marketing, and pricing competition that can create downward pressure on farmers' incomes and increase self-exploitation (Jarosz, 2008). More fundamentally, CSAs do not challenge the structural problems created by the commodification of food, even though they are a potential avenue through which this might occur (Cone and Myhre, 2000), because CSAs do not necessarily challenge a belief in the market as the prime organizing principle for society (Hinrichs, 2000). Summing up some of these tensions, Goodman and DuPuis (2002, 17) note:

> from a production-centered viewpoint, [CSA] may appear to be an epiphenomenal and transitory utopian entertainment for a few middle class consumers and their fortunate few farmer friends. Alternatively, this movement can be seen as bearing the seeds of a political struggle to re-define consumer-producer relationships that may, or may not, succeed in creating a broader farmer-consumer (or broader class) alliance.

Even as we increasingly note the limitations and tensions in alternative agrifood systems, I believe CSA remains very important. At the farm level, moving beyond pesticide-intensive monocultures still matters. CSA farms generally use highly diverse and complex rotations, organic or beyond-organic methods, and livestock integration. These characteristics require skilled and committed labor, which means that many of these farms, at least in California, employ workers year-round; "some of these farms also offer significantly higher pay and real benefits, such as health care and vacation" (Guthman, 2004, 185). As many young adults seek to become farmers, CSA offers a mode of finance and marketing through which they might avoid some heavy debts from start-up costs. At the level of the food system, CSA fosters foodways independent of the increasingly concentrated food industry, spurs members' interests in food systems issues (Allen et al., 2003), and can create farmer-consumer alliances (Goodman and DuPuis, 2002) that might prevent industry's surplus extraction from farms, an integral feature of the industrial agrifood system (Levins, 2000).

In light of the above, there is an important alignment between the goals of critical geography and CSA. In defining critical geography as "part of the praxis of social and political change aimed at challenging, dismantling, and transforming prevalent relations, systems, and structures of capitalist exploitation, oppression, imperialism, neo-liberalism, national aggression, and environmental destruction" (Moss et al., 2002, 3), it is evident that CSA shares some goals. Although CSA does not, and cannot, take on all of these relations, CSA as a movement seeks to redress aspects of capitalist exploitation and environmental destruction. Critical geographers, as academics and citizens, should be proactive in supporting these progressive producer-consumer relationships in the face of the important material and social limitations of industrial agriculture while at the same time remaining aware of shortcomings.

If I am correct that CSA remains an important alternative to the industrial agrifood system, CSA numbers matter. In blog entries about the new census CSA count, many in the alternative agriculture movement happily take the USDA number at face value. Although I generally align myself with the movement, I argue that subjecting the USDA count to critique is important for a number of reasons. First, we cannot anticipate what effects the perceived increase in numbers will have on resource flow. For example, those deciding about where to target government and NGO resources to assist in developing direct marketing might look at the apparent vast increase in CSA and decide that no help is needed on that front; the opposite might also be the case, as more resources may flow to a larger population. If these effects cannot be predicted, working with accurate data is important. Second, without accurate data on CSA, constructive critiques of CSA might be misplaced or misinformed. For example, charges of CSAs being elitist might be blunted by their existence in regions with lower than average incomes, or greatly inflated numbers across many states may suggest that all regions are experiencing growth in CSA when this might not be the case. Lastly, creating better understandings of CSA can serve the movement in many ways, including improving activist strategies to expand CSAs. More detailed understandings of CSA numbers by geographic area can allow activists, farmers, and perhaps even consumers to direct attention to areas underserved by CSA arrangements. Thus, I believe that a critical geographical analysis of CSA, and counts of CSA, can help strengthen the alternative agrifood movement.

Questions and approach

The 2007 US Census of Agriculture (hereinafter, "the census") posed the first ever census question about CSA: whether farmers participated in CSA marketing arrangements. Since the resulting census counts are available at the county, state, and national level, many opportunities exist. This paper asks two main questions vis-à-vis CSA. First, the evaluative question: How accurate was the census' first attempt at documenting the existence of CSAs? Second, the spatial questions: Where are these CSAs concentrated? How does their distribution compare with the distribution of farming generally, and with that of the population? Instead of offering a comprehensive geographical analysis, the discussion of these distributions should be seen as exploratory and will require further qualitative and quantitative analysis to better explain. As the analysis stands, however, it can help those interested in understanding and expanding CSA coverage and adds more data about spatial distribution to debates around CSA and alternative agrifood.

For my analysis I draw on the tradition of critical cartography/GIS (Crampton and Krygier, 2005; Elwood, 2010; Harley, 1989; Harris and Harrower, 2005; Leszczynski, 2009a, 2009b; Monmonier, 1996; Schuurman, 1999; Sheppard, 2005; Wood, 1992). The "critical" in critical cartography/GIS means many things (Sheppard, 2005), yet generally refers to work exposing ideologies embedded in maps and their social effects, and proactive efforts to create alternative maps (Elwood, 2010). In response to critiques from critical human geographers concerned about how GIS affects knowledge production in the discipline and society, critical GIS practitioners have sought creative new engagements with queer theory (Brown and Knopp, 2008), feminist theory (Kwan, 2002), public participatory methods (Sieber, 2006), and qualitative approaches more generally (Cope and Elwood, 2009). I operationalize a critical cartography/GIS approach by presenting a multitude of different maps and through being reflexive about my own map creation and the motivations behind it. Thus, this is a critical cartography/GIS from within, rather than from a theoretical perspective that is not familiar with the practices of cartography/GIS (see Perkins, 2003). I aim to put CSA on the map and make these maps publicly available[3] to promote more discussion of the distribution of CSAs and how the alternative agrifood movement might expand these kinds of arrangements and perhaps work to fill in existing gaps in CSA locations. Although only tangentially a type of "countermapping" (Harris and Hazen, 2005; St. Martin, 2005), my critical cartographic/GIS has precedent in critical cartography/GIS work that critiques census data (Fiedler et al., 2005) and that draws on critical realist philosophy (Leszczynski, 2009a; Schuurman, 2002). The analysis is unique in its use of multiple maps and new ways of mapping CSA, and in its development of a CSA density indicator for future analyses.

My cartographic/GIS work here is critical in four ways. First, it carefully interrogates the reliability of seemingly self-evident data, especially that of the census. Second, it critiques the ways in which CSA is normally mapped, and offers constructive solutions using additional data and techniques to produce multiple maps. Third, it aims to draw greater attention to, and help spur new geographical knowledge about, CSA — which I view as a normatively positive departure from the dominant and problematic relationships among society, agriculture, and the environment. Fourth, I employ a critical realist understanding of cartography/GIS, drawing on Bhaskar (1986, 1993), Sayer (1992), and Leszczynski (2009a). Poststructuralism is the primary philosophical stance of most critiques of GIS (e.g., Pickles, 2004) and has provided powerful insights, especially that maps are social texts with an inherent ideology (Harley, 1989; Wood, 1992). Poststructuralism

[3] Online, publicly-accessible journals like *ACME* allow for incorporating more maps into public scholarship than is possible through subscription, print journals.

contests the *ontic fallacy* common to positivism[4] (Bhaskar, 1993, 4), which is a de-socialized ontology of raw perceptions — mind meets object and produces knowledge that precisely mirrors it — that ignores how knowledge is always shaped by social contexts and processes (Sayer, 1992). Yet, to reduce maps to power, discourse, and text is to collapse the reference to the referent; the radical metaphysical position of poststructuralism is that epistemology determines ontology unidirectionally. This is Bhaskar's (1986) *epistemic fallacy* — the reduction of ontology to epistemology by "reducing questions about the nature or makeup of the contents of the world to mere constructs of knowledge" (Leszczynski, 2009a, 583). Drawing on such critical realism, I maintain that maps, while social through and through, are, at the same time, usually attempts to reference an external reality not collapsible to the cognitive or social domain of creator or reader. This recognizes that GIS is "technology, methodology, and social practice" (Elwood, 2010, 48), *and* is supported by and embedded in philosophical commitments about knowledge and reality.

Approaching CSA through a critical cartography/GIS approach has not yet been done, although previous analyses of CSA by rural sociologists and geographers have presented a handful of simple maps (Lass et al., 2003; Light et al., 2007; Martin-Schwarze et al., 2006; McIlvaine-Newsad et al., 2008; McIlvaine-Newsad et al., 2004; Schnell, 2007). Few geographers map and analyze the spatiality of the burgeoning alternative agrifood movement.[5] The inattention to detailed geographical analysis of alternative agriculture in the social science literature is widespread. "Mapping" of alternative agriculture in North America has been used metaphorically (Feagan, 2007) rather than referring to a cartographic praxis, mirroring a larger trend in critical human geography over the last few decades that avoids engagement with quantitative data and mapping (Wheeler, 1998). Agricultural geography as a subfield — and its tradition of mapping agricultural patterns, even if purely descriptive — has withered, at least in North America, even as we have more powerful tools available.

The essentialized divide between "critical" and "quantitative" is being challenged by critical cartography/GIS practitioners (Cope and Elwood, 2009; Kwan, 2002; Kwan and Schwanen, 2009; Sheppard, 2001). While critical human geographers tend to portray use of quantitative data as necessarily rooted in

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[4] Benton and Craib (2001) define positivism as (1) accepting the empiricist account of the natural sciences, including its view of the value-freedom of science, (2) valuing science as the highest form of knowledge, (3) seeing empiricism as applicable to human mental and social life and believing in fixed behavioral and social laws, and (4) believing scientific knowledge should be used to control individuals and groups. Critical realism rejects these tenets of positivism (Sayer, 1992), making a critical realist cartography/GIS congruent with critical geography (Leszczynski, 2009a).

[5] There are certainly exceptions, including local food networks (Ilbery et al., 2006; Ricketts Hein et al., 2006; Schnell, 2007) and urban agriculture (ABUNDANCE, 2010; McClintock and Cooper, 2009; Myers, 2008). There is also recent mapping of so-called "food deserts" (Blanchard and Matthews, 2007; Shaw, 2006; Short et al., 2007).

positivism and therefore suspect, I hope to contribute to a critical geography that takes quantitative data seriously, for I believe that knowledge of numbers of farms and their locations is a necessary building block for mapping CSA, pursuing future qualitative and quantitative research, and spreading a promising movement such as CSA.

Data and methods

I rely on secondary data sources to analyze the census CSA data and the distribution of CSA operations. From these data I construct choropleth and dot maps at the regional, state, county, and zip code level. The analysis first examines the national level then proceeds to a detailed case study of California. I chose California because it has the largest number of CSAs in the census data set, a large number of counties, considerable diversity in agricultural production by county, and large geographic differences in CSA concentrations. These characteristics offer the possibility of seeing where overcounting occurred in relation to heavily agricultural counties and counties with little agriculture, and in relation to counties with high and low CSA numbers. Additionally, detailed geographic information on land uses at the county level is available for most of California (Department of Conservation, 2006), fitting with with my goal of mapping CSA vis-à-vis population and agriculture.

I use the census data at the national (NASS, 2009a) and state levels (NASS, 2009b) as the main data sets because of the general tendency to take census data as definitive, and to evaluate the USDA's CSA data-collection effort. These data are compared to other national level data on CSAs from the Robyn Van En Center (2009) and LocalHarvest (2009). These data sets are practical ones, meant to more easily connect consumers and CSA farms via the internet. Both sites depend upon CSA farmers to list themselves, though LocalHarvest appears to be more popular among CSA farmers given its longer list than the Robyn Van En Center. CSA farmers have strong incentive to list themselves, as CSAs need to be known by a clientele to succeed.

In the analysis below, I first map the raw numbers of CSA operations in each data set by state and county. Almost all maps of CSA in the US present farms in raw numbers, such as with choropleth maps (e.g., Lass et al., 2003, 3; Light et al., 2007, 31; Martin-Schwarze et al., 2006, 1; Schnell, 2007, 553) or dot density maps (McIlvaine-Newsad et al., 2008, 80-81; McIlvaine-Newsad et al., 2004, 1). While useful for understanding gross distributions, this is a non-standardized way of presenting data that does not control for underlying patterns strongly affecting the data's distribution (Monmonier, 1996). For example, we should expect a higher number of CSA farms in areas where there are a large number of farms relative to areas where there are very few or no farms, and a higher number of direct marketing relationships in areas with larger populations.

Thus, standardizing the data by underlying patterns of both agriculture and population is an important part of spatial analysis. As CSAs are multifaceted, I maintain that we should not reduce their spatiality to a single spatial analytic reading (cf. Elwood, 2010; Monmonier, 1996), and should instead be represented by multiple maps. One set shows CSA operations relative to all farming operations in the census data — CSAs per 1,000 farms — thereby revealing areas where CSAs are a relatively large or small proportion of farms. I also show CSA in relation to population — CSAs per 100,000 residents, with data from the population estimate for 2007 at the state level (United States Census Bureau, 2009) — because it is agriculture directly linked to consumers, and more populous areas can, in principle, support more CSAs.

National level analysis

Table 2 presents the number of CSA operations per state for the three data sets discussed above (in black), and for three other data sets from 2006 and 2008 (in grey). The order of magnitude differences are striking. The census produced CSAs numbers one order of magnitude higher than the counts from the Robyn Van En Center and LocalHarvest, and compared to the 2006 estimates from USDA and the 2008 Organic Production Survey (NASS, 2010).[6] There are a number of possible interpretations: (1) the census greatly overcounted the number of CSAs, (2) all the other data sources are strongly undercounting CSAs, and (3) the actual number lies somewhere in the middle, so that none of the data sets are good reflections of the true number of CSAs in the US. Below I argue for the third explanation, although I place a more accurate count closer to LocalHarvest's count and farther from the census count.

The census likely overcounted because the way the data were collected. The census questionnaire asked only about CSA as a marketing arrangement (NASS, 2009a, B-47). This is but one option in a long list of questions. Neither the question nor the glossary of the questionnaire include a definition of CSA.[7] I believe overcounting occurred partly due to farmers' varying interpretations of the question and the term. Intersubjectivity — a shared meaning held among individuals — about the concept of CSA was likely not achieved with many respondents. The problem of not achieving intersubjectivity is that "without systematic provision for a world known and held in common by some collectivity of persons, one has not a misunderstood world, but no conjoint reality at all" (Schegloff, 1992, 1296).

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[6] The 2007 census included the 2008 Organic Production Survey, focused on organic farmers. While not all CSAs are certified organic, the ratio of the organic production survey count (906) to the census count (12,549) is likely far too low.

[7] Interestingly, the 2008 Organic Production Survey includes a definition of CSA (NASS, 2010, B-12). Undercounting rather than overcounting appears as a problem with that data (Table 2).

Table 2: CSAs by state according to different data sets, 2006-2009

State	2007 Census[a]	2008 Org. Prod. Survey[b]	2006 USDA[c]	RVEC 2009[d]	LH 2009[e]	LH 2006[c]
Alabama	260	4	7	2	20	6
Alaska	20	3	6	7	8	5
Arizona	63	2	9	14	23	8
Arkansas	187	2	4	5	16	1
California	953	124	81	91	178	81
Colorado	214	21	27	29	72	26
Connecticut	102	15	22	20	44	17
Delaware	19	0	4	2	7	3
Florida	193	13	15	23	41	9
Georgia	339	18	5	12	57	14
Hawaii	135	17	3	4	12	9
Idaho	136	12	16	19	42	12
Illinois	302	8	20	24	91	26
Indiana	273	2	12	19	52	16
Iowa	487	17	39	48	70	37
Kansas	173	8	8	8	32	11
Kentucky	544	11	15	21	50	15
Louisiana	111	0	3	4	8	1
Maine	159	50	32	16	65	25
Maryland	161	32	36	41	67	37
Massachusetts	221	26	60	61	113	45
Michigan	463	28	40	17	141	44
Minnesota	368	20	35	45	97	42
Mississippi	191	4	2	2	4	3
Missouri	450	8	18	22	63	24
Montana	148	8	3	4	16	3
Nebraska	161	4	5	8	15	4
Nevada	28	4	1	5	15	4
New Hampshire	87	18	21	33	55	22
New Jersey	81	18	16	26	46	15
New Mexico	139	9	16	17	19	16
New York	364	58	101	126	205	76
North Carolina	413	21	26	37	92	33
North Dakota	46	0	2	2	8	4
Ohio	424	25	31	40	107	35
Oklahoma	286	6	4	5	16	5
Oregon	311	44	45	50	115	39
Pennsylvania	379	30	69	90	162	64
Rhode Island	33	7	10	11	16	7
South Carolina	193	5	4	4	22	5
South Dakota	102	1	2	4	7	4
Tennessee	251	6	15	20	54	17
Texas	883	13	21	16	74	24
Utah	110	1	3	4	15	2
Vermont	164	38	40	46	88	36
Virginia	335	15	25	43	85	32
Washington	437	69	61	72	150	60
Washington, D.C.	—	—	—	1	3	—
West Virginia	163	3	7	9	15	9
Wisconsin	437	57	66	73	148	71
Wyoming	50	1	1	2	11	4
Total	12,549	906	1,114	1,304	2,932	1,108

Sources: [a] NASS, 2009; [b] NASS, 2010; [c] Adam, 2006; [d] Robyn Van En Center, 2009; [e] LocalHarvest, 2009.

I suggest successes and problems in intersubjectivity occurred in the following ways. Almost all farmers who run CSAs according to the definition used in this paper, and understood more broadly, would have answered yes. However, many farmers who sometimes sell to other farmers who run CSAs — e.g., by providing walnuts to be included in a box — likely responded yes, as the question does not differentiate between running a CSA and marketing through a CSA (see also Barnett, 2009). This problem alone would lead to some, or a great deal of, overcounting in the census data. It also means that the data cannot be used to differentiate those farmers who are in charge of a CSA from those who sporadically provision the CSA farm with a single product, or any arrangement between these two extremes.

This definitional confusion extends more problematically to the likely inclusion in the census CSA data of farms that are not, and do not have contact with, CSA operations. Not all of the more than 2 million farmers as counted by the census are familiar with the specific definition of CSA as farming based on subscription or customer investment. Yet some of these non-CSA farmers unfamiliar with the common CSA definition likely answered yes. For example, those who use direct marketing — including farmers' markets, you-pick setups, restaurants, etc. — likely see this as agriculture that is supported by a community. Thus, because of the way the question was asked, some farmers who (1) provision CSAs but do not run them and (2) are not familiar with the common definition of CSA but have community-based or direct marketing relationships likely answered yes to the question, leading to overcounting the number of CSAs in the US by the census.[8]

Importantly, these possible sources of overcounting in the census data — lack of intersubjectivity and applying too great of a nonresponse adjustment — do not apply to the Robyn Van En Center and LocalHarvest data sets used here. As noted

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[8] Other possible sources of overcounting is adjustment of the data by the National Agricultural Statistics Service (NASS). NASS adjusts for farmers who did not respond (nonresponse adjustment) and adjustment for farmers who exist but were not included (coverage adjustment). Adjustments in 2007 were 14.65 percent and 16.24 percent, respectively, adjusting data from the 1.6 million US responding farmers to 2.1 million farmers. The procedure assumes that the nonresponse rates are similar between different farm types, such as CSAs and conventional farms. I doubt this is the case for two reasons. CSA farmers, a marginalized group vis-à-vis US farm policy and the agrifood industrial complex, might have a stronger commitment to being counted than non-CSA farmers. Many are also younger farmers not yet bombarded with survey questionnaires in the mail, so are less survey fatigued than more senior farmers. Thus, I suspect that nonresponse rates among CSA farmers are lower than other types of farmers, meaning that applying similar nonresponse adjustment rates from other farm types would lead to overcounting. NASS also imputes from other data sources for missing values, another potential source of overcounting, yet NASS's data editing procedures for CSA question responses were conservative. These included (1) only one automatic editing procedure for the CSA question, which involved turning a "yes" and "no" response into a "yes" response (very few cases), and (2) analysts changing CSA responses, almost always from "yes" to "no" (also very few cases). No values for missing CSA responses were imputed, so "yes" answers were not created from "no" responses (Jeff Beranek, pers. comm., September 1, 2009 and Brad Summa, pers. comm, November 10, 2009). Thus, data imputation did not contribute much to overcounting.

above, they rely on self-reporting by CSA farmers. Because of this, it is unlikely that a large number of non-CSAs self-identify as CSAs on their websites, or that farmers only supplying selected foods for CSA boxes run by other farms will add themselves to the site. For these reason, these data sets are likely undercounting the number of CSAs, as they themselves suggest (Barnett, 2009). The problem is that we do not know the extent to which NASS is overcounting, nor the extent of undercounting on these websites. One way forward is to geographically compare the data.

Number of CSAs by state

Figure 2 shows the number of CSA farms by state in each data set. For Figures 2 through 4, the census data are in grey, the Robyn Van En Center (2009) data are in orange, and LocalHarvest (2009) data are in blue. Data appear in absolute numbers (via the text labels) and colored according to quartile, with the lowest quartile the lightest saturation, and the highest quartile the darkest. The two small maps on the right show agreement among the quartiles of the three data sets. The top map on the right shows the level of agreement among quartiles for the three data sets, with the darkest red signifying that all data sets put that state in the same quartile, and the lightest pink showing no agreement. The map in the lower right shows strong agreement among only the top (aquamarine) and bottom (brown) quartiles.

Figure 2 shows that states with high numbers of CSAs are on the West Coast, Northeast, and the northern Midwest. Agreement among the top and bottom quartiles in these data sets shows that California, Washington, Minnesota, Wisconsin, Ohio, Pennsylvania, and New York have the largest number of CSAs, while Nevada, Utah, Wyoming, North Dakota, South Dakota, and Louisiana have the lowest number of CSAs. The raw numbers suggest that previously identified patterns persist (Lass et al., 2003, 3). Lyson noted the Northeast as being “in the vanguard of the relocalization efforts. Large-scale, industrial farming has largely bypassed this region, and consumers there must rely on food produced elsewhere” (Lyson, 2004, 6). Patterns established a decade or so ago appear to persist, at least at the national level.

But there has also been an increase across all states, as none of the data sets show zero farms as did presentations of CSA data at the state level in the 1990s. The extent to which densities of CSAs are evening out — i.e., if CSA numbers are growing more rapidly in previously less-dense regions — cannot be determined here since only cross-sectional data are used, but examining changes over time provides an opportunity for future analysis.

CSAs per 1,000 farm operations by state

Standardizing the data by number of farm operations creates a different pattern (Figure 3). The South from Texas to Alabama has low CSA numbers in relation to all farming operations, as does a north-south oriented swath in the

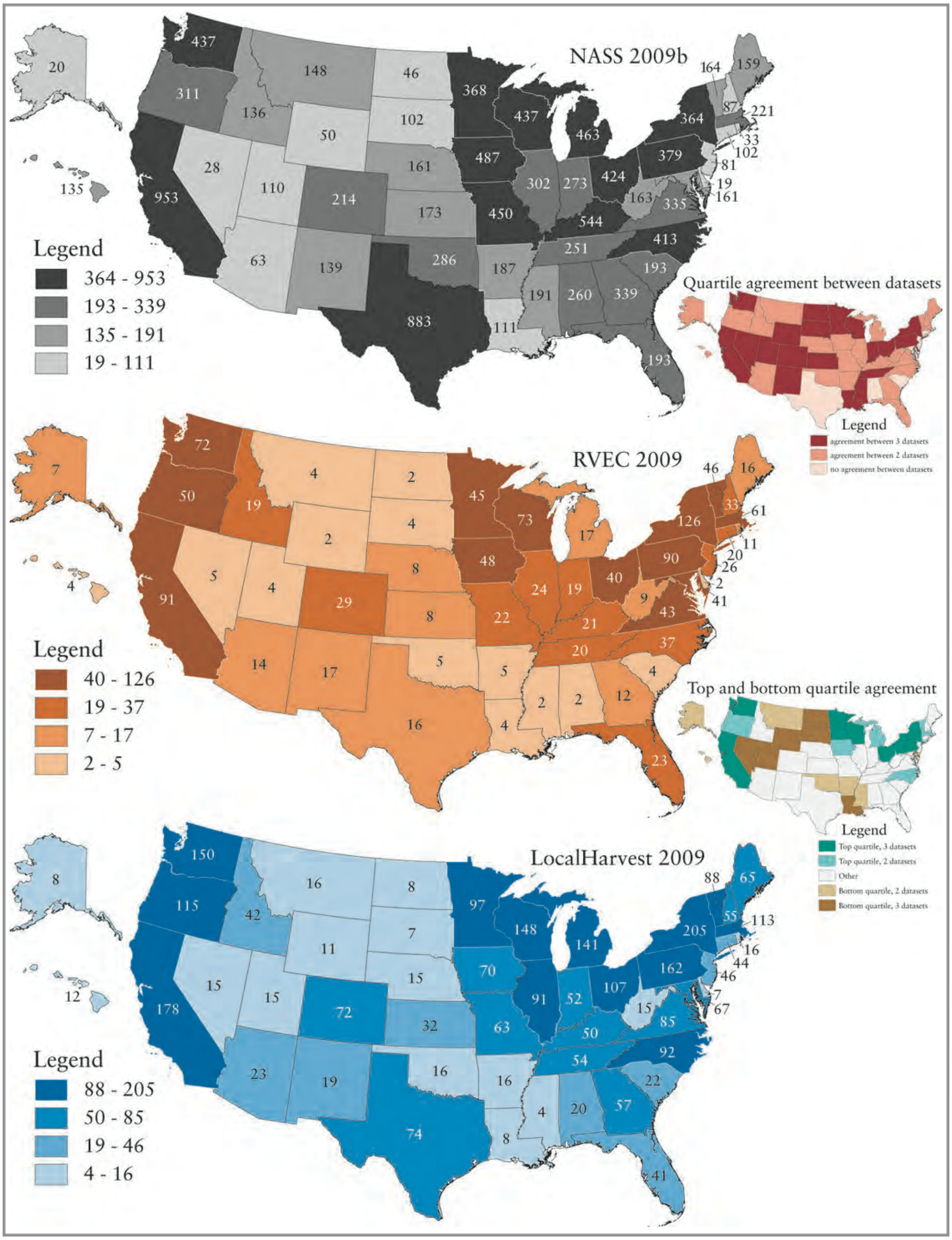

Figure 2: Number of CSA operations, by state, United States

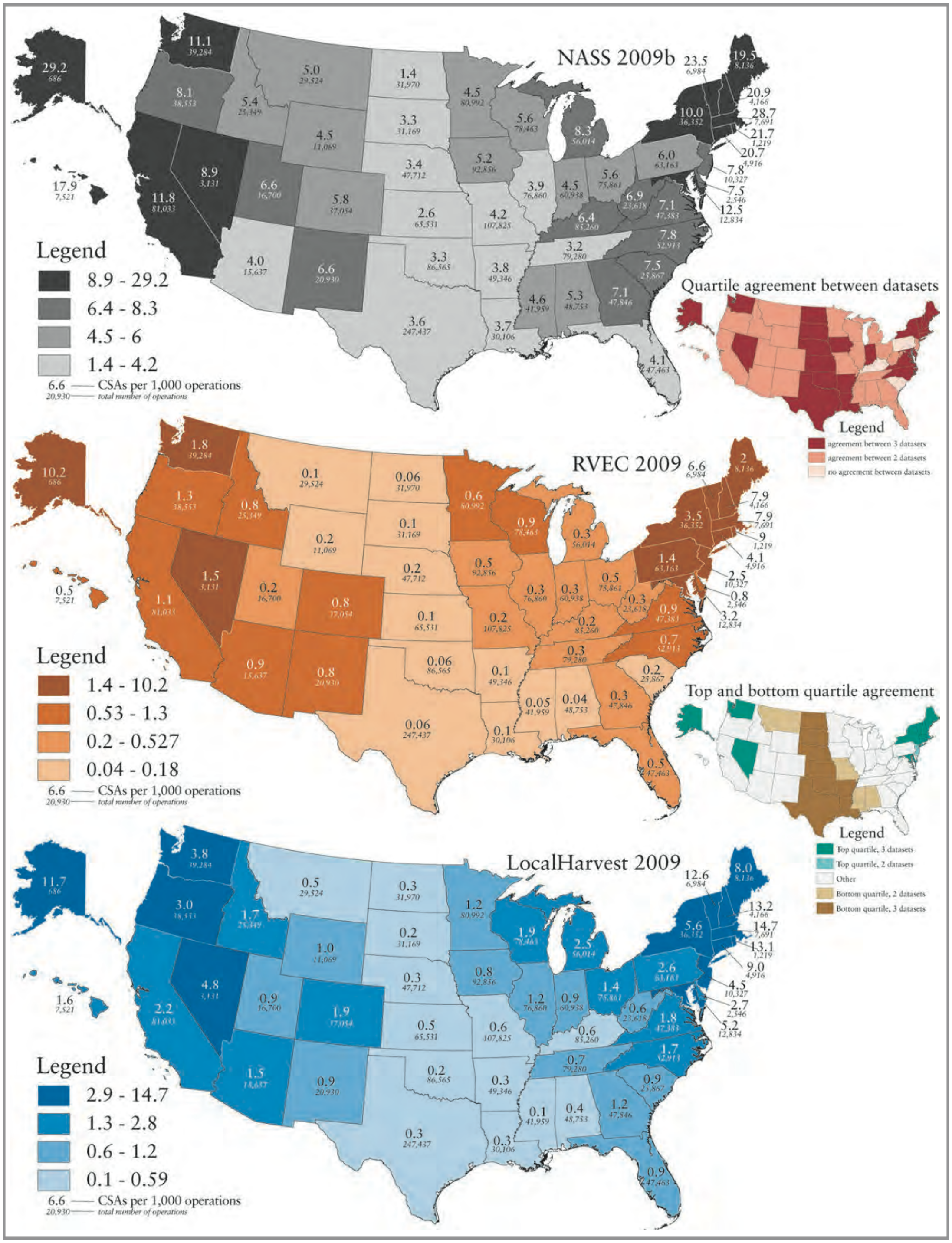

Figure 3: CSA operations per 1,000 farm operations, by state, United States

middle of the country from North Dakota to Texas. The West Coast and East Coast stand out as having higher densities of CSA operations. The Midwest and Intermountain West also are generally in the higher quartiles.

Focusing on the strong overlap of quartiles, New York, New England, Alaska, Washington, and Nevada are in the highest quartile in all data sets. While Alaska and Nevada may seem strange places to have a high proportion of CSAs, few agricultural operations exist in these states, so the presence of a few CSAs means that they make up a high proportion of total operations. In the Northeast, farms specialize heavily — relative to other regions — in localized relationships and specialty, value-added production (Lyson, 2004), having been disadvantaged by historical processes and political economic conditions, especially the marketing efforts of California produce growers and shaping of national and international markets and infrastructure to favor long-distance transportation (Steinberg, 2002). In contrast, the core Great Plains states, plus Arkansas and Louisiana, fall into the lowest quartiles in the data sets. There are a large number of farms in these states due to the Euro-American settling of the Great Plains, and since the rise of the world wheat market in the 1870s these farms and the region have specialized in grain production for transnational grain markets (FitzSimmons, 1990; Friedmann, 1978). The "regional social contracts" around specialized production (cf. FitzSimmons, 1990) appear to be resilient in the face of the alternative food movement, although it is also important to note the role of increased concentration in grain milling, and the food industry generally (Hendrickson and Heffernan, 2007), in decreasing local processing and distribution options even for commodities in which regions specialize.

CSAs per 100,000 residents by state

Standardizing the CSA data per 100,000 residents results in yet a different pattern (Figure 4). The Northeast and Northwest tend to be in the higher quartiles, as does the northern Midwest and the northern Great Plains. States in the Southwest and the South tend to be in the lower quartiles.

Looking at agreement across the three data sets, Nevada, Louisiana, and Florida lead the states with the lowest numbers of CSA operations per capita. Oregon, Idaho, Iowa, Vermont, and Maine lead the states with the highest concentrations of CSAs per capita. More generally, the northern part of the country has a higher density per capita, and the southern part has a lower density per capita. One could suggest that socioeconomic differences — income, political orientation, values, and education (Schnell, 2007) — and climatic differences influence this pattern, all of which might hold a grain of truth. More qualitative work has shown that agroindustrial discourses and conservative politics are the main reasons why CSA farmers are largely absent from certain central Washington counties (Qazi and Selfa, 2005). Jarosz's (2008, 232) work in Washington found that "[r]ural restructuring in metropolitan settings entails, among other things, the rise of small-scale farms dedicated to supplying nearby cities and towns with seasonal foods sold

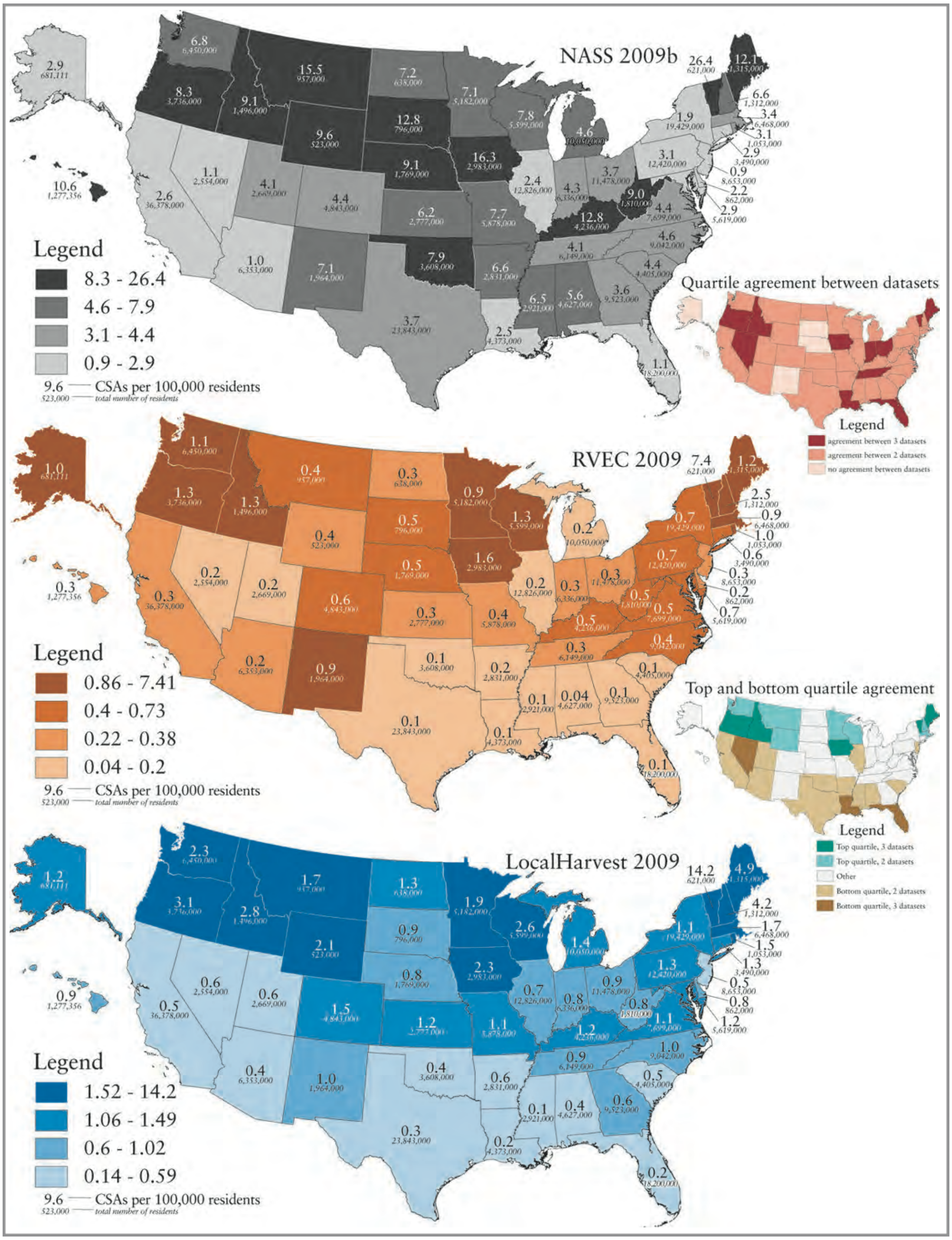

Figure 4: CSA operations per 100,000 residents, by state, United States

in venues such as farmers markets and community supported agriculture (CSA)." Jarosz usefully links alternative food networks to processes of urbanization and rural restructuring (Hoggart and Paniagua, 2001), yet does not address larger-scale differences between regions. There remains a great deal to be learned in places with different densities of CSA operations, including places in which they are relatively rare, as alternative food networks are constituted by "[d]ifferential, place-based processes" (Jarosz, 2008, 235).

An indicator of CSA density at the state level

Using these ways of visualizing data on CSAs geographically by state — CSAs numbers, then CSAs per farm and per capita — allows for the creation of a general metric on CSA density (Figure 5). To construct an indicator of CSA density at the state level, I sum for each state its quartile scores for each of the figures created from the three data sets (e.g., for California, Figure 2 yields 4+4+4, Figure 3 yields 3+3+3, and Figure 4 yields 1+2+1, for a total of density score of 26). Since there are 9 maps per state, the maximum possible score on the indicator is 36 (4 x 9) and the minimum is 9 (1 x 9). Figure 5 shows this indicator at the scale of states, and the 9 census divisions and the 4 census regions of the US Census Bureau. Washington leads (35), followed by Vermont (34), Massachusetts and Oregon (33), and then Maine, New York, and Wisconsin (31). Louisiana is at the bottom (9), preceded by Arkansas (12), Mississippi (13), Oklahoma and Utah (14), and Alabama (15). Aggregating those data by census division, New England leads (29.8), followed by the Pacific (28) and the Mid-Atlantic (26.7). The census divisions with the lowest indicator are West South Central (12.8) and East South Central (18.5). For census regions, the Northeast has the highest indicator (28.8), followed by the West (23.1), the Midwest (22.2), and the South (18.8).

While the indicator of CSA density developed here may be more robust than using a single data set, it has some important limitations. First, it is only a relative indicator, in that it ranks the areas, rather than showing their absolute differences. Second, the census data are more problematic than the other two data sets, and its inclusion might skew the indicator in unknown ways. The indicator, then, has significant limitations, but might be used as a variable for future regression and other quantitative analyses.

CSAs at the county and zip code level, nationally

Figure 6 presents the nationwide data at the finest scale possible: by county for the census data and by zip code for the other two data sets. This allows an examination of disconnections among the census data and the other data sets at the county level. In many places there appears to be overlap in distributions: the Northeast, the northern Midwest, and the Northwest. But there are also many counties that the census describes as having many CSAs, but in which very few or none are identified in the LocalHarvest and Robyn Van En Center data sets. Counties in western Wyoming, central Nebraska, northeastern New Mexico,

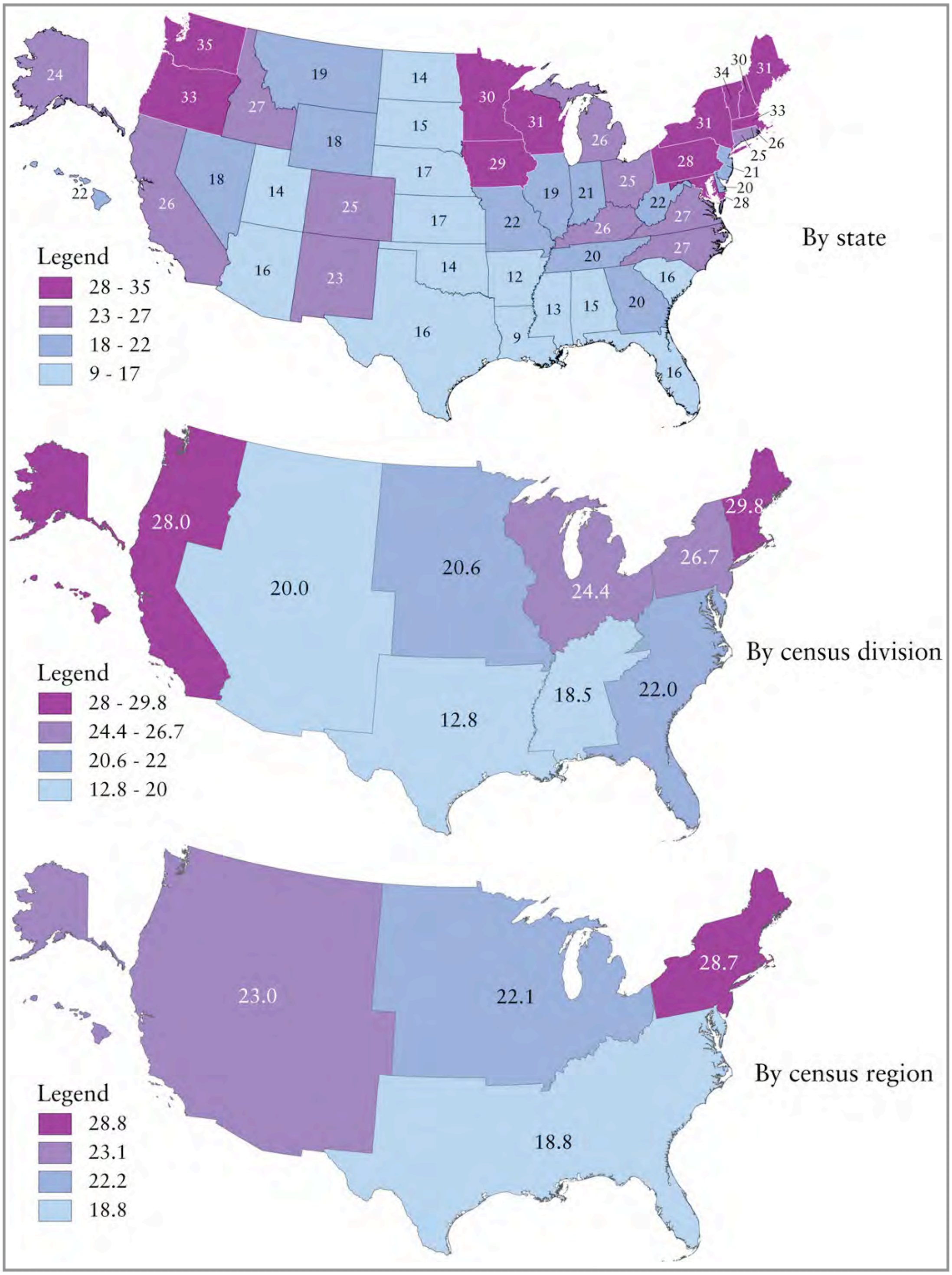

Figure 5: CSA density indicator at various scales, United States (36 is highest possible, 9 is lowest possible)

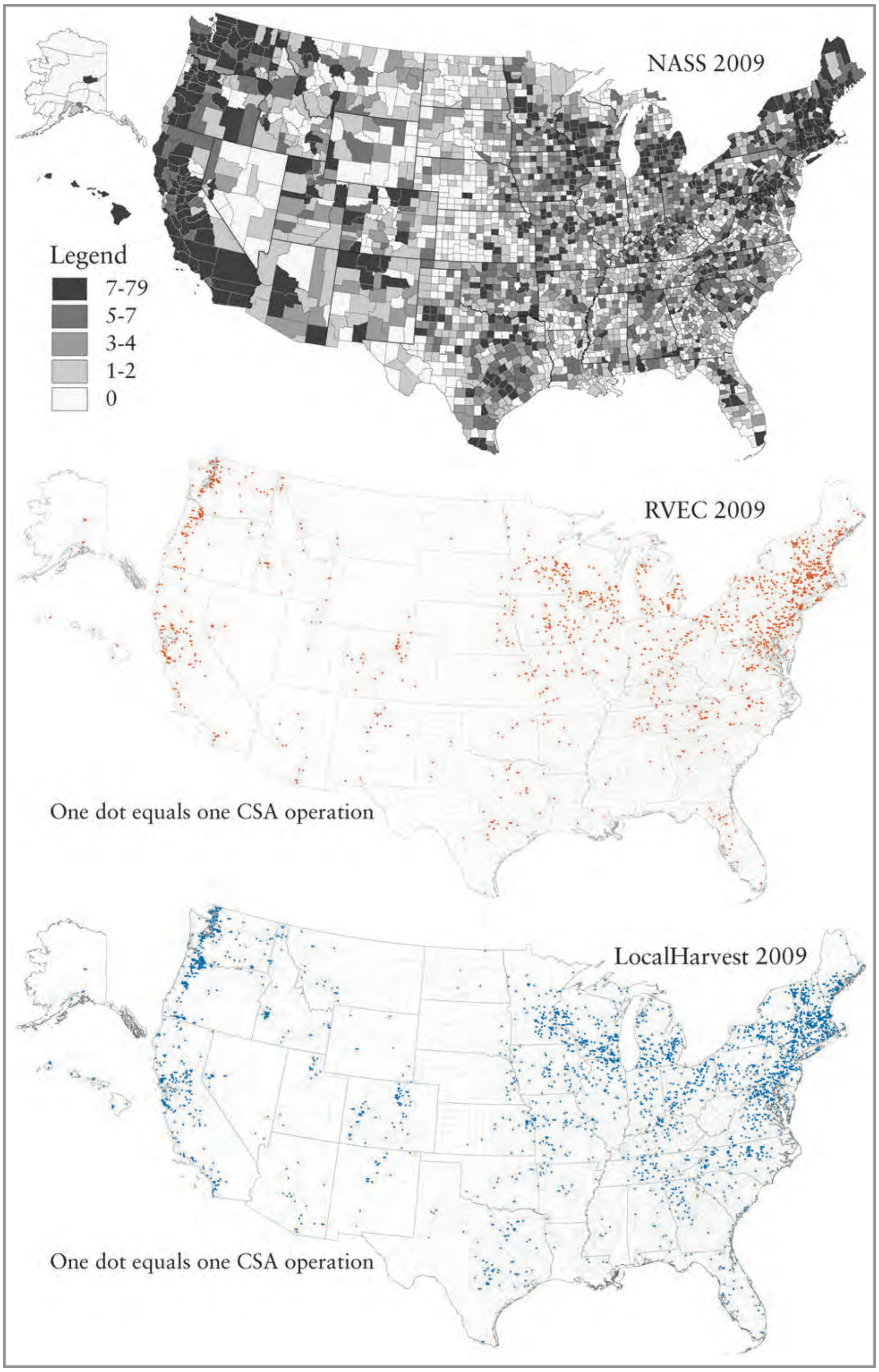

Figure 6: Number of CSA operations by county and zip code, United States

southern and northeastern Texas, and many other places fit this description. A more fine-grained analysis is needed to see exactly where this kinds of overcounting occurred. For this I focus on California.

State level analysis: California

Figure 7 shows CSA locations in California by zip code with data compiled from seven existing CSA lists that include California farms.[9] This compilation,

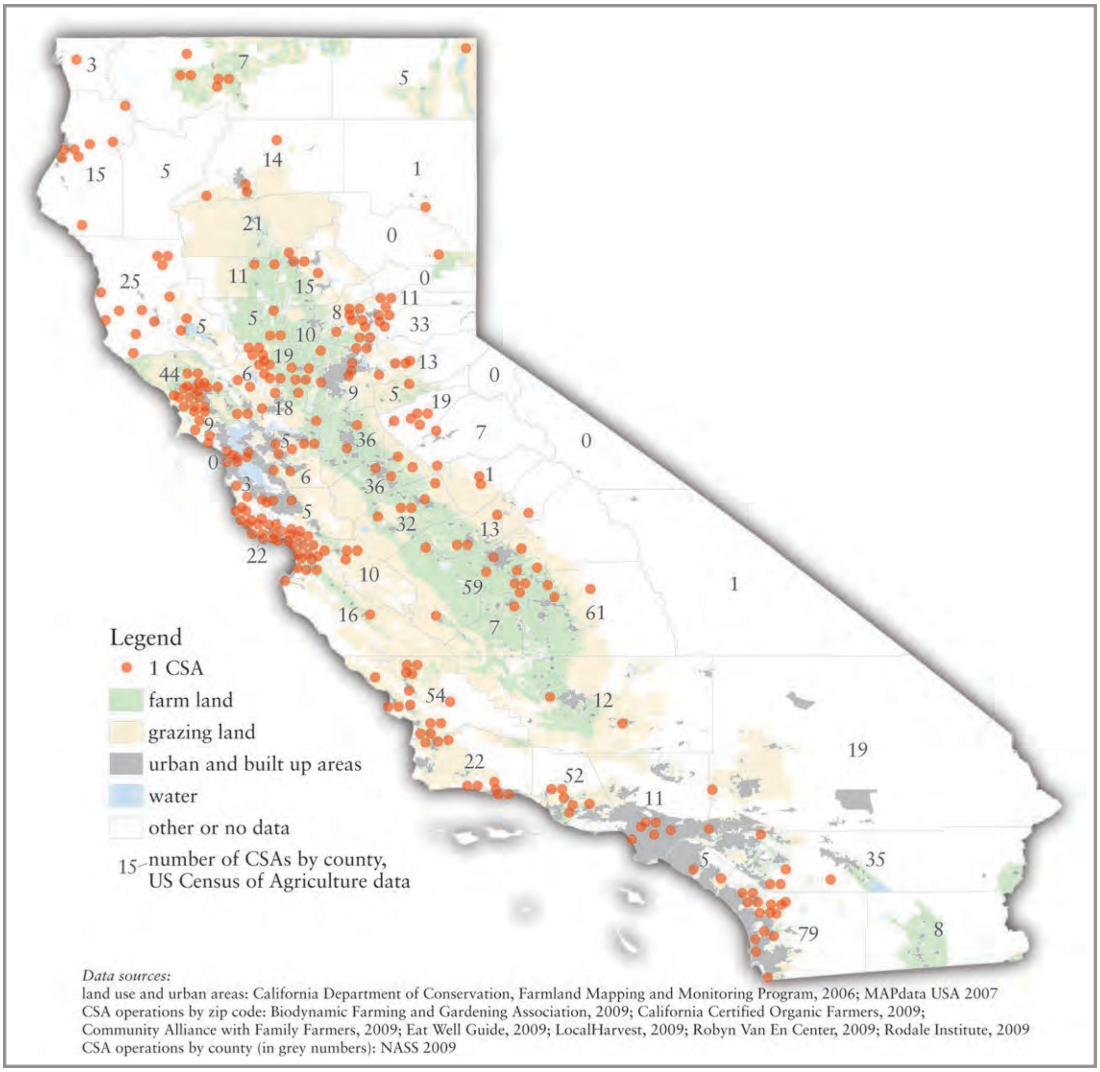

Figure 7: CSA operations in relation to agricultural and urban areas, California, 2009

[9] These are Biodynamic Farming and Gardening Association (2009), California Certified Organic Farmers (2009), Community Alliance with Family Farmers (2009), Eat Well Guide (2009), LocalHarvest (2009), Robyn Van En Center (2009), and Rodale Institute (2009). Compilation was completed in July 2009.

with duplicates removed, provides a "best estimate" of self-reporting CSAs in California.[10] According to this best estimate, there are 276 CSA operations as of July 2009 as mapped in Figure 7. The data are shown vis-à-vis the census data on CSAs at the county level (the numbers in the counties), and urban and agricultural areas.

Figure 7 and Table 3 reveal interesting patterns in overcounting by the census; for California as a whole, the census overcounted CSAs by 677, or 245%. Table 3, sorted by the percentage that the census overcounted CSAs, suggests that the highest levels of overcounting occurred in counties with a low number of CSAs, but with a very high number of farms. For example, the eight counties in the San Joaquin Valley — where there are a large number of farms, but few CSAs — have an average overcounting rate of 760%, meaning that the census counted 7.6 times more CSAs than the best estimate in those counties. Conversely, in counties where there are a relatively high number of CSA operations and a fairly small number of farms — e.g., Yolo, Santa Cruz, and Nevada — overcounting is much lower (27%, 10%, and -8%, respectively). These relationships contribute to a strongly positive correlation coefficient between the percentage overcounted and the total number of farms in a county (r=0.61 for pairwise correlation in Stata 9, significance is $p<0.00$). It also appears that overcounting in areas with high CSA numbers was much lower than in areas with low CSA numbers since the correlation coefficient between the percentage overcounted and the total number of CSA operations in the best estimate data is negative (r=-0.17, p=0.21), although this relationship is not as strong as the correlation between percentage overcounted and total number of farms.[11]

There appears to be geographic variability in the non-CSA farmers' interpretation of the question, i.e., the geography of disconnections in intersubjectivity. In counties where CSAs are common, there might be a lower number of farmers answering yes to the question when they do not run a CSA,

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[10] There is some overcounting in this best estimate, as there are a handful of you-pick operations, community gardens for education, and other non-CSAs. I intentionally left these operations in since they are self-reporting, as were the census respondents. Another problem with comparing the best estimate with the census data is that two years have passed since census data collection, and there has likely been growth in the number of CSAs. Nevertheless, I submit that the data compiled from these seven lists is the best one can do short of a resource-intensive search, and is fairly close to the actual number of CSAs in California, thereby providing an important point of comparison with the census.

[11] An ordinary least squares regression with the percentage overcounting as the dependent variable shows that these two independent variables, best estimate of CSAs by county and the total number of farms by county, continue to have this relationship when controlling for one another: the best estimate of CSAs by county is very negatively related to overcounting (coefficient t=-4.27 and significance $p<0.00$), while overcounting's relationship to the number of farms in the county from the census data is very positively related to overcounting (t=7.47 and $p<0.00$). The overall model has an R^2 of 0.53 and an F-value (regression significance) of 0.00. While there is a positive correlation between the best estimate of CSAs by county and the total number of farms by county (r=0.36), this is below Hamilton's (2006) standard of r=0.6 for bivariate correlations that indicate problems of multicollinearity within the regression analysis.

Table 3: Comparison of California CSA numbers in the census and in the best estimate CSA data set, by county

County	CSA numbers in 2007 Census of Agriculture (A)	CSA numbers in best estimate data set (B)	Census overcounting, by number (A-B)	Census overcounting, by percentage ([A-B]/B)	Farm numbers in 2007 Census of Agriculture
Imperial	8	0	8	NA[a]	452
Inyo	1	0	1	NA	94
Tehama	21	0	21	NA	1,752
Trinity	5	0	5	NA	181
San Joaquin	36	2	34	1700%	3,624
Tulare	61	4	57	1425%	5,240
Sutter	10	1	9	900%	1,263
San Bernardino	19	2	17	850%	1,405
Stanislaus	36	4	32	800%	4,114
Ventura	52	6	46	767%	2,437
Yuba	8	1	7	700%	828
Fresno	59	8	51	638%	6,081
Riverside	35	5	30	600%	3,463
Merced	32	5	27	540%	2,607
Kern	12	2	10	500%	2,117
Solano	18	3	15	500%	890
Glenn	11	2	9	450%	1,242
Placer	33	6	27	450%	1,488
San Diego	79	15	64	427%	6,687
Amador	5	1	4	400%	479
Modoc	5	1	4	400%	448
San Luis Obispo	54	14	40	286%	2,784
Calaveras	19	5	14	280%	631
Butte	15	4	11	275%	2,048
Kings	7	2	5	250%	1,129
Shasta	14	4	10	250%	1,473
Tuolumne	7	2	5	250%	366
El Dorado	13	4	9	225%	1,268
Madera	13	4	9	225%	1,708
Del Norte	3	1	2	200%	85
Sacramento	9	3	6	200%	1,393
Lake	5	2	3	150%	845
Orange	5	2	3	150%	325
San Benito	10	4	6	150%	625
Santa Barbara	22	9	13	144%	1,597
Sonoma	44	18	26	144%	3,429
Mendocino	25	11	14	127%	1,136
Napa	6	3	3	100%	1,638
Humboldt	15	8	7	88%	852
Los Angeles	11	6	5	83%	1,734
Colusa	5	3	2	67%	814
Alameda	6	4	2	50%	525
Monterey	16	12	4	33%	1,199
Marin	9	7	2	29%	255
Yolo	19	15	4	27%	983
Santa Clara	5	4	1	25%	1,068
Siskiyou	7	6	1	17%	846
Santa Cruz	22	20	2	10%	682
Alpine	0	0	0	0%	7
Contra Costa	5	5	0	0%	634
Lassen	1	1	0	0%	459
Mono	0	0	0	0%	84
Sierra	0	0	0	0%	50
Nevada	11	12	-1	-8%	690
Mariposa	1	2	-1	-50%	302
San Mateo	3	6	-3	-50%	329
Plumas	0	1	-1	-100%	142
San Francisco	0	4	-4	-100%	6
California	953	276	677	245%	81,033

[a] NA = incalcuable, as there were zero CSA operations in the compiled data set.

since they are more familiar with the common definition of CSA given its ubiquity in the area. For example, Yolo County is known for a number of famous CSA farms in the Capay Valley and Table 3 shows that overcounting was relatively low (by 4 CSAs, or 27%). In contrast, in counties where CSA operations are few and relatively unknown, more farmers would likely answer yes, even if their market arrangements do not conform directly to the common definition of CSA. For example, the county where I am from — Stanislaus County — has only four CSA operations according to the compiled data set, yet the census says it has 36, an overcounting of 800%. In Stanislaus County there are farmers who attend farmers' markets and there are likely many other direct marketing relationships, but CSAs are not a well known type of operation. It might be that in counties with a relatively high level of direct marketing relationships, but in which CSAs are not prominent, a relatively high level of overcounting occurred in the census because farmers understood the definition of CSA differently than the commonly held definition. Further analyses comparing the census data and "best estimate" data sets for other states could provide more evidence on overcounting patterns. These analyses could also provide more accurate numbers than the census data at the county and state level.

In terms of the geography of CSAs in California, Figure 7 shows two major patterns. CSAs tend to be located near population centers, especially those that have a reputation of being progressive, such as Santa Cruz, the San Francisco Bay Area, Davis (and Yolo County generally), Nevada City/Grass Valley, and Sebastapol (cf. Schnell, 2007 on a similar nationwide pattern). There are, however, a significant number that are closer to small cities, and a fair number that are far from metropolitan areas, and would seem to serve a local, perhaps rural, population. Second, CSAs tend to be located on the margins, rather than in the middle of, the most productive agricultural land. Instead of seeing CSAs ringing the California cities located on and next to the most productive farm land — e.g., Fresno, Modesto, Bakersfield — CSAs tend to surround the larger urban areas and the coast in Northern California, and cluster around the margins of the very productive Central Valley and Salinas Valley. The locations on the margins of the Central Valley point to Guthman's (2004) analysis of California agriculture: land rents are based on the potential profitability of the land, and thereby can preclude more sustainable, but less mainstream, kinds of operations. Land prices are extremely high in the Central Valley and the Salinas Valley since very high-value crops — especially fruits and vegetables — flourish in the area. Buying or renting farmland in the most productive areas of the Central Valley might be difficult for CSA farmers, who cannot show banks the same solid data that exist for returns on conventional commodity crops grown in an area.

In addition to political economy, there are possible cultural explanations for the distribution of CSAs. The Central Valley is well known for being socially and politically conservative, and CSAs do not yet appear to be equally embraced by conservatives, even though one might see how CSAs can align with concerns of the left and the right. Thus, for now in California, CSAs are located on the margins of the most productive agricultural land, and near progressive cities. These patterns support Jarosz's (2008, 237) argument that "conceptualizing an [agrifood network] solely at the state level may be regionally inaccurate since cropping patterns, farm size, consumption patterns and environmental conditions vary within states and provinces."

Similar patterns will not necessarily exist in other states. Analysis of distributions of CSA vis-à-vis agricultural and urban areas in other states would allow interesting comparisons. Analysis of the extremes — Washington and Vermont in comparison to Louisiana and Arkansas — would allow us to see whether CSAs in other states similarly cluster around progressive cities and on more marginal farmland or display another pattern.

Conclusion

With the analysis above, I've argued that the census overcounted CSA numbers and that CSA data should be standardized when considering the geography of CSA. There are a number of options for standardization, including visualizing CSA operations (1) as a proportion of all farming operations, (2) in relation to population, or (3) in terms of absolute density, i.e., numbers per standardized area. This last option is not done here except informally through dot maps, but more detailed analysis is possible, such as counting CSAs on a kilometer by kilometer grid or standardizing the data through location quotient analysis, and could provide additional maps that overcome the problem of vast differences in state and county sizes that plagues traditional choropleth maps.

The patterns highlighted here should be subjected to more detailed analysis. The geography of CSAs is likely influenced by: consumers' values/politics, education, and income levels; institutional infrastructure that can support diversified and organic agriculture; and the biophysical environment, since, for example, the South has major insect pest and disease problems that are less severe in the West. Agricultural geographers, informed by a political ecological perspective that takes political economy, identity, and ecology seriously, can contribute greatly (Qazi and Selfa, 2005). For example, one might develop multiple regression analyses with a CSA density indicator as the dependent variable and existing data — e.g., population, education, income, race/ethnicity, metropolitan and non-metropolitan designations — as independent variables at various levels. This might identify correlates with CSAs beyond Schnell's (2007) analysis, and could be paired with structural analyses of how agricultural regions are affected by historically contingent political economic processes (cf. FitzSimmons, 1990) and qualitative data collection targeting areas with different densities of CSAs to understand similarities and differences among regions. Future analyses can also incorporate time series analyses to show where growth occurs and how rapidly.

The case of California shows census overcounting vis-à-vis CSA and total farm numbers. Overcounting is relatively low when CSA numbers are high and overcounting is very high when there are a large number of farms. If this is representative of overcounting across the nation — perhaps a reasonable assumption given the diversity of California counties' agriculture — we can estimate total CSA numbers in the country. Since California CSAs were overcounted by 245% (i.e., the census count is 345% of the best estimate), we can divide the census CSA total of 12,549 by 345%. In doing so, we arrive at an estimate of 3,637 CSAs in the U.S. in 2009. While I believe this is a better estimate than the census data, it is based on extrapolating from a snapshot of California to the nation, which is problematic because of differences in land rent structure, prevalent political orientations, and available opportunities for CSA establishment, among other factors.

How, then, should we treat the census CSA data? Researchers and the government should use the census data on CSA only with great caution and skepticism, as it does not correspond closely to other available data on CSA, which I believe is caused by (1) problems of the researchers and the subjects not sharing an understanding of the CSA concept, and (2) potential problems with nonresponse adjustment. The census data should not be used by itself as a representation of CSA numbers because of the serious and geographically heterogeneous inaccuracies identified in the California case.

Ideally, this analysis will inform future data collection efforts. The USDA should change the way it inquires about CSA in the census. First, the question must refer the respondent to a specific definition, ideally in the question, but if necessary in the glossary. Thus, at a minimum, it should be modified to the following:

- *At any time during [year], did this operation: … Market products through a community supported agriculture (CSA) arrangement? (Please refer to the specific definition of CSA in the glossary, page B-__.)*

Second, a follow-up question should be added to distinguish between farmers who have primary responsibility for CSA operations, and those farmers who sometimes supplement the shares by selling to CSA operations:

- *Is your operation primarily responsible for the CSA share provided to subscribers?*

And third, I suggest using the CSA definition from the 2008 Organic Production Survey (NASS, 2010, B-12) for the glossary:

- *Community Supported Agriculture is a type of organization intended to create a relationship between farmers and consumers in which risks and bounties are shared. CSA customers buy shares for a season by*

> *paying a fee in advance. In return they receive a regular (in most cases weekly) selection of food.*

Adding a definition will help to reduce errors in overcounting in the census, and adding a question on primary responsibility for CSA shares will help distinguish between CSA operations that are primarily in charge and those that provide components of the shares. Additionally, research should examine whether nonresponse and coverage adjustments should be treated the same for CSAs as for other kinds of farms. These two changes — to the census instrument and to the census data editing methodology — can help correct the accuracy problems with the 2007 census CSA data.

I want to end on the relationships between geographic thinking, including exploration and analysis through critical cartography/GIS, and alternative agrifood movements. Connecting the two can have positive, instrumentalist results, in that these types of analysis might inform better data collection on them (as I have done here), help farmers in locational decision-making, or persuade local and regional governmental bodies to support initiatives related to land access for CSAs, for example. But increasing the connections can also advance a more radical project of rethinking, visioning, and supporting progressive possibilities around the current social and spatial arrangements of our agrifood systems and the forces shaping them.

Acknowledgements

This research is from Hatch project number CA-D*-HCD-7743-H, funded by a Hellman Fellowship and the Agricultural Experiment Station at UC Davis. I thank Rachel Slocum, another reviewer who remained anonymous, editor Salvatore Engel-Di Mauro, and Maggie Lickter, Trina Filan, Gail Feenstra, Jennifer Gardner, Alida Cantor, Damian Parr, and Aubrey White for helpful suggestions; Colleen Hiner for research assistance; Erin Barnett for an exchange of ideas and for access to LocalHarvest's data; and Jeff Beranek and Brad Summa at USDA for help in understanding NASS's treatment of the census data. This paper benefitted from feedback during the Geography Speakers Series at the University of California, Davis and the Geography Department Colloquium at the University of California, Berkeley. I remain responsible for errors and omissions.

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