Letter

County-level analysis of current local capacity of agriculture to meet household demand: a dietary requirements perspective

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Abstract

With the goal of informing local food-action planning, this paper develops the first county-level database detailing agrifood consumption and production across 3114 counties in the United States. The database covers 12,070 food items that comprise the entire diet, mapping them to the production demand of 95 agrifood commodities. Agrifood demand is delineated further into fresh and processed components, along with characterization of animal feed, and compared with local food production to yield the current local agrifood capacity (CLC). CLC results are shown for individual agrifoods and for aggregated categories (e.g., on average, 0.03 for fruits and nuts, 0.24 for vegetables, 0.31 for non-meat animal products) across all US counties. CLC results for the entire diet find that a large proportion of US counties can be self-sufficient in individual agrifood commodities (ranging from <0.5% of counties for agrifoods like hops, papayas, and artichokes to 59% of counties for beef), and 23% of US counties can supply over half of their total human dietary demand through local production, but only 9% of the US population resides in these counties. Such granular, subnational baselines are essential to inform future goal-setting for urban agriculture.

1. Introduction

Localizing food production, i.e. increasing urban agriculture, is proposed by a variety of local and regional policy bodies to address multiple food system challenges, including food insecurity [1], supply chain-related environmental burdens [2–4], and economic leakage [5] (i.e. money spent on imported goods). However, localization can also have negative impacts such as economically inefficient use of urban land, increased local environmental burdens [6], and difficulty in achieving high yields efficiently [7, 8]. To evaluate a range of potential policy scenarios for urban agriculture, researchers and policymakers need foundational, publicly available data on their local agrifood system, including quantitative information on local agrifood production compared with the agrifood requirements associated with local consumption. However, such data are not systematically available at the local scale (i.e. cities and counties) in the United States. Indeed, more than 200 cities have signed on to the Milan Urban Food Policy Pact (MUFPP), seeking to develop sustainable urban food systems, wherein local agriculture is a key policy instrument [9]. For these and other cities, baseline data on agrifood production and consumption at the local level are important in informing a range of food-system interventions.

Focusing on the US, most studies at the local level tend to focus on the maximum potential for urban agriculture, exploring the impact of utilizing all land deemed available for urban production [10, 11], but this does not address the current capacity of local production to meet local demand, which is essential for baseline analyses. Our previous study [12] assessed current local capacity, i.e. current production capacity to meet local household consumer demand, but only for six agrifood categories and items, rather than the entire diet. Recent efforts at the national and regional level have sought to align consumption by
dietary groupings (e.g. plant oils) with agrifood production, in efforts to identify regional and national agrifood-carrying capacities under different potential production and dietary scenarios [13–15]. Similar efforts are needed at the local level of cities and counties, which is the focus of this paper.

Oftentimes the dietary or agricultural interventions of interest to local policymakers or entrepreneurs focus around a few individual agrifood or agrifood categories (e.g., individual vegetables, herbs, mushrooms [16, 17]). Thus, soliciting the need for granular data on individual food items eaten, delineated into fresh versus processed foods, and compared to the local capacity to meet that local demand. However, local production versus dietary agrifood demand data in such granular detail (e.g. specific items eaten, fresh versus processed) are lacking across large numbers of cities/counties.

This paper develops a granular, county-level dataset, quantifying the current local capacity for local agrifood production to satisfy household dietary demands for all major agrifoods individually, and for the whole diet. The dataset includes all counties throughout the conterminous US (ranging from Loving County, TX, population 85, to Los Angeles County, CA, population 9.8 million in 2012) in a manner that aligns with available national data. Overall, this means harmonizing the per capita dietary intake of 12,070 food items to 573 food ingredients and mapping those ingredients to 95 agrifood commodities, which in total account for 94% of the average American dietary intake by weight, providing baseline food system metrics at the county level, which can be leveraged for further analyses.

Achieving this paper’s objectives requires overcoming four data challenges: (a) agrifood production data are frequently undisclosed; (b) conversion factors need to be incorporated to allow for the harmonization of various data; (c) loss factors need to be incorporated into the data to estimate weight changes (i.e. losses) along the supply chain; and (d) the total aggregate food production and consumption needs to be consistent with national production and consumption data. This paper addresses these complexities by harmonizing two public datasets: the United States Department of Agriculture (USDA) 2012 Agricultural Census, and the Center for Disease Control’s National Health and Nutrition Examination and Survey (NHANES). Furthermore, our dataset delineates agrifood demand by their supply chain complexity (i.e. identifying fresh or minimally processed food, which can be sourced locally), as well the estimation of the indirect animal feed demand via livestock meat, dairy, and eggs.

The objectives of this paper are to: (a) create a county-level database addressing local production and demand of all food items eaten in the average American diet scaled up by population and mapped to their associated ingredients and agrifood commodities, overcoming the data challenges outlined above; (b) verify mass balances in the database across 95 commodities by aggregating county-level data and comparing with national data; (c) explore the magnitude of agrifoods demand delineated by their estimated supply chain complexity (fresh vs. processed); and (d) compute a policy-relevant metric called the current local capacity (CLC) to inform local food-action plans. The CLC quantifies the current capacity of existing local agriculture to meet local demand, assuming supply chains enable such local distribution. The CLC metric offers a physically based current estimate of what is possible based on actual local production and estimated local agrifood demand in the US. Local agrifood demand is modelled from food dietary intake databases, to which supply chain losses are added. Counties with CLC results above one are referred to as ‘self-sufficient’ in the context of this paper, which focuses strictly on current production and demand (as opposed to theoretical future scenarios).

2. Methods

We note four key challenges and associated innovations in creating a US county-level database of both production and consumption.

2.1. Modelling undisclosed county-level agrifood production data

The USDA Agricultural Census does not disclose production data in counties where single operations contribute >15% of local production. Thus, across 3114 counties, an average of 27% of the total acreage or production by weight occurred in counties where the exact totals were undisclosed. The total undisclosed data varied by crop, with niche crops like camelina having >90% of their data undisclosed at the county level, while more common agrifoods like pork, sugar beets, and 45 others had <10% of their data undisclosed at the county level. Undisclosed data were estimated via modelling from state-level data, utilizing county-level crop-land acreage as a weighting metric, and repeating the process with national-level data when the state totals were undisclosed. SI-text 2 (available online at stacks.iop.org/ERL/17/044070/mmedia) provides further notes on the component data and methods used. Crop-production totals were calculated and compared with national totals reported by the USDA and the Food and Agriculture Organization (FAO) to ensure coherence, as described in section 2.4.

2.2. Mapping food items consumed to agrifood demand, delineating fresh versus processed

We convert estimates of average American dietary intake to farm weight equivalents of agrifood demand using the Center for Disease Control’s NHANES
dietary recall surveys, combined with the Environmental Protection Agency’s (EPA) What We Eat In America—Food Commodity Intake Database (WWEIA-FCID 0510) [18]. This approach has been used previously by other researchers [14, 19]; our key contribution is the delineation of fresh versus processed agrifood demand mapped to every item in the US diet. The delineation of fresh and processed demand was previously tested for a few commodities [12] and is here expanded to the whole diet. The dietary recall data from 2005 to 2010 (years chosen to align with the FCID) are mapped to agrifood production, including requirements for animal feed, in three steps, noted below (2.2.1–2.2.3).

2.2.1. Mapping dietary ‘items eaten’ to agrifood commodities via food ingredients

NHANES [20] reports the weight of food items (e.g., sandwiches, candy bars, etc) consumed by individual consumers who recall what they ate the previous day in two consecutive 24 h recall surveys. The food items eaten per capita were mapped to food ingredients using EPA's FCID. The FCID contains a crosswalk to convert the 12 070 food items eaten to 563 estimated food ingredients. For example, lemonade as a food item is then broken down into food ingredients such as “beet, sugar”, “lemon, juice”, etc. We mapped food ingredients to respective agrifood commodities used in production datasets. Only a few agrifood commodities identified in the FCID database are not noted in the USDA datasets, namely fish and niche tropical crops, which account for 6% of the total dietary intake. Our analysis uses average American diet when comparing aggregate household demand calculated with national average diet. Calculating the aggregate household demand using diets of different demographics had results which were not substantially different at the metropolitan level for major agrifoods [12].

2.2.2. Delineating demand for agrifood commodities by degree of processing

Food ingredients were delineated by their estimated supply chain complexity into ‘fresh or minimally processed’ agrifood demand (e.g., fresh apples eaten, or eggs used for scrambled eggs) versus ‘processed’ agrifood demand (e.g., apples processed into fruit juice, or eggs within cake), providing a more nuanced view of local demand relevant to local policymakers who seek to enhance local supplies of fresh foods. Ingredients to which the degree of pre-consumer processing was unclear were identified as ‘potentially fresh or minimally processed’. See SI-text 5 for the classification guidelines.

2.2.3. Estimating per capita animal feed requirements

The per capita animal feed demand was estimated using the dietary consumption of livestock meats and animal products from an earlier step, to which were applied feed conversion factors and dressing adjustment factors (see SI-table 4 for conversion factors and sources). Animal feed demand was further delineated into four categories based on their origin and land-use requirements using animal feed characterization data originating from the FAO’s Global Livestock Assessment Model database and processed in Mottet et al [21]: cereal grains and whole soybeans, roughage, agricultural co-products, and nutritional supplements. Cultivation of cereal grains and soybeans requires high-fertility land and thus competes with the cultivation of other human-edible crops. Roughage sources, by contrast, grow on low-fertility land or are valorized crop byproducts like silage. Agricultural co-products are produced in conjunction with other agrifood products (namely crop oils and ethanol) and hence were not included in animal feed demand totals to avoid potential double-counting. Nutritional supplements were also not included as their weight contribution is marginal.

2.3. Incorporating food losses

Two types of loss factors were applied. First, conversion and processing loss was applied to convert food ingredients to agrifood commodities (e.g. soybean oil to soybean). Next, all other post-harvest supply chain losses were applied (including consumer waste), primarily utilizing the food-loss factors outlined in the USDA's Loss-Adjusted Food Availability (LAFA) dataset [22], with supplemental data from academic publications, extension programs, and industry trade groups. When no loss data were available for a specific agrifood ingredient, loss data from similar food ingredients were utilized.

2.4. Verifying the results via mass balance for production and consumption

For production, the sum of the modelled county-level production data was compared to the total US production as reported by the USDA Agricultural Census or the FAO data for the year 2012, and is shown in SI-tables 2(a)–(c). See SI-text 4 for a discussion of the nuances of the national-level production data utilized.

The agrifood consumption estimates were verified for select foods against the USDA’s LAFA dataset, which reports the per capita availability of a variety of food items at the national level, as well as the ‘primary weight equivalent’ of the available food items. All LAFA primary weight estimates were converted to harvest weight equivalents, shown in table 1. To the best of our knowledge, no previous studies compared NHANES-derived food consumed converted to agrifood demand versus LAFA.

2.5. Estimating the current local capacity for US counties

The county-level agrifood production and household demand data were used to compute the CLC
Table 1. Comparison of self-reported per capita dietary intake converted to commodity demand (NHANES-derived) and per capita availability (LFA).

| Select Agrifood | 2005–2010 average LAFA per capita availability | 2005–2010 NHANES-derived demand estimates |
|----------------|---------------------------------------------|------------------------------------------|
|                | - lbs./person/year (harvest weight equivalent) - | - lbs./person/year (harvest weight equivalent) - |
|                | 2005–2010 average LAFA per capita availability | 2005–2010 NHANES-derived demand estimates |
|                | Fresh | Processed | Total per capita availability | Fresh | Potentially fresh | Processed | Total demand |
| Beef           | n/a   | n/a       | 90.1                        | 57.0  | 5.6               | 11.5      | 74.0         | -10%         |
| Chicken        | n/a   | n/a       | 98.1                        | 50.5  | 2.9               | 12.9      | 66.4         | -19%         |
| Pork           | n/a   | n/a       | 63.2                        | 15.7  | 7.4               | 17.0      | 40.1         | -22%         |
| Eggs           | n/a   | n/a       | 32.8                        | 22.5  | 7.9               | 3.3       | 33.7         | 1%           |
| Milk (Dairy)   | 196.7 | 409.2     | 606.0                       | 126.8 | 38.0              | 402.0     | 566.8        | -3%          |
| Almonds        | n/a   | n/a       | 1.2                         | 0.8   | 0.2               | 0.2       | 1.2          | 1%           |
| Peanuts        | n/a   | n/a       | 8.8                         | 2.0   | 0.0               | 0.2       | 7.2          | -10%         |
| Watermelon     | 14.9  | 0         | 14.9                        | 19.3  | 0.3               | 0.0       | 19.6         | 14%          |
| Wheat          | n/a   | n/a       | 183.5                       | 0.0   | 0.0               | 145.5     | 145.5        | -12%         |
| Rice           | n/a   | n/a       | 20.2                        | 12.7  | 0.8               | 9.2       | 22.6         | 6%           |
| Apples         | 16.5  | 32.0      | 48.5                        | 25.9  | 1.1               | 30.7      | 57.7         | 9%           |
| Oranges        | 9.6   | 57.2      | 66.8                        | 14.7  | 6.8               | 68.2      | 89.7         | 15%          |
| Blueberries    | 0.7   | 0.5       | 1.2                         | 1.6   | 0.7               | 0.4       | 2.7          | 38%          |
| Strawberries   | 6.5   | 1.8       | 8.3                         | 6.9   | 0.4               | 3.4       | 10.8         | 13%          |
| Broccoli       | 5.8   | 2.5       | 8.4                         | 5.9   | 1.4               | 1.7       | 9.0          | 4%           |
| Onions         | 20.3  | 1.5       | 21.8                        | 15.9  | 3.3               | 4.4       | 23.6         | 4%           |
| Potatoes       | 38.3  | 81.5      | 119.8                       | 33.3  | 5.7               | 30.2      | 69.1         | -27%         |
| Tomatoes       | 19.6  | 69.2      | 88.9                        | 26.5  | 4.4               | 57.5      | 88.4         | 0%           |
| Sweet corn     | 3.2   | 10.8      | 14.1                        | 5.0   | 1.1               | 4.3       | 10.4         | -15%         |
| Mushrooms      | 2.5   | 1.3       | 3.8                         | 2.1   | 0.3               | 0.3       | 2.7          | -17%         |
| Honey          | n/a   | n/a       | 1.0                         | 0.5   | 0.1               | 0.4       | 1.0          | -2%          |

1 Carcass weights listed.
2 LAFA does not include veal.
3 'Fresh' in this case refers to all beverage milk; reported in raw milk eq.
4 In-shell basis; LAFA data modified using the x0.75 conversion factor.
5 Fresh watermelon only for LAFA; NHANES-derived estimates assume rind is eaten based on ingredient description.
6 LAFA reports wheat in the form of wheat flour (ignoring small amount of wheat consumed as whole grain).
7 LAFA orange data includes temples.
8 Cob and husk weights removed from fresh and frozen sweet corn availability estimates (LAFA).
[12] (equation (1)), which quantifies how much of a region’s agrifood demand can be satisfied by current local agrifood production (as opposed to theoretical). The CLC is computed for individual agrifood commodities (e.g., tomatoes, eggs) as the ratio of the current annual production of that agrifood within a defined boundary to the current annual household demand of that same agrifood item within a defined boundary. The CLC of entire food categories, such as vegetables, was estimated as well, with data on production and demand aggregated for all individual commodities in the same agrifood category. CLC results were computed for both the total agrifood production and demand as well as the fresh production and demand (e.g., fresh fruit), which may be of greater interest to many local food advocates than the CLC of all agrifood demand (i.e. fresh and processed):

\[
\text{Current Local Capacity}_i = \frac{\text{Local Agrifood Production}_i}{\text{Local Household Agrifood Demand}_i}, \quad i = \text{Individual agrifood or agrifood category.}
\]  

(1)

For field crops, the CLC was calculated once on its own (CLC_{Field Crops}), and a second time in conjunction with roughage production and demand (CLC_{Field Crops & Roughage}), which is associated with animal feed, for which field crops could be considered fungible. For all calculations involving field crops, the production of local grain corn was lowered by 45% to account for the competition of grain corn use in ethanol production (corn supply disappearance from ethanol ranged from 33% to 55% throughout the 2011–2012 fiscal year [23]).

Last, a diet-weighted CLC was estimated, which denotes an estimated percentage of the total diet demand of all households in a county that can be satisfied with current local production. Shown below in equation (2), the diet-weighted CLC multiplies the CLC result of each individual agrifood (not including production in excess of demand) by the portion that each individual agrifood makes up in the total average American diet:

\[
\text{Diet-Weighted CLC} = \sum_i^n \left( \max \left\{ \frac{\text{Local Agrifood Production}_i}{\text{Local Household Agrifood Demand}_i}, 1 \right\} \times \frac{\text{Per Capita Agrifood Demand}_i}{\text{Per Capita Agrifood Demand}_w} \right) \quad i = \text{Individual agrifoods or agrifood categories within diet} \quad n = \text{All agrifoods or agrifood categories considered.}
\]  

(2)

The diet-weighted CLC was calculated for three different pairings of production and demand: (a) fresh, human-edible agrifoods (sum of all fresh fruits, vegetables, eggs, etc in the diet); (b) total human-edible agrifoods (sum of all fresh and processed fruits, vegetables, eggs, etc; including meat demand and production but not the indirect animal feed demand of grain and roughage); and (c) total primary agrifoods, which includes animal feed and roughage inputs into producing meat and eggs; hence meat and egg production are not included as the analogous animal feed requirements are already counted. The diet-weighted CLC estimates were calculated with and without an assumption of demand fungibility within agrifood categories, namely field crops (and roughage), fruits and nuts, vegetables, livestock meats, and animal products.

3. Results

3.1. Database verification via mass balance

The aggregate of the county-level production estimates aligned well with national totals, as seen in SI-tables 2(a)–(c), which delineate by agrifood categories. When comparing the aggregate of estimated county-level production to the best available national-level production totals data for each agrifood (USDA data for field crops, livestock meats, and animal products and FAO data for fruits and nuts, vegetables, and horticulture), only 17 agrifoods (all fruits and vegetables) did not align within 10%. Overall, barring some lesser produced crops like bananas, the sum of modeled US county-level estimates aligns with published national data.

Table 1 examines the alignment between per capita agrifood demand estimates derived from the NHANES (this paper) versus per capita loss-adjusted availability data for the United States for 21 diverse agrifoods. Given the uncertainty in both methodologies, table 1 shows good alignment between the two estimates, with a majority of select agrifoods (85%) being within 20% of midpoint estimates of the two methods. Only three agrifoods (15%) displayed differences greater than 20% (this includes pork at 22%, blueberries at 38%, and potatoes at 27%). Such differences are expected given the uncertainty in the loss-adjusted national availability data itself, as discussed by the LAFA’s Expert Panel Report [24]. Other factors include survey biases that influence the NHANES data [25] and trade data limitations in LAFA import–exports estimates, particularly affecting the fruit/fruit juice availability. Overall, table 1 shows a broad alignment of this paper’s bottom–up approach versus national data.

3.2. Per capita fresh, processed, and animal feed agrifood demand

The per capita agrifood demand derived from dietary data and delineated as fresh, potentially fresh, and processed, are shown in figures 1 and 2. Figure 1(A) describes six broad categories of agrifood demand (field crops, fruits and nuts, vegetables,
Figure 1. (A), (B) Annual per capita household demand for six broad categories of raw agrifoods, delineated by type of demand. Figure (A, left) delineates the household demand additionally by the USDA agrifood production category. The whole diet is presented as a pie chart in figure (B, right), where the total per capita processed, potentially fresh, and fresh household demands are also listed in kilograms. Livestock meats and animal products considered "fresh" include beverage milk and unprocessed cuts of meat, which travel along ubiquitous cold chains.

Furthermore, by incorporating agrifood requirements for animal feed, we find per capita animal feed requirements (1030 kg) are similar in magnitude to the entire direct human dietary intake (1144 kg, harvest weight equivalent) (figure 3). See SI-table 4 for animal feed demand calculations. This estimation of animal feed then allows us to calculate current local capacity of the whole diet from three different perspectives (see figure 5).

3.3. Current local capacity results
Figures 4(A)–(E) show county-level CLC for the five main agrifood categories shown in figure 1 (excluding miscellaneous and seafood); figure 4(F) also includes the production and demand relating to animal feed (roughage and pastureland contributions included). Side-by-side maps within each figure compare CLC to meet fresh versus total (fresh plus processed) demand. Clear clustering of high CLC results emerges for all agrifood categories, reflecting the geography of production. For example, compared to fruits, which predominantly grow in Florida, California, and Washington, vegetable and animal product results are relatively more dispersed and heterogeneous across neighboring counties. SI-table 5 provides example CLC results for Autauga County, Alabama, detailing CLC results for each of the 95 individual major agrifoods. Results for all counties are available upon request.

Figure 5 plots the CLC results for each agrifood category together with the diet-weighted CLC results, which estimates what percent of the average Amer-
Figure 2. (A), (B) Annual per capita household demand for individual agrifood commodities, separated into two groups based on mass contribution. Figure (A, left) displays all agrifoods in this study with a total per capita demand >25 kg annually. Figure (B, right) displays all agrifoods with a total per capita demand between 5 kg and 25 kg annually. Milk is shown here in raw milk equivalents. ‘Not listed field crops’ refer to agrifoods that were judged to be similar to the agrifoods categorized as field crops by the USDA but are not adequately reported on in the subnational production data published by the USDA.

Figure 3. Production required to satisfy per capita dietary demand, including indirect animal demand. Annual harvest weight demand of agrifoods from direct human dietary intake is delineated by its supply chain complexity (left bar), with livestock meats and animal products demand separated out to illustrate the portion of dietary demand that contributes to animal feed demand. Per capita animal feed demand (right bar) is further delineated to provide further context as to the full mass demand of an average American diet. Cereal grains and whole soybeans refer to the cereal grains common in animal feed (maize, wheat, and barley), as well as unprocessed soybeans. Roughage includes dry mass intake of corn silage, hay and haylage, and fresh grass intake from pastureland. Agricultural co-products are mainly oilseed cakes/meal and distillers’ grains but also fishmeal and bran. Nutritional supplements include limestone, amino acids, and minerals.

An American diet (by harvest weight) can be satisfied with local production, showing the results both as percent of US counties (figure 5(A)) and percent of the US population that reside in counties with a given CLC (figure 5(B)). As can be seen in the left-hand graphs of figure 5, more than half of all counties have the
Figure 4. County-level current local capacity results by agrifood category when considering total agrifood production and demand and only fresh production and demand. Vegetables include melons and mushrooms. Roughage production includes contributions from pastureland.
potential to satisfy all local demand for field crops and roughage (including animal feed demand) (68% of counties), field crops (human-edible only) (59% of counties), livestock meats (55% of counties), but only about a fifth of the US population lives in those counties. A significant number of US counties are also able to satisfy their vegetable and animal product (milk, eggs, and honey) demand with just local production (26% and 34%, respectively), but even less of the US population lives in these counties (12% and 15%, respectively).

Shown in the right of figure 5 are the diet-weighted CLC results calculated under three production and demand delineations (fresh, total, and primary), and two assumptions of agrifood demand fungibility (demand fungibility permitted within the same agrifood category, and no demand fungibility). If the population strictly adhered to each of the individual items represented in the average American diet, no county is capable of self-sufficiency under any whole-diet definition. If fungibility is allowed within categories (i.e., eating locally produced apples instead of imported bananas), a small number of counties do achieve complete self-sufficiency: 31 counties (1.0%) for fresh demand, 43 counties (1.4%) for total (fresh and processed) demand, and 77 counties (2.5%) when considering all primary demand (incl. animal feed but not intermediate animal products). These 77 counties are mostly concentrated in the inland counties of the West Coast, other clusters in the Wisconsin-Michigan region, and in the Southeast. Fruit (and nut) cultivation appears to be a limiting factor for most counties in achieving 100% capacity for self-sufficiency.
More than half of all counties were able to supply 50% or more of their demand when considering all primary agrifood weight. This high percentage of potentially self-sufficient counties is due to the influence that field crops and animal feed demand have on the total primary demand, which also explains the ‘elbow’ shape of the line, which denotes a sharp drop in the portion of counties with the capacity for self-sufficiency beyond 80%—the percentage of the primary agrifood demand made up of animal feed and field crops. Assumed demand fungibility (within agrifood category) boosted the number of counties capable of supplying 50% of local demand or more on the order of 50% under all scenarios. As seen in figure 5(B), only 9% of the US population reside in counties capable of satisfying half or more local demand with local production, when considering total human-edible demand.

4. Discussion

This paper details methods to enable three distinct types of analyses for different policy audiences. (a) Individual counties can identify their current local capacity to meet local household demand for the entire diet, within individual agrifood commodities, delineated as fresh or processed. This can inform food-action planning, with local agriculture being able to contribute to fresh food requirements without additional infrastructure needs. (b) At higher spatial scales (e.g., state or national), figure 4 allows for a deeper spatial understanding of local production and consumption magnitudes. The maps yield important national-level insight about local food system sufficiency and national food system resilience. (c) For individual industries, the database informs agro-commodity inputs to specific food items, which can be valuable for businesses in evaluating sustainable alternatives.

The dataset created in this paper is a step forward in offering concrete, specific, and actionable locally relevant data to food-focused policymakers, community groups, and researchers of the subnational food system. Previous studies quantifying agrifood demand that tackle the whole American diet [26, 27] lack either geographic or agrifood granularity, and have not disaggregated demand by fresh or processed or compared the demand to current local production to inform urban food systems policy. Our prior study initiated such an analysis for a select set of six agrifood categories across 377 metropolitan areas [12]. This paper extends the work substantially by quantifying production-demand ratios across 3114 counties and 95 individual agrifoods, with attention to land requirements for animal feed. These methods and associated baseline data provide for the modelling of local and regional agriculture in a simplified manner that supports policymaking.

Specifically, the CLC metric can quickly identify net-exporting and net-importing crops and crop categories, which can be targeted for local food initiatives either to fill nutritional gaps or reduce food-miles travelled for food items that quickly lose nutritional value, particularly fresh fruits and vegetables [28]. Thus, the delineation of demand into fresh and processed components is particularly valuable. For food-policy priorities focused on local self-sufficiency, the CLC informs strengths and weaknesses from a full-diet perspective. If demand is fungible within agrifood categories, as occurs during times of food stress, an important finding is that over 50% of US counties (housing 30% of the population) could satisfy over half the dietary needs of their local populace through local production alone. This is an interesting and unexpected finding to inform food-system resilience. In contrast, the diet-weighted CLC without fungibility would inform policymakers interested in food-system localization over the long term. Overall, connecting food items eaten to agrifood production at different scales is essential baseline information for designing sustainable food futures.

Data availability statement

The county-level database on local production, consumption, and local capacity described in this paper will be available upon request by writing to the corresponding author. A data summary describing available data fields will also be publicly posted at the Sustainable Healthy City Network with contact for data requests.

The data that support the findings of this study are available upon reasonable request from the authors.

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