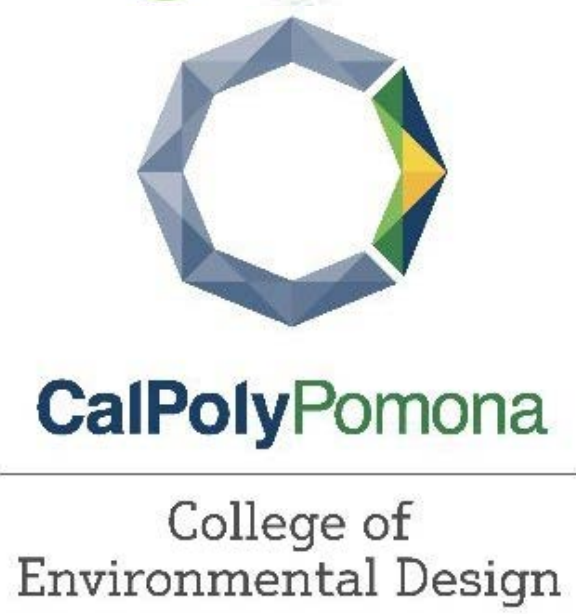


Following the Food Trail: A Spatial Analysis of Food Insecurity and Food Waste at Upland Unified School District



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Introduction

Schools play a vital role in providing enhanced learning opportunities that further the study of food waste. SB 1383 requires that food waste generators recover the maximum amount possible. Addressing source reduction measures and collaborating with other organizations to recover food is the first step to implementing SB 1383 (EPA, 2022). The project goal is to research best practices and approaches that further establishes a sustainable food recovery model.



Source: Author

Methodology

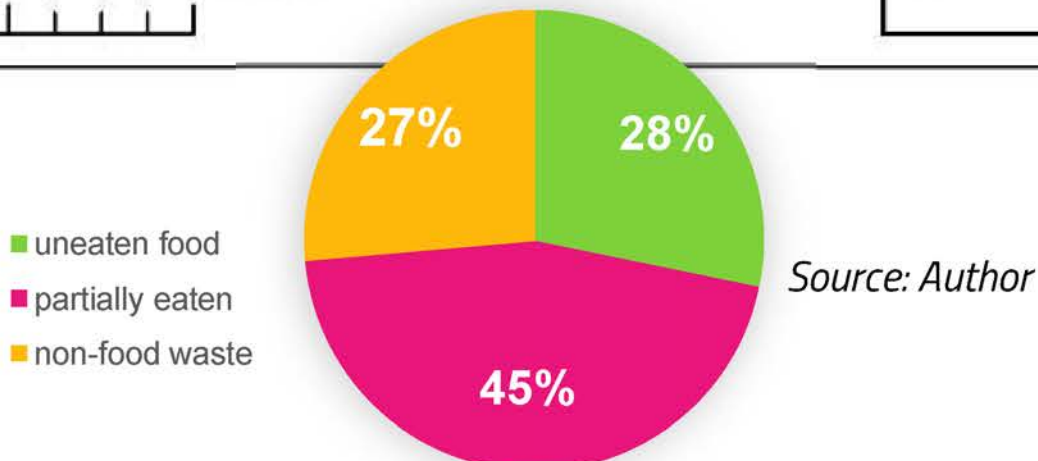
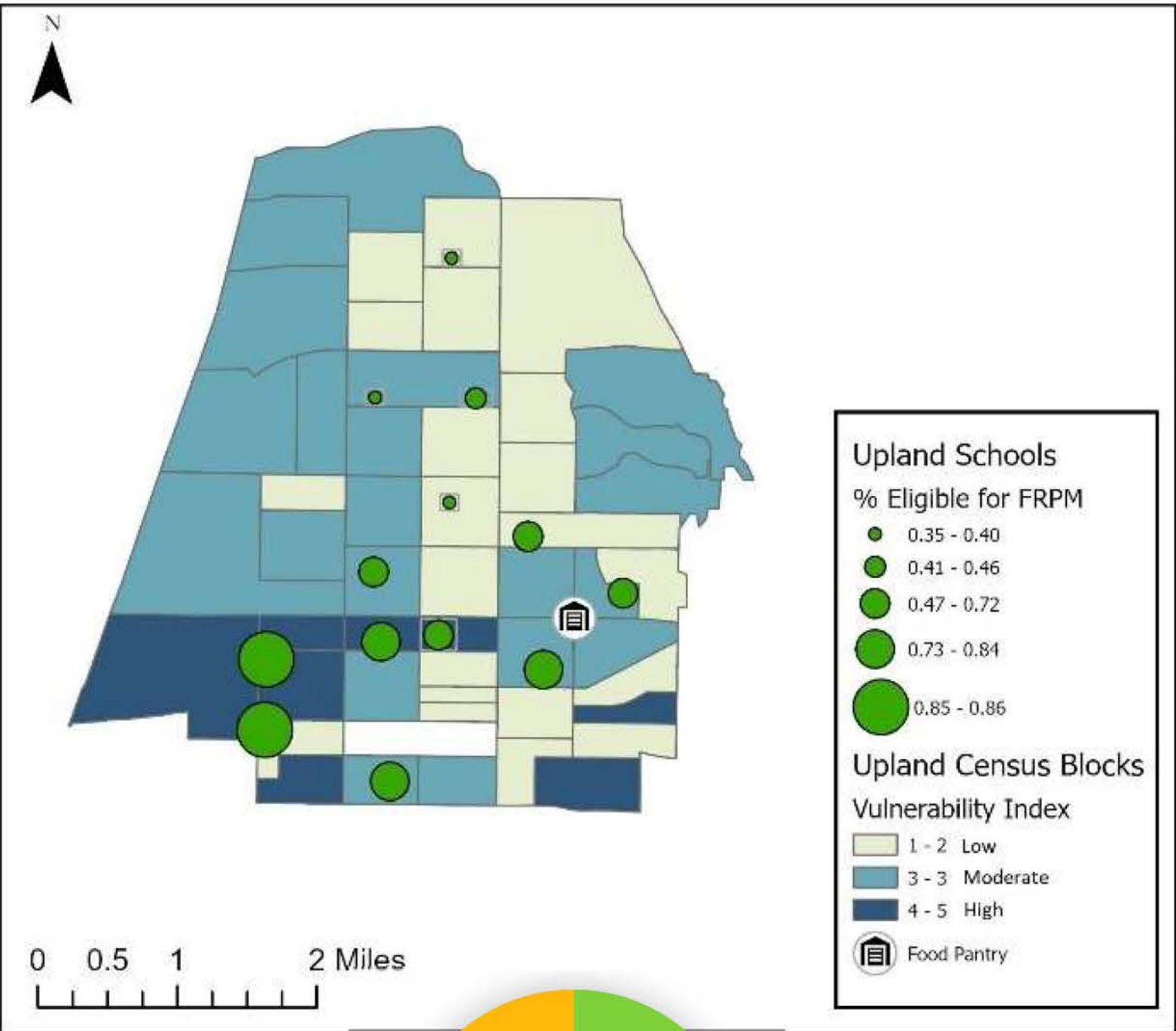
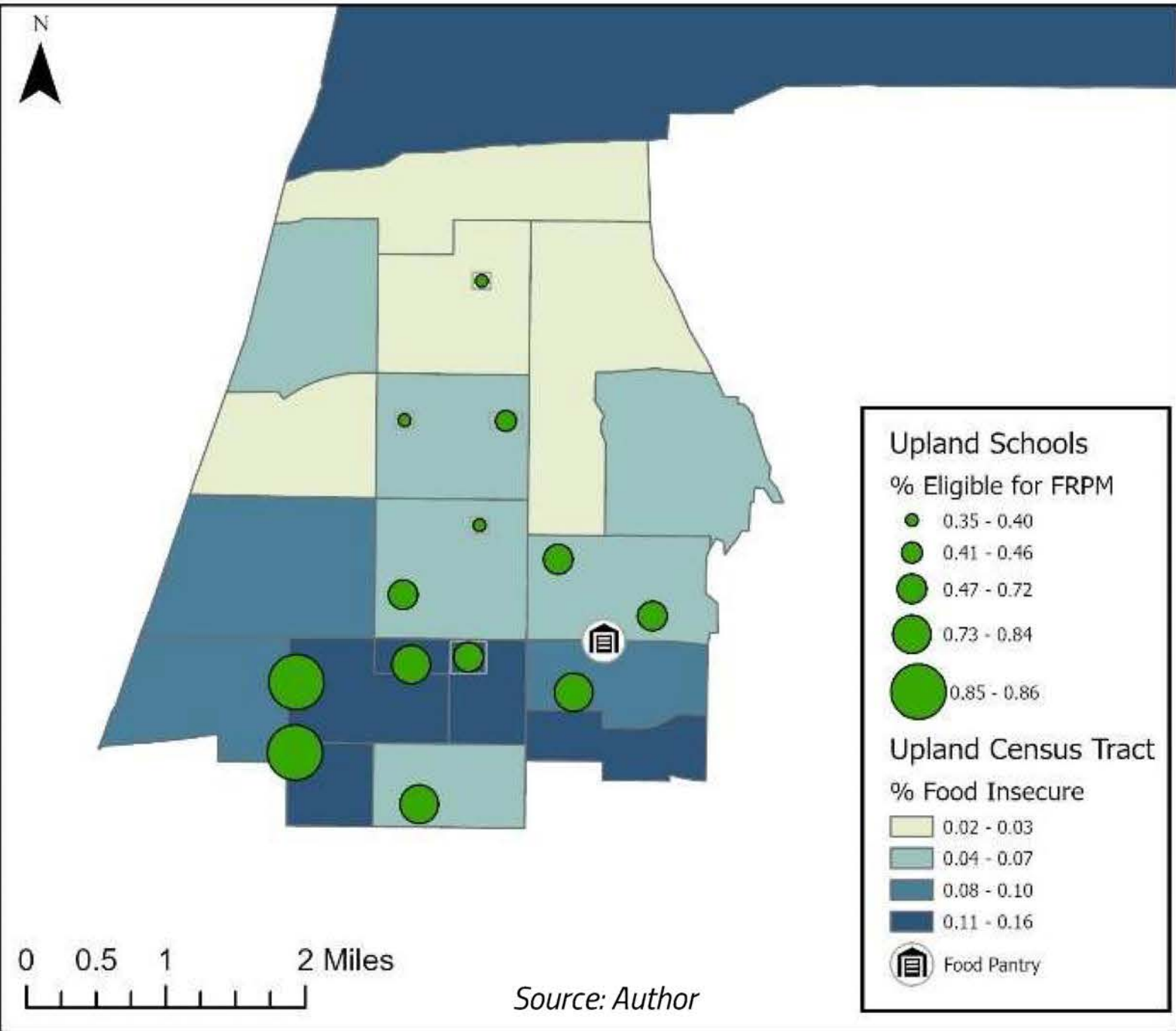
- Waste audits:** Study area (school) and mealtime at select schools.
- Identify post-consumer plate waste during cafeteria mealtimes aka waste audit: mealtime observation at 3 schools, create audit sheet/survey with 3 main waste types – organic, paper, plastic ;
 - unit of analysis: pounds;
 - categorization: liquid, partially eaten/opened food, uneaten food/milk, whole fruit, other non-food waste like plastic, paper, and metal



Source: Author

- GHG emissions:** Assess common food type throughout waste audits for different mealtimes i.e., milk, apples, bread/wheat
- Calculate pounds, convert to tonnage and project over a typical school year (180 days)
 - Calculate total tons per food type in this case, milk, apples, bread/wheat
 - FLW value calculator , EPA GHG equivalencies calculator
- GIS:** Conduct spatial analysis of food insecurity and student poverty throughout the District – Variables and unit of analysis:
- Census Tract layer:* healthy place index -HPI, food insecurity (count), vulnerability index (variables: food insecurity rates, unemployment rate, % poverty, % Black, % Hispanic/Latinx, % renters, % disability) in relation to free/reduced price meal (FRPM) rate
 - Census block layer:* no food insecurity data available, vulnerability index (variables as contributors to food insecurity: unemployment count, non-white persons count, no health insurance count, no food stamps with households w/ 1+ disability member, low income, renter, coronary heart challenges) in relation to FRPM rate.

Results



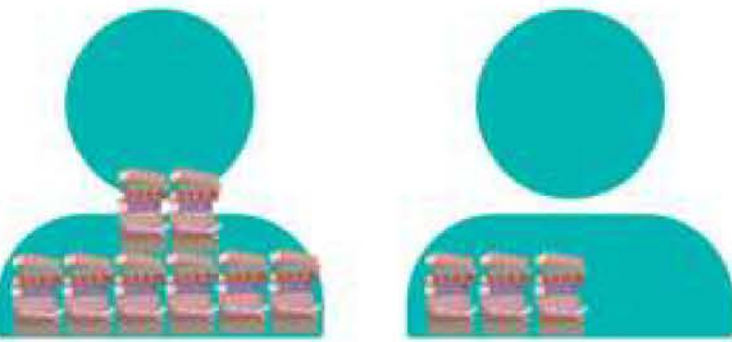
Assumptions are that these vulnerability variables would be spatially relevant due to proximity i.e., school by residence (students living near schools or within school district boundaries). Therefore, schools with higher levels of student poverty (FRPM proxy) and diversity near vulnerable census tracts and blocks are given additional weight when ranking the food banks or school sites as food pantries.

Although Upland High (UH) and Pioneer Junior High (JH) generate significant food waste, Pioneer JH (n=709) generates more food waste per student than UH (n=3251). Baldy View and Foothill Knolls stay relatively proportionate to the total food waste generated and food wasted per student.

	Uneaten Food	Partially Eaten	Non-Food Waste	Total Waste Produced Per School
Upland High School (lunch only)	73	161	114	348
Pioneer Junior High (lunch only)	108	94	50	251
Baldy View Elementary (breakfast only)	11	49	19	79
Foothill Knolls (breakfast only)	9	20	5	34
Total Waste by Category	201	324	188	712

Source: Author

If a 360-page book weighs 1 pound, it's like throwing away 64 books per student at Pioneer JH (right) versus 19 books per student at Upland High (left)!



Source: Author

Total waste produced in one mealtime for four schools is around 712 pounds, about three-quarters of which is food (pie chart). Waste audits were conducted during a typical mealtime period. Projecting the amount of waste generated over a typical school year (180 days) is equivalent to about 128,218 pounds or 64 tons of waste. Over a school year, the amount of uneaten food wasted could feed about 7,247 families of four while partially eaten food could go towards creating renewable energy like natural gas. In fact, 100 tons of food waste per day can generate enough energy to power 800 to 1,400 homes each year (Tanigawa, 2017).

Additionally, paper and plastic food packaging contribute a significant amount of waste, amounting to 15,997 lbs. (~8 tons) and 15,516 lbs. (~7.8 tons) over a typical school year, respectively.

Table 2. Climate change* (in kg CO2 eq) impacts from 3 main waste audit food types

	Agricultural impacts	Landfill impacts	Total
1. milk, region: North America	10,604	1,272	11,875
2. apple, region: North America	1,332	3,482	4,814
3. wheat, region: North America	19,521	39,676	59,197

Source: Food Loss & Waste Protocol, 2023
*Biogas emission of 45% CO2 and 55% CH4 according to IPCC

The total climate change impact from landfilling milk, apples, and bread is equivalent to charging 9,231,024 smart phones or driving roughly 7 and a half times around the planet in an average gasoline-powered passenger vehicle. This is also equivalent to carbon sequestered by 89.8 acres of U.S. forests annually (EPA, 2022).

The GIS analysis shows the spatial distribution of demographic vulnerability factors, including 2020 food insecurity rates (census tract only), within the District in relation to the percentage of FRPM eligibility per individual school. The census tract layer shows that a higher vulnerability index is associated with increased food insecurity rates (higher than mean). Census tracts with high % food insecurity and above average vulnerability index (above mean value: 2.93369) are associated with lower HPI percentile ranking (less than 50 out of 100).

The census block layer shows that higher vulnerability indexes (contributors to food insecurity) are in proximity to schools with higher rates of student poverty (FRPM eligibility rate). Cluster and hotspot analyses confirms the concentration of vulnerable populations in the southern section of Upland near schools with high rates of student poverty.



Discussion

Source reduction methods such as menu planning, product sourcing, and bulk orders are currently spearheaded by the District. Food recovery methods such as share tables and food pantries should be prioritized in schools located in lower Upland to reduce food insecurity rates, decrease nutritional content loss, and alleviate student poverty. The District will implement share tables on April 3rd, 2023 in one of the schools where a previous waste audit was conducted. The amount of food recovered will be documented to measure the effectiveness of share tables. Outreach and education methods have Spanish translations since more than half of the student body are Hispanic/Latinx.

Future efforts include collaborating with a local food pantry and teachers/faculty to set up consistent hours for school pantries. Starting a school pantry contract/memorandum of understanding with Kid Care International Food Pantry is recommended due to its proximity to increased food-insecure and vulnerable demographics. Food recovery education and outreach such as engaging students in food waste curriculum, forming student-led green teams that sort waste, and collaborating with the city and/or county are best practices. Nutrition Services at UUSD is innovative when addressing food recovery and can be a model for other jurisdictions.

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