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Implementing Green Infrastructure Near Industrial Zones in Los Angeles County: A Versatile Initiative to Combat Food Insecurity

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Cluster M1A Food: Lens for Environment and Sustainability

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Establishing the Problem

In the midst of rapid urbanization, it is difficult to imagine significant numbers of people suffering from food insecurity. Yet, in the case of Los Angeles County, about 30% of households face food insecurity (de la Haye et. al, 2023, p. 1). Defined as when "a person lacks access to enough safe and nutritious food to live a healthy and active life," food insecurity has long remained a persistent challenge in urban environments, particularly in areas with high industrial zoning, like Los Angeles, where a lack of access to fresh, healthy food is often a defining characteristic (Mendly-Zambo & Raphael, 2025). Food insecurity is also exacerbated by several factors, mainly a lack of access to nutritious food and lack of financial means to purchase it. One of the main causes for a lack of access stems from inefficient zoning laws prioritizing industrial activities over community needs, leading to "food deserts" where residents struggle to find convenient and affordable sources of nutritious food (Public Health Law Center, 2019).

In industrial areas with limited supermarkets and agricultural land, residents struggle to afford fresh produce and face transportation difficulties, making accessing healthy food even harder. Zoning laws regulating industrial areas have historically placed harmful developments–industrial zone sites like "hazardous waste facilities, landfills, and other polluting industries"–in poorer areas (Mojica, 2024). Such areas are often characterized by "small grocery stores and an abundance of convenience and fast food outlets, resulting in residents consuming a diet high in low-cost, highly processed foods (Hardin-Fanning & Wiggins, 2017)." These systemic barriers reveal a stark urban inequality: where you live determines not just your environment, but your fundamental right to nutritious food.

As demonstrated, there is an established lack of access to and a lack of means to purchase fresh produce in areas near industrial zones. Considering this, it is unsurprising that recent

statistical testing has shown that there is significant evidence of a correlation “between the percentage of per capita income allocated to food expenses,” or food insecurity, “and the percentage of parcels of land in designated industrial zones in cities in Los Angeles County (Vartak, 2024).” To combat this, a feasible solution that both increases access and affordability for fresh produce may prove extremely impactful on multiple ends.

Proposed Solution

The institution-level implementation of green infrastructure—specifically green belts and infill green spaces—within and around industrial zones can help mitigate food insecurity for especially vulnerable communities. This solution involves two stages. The first involves the creation of green belts, or areas of undeveloped, agricultural, or wildland surrounding a designated area, around industrial zone clusters. This would protect sustainable farms and decrease the distance between urban centers and farms, thus mitigating food transportation and processing costs while increasing healthy food accessibility for locals living around industrial zones (MacDonald et al., 2022).

The second is transforming underutilized or vacant land into community gardens, urban farms, orchards, and other green spaces for food production. The vacant land would specifically be areas designated as vacant zones with ratio of improvement to land assessed value (IL Ratio) less than one . The IL Ratio of a parcel of land highlights the value of a property compared to the inherent value of the land it is built upon. If this ratio is less than one, the vacant area in question would be used more efficiently if used differently, and thus has redevelopment potential. As demonstrated later through a hypothesis test for linear regression utilizing the Southern California Association of Governments’ HELPR (Housing, Environment, and Land Use Parcel) tool, there is also significant evidence to suggest a correlation between the percentage of parcels

of land in industrial zones and the percentage of parcels of land in designated vacant areas with IL Ratio less than one in cities in Los Angeles County. By strategically integrating green spaces, including community gardens, into vacant areas with redevelopment potential, we can allocate our resources more effectively to address the lack of access to nutritious, sustainable food in high-industrial zones.

Green Belts and Green Spaces

Green belts and green spaces serve as a top-down intervention, providing valuable sources of fresh, affordable produce, directly combating food deserts, and improving nutrition among low-income residents who may have limited transportation options. A common misconception about food insecurity in industrial areas is that it primarily results from individual choices rather than systemic issues. Many incorrectly assume that residents prefer convenience foods, lack nutritional education, or cannot afford nutritious food when research demonstrates that structural barriers—including limited supermarket options, disproportionately higher prices for healthy foods, and inadequate transportation infrastructure—are the primary drivers of food insecurity (Jeffries, 2022). This misconception leads to ineffective solutions focused on nutrition education rather than addressing the lack of physical and economic access to healthy food. By recognizing the systemic nature of food deserts in industrial zones, our green infrastructure approach directly targets the built environment that constrains food choices at an institutional level rather than placing the burden of change solely on individuals.

The Green Belt Policy was initially introduced in the United Kingdom to “prevent unnecessary urban sprawl” and to “encourage the upkeep of deteriorating urban lands (Safdie, 2023).” Implementing green belts could be vital to address low-density residential zoning in

wealthy areas of Los Angeles and to combat the decline of urban food systems in industrial zones, which foster food injustice and inequality.

These green belts would have areas of plain vegetation/fields, community gardens, and leased local farms. The vegetation and fields would preserve and restore local biodiversity and natural resources and reduce greenhouse gas emissions by capturing excess carbon dioxide, which is especially crucial for areas with industrial zones that produce a significant amount of greenhouse gases (Safdie, 2023). Leveraging green belts and green spaces to include community gardens and local farms while allowing on-site produce sales can cut down on transportation costs, making healthy food affordable (Hervey, 2024). By implementing this idea, people living near industrial zones would be able to afford healthier foods. This would combat both the lack of access and lack of affordability that these communities face.

Developing green belts and spaces could also have far-reaching positive effects beyond just food systems. On the sustainability front, green belts can enhance the environmental sustainability of industrial areas by mitigating the urban heat island effect, improving air and soil quality, and promoting biodiversity (Shishegar, 2014). Evidence also shows that implementing green belts helps foster community engagement and social cohesion through shared sustainable development while creating local jobs (Meenar & Hoover, 2012). By implementing this idea, policymakers can transform urban landscapes into healthier, more equitable communities.

Addressing Potential Concerns

While implementing green belts and green spaces has clear benefits, there are several concerns over the plan's feasibility. One primary concern for all projects in urban areas is whether there is enough space for these initiatives. Areas with industrial zone clusters are already densely populated, prompting skepticism about integrating additional green spaces. It may also

be challenging to convince institutions to disregard current zoning ordinances and support this initiative. Implementing green belts and green spaces can also be costly. However, that cost is largely offset by the environmental and societal benefit green belts and green spaces can have in our county. Industrial zones create external costs, like those needed for climate repair and medical issues caused by the downsides of the emissions. At the same time, green belts and spaces help make the environment greener and the community healthier. Below, we explore just one example of a way that implementing the idea has a positive net impact.

The green belt and green space solution also has its limitations. For one, even with vacant space, existing zoning regulations are strict in industrial zones. In order to have an agricultural/green urban agriculture project, we may have to modify or even petition against the current zoning laws. The initial set-up cost of acquiring and converting vacant land can be costly for the government due to high land values and competing interests. To address these limitations, institutions would have to work with policymakers to update zoning codes and acquire subsidies or potentially private funding through development bonds to take on this project, citing the financial and social profit it would accumulate.

Identifying Opportunities for Green Spaces With Land Use Analysis

Although the primary concern about space may initially seem unavoidable, evidence shows there exists a sizable amount of undeveloped land in Los Angeles County. According to the Exhibit 13 of *Raising the Roof : California Housing Development Projections and Constraints*, in 2020, there were more than 375,000 projected acres of "developable and accessible land sites" excluding wetlands in the county (Landis, 2000). A recent suitability analysis conducted shows that there are a significant number of areas that are suitable for green spaces based on six parameters: "land use, vegetation coverage, impervious surface coverage,

population density, median income, and distance to bus routes (Hutchinson, 2021).” To show that many of these areas may be in places with high levels of industrial zoning or high food insecurity, I set up a hypothesis test for linear regression to find a correlation between the percentage of parcels of land in industrial zones and the percentage of parcels of land in designated vacant areas with ratio of improvement to land assessed value (IL Ratio) less than 1.

I fulfilled several key assumptions of linear regression to satisfy the requirements for generalizability. To ensure independence by satisfying the 10% rule, I selected eight towns from the total of 88 in Los Angeles County. For randomization by random sampling, I assigned each city a number using a random number assigner and used a random number generator to select eight cities. Although my sample size was less than fifteen, the sample appeared to have a normal distribution and a linear relationship, while the residual plot had no pattern.

To collect my data, I used the SCAG’s HELPR tool to isolate individual parcels of land that were in a certain location and classified as a certain zone. I then used Google Sheets to organize and perform a regression analysis using the linear estimation function and interpreting the subsequent results. To begin my test, I set my significance level to $\alpha = 0.01$ and formulated my hypotheses:

$\mathbf{H_0}$: There is no significant relationship between the percentage of parcels of land in designated industrial zones and the percentage of parcels of land in designated vacant lots in cities in Los Angeles County.

$\mathbf{H_A}$: There is a significant relationship between the percentage of parcels of land in designated industrial zones and the percentage of parcels of land in designated vacant lots in cities in Los Angeles County.

Table I: Parcel Data for Selected Cities

#	City	Total # of Parcels of Land	# of Parcels of Land in Designated 13XX Industrial Zones	Percentage of Parcels of Land in Designated Industrial Zones (%)	# of Parcels of Land in Vacant Areas with IL Ratio below 1 (3XXX)	Percentage of Parcels of Land in Designated Vacant Lots with IL Ratio less than 1 (%)
1	Walnut	9,500.0	90.0	0.95	44	0.46
10	La Puente	7,707.0	32.0	0.42	3	0.04
17	Long Beach	106,018.0	1,388.0	1.31	1,375	1.297
24	West Hollywood	9,884.0	35.0	0.35	34	0.34
50	Monterey Park	16,471.0	134.0	0.81	32	0.19
78	Santa Monica	23,469.0	253.0	1.08	44	0.19
76	San Dimas	10,964.0	147.0	1.34	63	0.57
8	Compton	20,293.0	583.0	2.87	580	2.86

To conduct my t-test, I used the linear estimation function to generate a regression summary:

Table II: Regression Summary Statistics

Regression Summary for Industrial Zones			
Slope	0.7821073209	0.5599918403	Intercept
Std. Error (Slope)	0.1262918138	0.1452884884	Std. Error (Intercept)
Coefficient of Determination	0.8647170752	0.3136224696	Standard Error
F-Statistic	38.35149526	6	Degrees of Freedom
Regression Sum of Squares	3.772216773	0.5901543208	Residual Sum of Squares

I calculated the t-score by utilizing the slope (b), expected slope (β), and standard error for slope (SE_b):

$$t = \frac{(b - \beta)}{SE} = \frac{0.7821073209}{0.1262918138} = 6.19285841$$

Figure 1: T-Score Calculation

An online t-score to p-value converter, accounting for 6 degrees of freedom, yielded a final p-value of $p = 0.00081$.

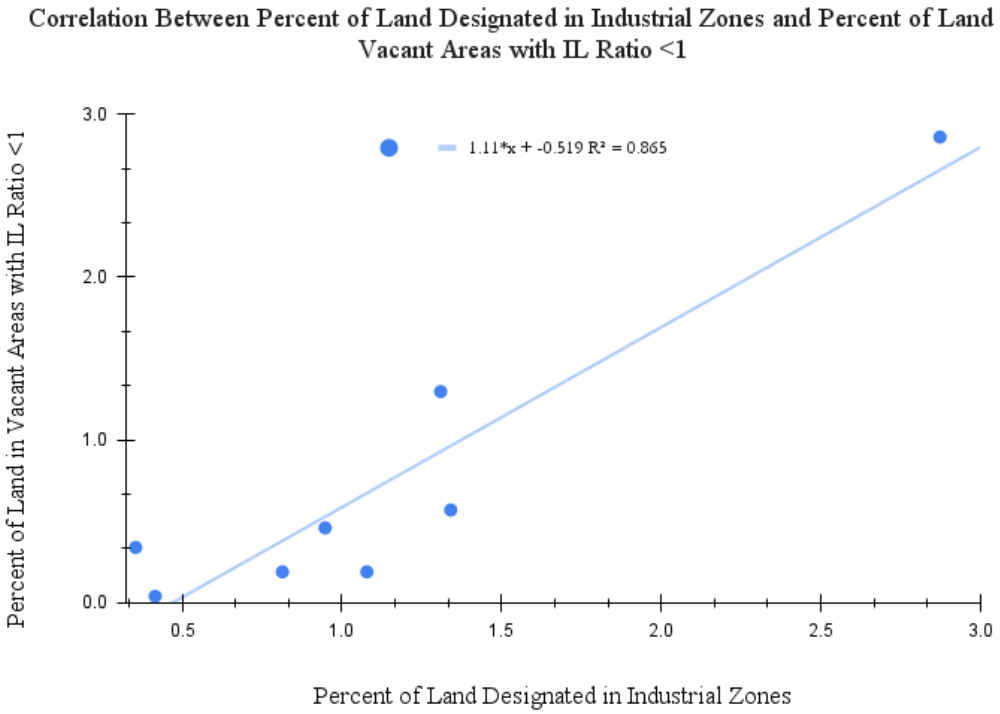

Figure 2: Scatterplot and Linear Visualization of Correlation

Since the p-value, 0.00081 was much less than the significance value, 0.01, I rejected the null hypothesis in favor of the alternative. There is significant evidence at the 99% confidence level of a correlation between the percentage of parcels of land in industrial zones and the percentage of parcels of land in designated vacant areas.

Thus, we can assume that given a city with a high presence of industrial zoning, there will be a significant amount of vacant and open land near industrial zones that can be used as green space. Since the previous study found a correlation between industrial zones and food insecurity, we can be sure that using vacant areas as green belts and green spaces will have a high impact on those facing the brunt of food injustice (Vartak, 2024).

Impact Potential Partial Analysis

Implementing this green space initiative would be extremely costly. Yet, converting a vacant area to a green space can provide significant funds to the government as well. For reference, let's look at the revenue we would earn simply from community gardens. Out of the developable land we found earlier, let us assume that only 10% fits the criteria and is a desirable location for being converted into a green space. That would mean that of about 375,000 acres of projected developable land, 37,500 acres of land would be suitable. Almost two-thirds of green belt land is traditionally used to produce food (Safdie, 2023). ⅔ * 37,500 acres = 25,000 acres would be used to produce food. Let us say that of those 25,000 acres, only ⅕ went to community gardens, and the rest to local farmers. That would leave ⅕ * 25,000 acres = 5,000 acres for community gardens.

According to “How Much Does a Community Garden Plot Cost?”, a large plot of land, identified as 20 ft x 20 ft to 40 ft x 40 ft, can cost between $100 and $200 per year. Adding in $50 for plants, overhead, and miscellaneous costs, a 40 ft x 40 ft plot of land would yield a total consumer cost of $250 per year, with $200 being local government profit after the setup cost of the land plot.

40 ft x 40 ft = 1600 ft². A 2009 study in San Jose (chosen for similar location characteristics) found that a garden yielded 0.75 lbs/ft² each season (Cochran & Minaker, 2020). Multiplying 1600 ft² by 0.75 lbs/ft², we get 1600 ft² x 0.75 lbs/ft² = 1200 lbs/year.

Accounting for just the average diet, the average human should consume 275 lbs of vegetables per year. A family of four would need to consume 275 lbs/person/year x 4 people = 1100 lbs/year.

With a 40 ft x 40 ft plot, they would have a surplus of 1200 lbs/year - 1100 lbs/year = 100 lbs/year of veggies. Converting 1600 ft² to acres, we get 1600 ft² = 0.037 acres. Dividing the previously found 5,000 acres used for community gardens by this, we would get 5,000 acres/ 0.037 acres/plot = 136,125 plots.

With the 5000 acres of developable land alone, 136,125 four-person families could produce enough to satisfy their need for vegetables and fruits each year for simply $250 per year per family, without significant transportation costs. This is significantly less than what they would need to pay otherwise–data from the USDA Economic Research Service shows that potatoes, the United States' cheapest vegetable, retail at an average price of $0.82 per pound (lb), coming out to $0.82/lb x 1100 lbs/year = $902 per year per family (2024).

Community garden green spaces alone have the potential to bring fresh produce and food security to families in Los Angeles that need it. The local government would also make 136,125 plots x $200 = $27,225,000 per year in revenue from gardens alone if they were willing to spend the initial investment to implement the green belt and green space initiative. These economic and nutritional benefits underscore the transformative potential of reimagining urban spaces–not just as vacant lots, but as fertile grounds for community resilience, health, and economic opportunity.

Conclusion

The integration of green belts and community gardens around industrial zone clusters represents a viable solution to combat food insecurity and promote health equity. By prioritizing sustainable food access and environmental restoration, we can create healthier, resilient, and engaged communities, ultimately transforming urban landscapes into spaces of opportunity for all residents.

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