Zoning and Pollution Exposure

Research Findings

March 2025

Metropolitan Planning Council
Building Equity in the Built Environment
90 years

Key outcome of focus

TOPIC	DESCRIPTION
Affordable Housing	Diverse and affordable housing options (subsidized, affordable, workforce/middle, market, luxury) are available in every neighborhood including for the job insecure and unhoused populations
Business Corridors	Strong and vibrant business corridors with diverse business opportunities to support the economic needs and resiliency of every community
Pollution Exposure	**All neighborhoods feature low levels of pollution, taking into account cumulative impacts on overburdened communities**
Public Transit Hubs	All communities feature public transit options that are convenient and reliable, and serve hubs with housing, businesses, recreation and other services
Productive Land Use	All land in communities is used productively, meaning beneficial to local residents and aligned with community needs
Groceries and Healthcare Availability	Affordable grocery options and healthcare providers are accessible in all neighborhoods
Climate Change Mitigation and Adaptation	All communities feature green infrastructure and energy-efficient building stock that both mitigates and adapts to climate change

This analysis uses two different measures of pollution exposure

Pollution is the release of wastes that result in contamination to air, land, and water.

*We looked at both **cumulative pollution exposure** and **air pollution (PM2.5)**:*

Cumulative Pollution Exposure Index

- An index that includes measures of air pollution (ozone, diesel particulate matter, etc.) along with proximity to waste (hazardous, superfund sites, etc.), and traffic data
- Reflects different types of ways that people encounter pollution, from breathing it in from an industrial facility, to living near a waste site, to exposure from a busy roadway
- Data is sourced from the **US EPA's EJ Screen**, which **MPC combined into a cumulative air pollution index**

Air Pollution (PM2.5)

- PM2.5 is a subset of particulate matter named for its small size (<2.5 micrometers) that is harmful to human health
- Vehicle and industrial emissions, and other sources, can create PM2.5 pollution composed of chemicals such as sulfates, nitrates, carbon, or mineral dusts that come from vehicle and industrial emissions as well as other sources
- Data is sourced from **satellite-based estimates compiled by the U. of Illinois's Healthy Regions and Policies Lab**

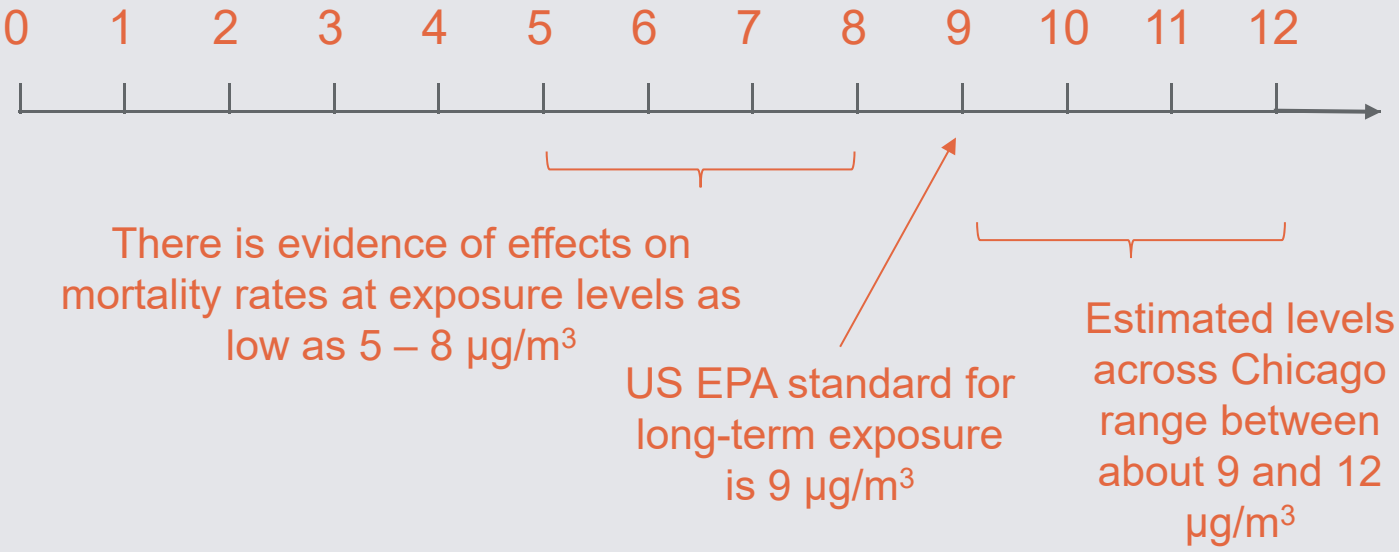
Even low levels of PM2.5 pollution are harmful to our health

When you breathe in PM2.5 particles, **pollution can enter your body and cause health problems.** More PM2.5 exposure causes increased rates of:

- Overall mortality
- Chronic obstructive pulmonary disease (COPD)
- Heart disease
- Lung cancer
- Stroke
- Type II diabetes
- Neonatal mortality
- Asthma, especially in children

The City of Chicago's 2020 Air Quality and Health report estimated that **5% of all premature deaths in Chicago** can be attributed to exposure to PM2.5 air pollution.

PM2.5 levels are measured in $\mu g/m^3$ (micrograms per cubic meter).



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Research questions and key findings

RESEARCH QUESTIONS		KEY FINDINGS
Understand the outcome:	***Which places and people experience pollution exposure?***	• Latinx populations are exposed to more overall pollution and more air pollution • Pollution is concentrated where tree coverage is sparse • The southwest and northwest sides have the highest concentrations of toxic releases in the city, and things have worsened on the southwest side.
Understand the zoning:	***Where is the land zoned for manufacturing?***	• Latinx and Black Chicagoans encounter more land zoned for manufacturing—and heavier types of manufacturing—in their neighborhoods • Within areas zoned for manufacturing, Latinx and Black Chicagoans are more likely to encounter land uses for transportation, utilities, and waste • Whiter, high-cost tracts are more likely to get rezoned to have less manufacturing • Loss of manufacturing zoned land is associated to some gentrification indicators in the central and north sides of the city. • 11% of manufacturing zoned land in the city is vacant – 61% of which is located in the far south region. • Industrial corridors on the south and west sides have significantly fewer jobs per acre than central and northside corridors.
Understand the relationship:	***How does zoning affect pollution exposure?***	• Pollution and manufacturing zoning are correlated • The share of land being zoned for manufacturing is a statistically significant predictor of higher levels of pollution exposure

Understand the outcome

Which places and people experience pollution exposure?

- Latinx populations are exposed to more overall pollution and more air pollution
- Pollution is concentrated where tree coverage is sparse
- The southwest and northwest sides have the highest concentrations of toxic releases in the city, and things have worsened on the southwest side.

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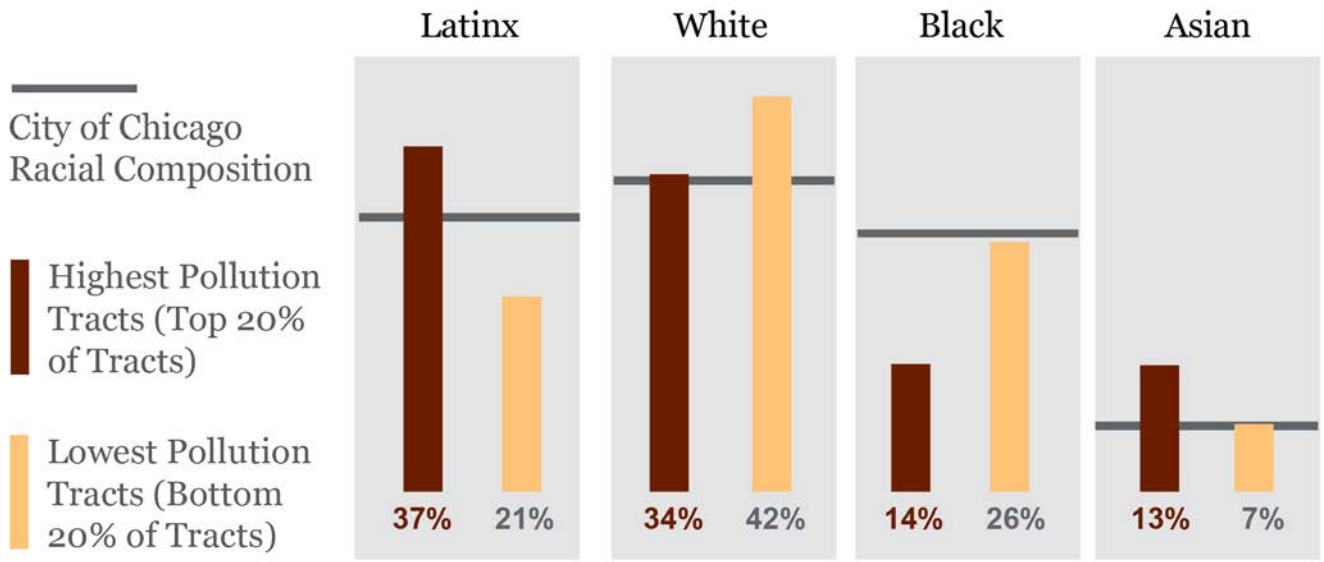
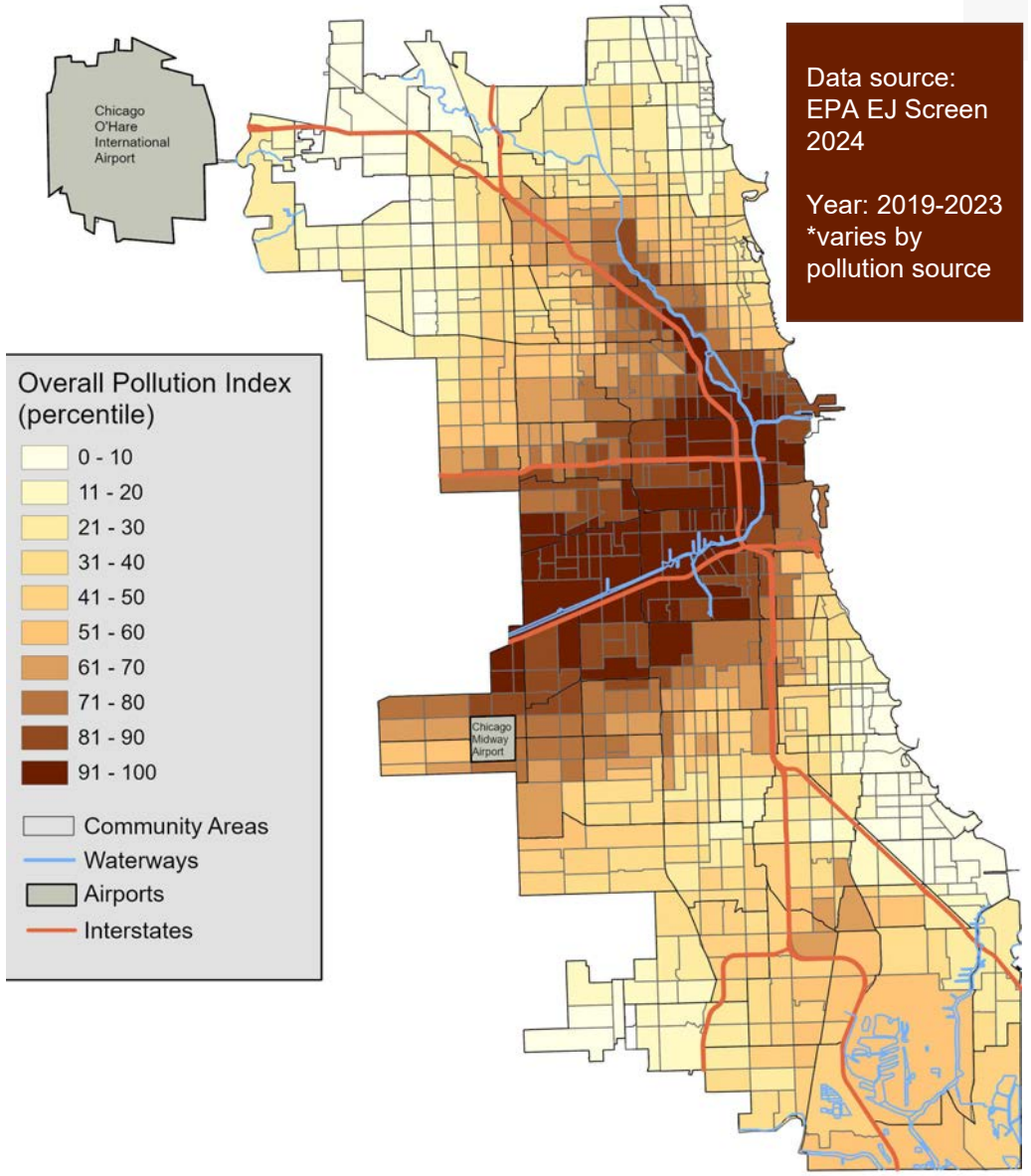
Latinx populations are exposed to more overall pollution

- Pollution is high near downtown, along expressways, and along major industrial corridors
- 37% of the population that live in the highest pollution tracts are Latinx

Racial Composition in Highest and Lowest Pollution Tracts





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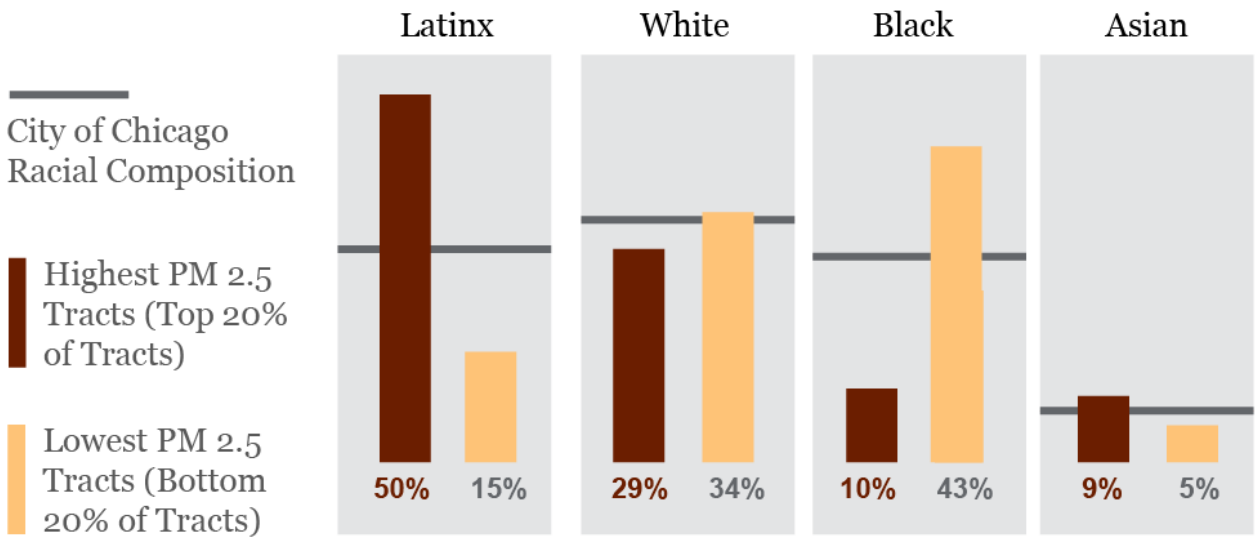
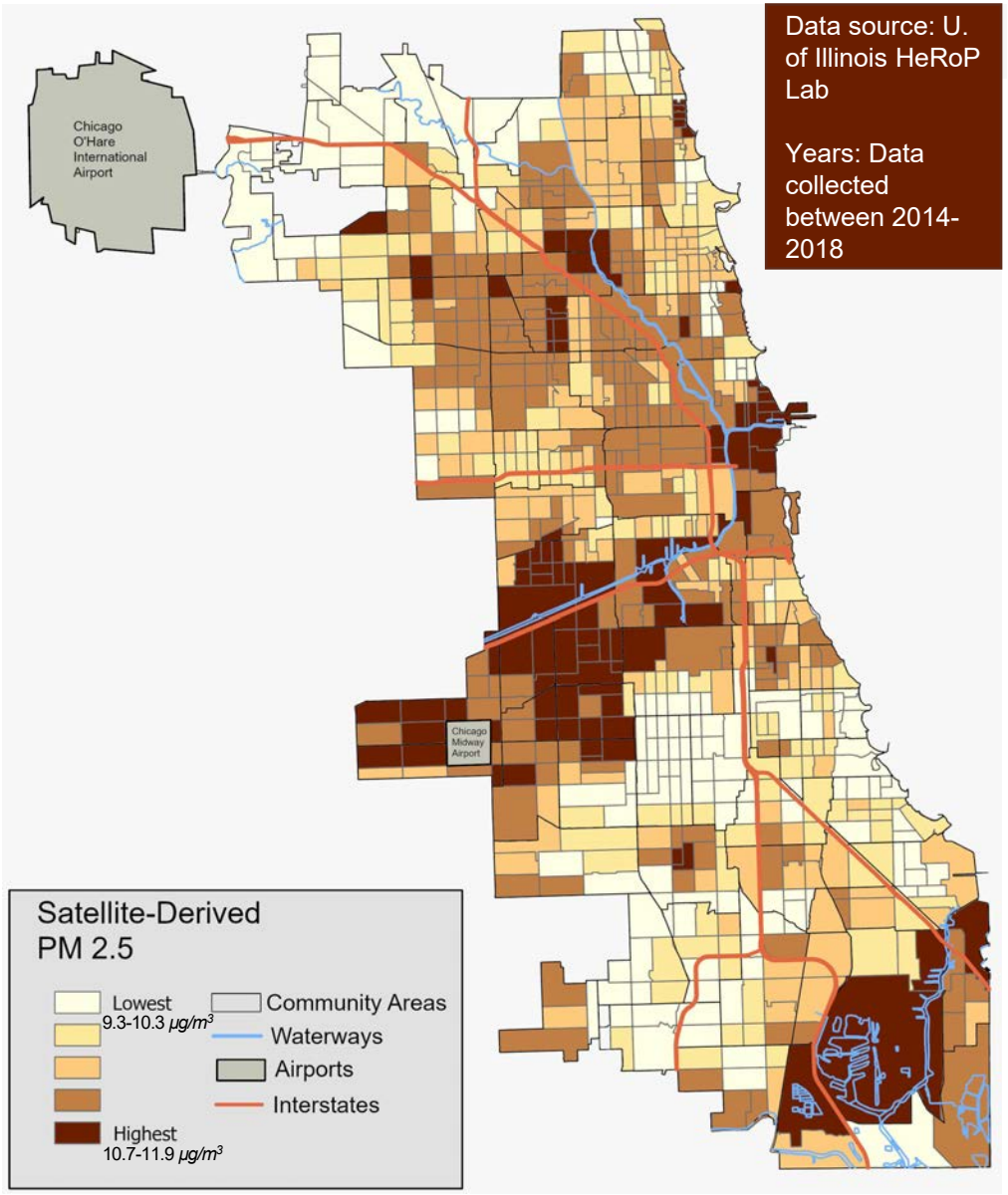
Latinx populations are exposed to more air pollution

- PM2.5 levels are highest in downtown, southwest and southeast sides
- 50% of the population in the highest PM2.5 tracts are Latinx
- Black population make up just 10% the population in the highest PM2.5 tracts and 43% of the population in the lowest PM2.5 tracts

Racial Composition in Highest and Lowest PM 2.5 Tracts





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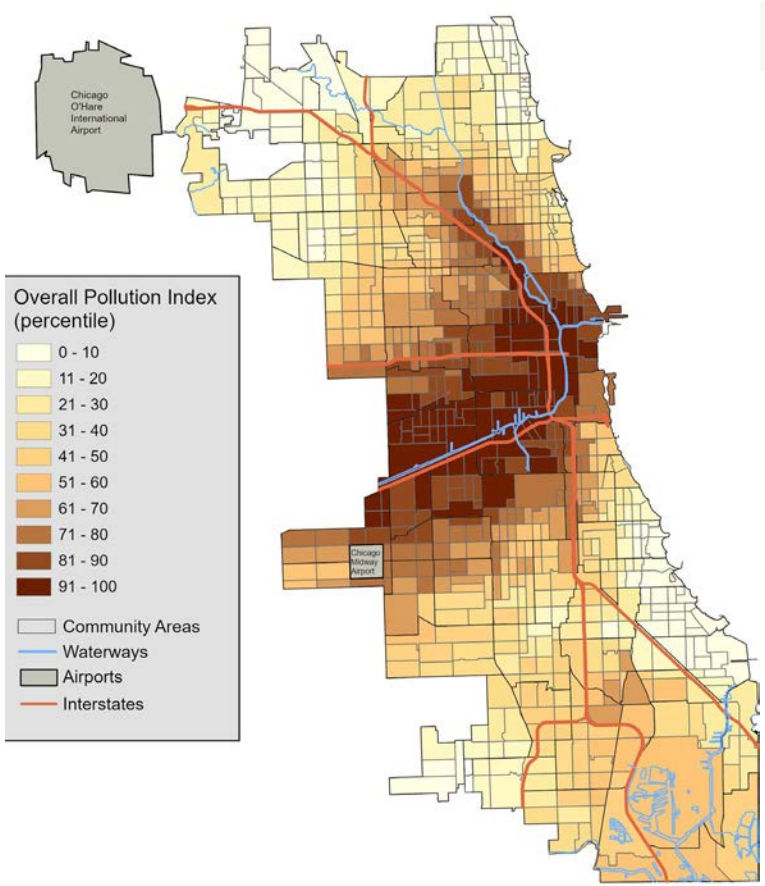
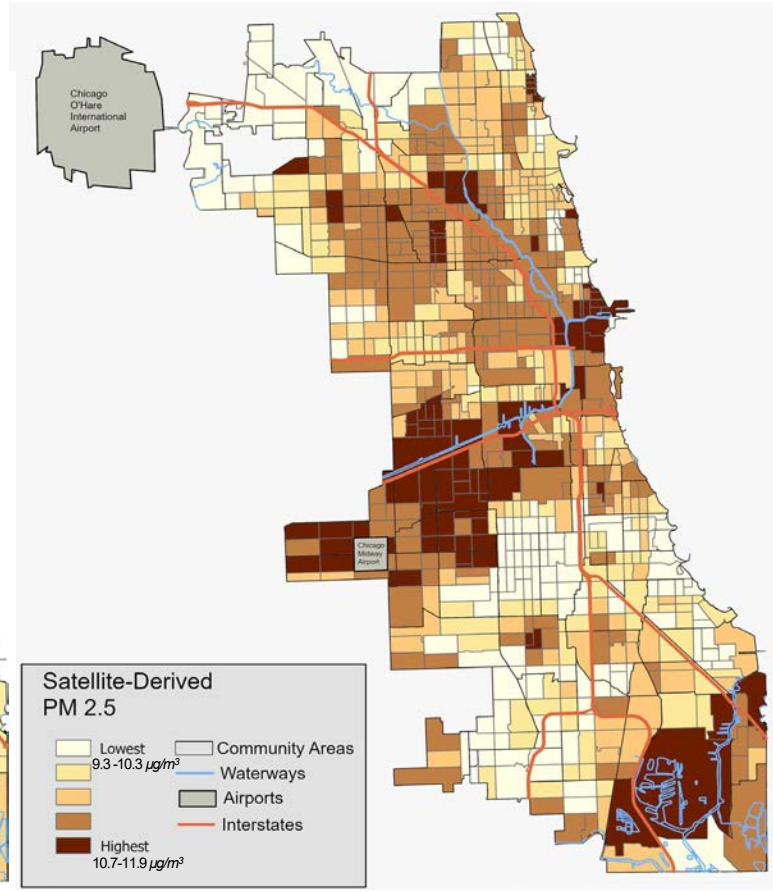
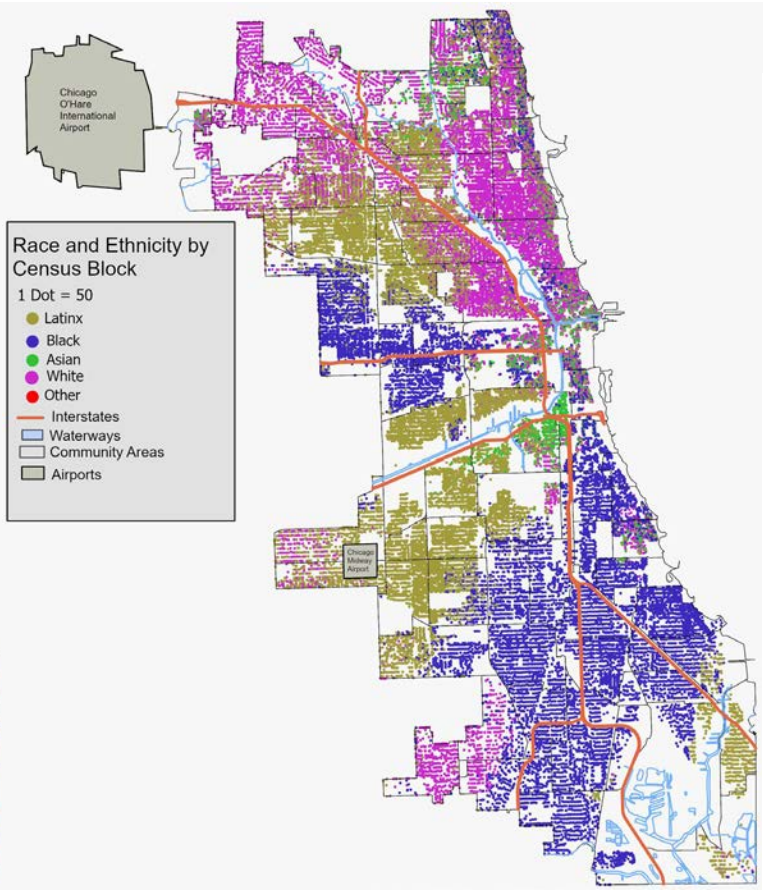
Latinx populations are exposed to more overall and air pollution

Overall and Air Pollution





Chicago Racial Composition



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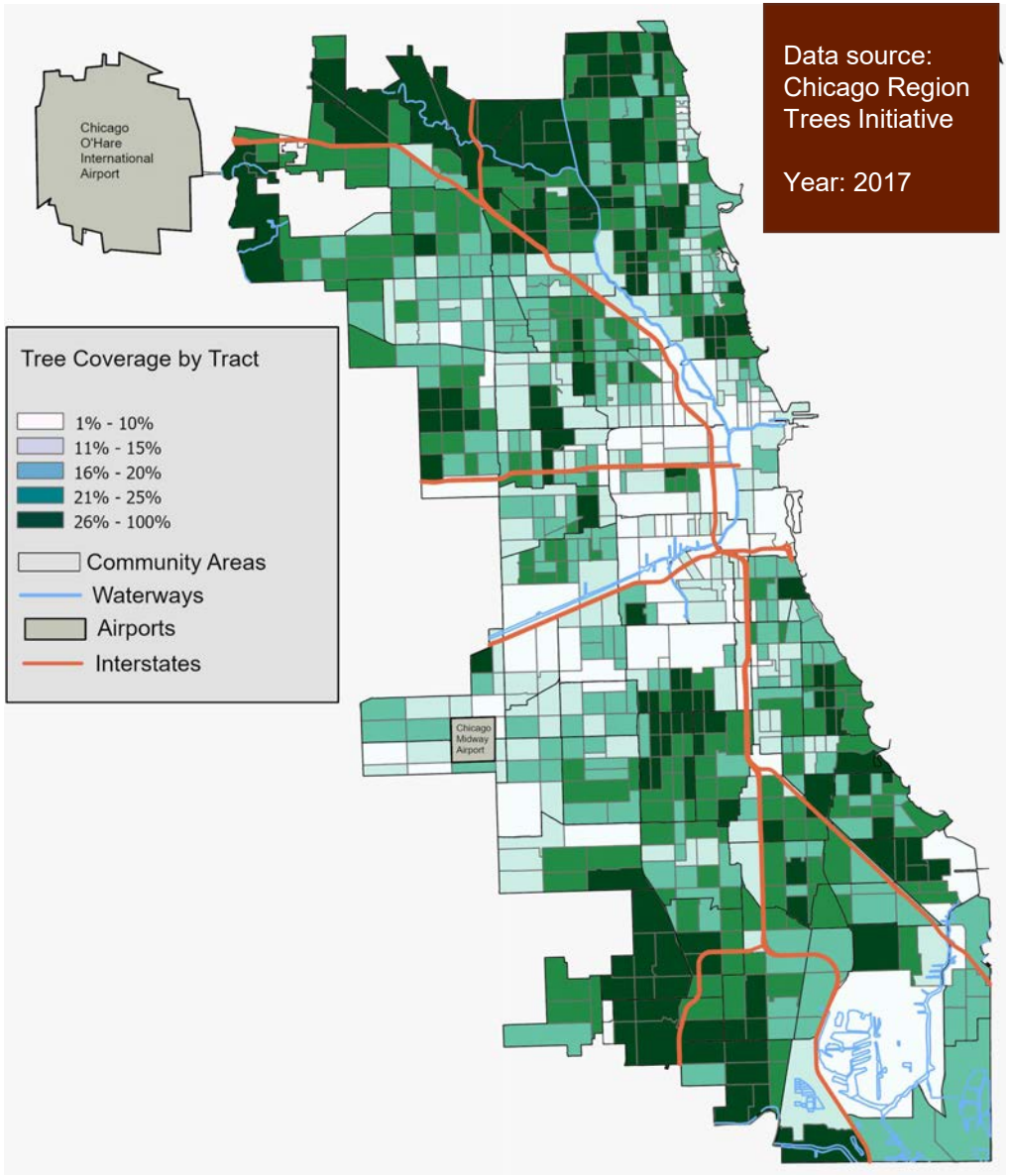
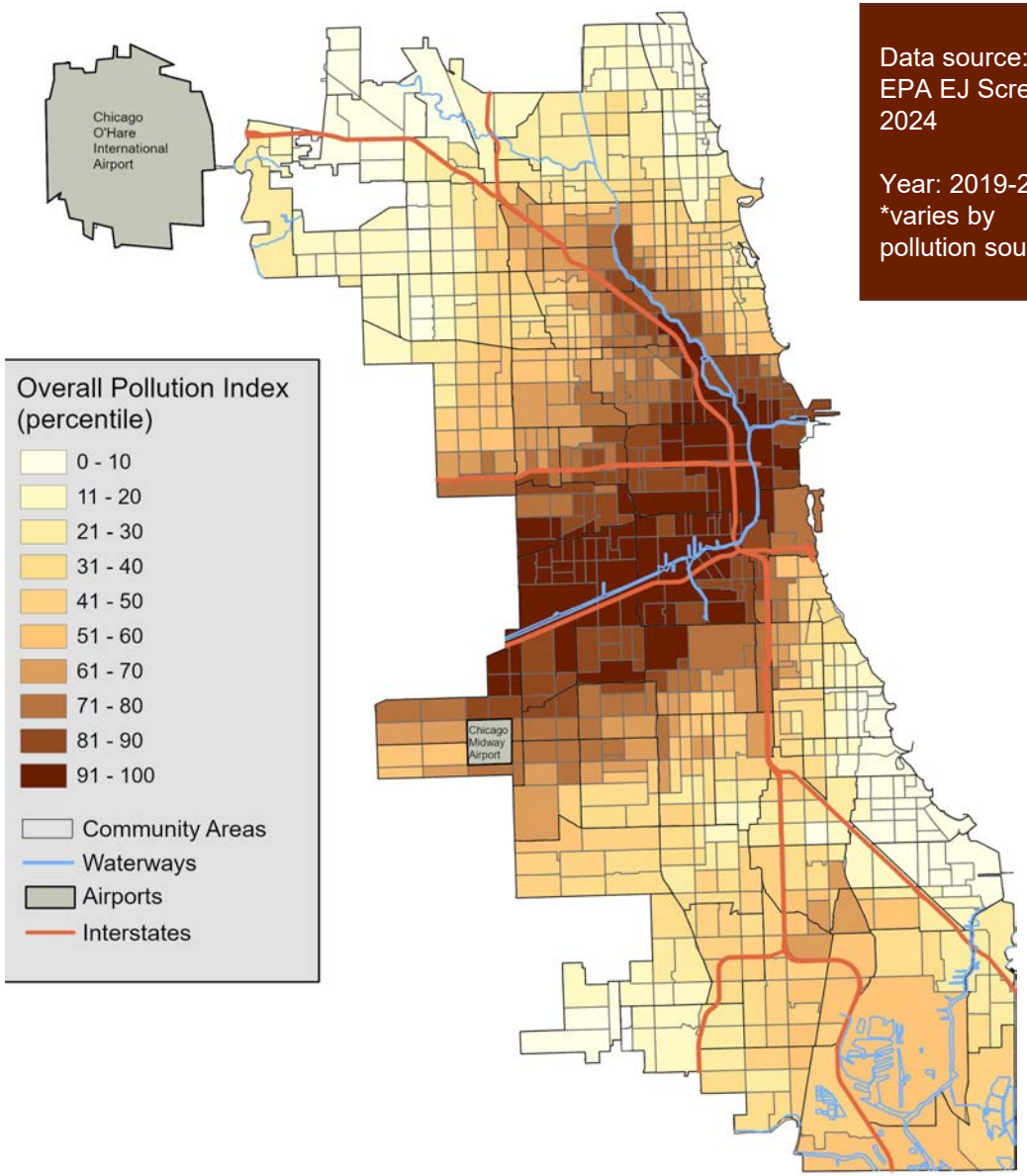
Pollution is concentrated where tree coverage is sparse



Data source: Chicago Region Trees Initiative

Year: 2017



Data source: EPA EJ Screen 2024

Year: 2019-2023 *varies by pollution source

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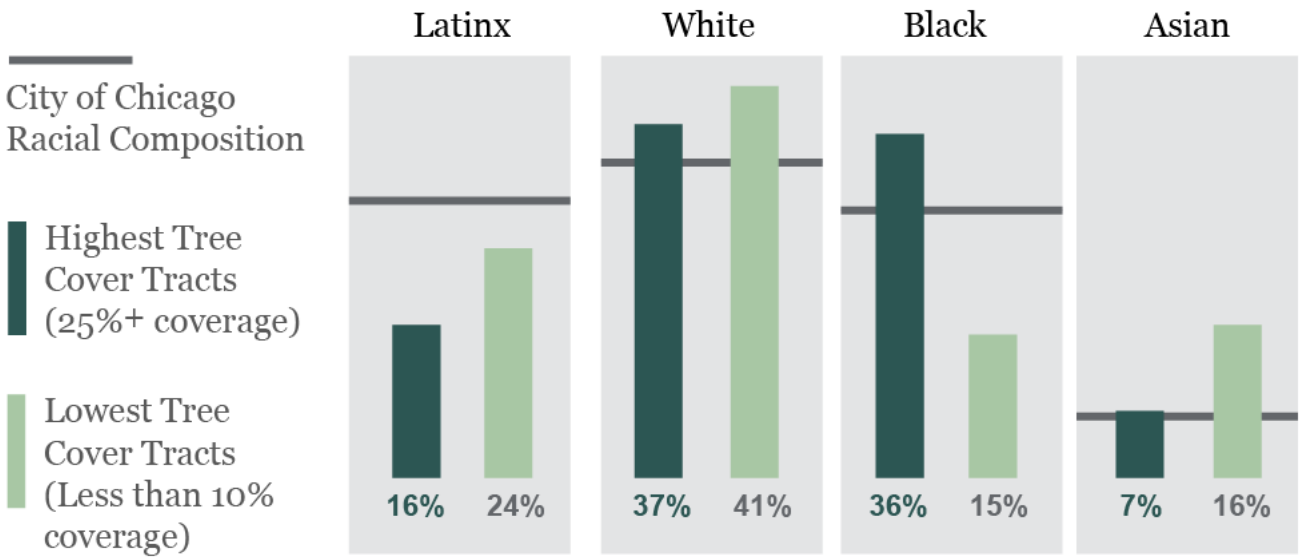
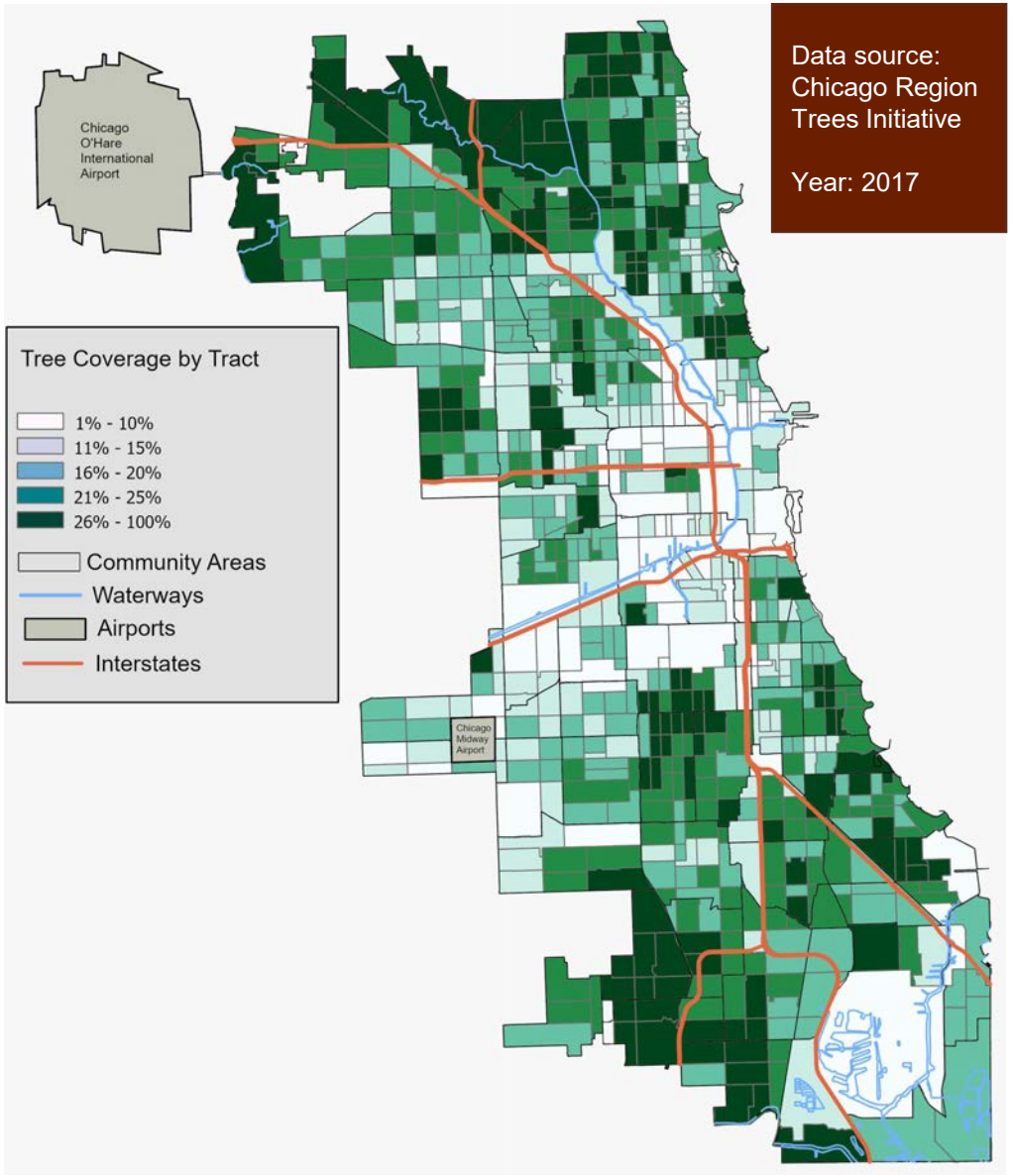
Tree coverage is sparser in Latinx neighborhoods

- There are fewer trees near downtown and on the lower west and southwest sides
- Only 16% of the population is Latinx in the tracts with the most tree coverage

Racial Composition in Highest and Lowest Tree Cover Tracts





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Toxic Releases in Chicago

- **Toxic Release Inventory (TRI):** Dataset maintained by the US EPA that tracks the release and management of certain toxic chemicals by industrial and federal facilities. It provides data on chemical releases to air, water, and land. **TRI is not comprehensive of all polluting facilities. For instance, facilities with fewer than 10 employees are not required to report their releases.**

- **Risk-Screening Environmental Indicators (RSEI) Microdata:** Dataset derived from TRI that models potential human health risks from toxic chemical releases. It incorporates factors like toxicity exposure pathways, and population distribution to estimate potential risk impacts rather than reporting just raw release quantities. **Our analysis uses census tract level microdata on chemical releases to air for the years: 2003, 2012, and 2022.**

- **Variables included:**
  - **Number of Facilities:** Number of facilities with releases affecting census tract.
  - **Number of Releases:** Number of individual releases affecting census tract.
  - **Toxic Concentrations:** Concentration multiplied by inhalation toxicity weight, summed over all chemicals impacting census tract.
  - **RSEI Score:** Risk-related score (surrogate dose * toxicity weight * population), summed over all chemicals impacting census tract.

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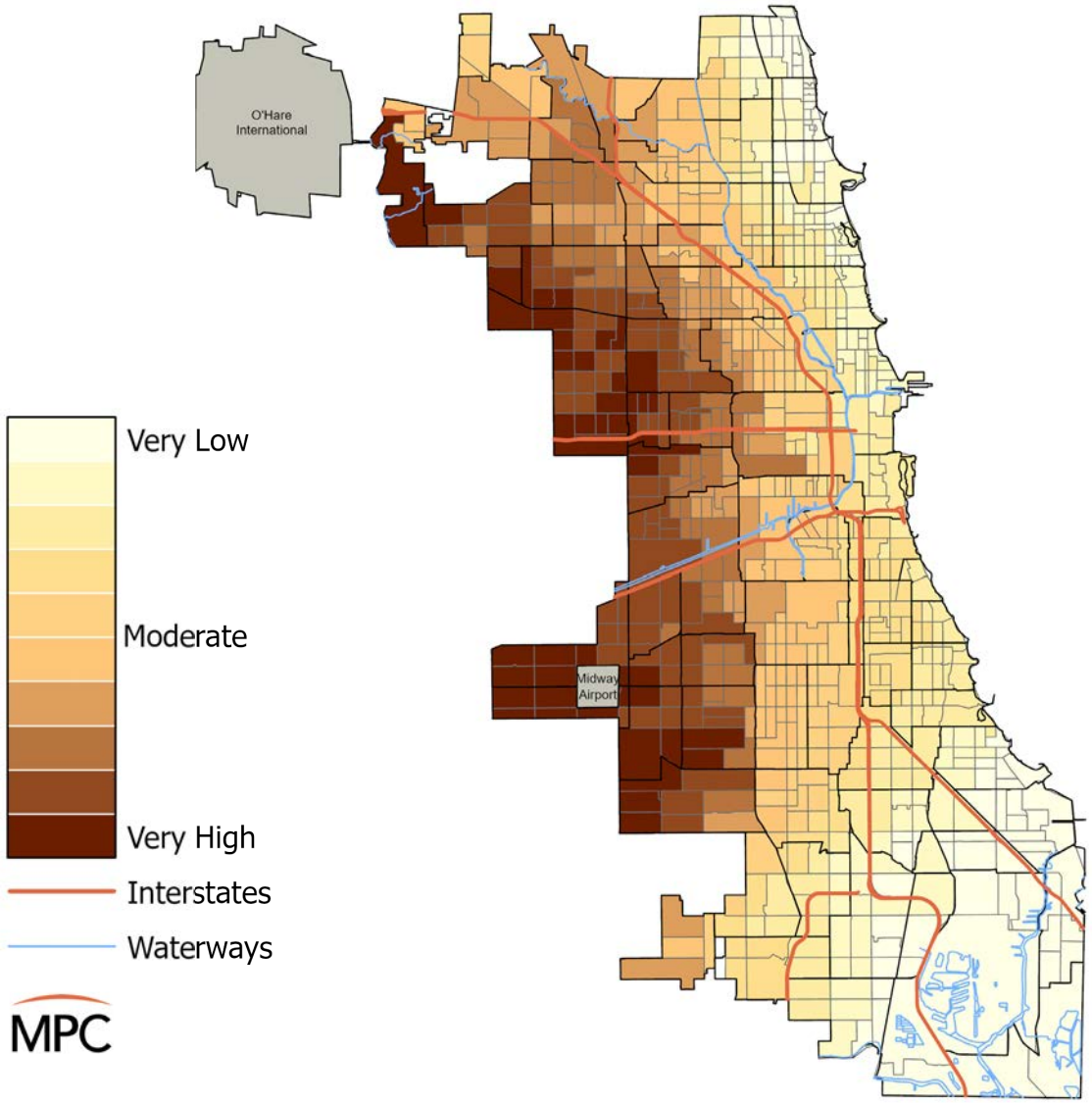
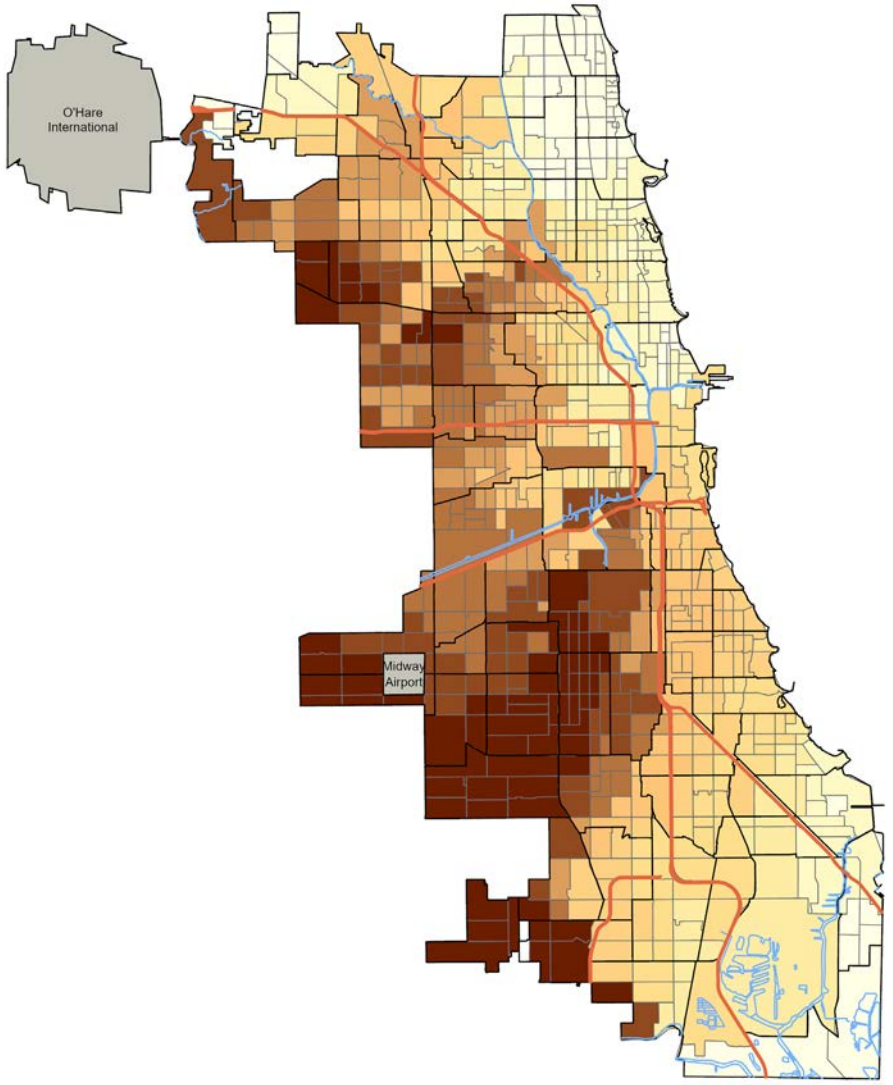
Toxic Releases in Chicago

Number of Facilities

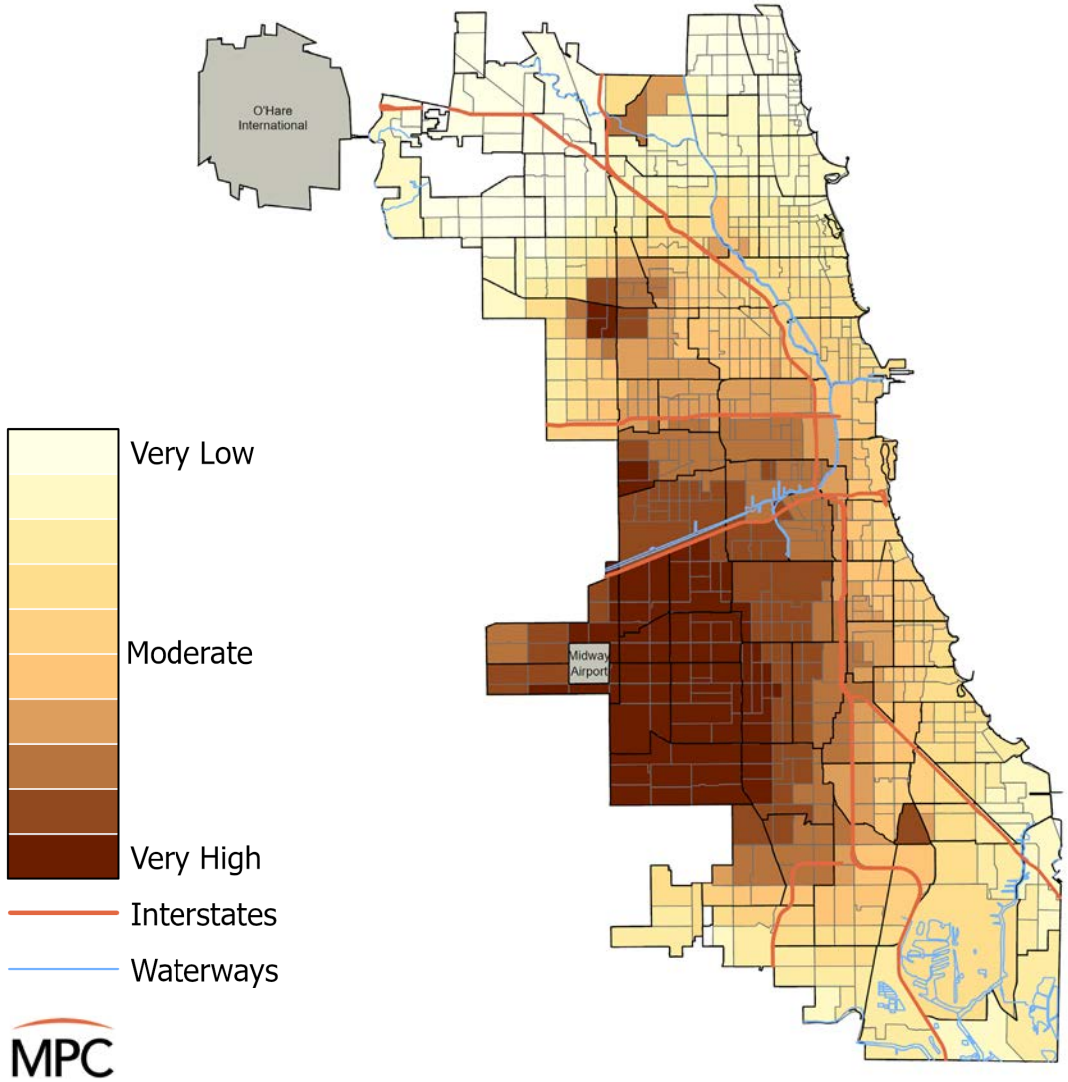


Number of Releases

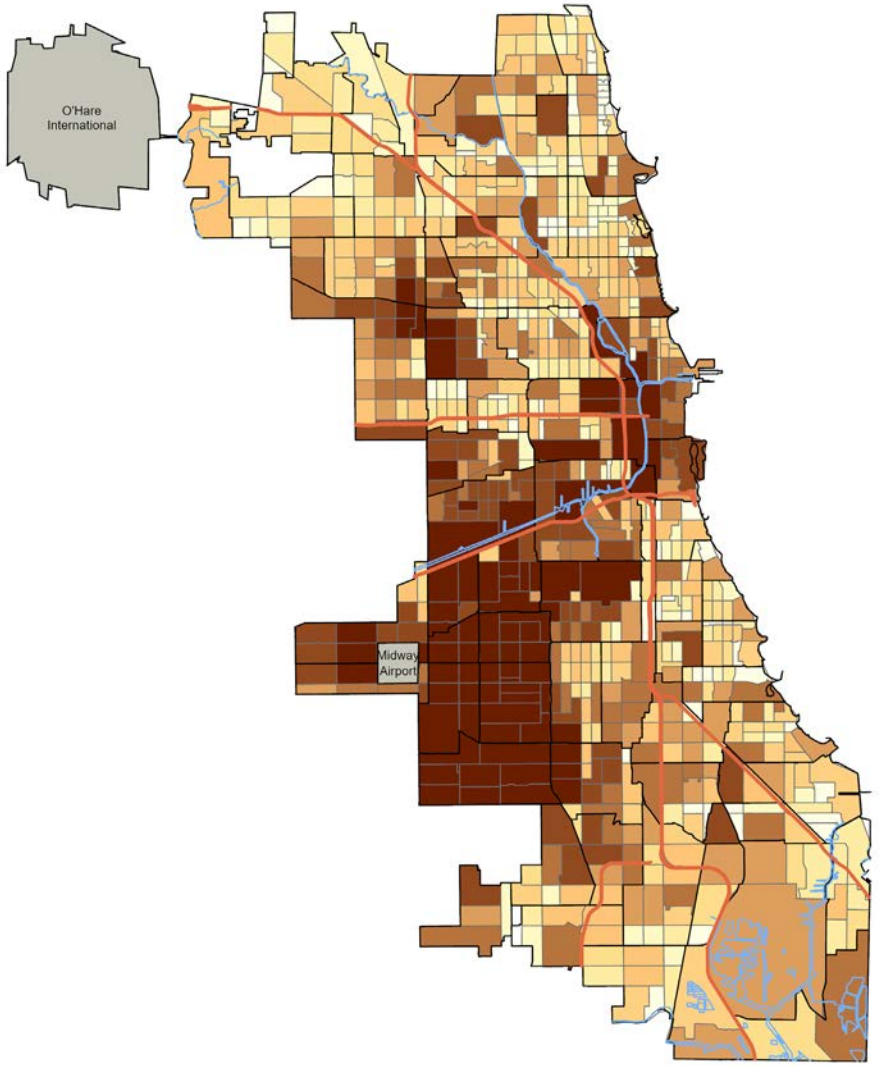


Toxic Releases in Chicago

Toxic Concentrations 2022

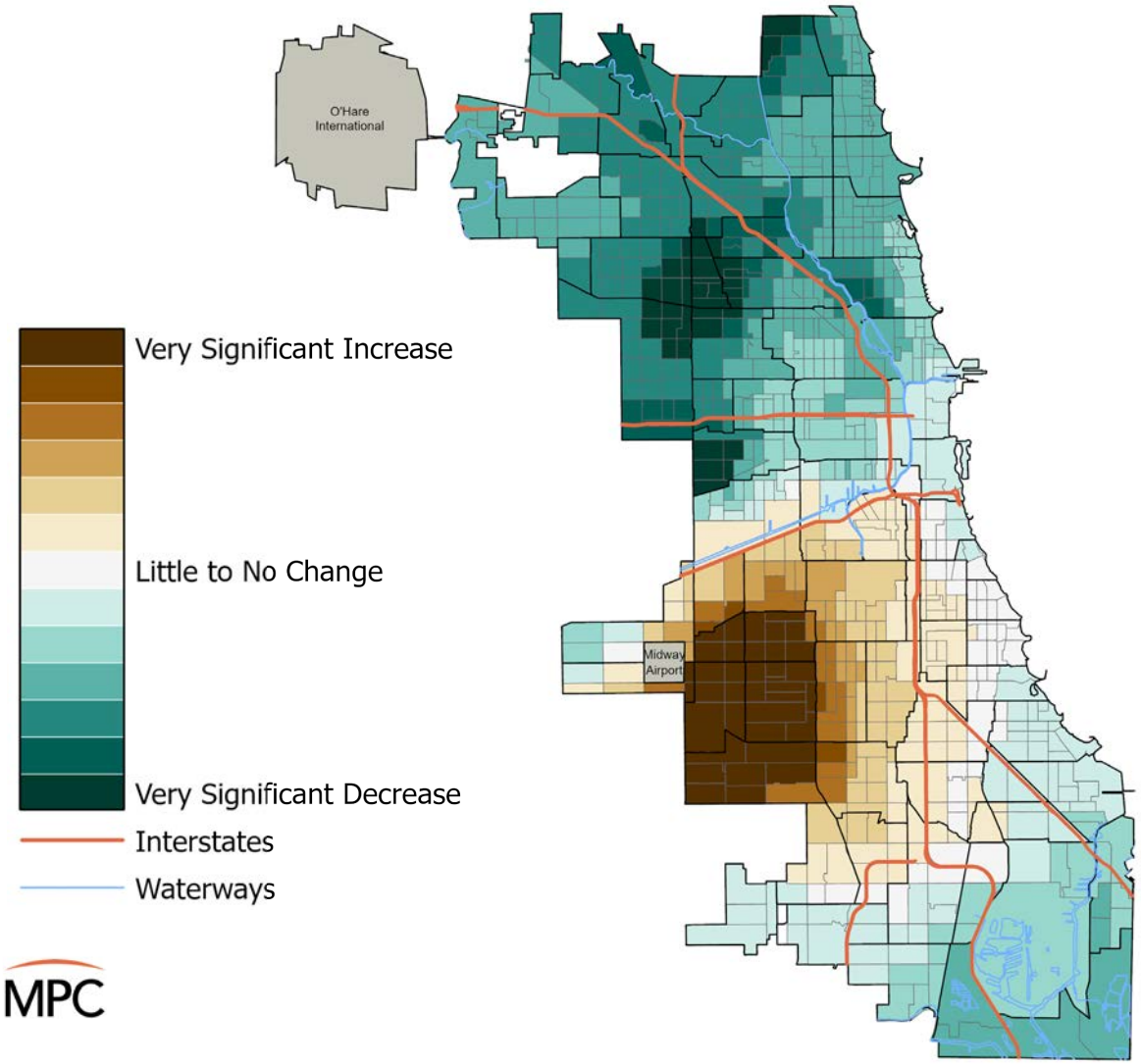


RSEI Scores 2022

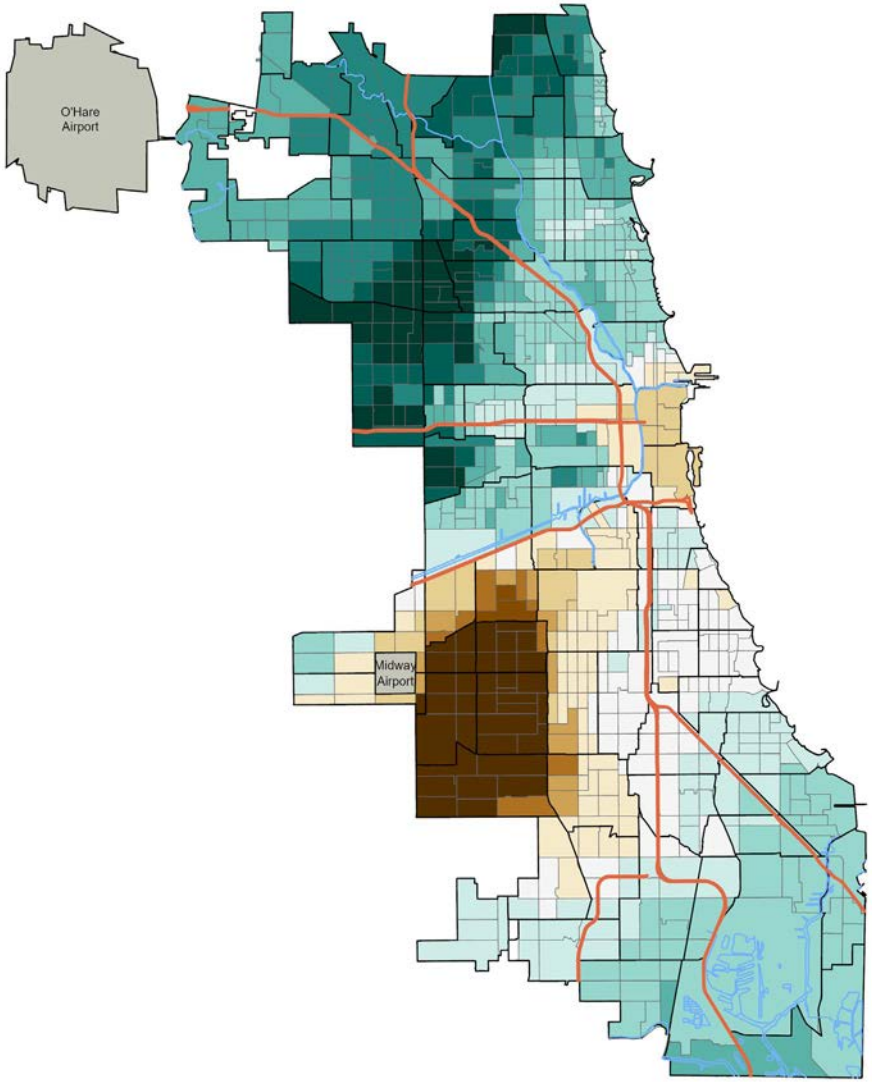


Toxic Releases in Chicago

Change in Toxic Concentrations 2003 - 2022



Change in RSEI Scores 2003 - 2022



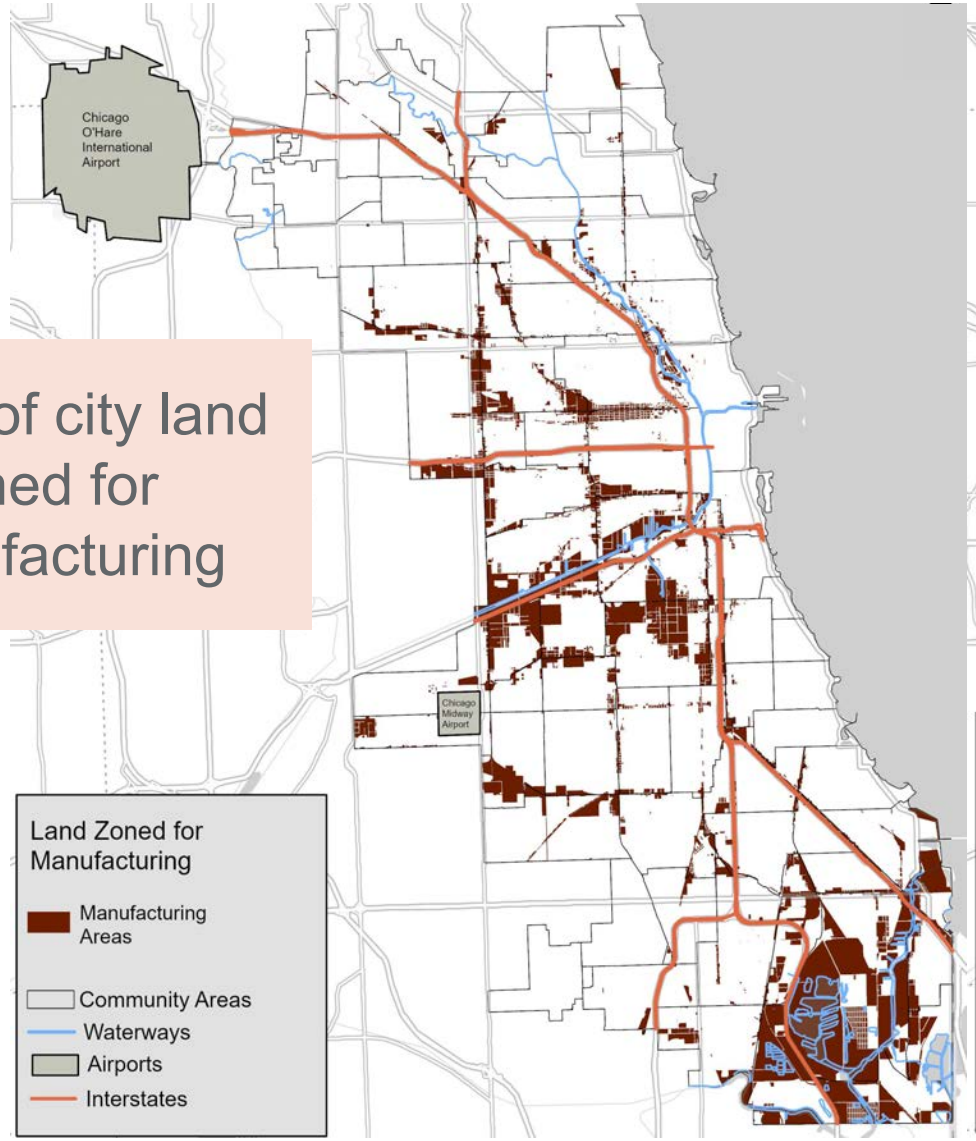
Understand the zoning

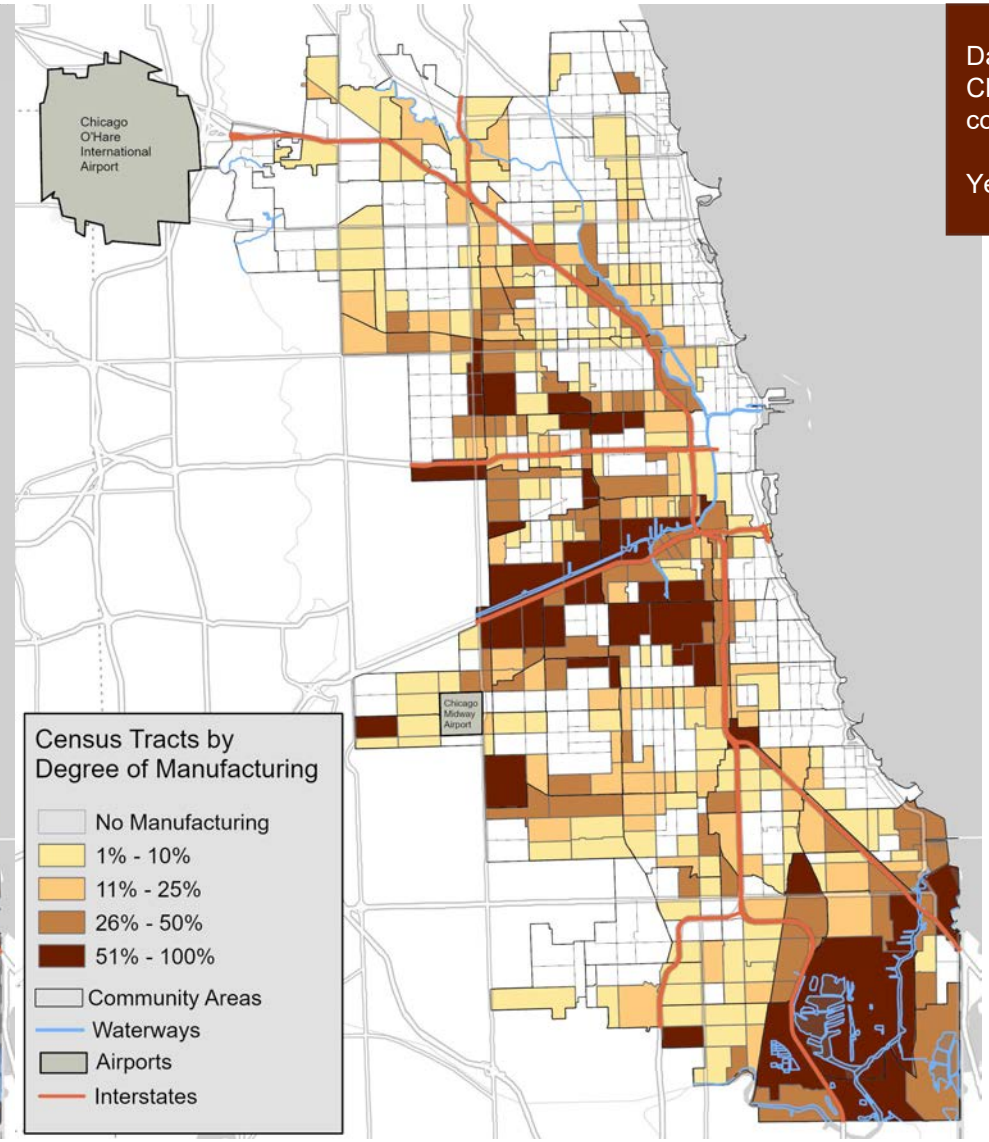
Where is the land zoned for manufacturing?

- Latinx and Black Chicagoans encounter more land zoned for manufacturing—and heavier types of manufacturing—in their neighborhoods than other groups
- Within areas zoned for manufacturing, Latinx and Black Chicagoans are more likely to encounter land uses for transportation, utilities, and waste
- Whiter, high-cost tracts are more likely to get rezoned to have less manufacturing
- Loss of manufacturing land is associated to some gentrification indicators in the central and north sides of the city.
- 11% of manufacturing zoned land in the city is vacant – 61% of which is located in the far south region.
- Industrial corridors on the south and west sides have significantly fewer jobs per acre than central and north side corridors.

Where in the city is land zoned for manufacturing?

17% of city land is zoned for manufacturing





Data source: Chicago zoning code and map

Year: 2023

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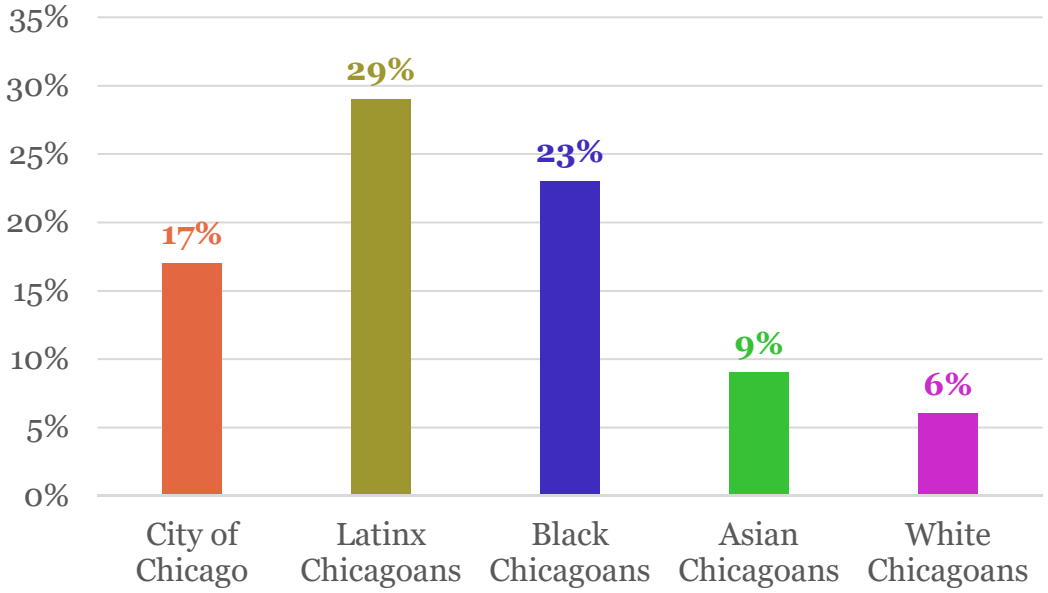
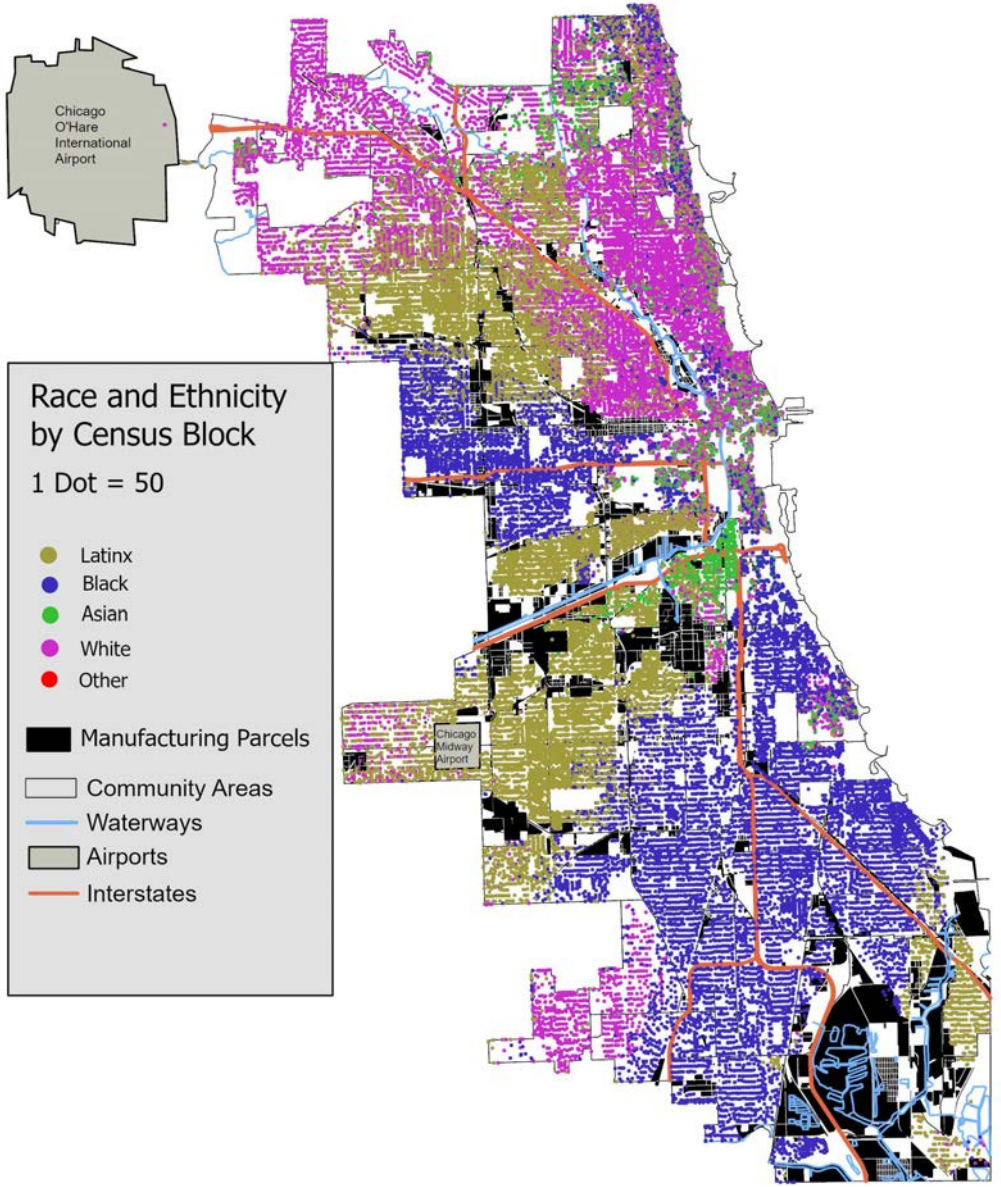
Note: includes Planned Manufacturing Districts (PMD)

Latinx and Black Chicagoans encounter more manufacturing in their neighborhoods

Share of land zoned for manufacturing in most populous areas for each demographic



This looks at the top 30% most populous tracts for each demographic (roughly 75 to 85 percent of the citywide population for each demographic). For example, in the top 30% of tracts with the most Latinx Chicagoans, 29% of the land is zoned for manufacturing.



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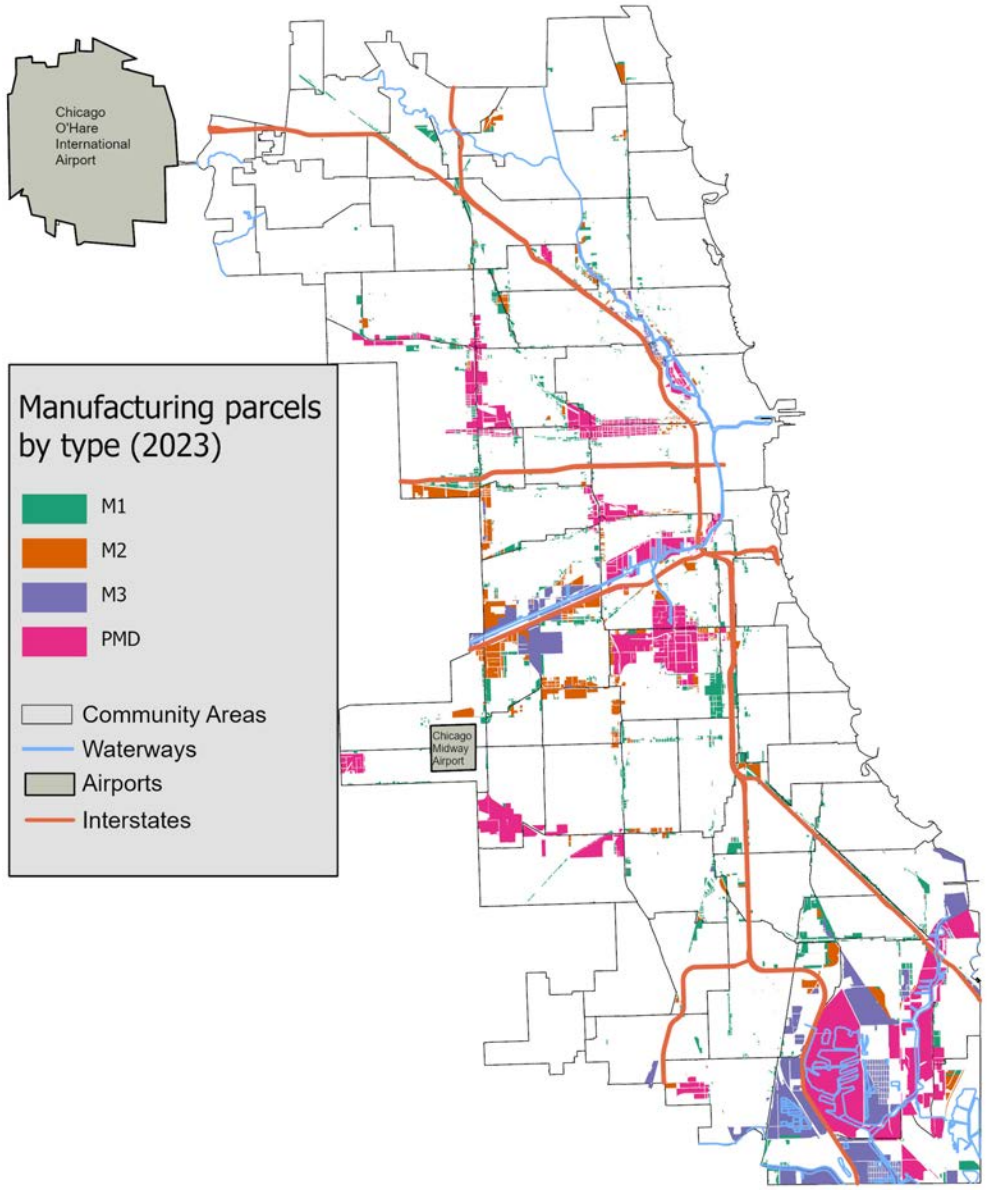
What are the different types of manufacturing districts?



M1 – Limited Manufacturing/Business Park District
Low-impact manufacturing, wholesaling, warehousing and distribution activities within enclosed buildings. Intended to promote high-quality new development and reuse of older industrial buildings.

M2 – Light Industry District
Moderate-impact manufacturing, wholesaling, warehousing and distribution uses, including storage and work-related activities outside of enclosed buildings. Intended to accommodate more land-intensive industrial activities than the M1 district.

M3 – Heavy Industry District
High-impact manufacturing and industrial uses, including extractive and waste-related uses.

PMD – Planned Manufacturing District
Overlay areas that prohibit residential development and other specific uses. There are 15 total PMDs within larger areas designated as Industrial Corridors.

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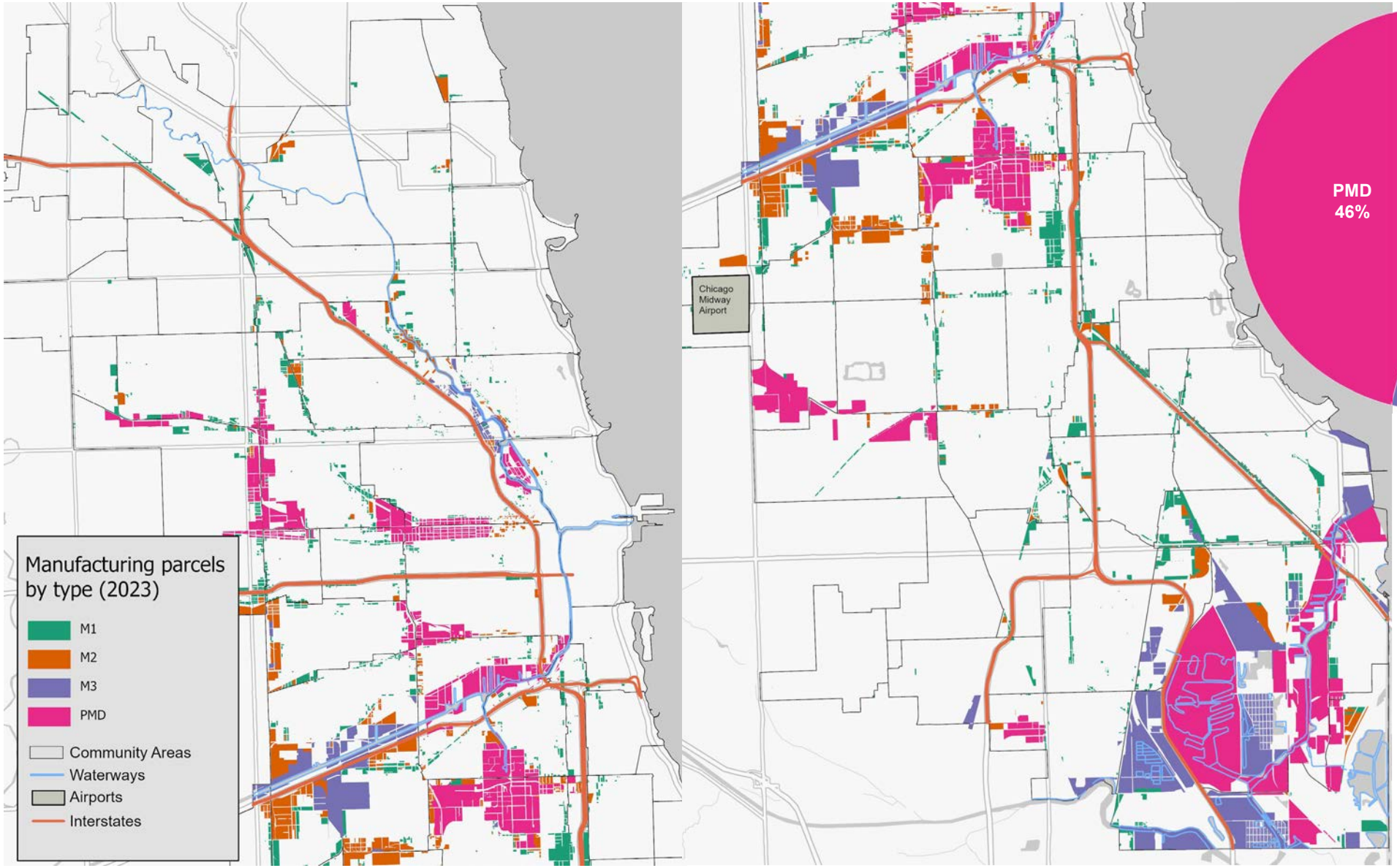
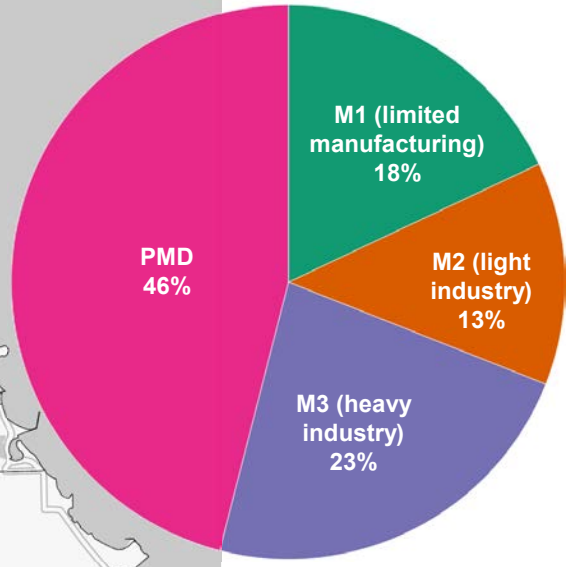
How are different types of manufacturing districts distributed across the city?





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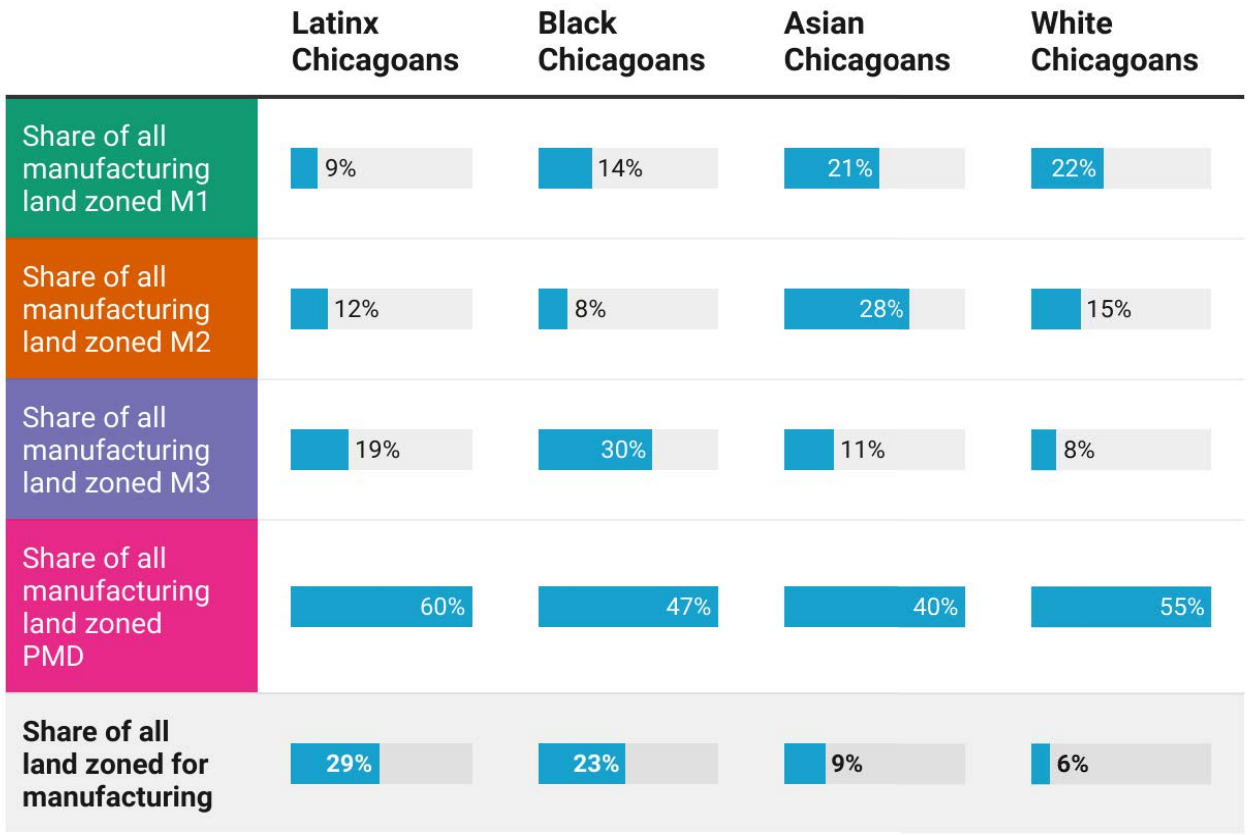
Black and Latinx Chicagoans are more likely to encounter areas zoned for heavier manufacturing

- Manufacturing in areas where most white and Asian Chicagoans live are much more likely to be zoned for **limited manufacturing (M1) or light industry (M2)**

- Manufacturing in areas where most Black and Latinx Chicagoans live are much more likely to be zoned for **heavy industry (M3)**

Types of manufacturing in most populous areas for each demographic



Created with Datawrapper

This looks at the top 30% most populous tracts for each demographic (roughly 75 to 85 percent of the citywide population for each demographic). For example, in the top 30% of tracts with the most Black Chicagoans, 30% of all manufacturing is zoned for heavy industry (M3).

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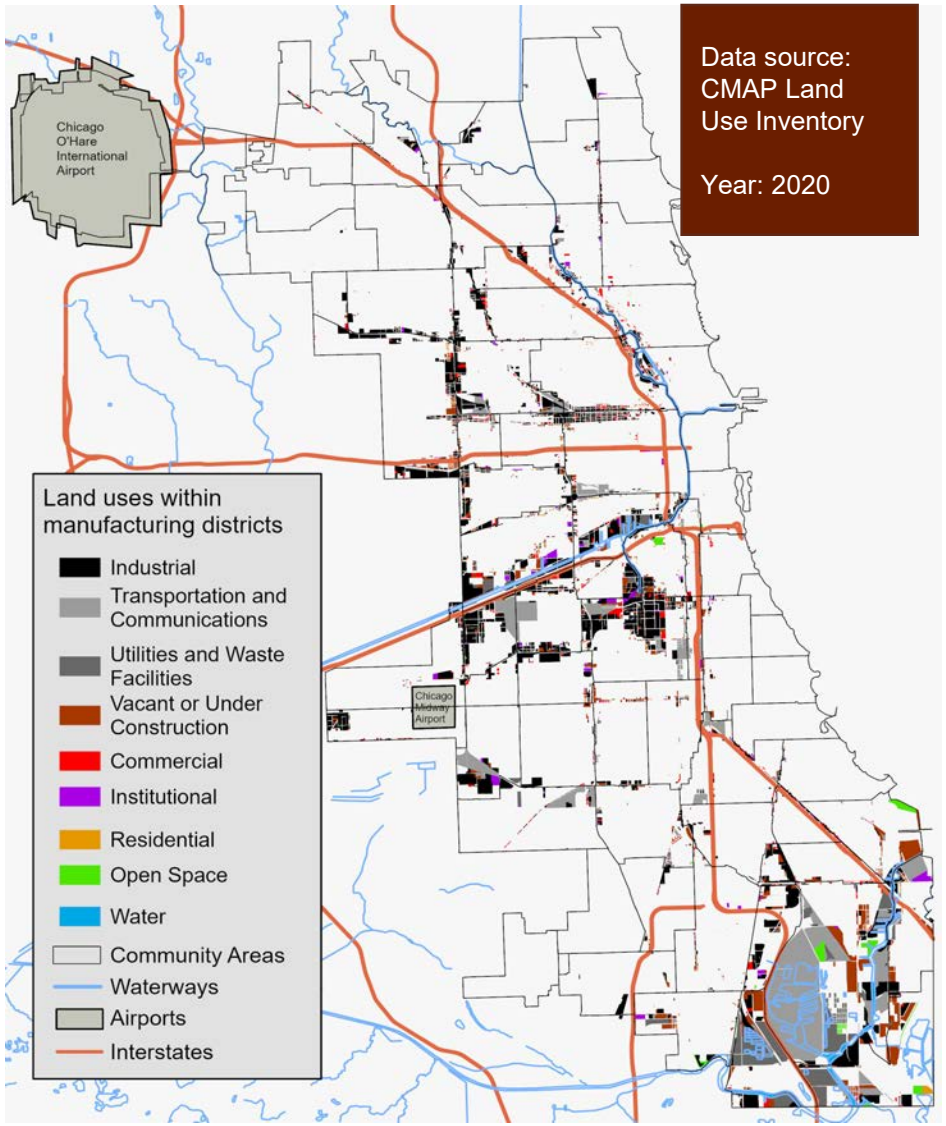
What land uses exist in manufacturing districts?



Industrial
Includes small- and large-scale manufacturing and warehousing operations such as distribution centers, storage facilities, auto junkyards, etc.

Transportation and Communications
Includes transportation-related activities such as freight and trucking terminals, bus ports, rail yards, and intermodal facilities. Also includes communications infrastructure such as telecommunications towers.

Utilities and Waste Facilities
Includes landfill, wastewater treatment facilities, and other utility- and waste-related facilities such as electric generation, gas production, and refuse and garbage plants.

Vacant or Under Construction
Includes vacant and undeveloped land in which there are no buildings and infrastructure intact, as well as land that has been platted for development and construction activities.

Commercial
Includes retail, offices, cultural/entertainment activities, hotels/motels, etc.

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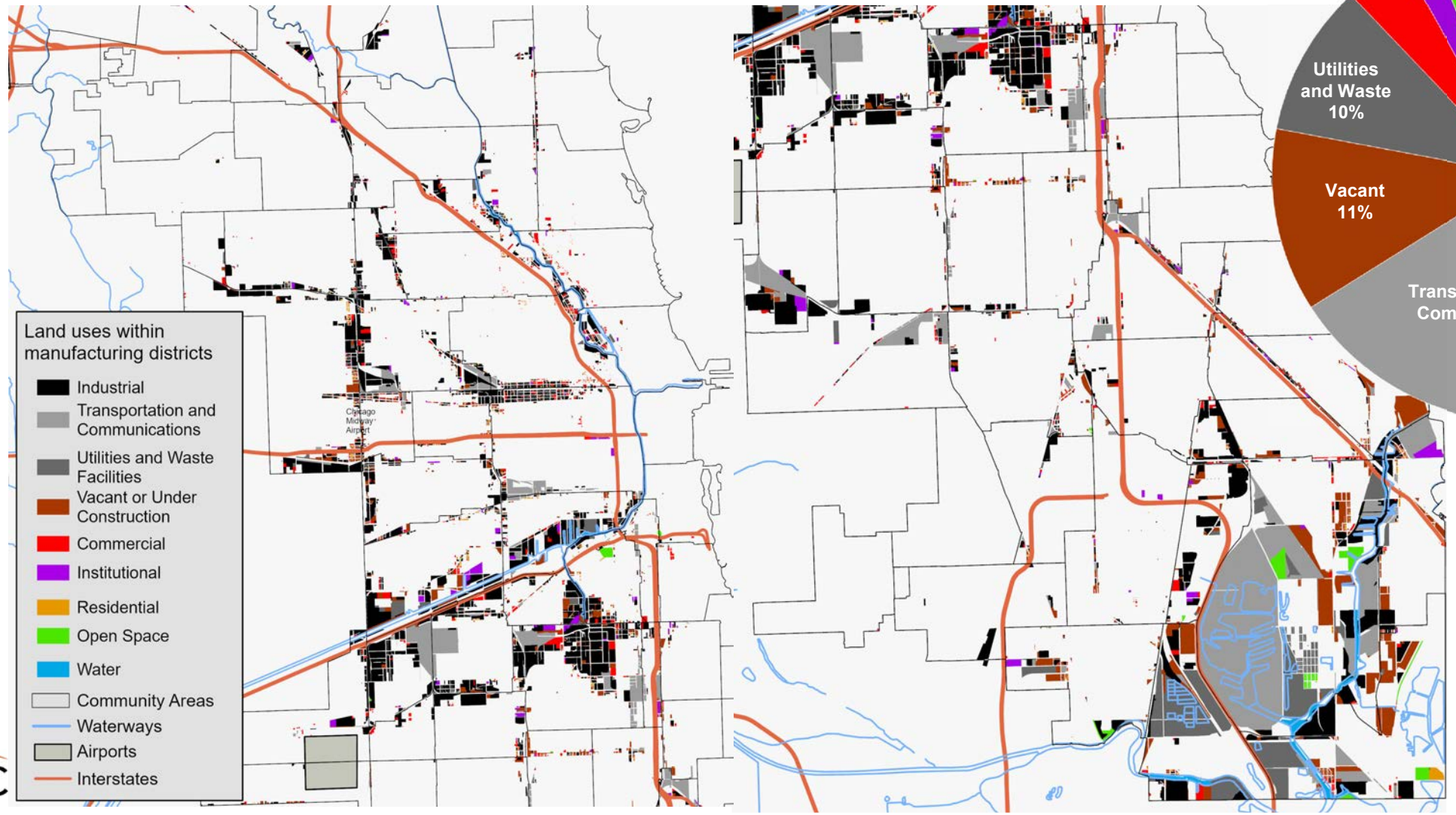
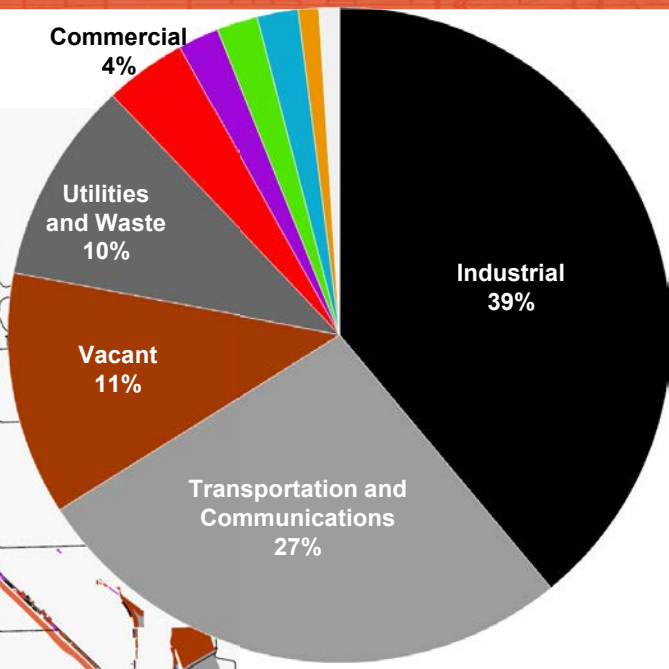
How do land uses within manufacturing districts vary across the city?





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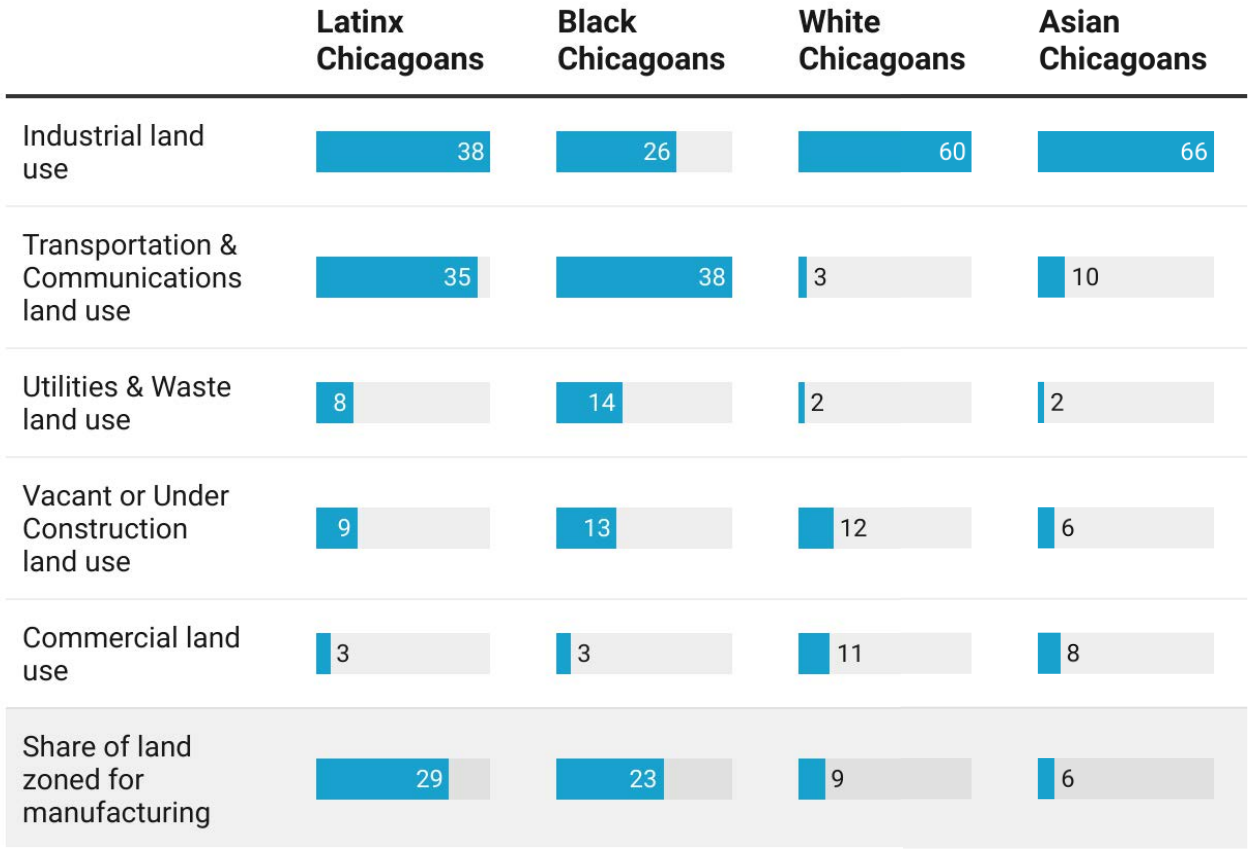
Within areas zoned for manufacturing, Latinx and Black Chicagoans are more likely to encounter pollution emitting land uses

- Latinx and Black Chicagoans are more likely than other groups to encounter some land uses categorized as **transportation & communications** and **utilities & waste** within the manufacturing districts in their neighborhoods
- White and Asian Chicagoans are more likely than other groups to encounter land uses categorized as **industrial** within the manufacturing districts in their neighborhood
- Encountering **vacant land** within manufacturing districts tends to be the most common for white and Black Chicagoans than for other groups

Top land uses within manufacturing districts



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This looks at the top 30% most populous tracts for each demographic (roughly 75 to 85 percent of the citywide population for each demographic). For example, in the top 30% of tracts with the most Black Chicagoans, 38% of the land zoned for manufacturing reflects Transportation land uses

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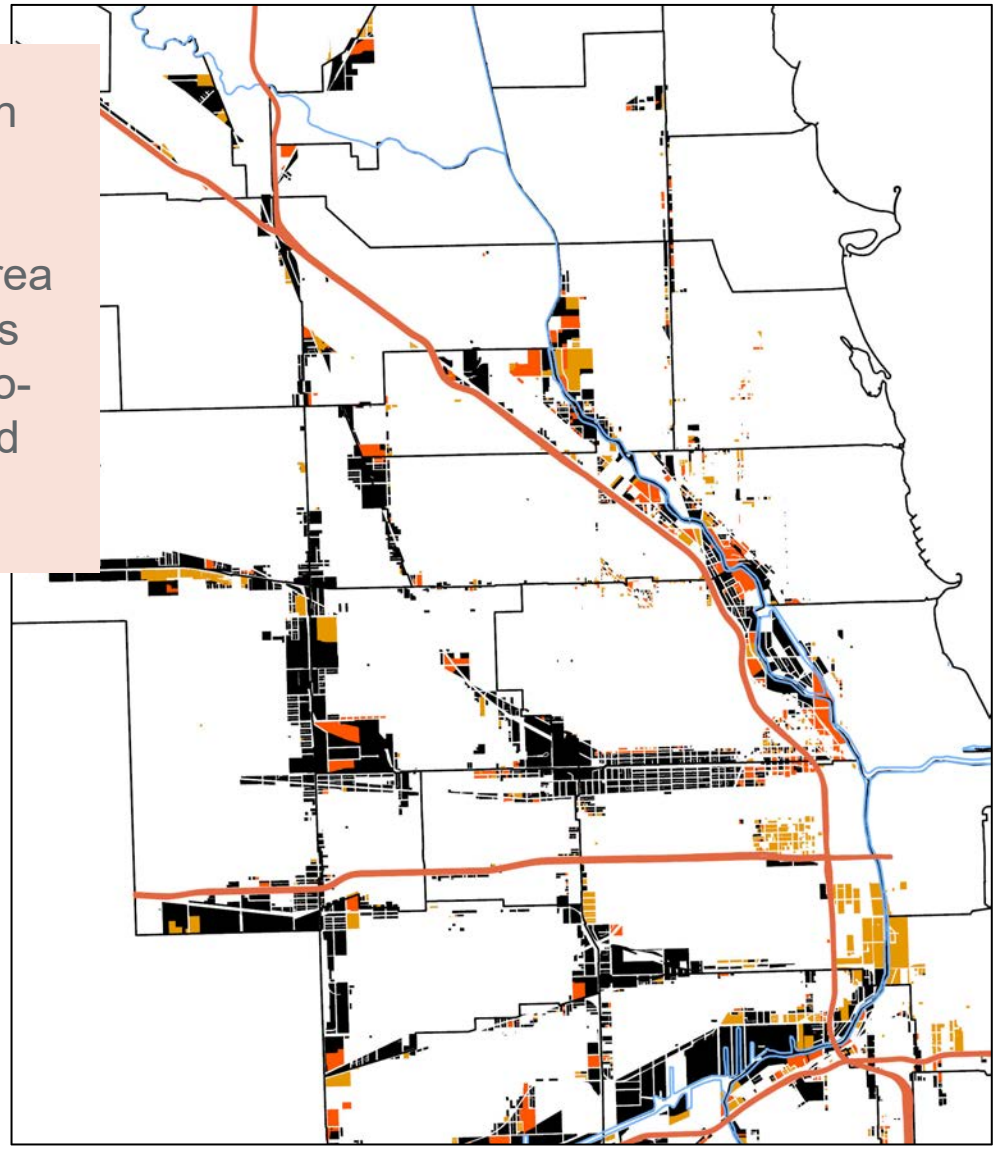
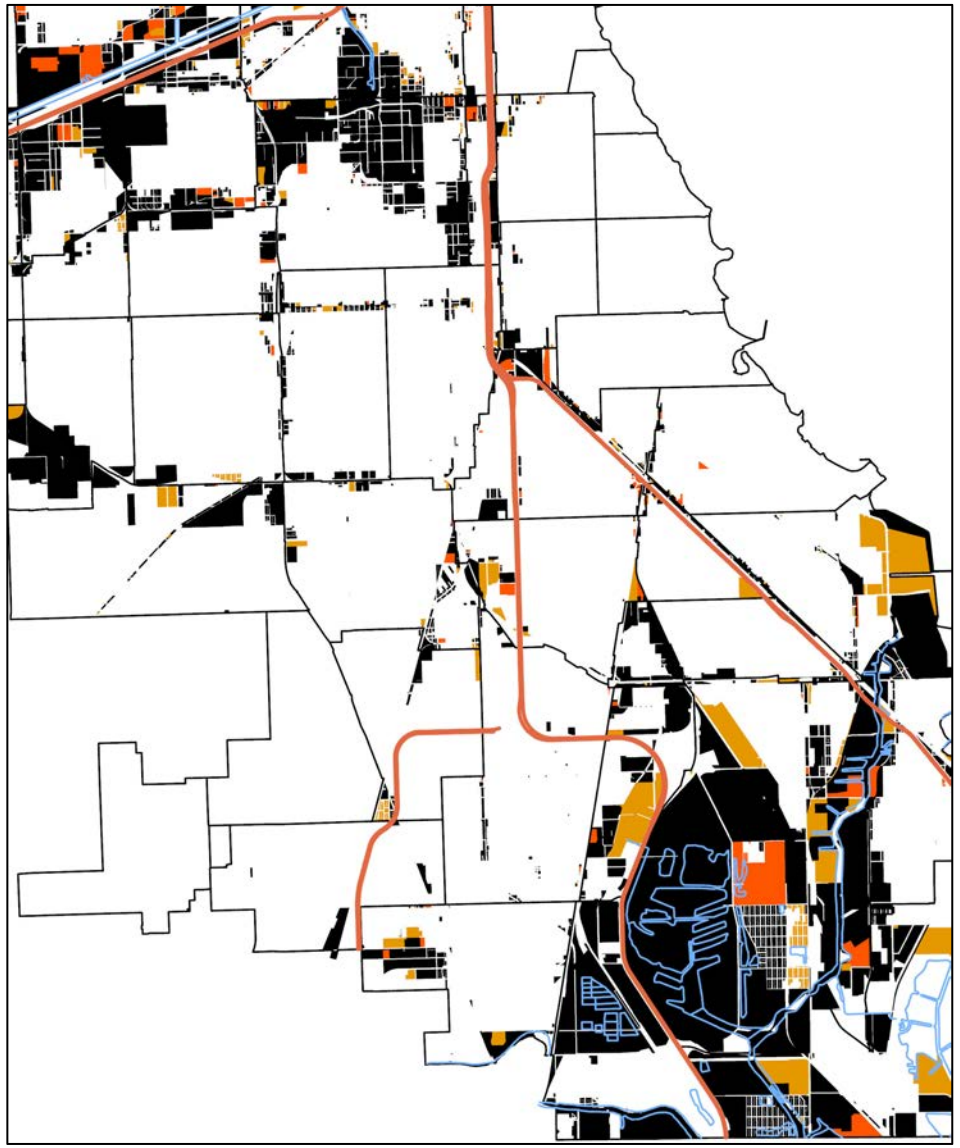
Where, when in the city did land get rezoned from manufacturing?

3% of city land has been rezoned from manufacturing to other uses since 2003 — an area larger than 74 of the city's 77 community areas. Two-thirds of the loss occurred between 2003 to 2012





- Rezoned 2003 to 2012
- Rezoned 2012 to 2023
- Manufacturing Today

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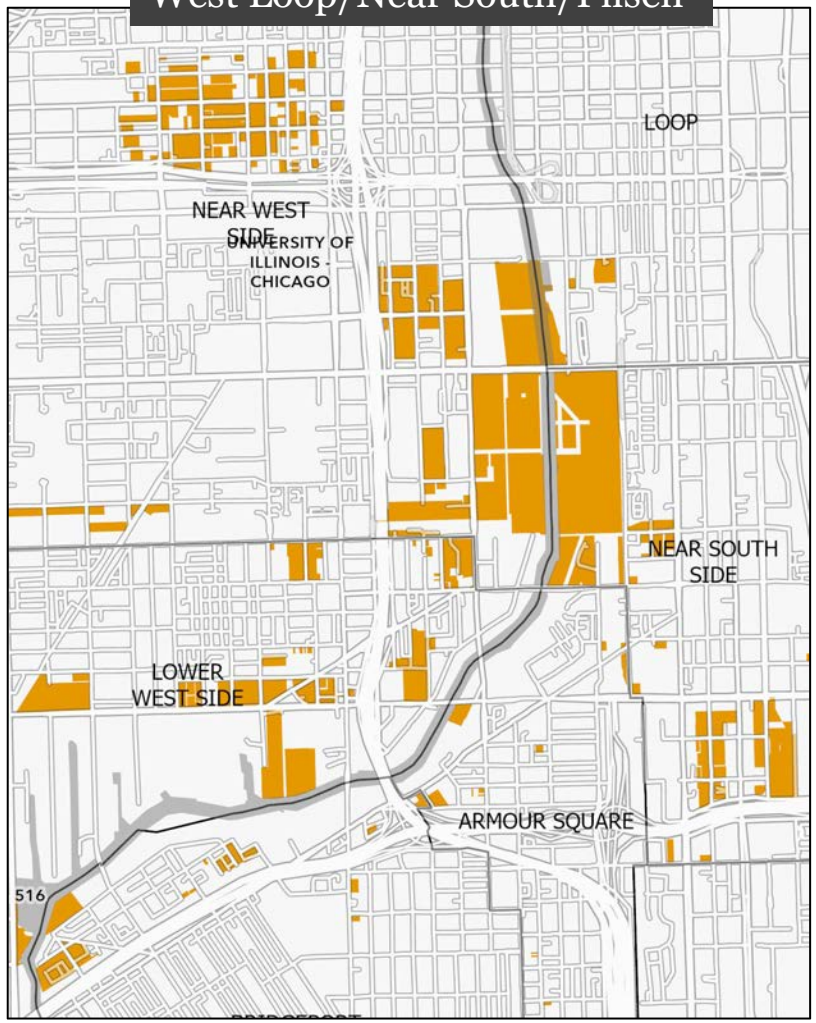
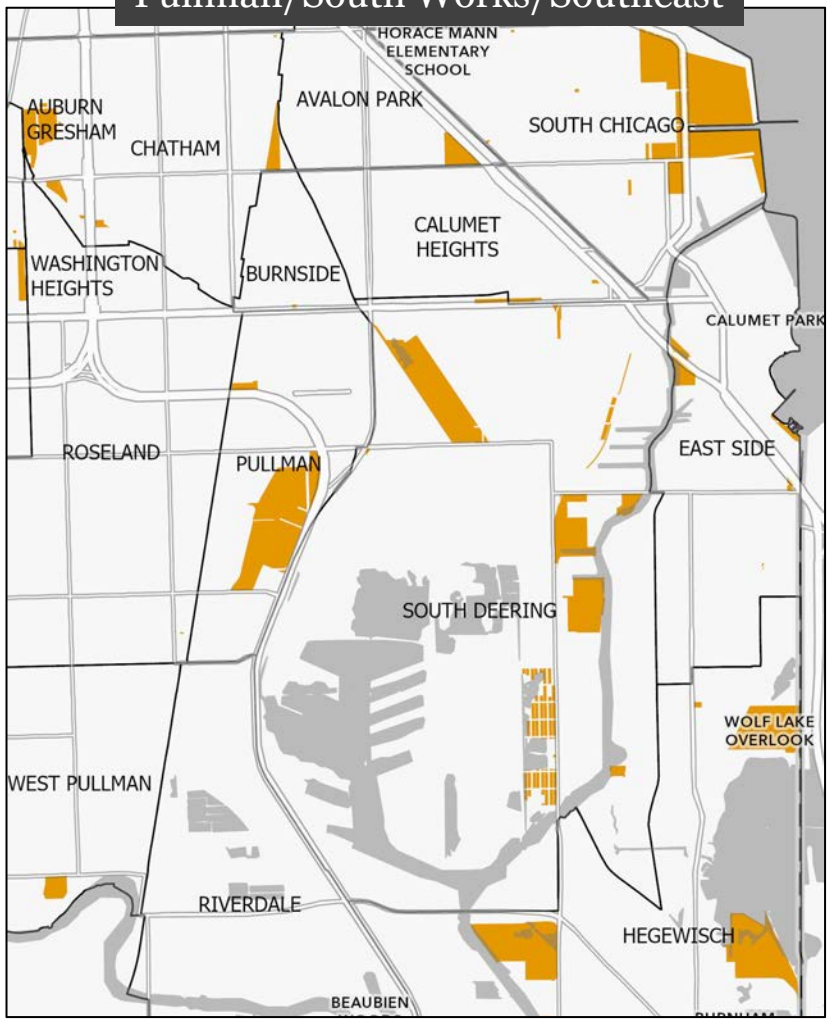
Rezoned from Manufacturing between 2003 to 2012

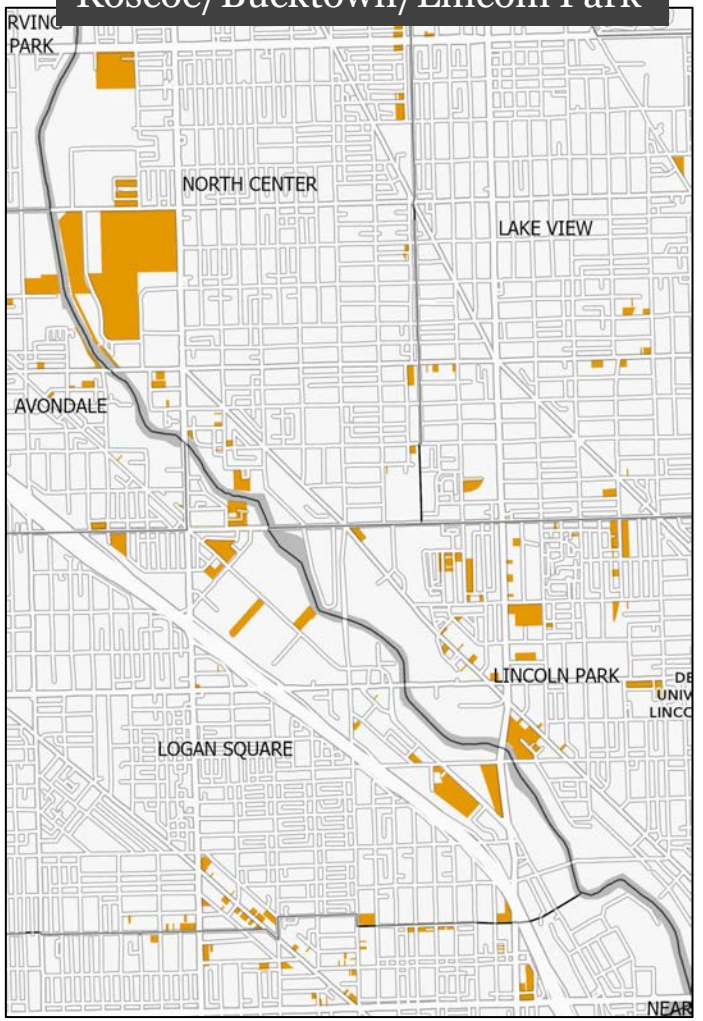
West Loop/Near South/Pilsen



Pullman/South Works/Southeast



Roscoe/Bucktown/Lincoln Park



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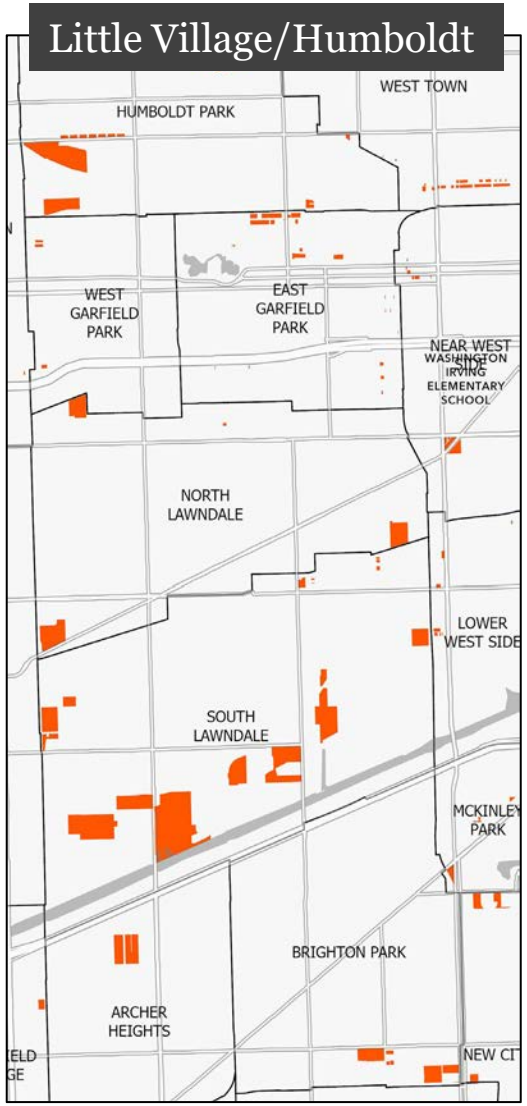
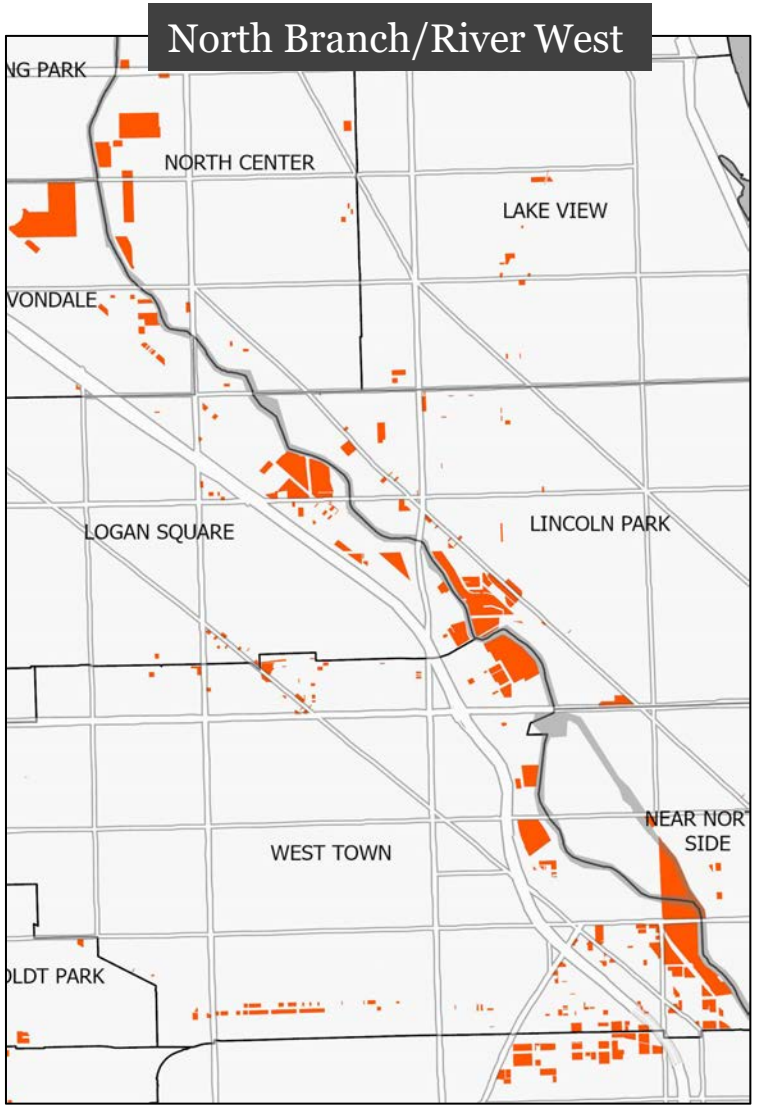
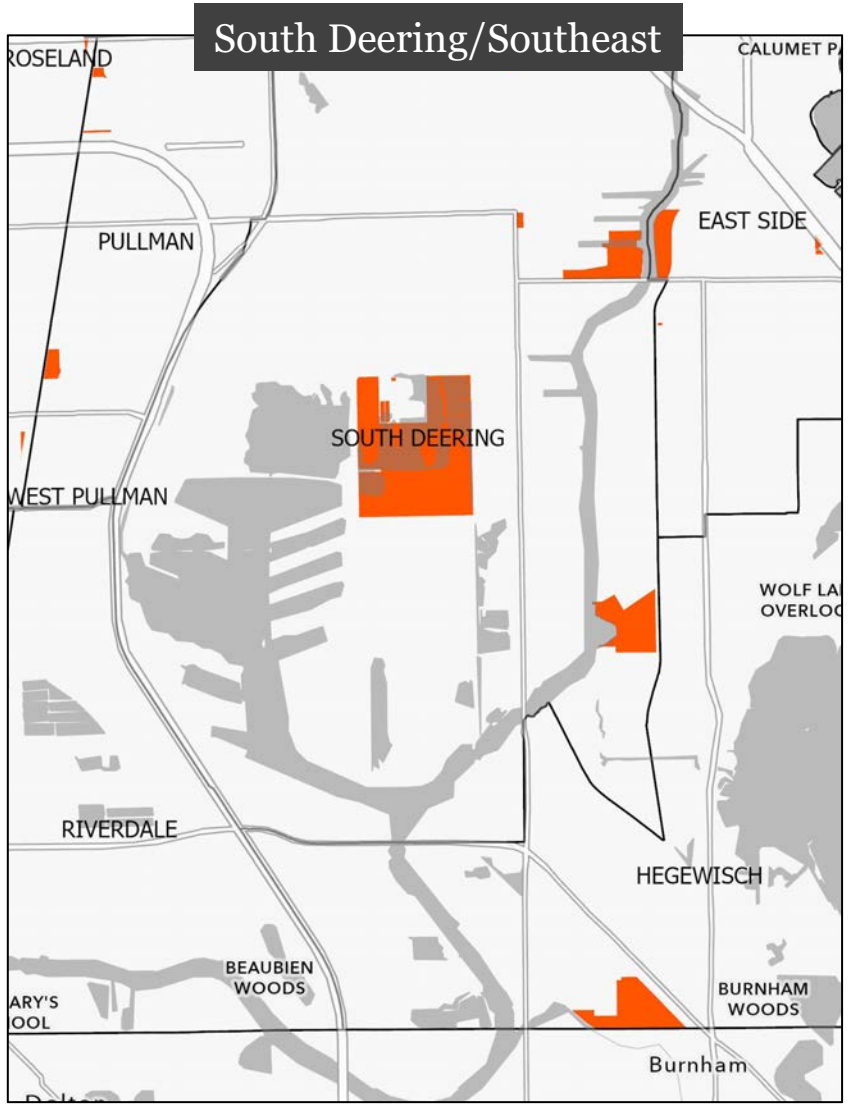
Rezoned from Manufacturing between 2012 to 2023







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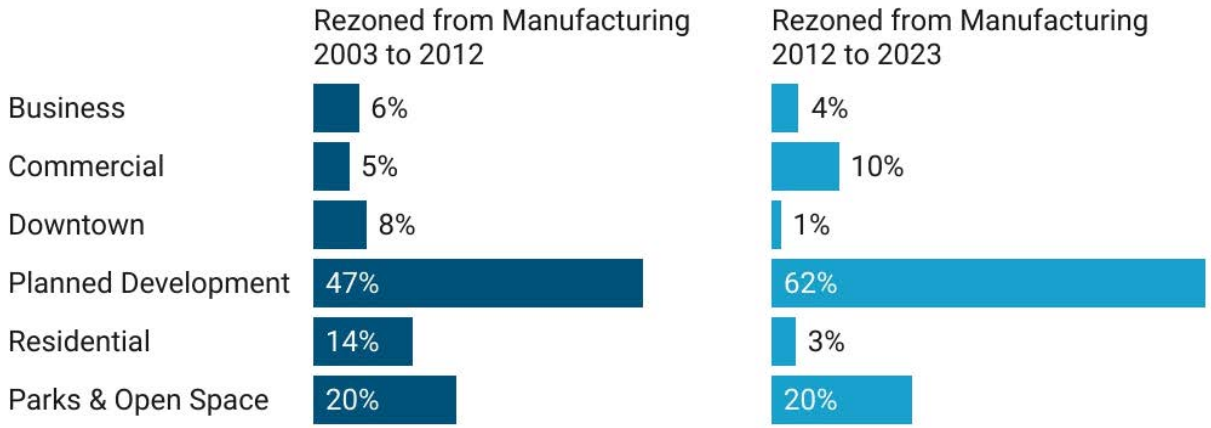
What is manufacturing typically rezoned to?

- Rezoned manufacturing land most often becomes part of planned developments – particularly in the latter decade.
- Significant chunks of manufacturing have also been rezoned to parks & open space, commercial, and residential.
- There is wide variation in what manufacturing gets rezoned to in different parts of the city.

Breakdown of zoning districts rezoned from manufacturing by decade, citywide



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Relationship of manufacturing loss with migration patterns and economic indicators and trends

Primary Questions:

- Which areas are more likely to get rezoned to have less manufacturing?
- What are some of the impacts as areas lose manufacturing? Do migration and economic trends precede or result from manufacturing loss?

Variables (1990, 2000, 2010-2014, 2018-2022):

- Race/Ethnicity
- Median Household Income
- Median Home Values
- Median Gross Rents

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Which areas are more likely to get rezoned to have less manufacturing?

- Tracts with higher shares of white population, household incomes, home values, and gross rents are more likely to get rezoned to have less manufacturing.
- Differences are more significant in the latter decade.

T-tests. Tracts that lost Manufacturing vs. Not.

	2003 - 2012	2012 - 2023
Avg Share white	29 vs 21% **	31 vs 16% ***
Avg Median Household Income	$40,172 vs $35,613 **	$53,286 vs $40,193 ***
Avg Median Home Values	$163,279 vs $123,660 ***	$225,435 vs $180,007 ***
Avg Median Gross Rents	$608 vs $578 *	$991 vs $929 *

*This looks at census data roughly at the beginning of each decade (2000 Decennial Census and 2010-2014 ACS). Excludes tracts that did not have any manufacturing in both ends of each decade. *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$*

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What happens as land gets rezoned to have less manufacturing?

- Looking at demographic and economic changes during each decade of rezoning, results are mixed.
- Loss of manufacturing is associated with greater increases in household incomes and either slower Latinx population growth or Latinx population loss.
- Ultimately, citywide statistical methods such as T-tests are not perfect. Subsequent mapping highlights some of the unique neighborhood-level dynamics.

T-tests. Tracts that lost Manufacturing vs. Not.

	2003 - 2012	2012 - 2023
Avg Pt Chg in Share White	-0.31 vs -3.09 *	0.60 vs 0.28
Avg Pt Chg in Share Latinx	1 vs 4 *	-1 vs 1 *
Avg % Chg in Median Household Income	32 vs 18% *	65 vs 49% ***
Avg % Chg in Median Gross Rents	67 vs 65%	41 vs 27% ***

*This looks at demographic and economic changes during each decade of rezonings (2000 Decennial Census to 2010-2014 ACS; 2010-2014 ACS to 2018-2022 ACS). Excludes tracts that did not have any manufacturing in both ends of each decade. No significant differences for changes in median home values and share Black population. *** p < 0.001; ** p < 0.01; * p < 0.05*

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Impacts of loss of manufacturing zone land (North Branch)

Change in demographic and economic indicators before, during, and after rezonings

	1990 to 2000	2000 to 2012	2012 to 2022
Avg chg in median household income*	1.74	3.39	1.70
Avg chg in median home values*	2.30	3.70	1.41
Avg chg in median gross rents*	0.24	1.22	1.63
Avg pt chg in white population share	−1.00	7.00	3.00
Avg pt chg in Latinx population share	−1.00	−7.00	−6.00

** as share of citywide median change. Value over 1 indicates greater than average increase*

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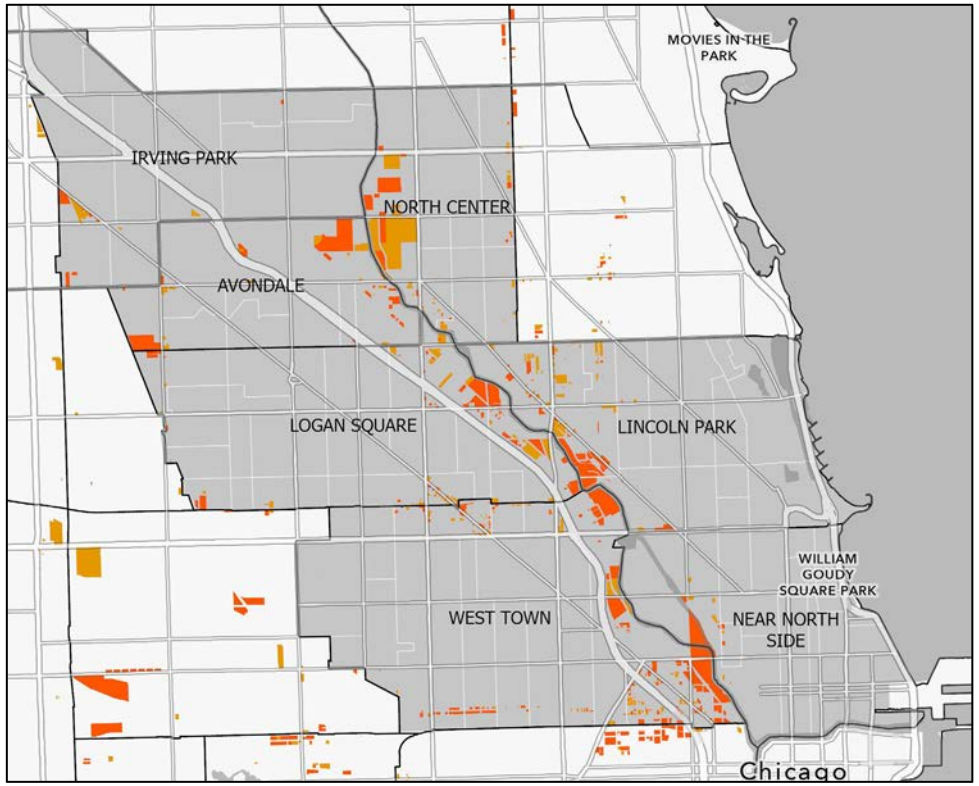

- Generally, the last two decades saw significantly higher than average increases in incomes, home values, and rents along this stretch of the north branch. White population share increased, Latinx population share decreased.
- There is some variation across the study area. For instance, trends are a lot more pronounced on the West Town, Near North, and Logan Square sections.

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Impacts of loss of manufacturing zone land (Far South & Southeast)

Change in demographic and economic indicators before, during, and after rezonings

	1990 to 2000	2000 to 2012	2012 to 2022
Avg chg in median household income*	0.69	0.37	0.89
Avg chg in median home values*	0.82	0.93	0.85
Avg chg in median gross rents*	0.18	0.99	0.73
Avg pt chg in white population share	−10.00	−3.00	−2.00
Avg pt chg in Latinx population share	4.00	2.00	1.00

** as share of citywide median change. Value over 1 indicates greater than average increase*

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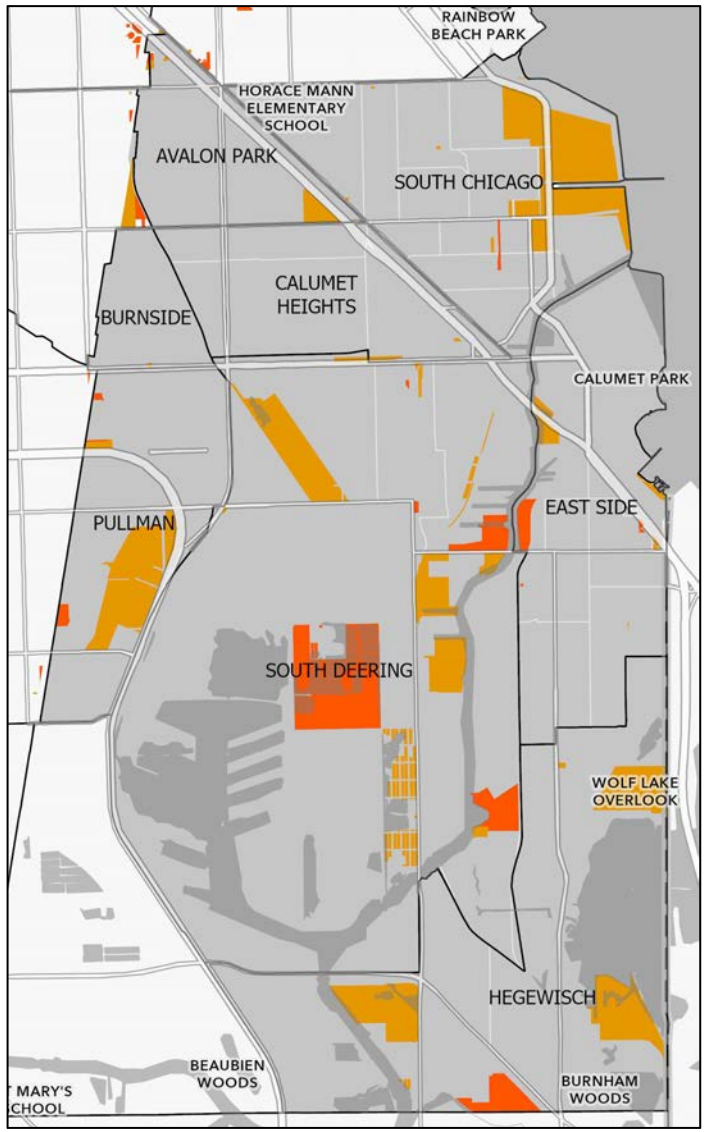
- The far south / southeast section of the city that has lost substantial manufacturing land have seen slower than average increases in incomes, home values, and rents. White and Latinx population trends are the opposite.



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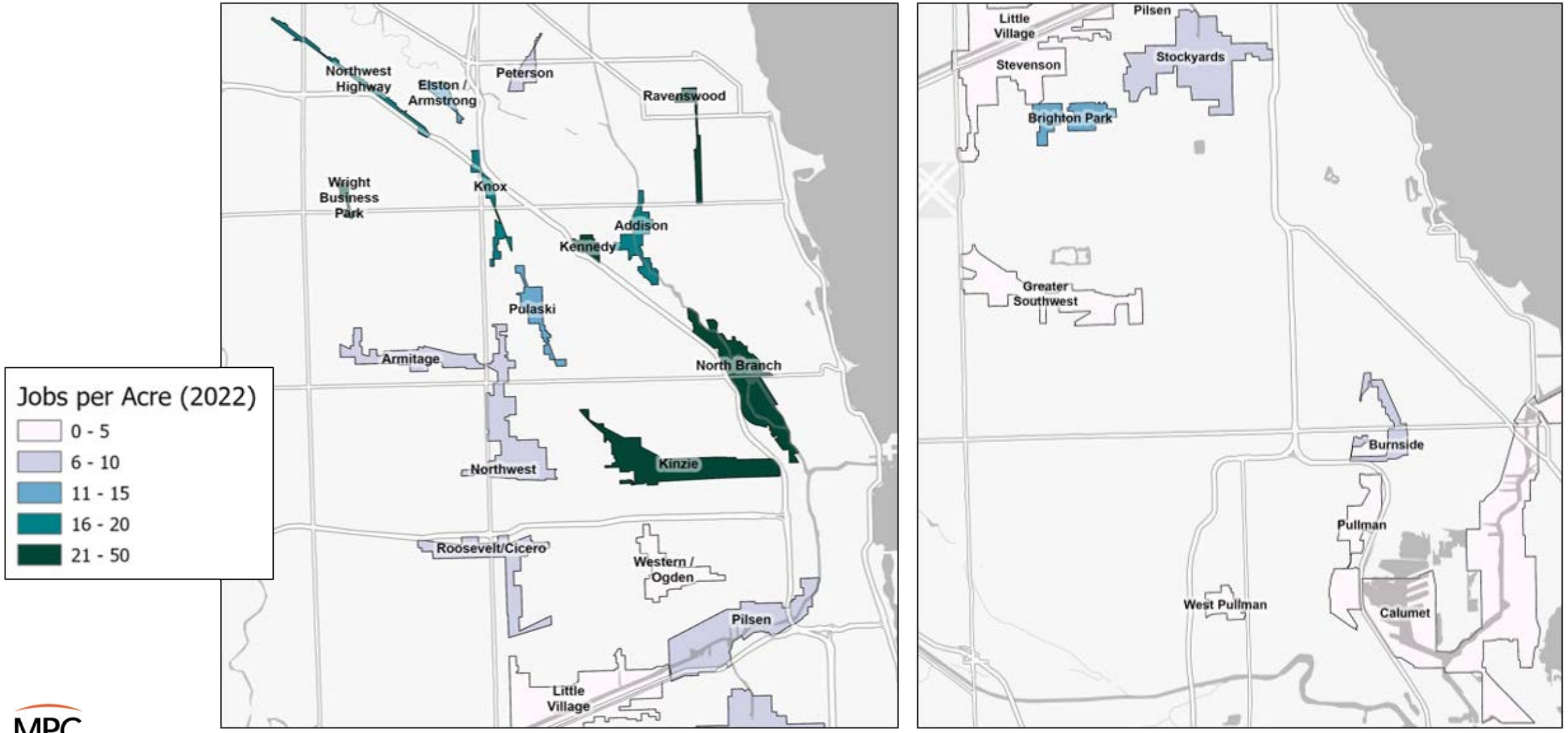
Jobs per Acre by Industrial Corridor



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Jobs per Acre by Industrial Corridor

Industrial Corridors (1-13)	Jobs per Acre	Jobs per Active Acre
Wright Business Park	49.7	78.9
North Branch	31.7	34.2
Kinzie	26.8	27.6
Ravenswood	24.8	24.9
Kennedy	21.7	22.2
Knox	16.6	17.0
Northwest Highway	16.3	16.3
Addison	15.6	15.8
Pulaski	13.4	13.5
Brighton Park	12.1	13.5
Elston / Armstrong	12.1	12.1
Pilsen	9.8	10.3
Northwest	9.1	10.1

Industrial Corridors (14-26)	Jobs per Acre	Jobs per Active Acre
Stockyards	8.3	9.6
Roosevelt/Cicero	8.3	8.9
Peterson	7.6	7.8
Armitage	5.3	6.1
Burnside	5.2	5.6
Harlem	4.9	5.4
Little Village	4.8	5.2
Stevenson	4.7	4.8
Western / Ogden	4.4	4.8
Greater Southwest	3.6	3.8
Pullman	2.8	3.7
Calumet	2.1	2.2
West Pullman	0.1	0.2

Notes: Jobs data from LEHD 2022. Jobs per "active" acre removes vacant land from each industrial corridor. In other words, the number of jobs per acre of active land.

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Vacant land zoned manufacturing by region

- 11% of land zoned for manufacturing is vacant.

Vacant Manufacturing by Plan Region (2023)

Plan Region	Share of manufacturing that is vacant	Share of citywide vacant manufacturing
Central	6%	1%
Far South	15%	61%
North	2%	0%
Northwest	2%	1%
Southeast	24%	9%
Southwest	5%	11%
West	11%	17%

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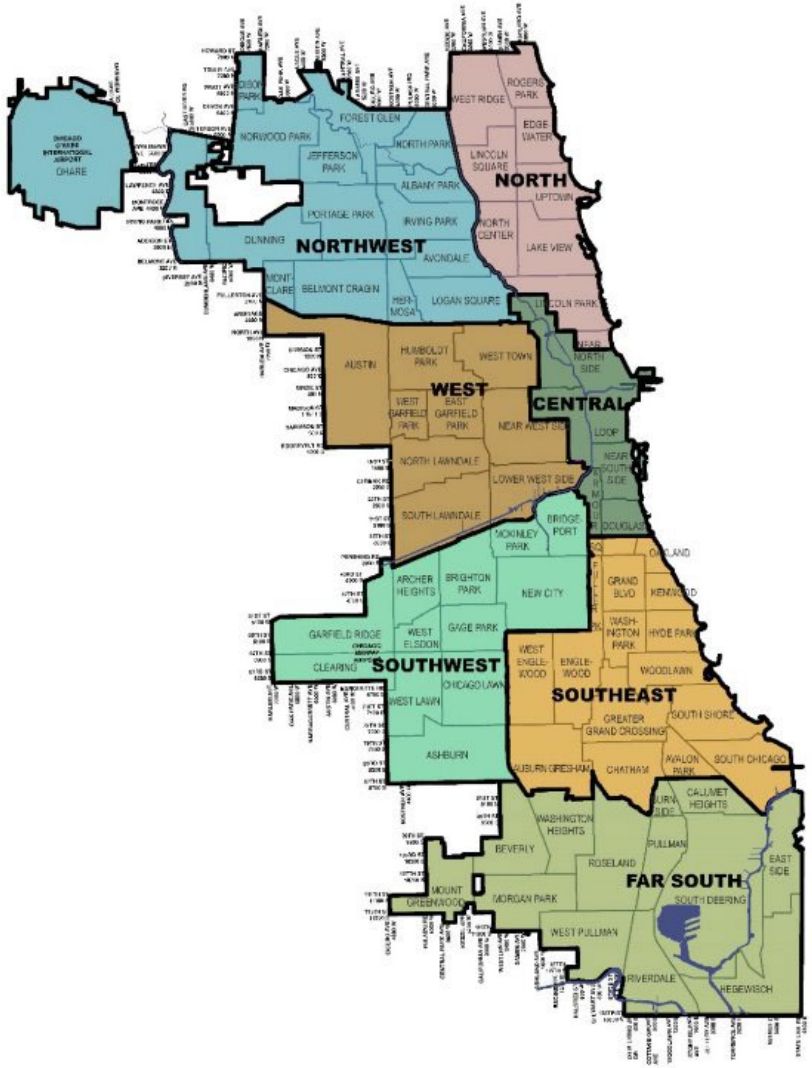

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Understand the relationship

How does zoning affect pollution exposure?

- Pollution and manufacturing zoning are correlated
- The share of land being zoned for manufacturing is a statistically significant predictor of higher levels of pollution exposure

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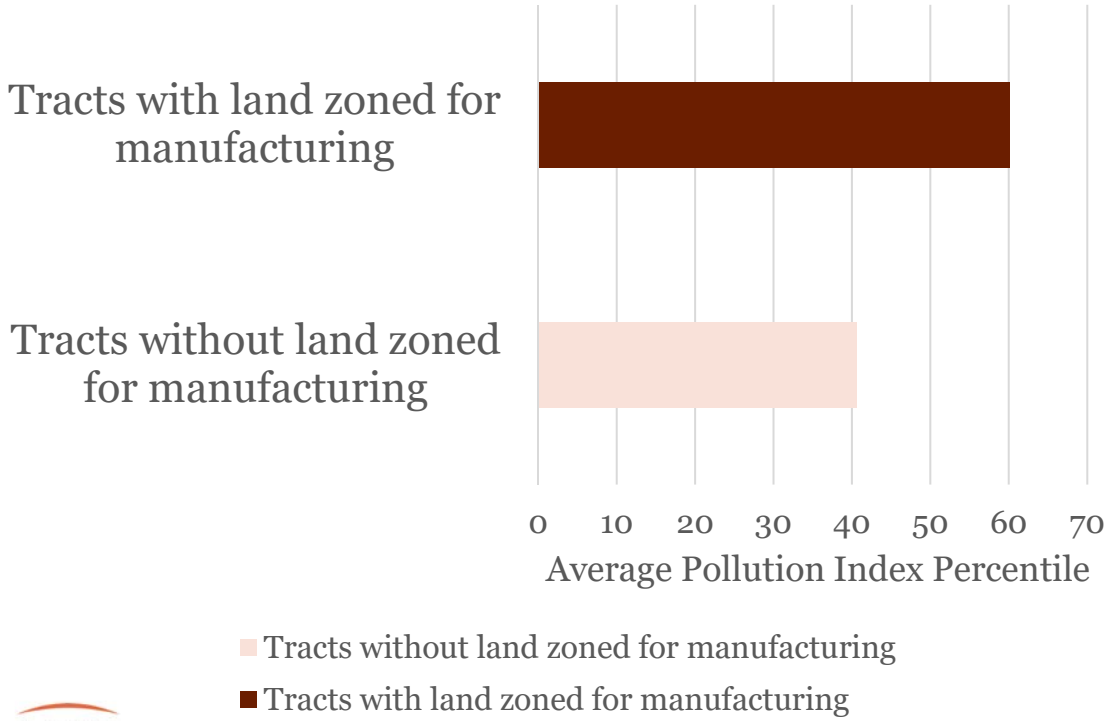
Pollution and manufacturing zoning are correlated

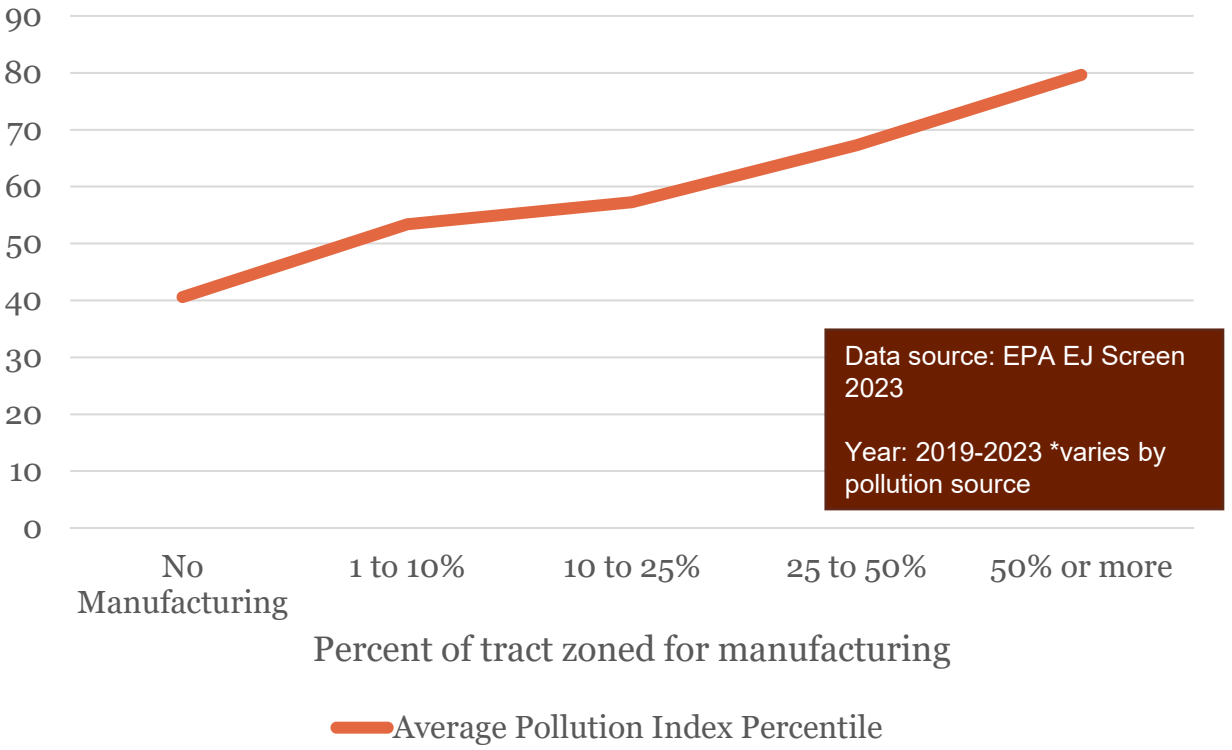
- Tracts with manufacturing have a higher pollution index on average

Average pollution index near vs. not near manufacturing



- Average pollution index increases as share of tract zoned manufacturing increases

Average pollution index by share of tract zoned for manufacturing



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What attributes predict higher exposure to pollution?

- The share of land being zoned for manufacturing is a statistically significant predictor of higher levels of *overall* pollution exposure

Neighborhoods have greater exposure to overall pollution:

- **Where there are greater shares of manufacturing zoning**
- Closer to the CBD
- Closer to the river
- Closer to interstates
- Where traffic counts are higher
- Where Black population is higher
- Where Latinx population is higher
- Farther from the lake
- Where tree coverage is lower
- Where white population is lower

Pollution data source: EPA EJ Screen 2023

Year: 2019-2023 *varies by pollution source

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Note: This includes some of the variables or attributes we find to be uniquely related to pollution ("statistically significant") even when considering the relative importance of other variables.

End