Environmental & Climate Equity: A local perspective

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Disclosures

- No financial Disclosures

ipcc

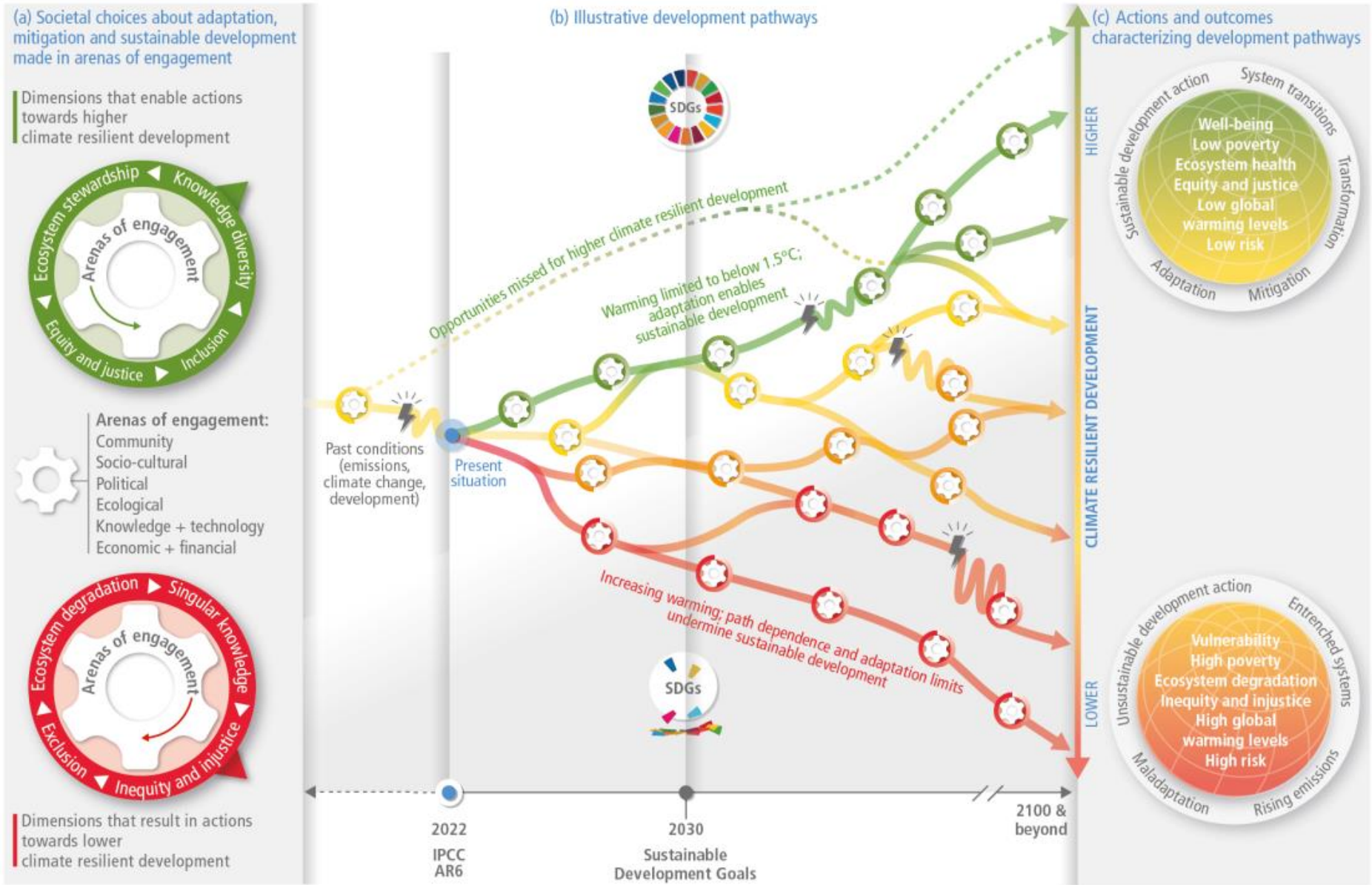
INTERGOVERNMENTAL PANEL ON climate change

Climate Change 2022

Impacts, Adaptation and Vulnerability

Summary for Policymakers

There is a rapidly narrowing window of opportunity to enable climate resilient development



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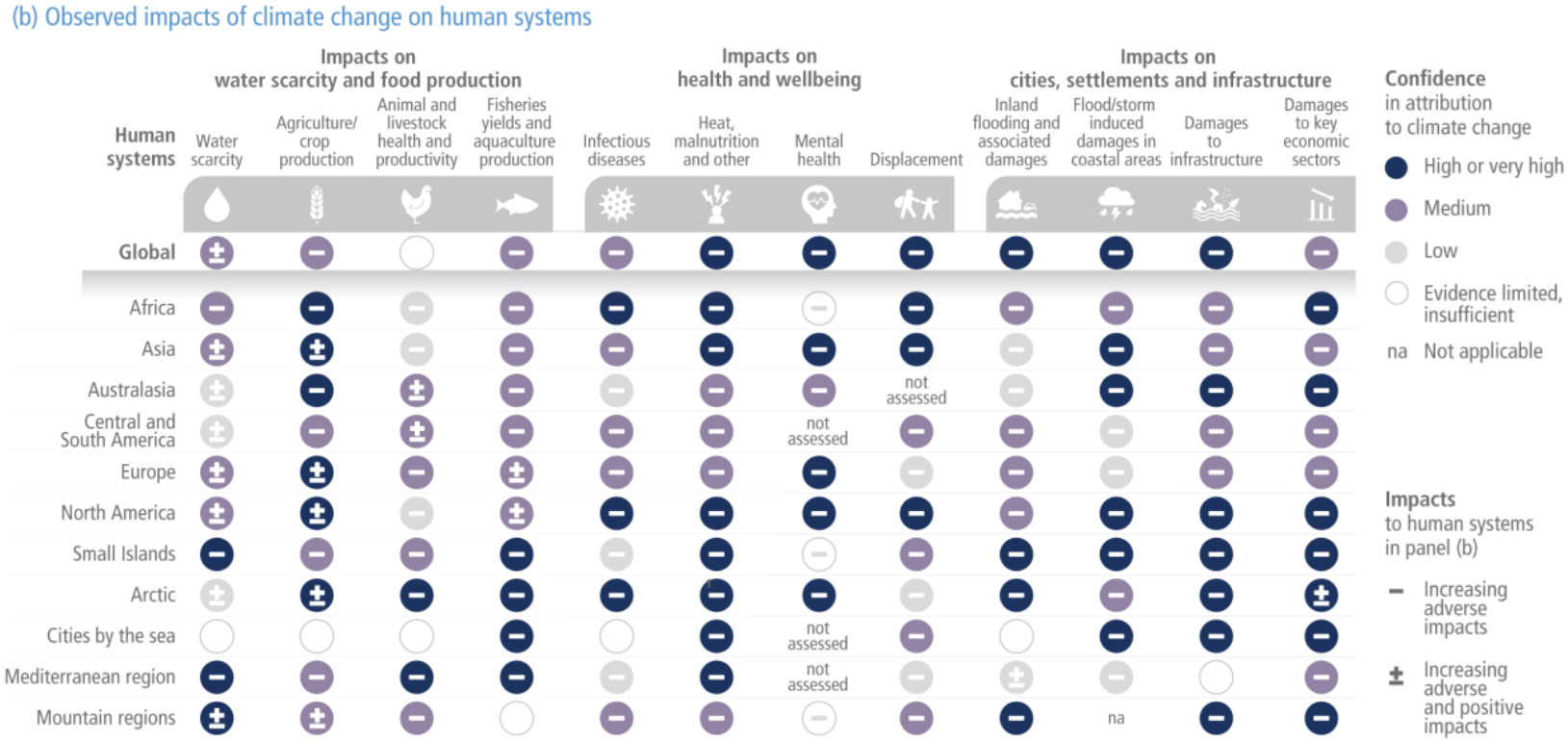
IF WE DON'T STOP WARMING BY 1.5-2ºC

- An additional 65 million people exposed to exceptionally extreme heat waves every 5 years
- 3 billion people will live in areas w/water scarcity
- An additional 9 million annual deaths from climate-related illnesses by 2100, compared to 1961-1990

IPCC Report 2022

IT WON'T BE FELT EQUALLY

Regions that contribute the least to the problem will suffer some of the harshest consequences



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IT WON'T BE FELT EQUALLY

Regions that contributed the least to the problem will suffer some of the harshest consequences

- Particularly Africa, Central America, South Asia & small island states
  - African countries have contributed <3% of cumulative global emissions, but will experience >50% of excess deaths from climate-related illness
  - In Africa, the worst-case scenario for warming would increase extreme heat exposure to 118x historical levels
    - In Europe heat exposure would only increase 4-fold
  - 31 – 143 million people could become displaced in sub-Saharan Africa, South Asia & Latin America
  - Access to climate financial support for adaptation measures is unequal
    - Only 3.8% of funding for climate research has gone to projects focused on Africa over the last 30 years
- The gap between rich and poor countries likely to widen as the planet warms

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THE US: GLOBALLY PRIVILEGED

CLIMATE & ENVIRONMENTAL INEQUITIES WILL STILL BE FELT INSIDE THE UNITED STATES

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AIR POLLUTION

Ozone = Smog

Particulate Matter = PM

PM2.5 = Fine particulate matter ≤2.5microns

- Poor air quality is the largest environmental health risk in the US
- PM2.5 is especially harmful & responsible for >100K deaths per year
- Currently 40% of Americans (>135 million people) live in areas w/unhealthy levels of ozone or particle pollution
  - People of color are >3x more likely to be in the most polluted air levels compared to white people

Am J Public Health. 2018 April; 108(4): 480–485.

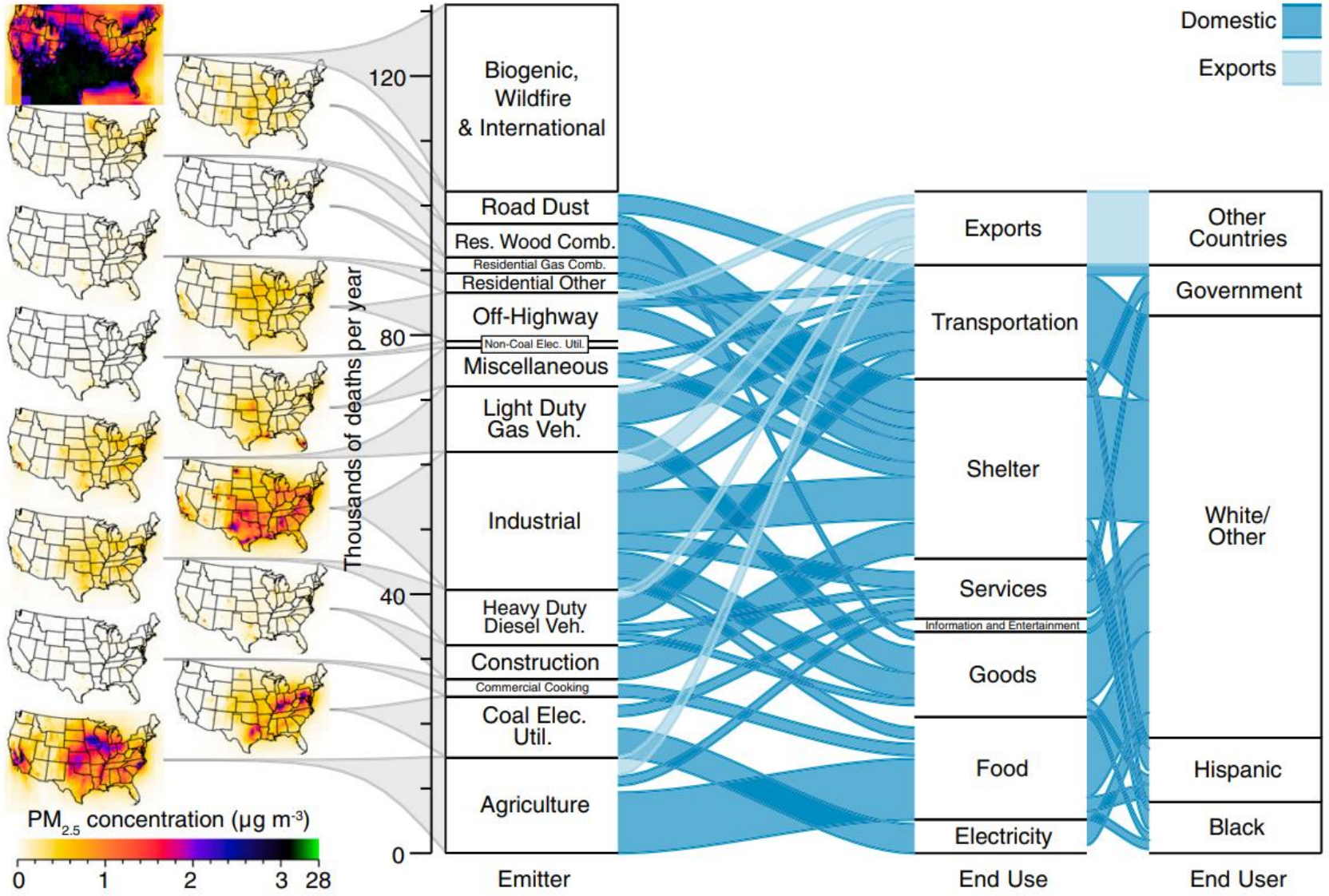
PNAS, March 11, 2019; DOI:

AIR POLLUTION

- **Pollution Inequity** = the difference between the environmental health damage **caused** by a racial-ethnic group & the damage of pollution that group **experiences**
- **Pollution Burden** = A group experiences more pollution exposure than caused by their consumption
- **Pollution Advantage** = A group experiences less air pollution exposure than caused by their consumption

PNAS, March 11, 2019; DOI:

AIR POLLUTION



PNAS, March 11, 2019; DOI:

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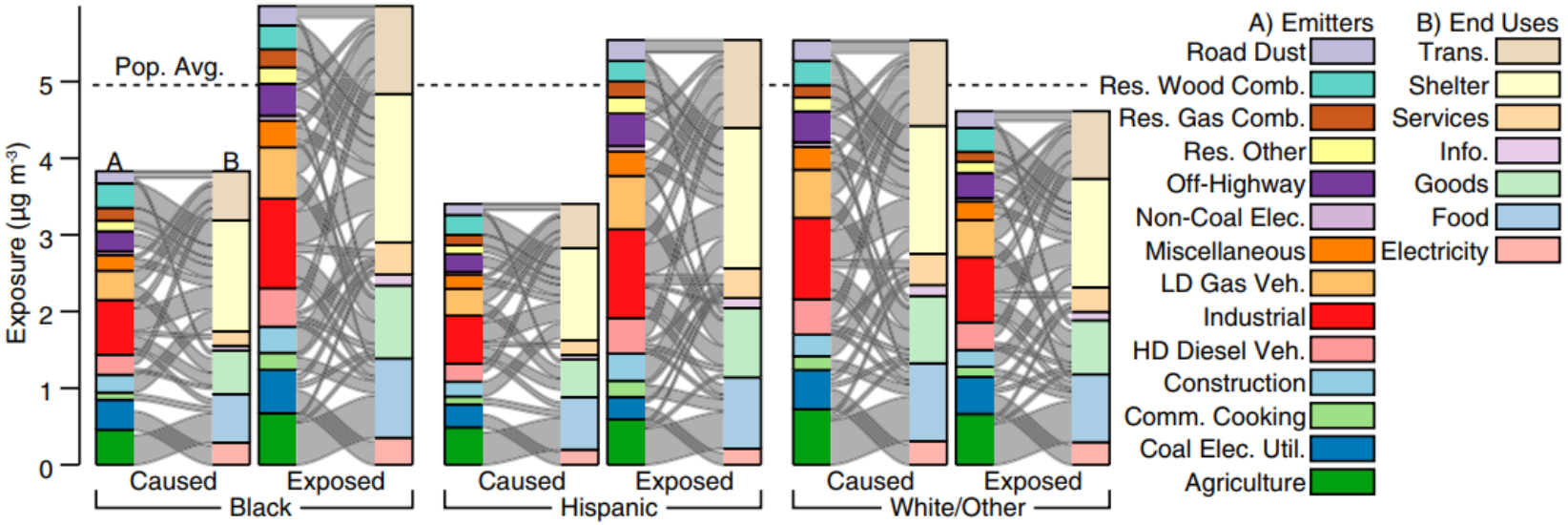
AIR POLLUTION



- Non-Hispanic White experience pollution advantage of ~17% less air pollution exposure than caused by their consumption
- Black & Hispanic experience pollution burden of ~56% more air pollution exposure than caused by their consumption

PNAS, March 11, 2019; DOI: 10.1073/pnas.1818859116

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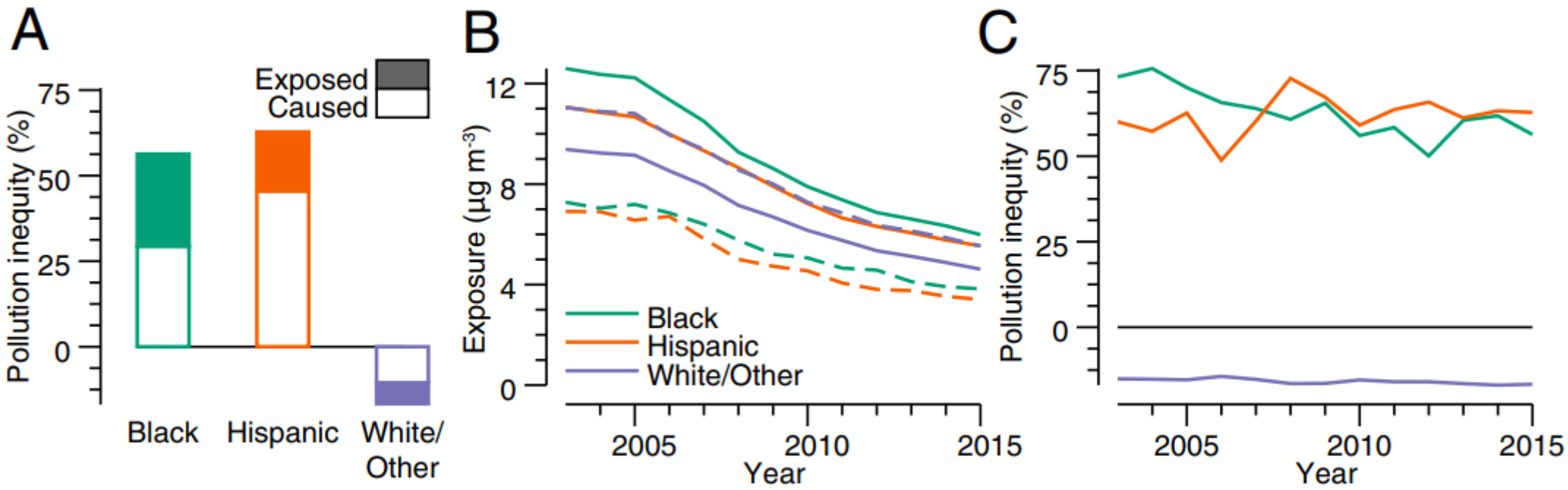
POLLUTION INEQUITY CONTRIBUTIONS & TRENDS



PNAS, March 11, 2019; DOI:

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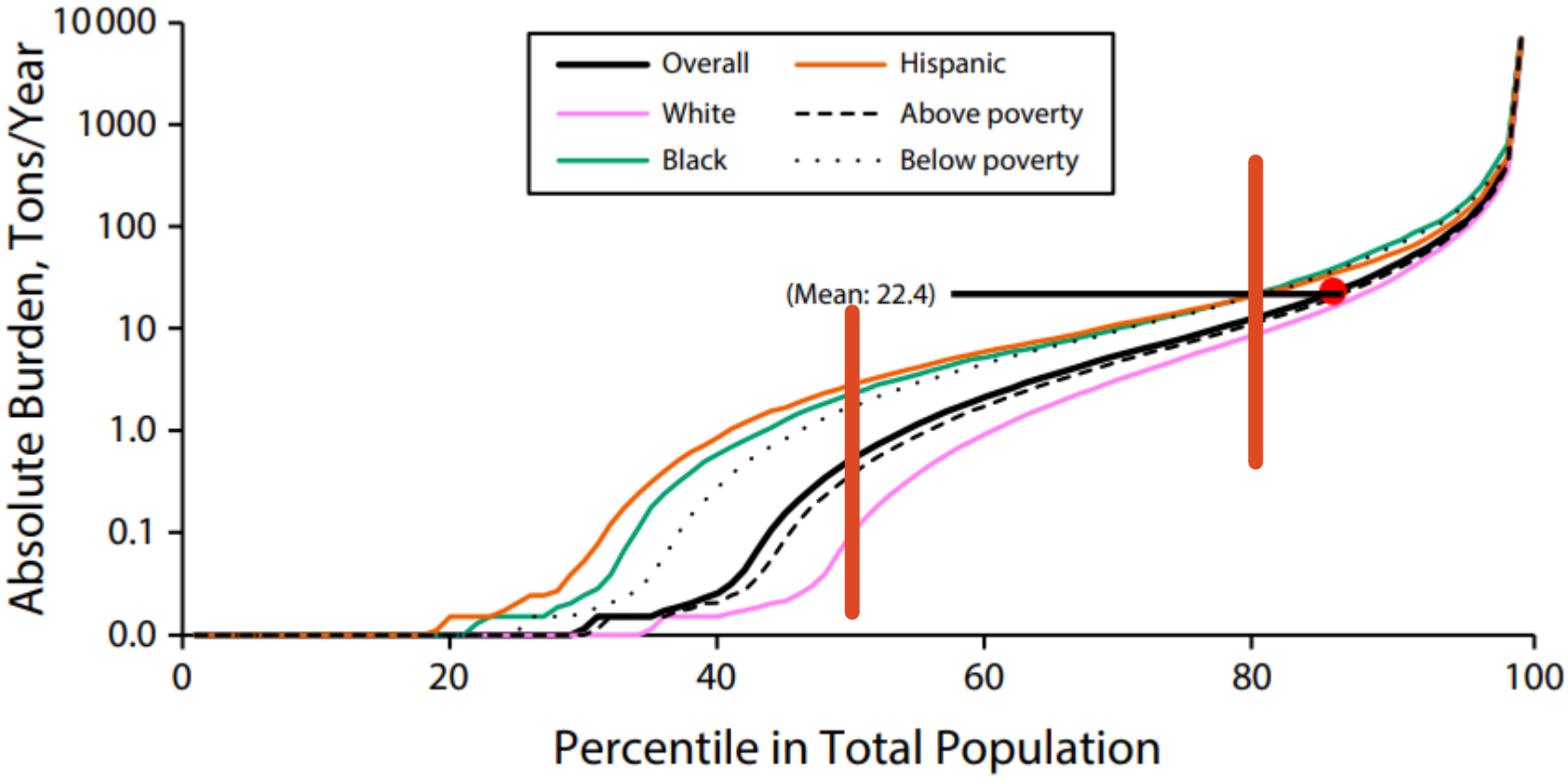
AIR POLLUTION

Proximity to facilities emitting PM2.5 significantly contributes

- Sources of pollution are often placed closer to minority communities
- Non-white communities are much more likely to be within 2.5 miles of a refinery or factory & be exposed to higher levels of fine particle pollution
  - In every state except New Mexico, North Dakota, Maryland, Virginia & DC, communities of color are exposed to more environmental pollution than white communities
- A study by NAACP in 2012 ranked all 378 coal-fired power plants in the US. They found the 6 million people living within 3 miles of those plants, had average income of $18K/yr and 39% were people of color
  - 75 of those plants received a “failing” grade bc they were responsible for 14% of emissions from all US plants
    - The 4 million people living within 3 miles those 75 plants have average income of $17K and 53% are minorities

Am J Public Health. 2018 April; 108(4): 480–485.

DISTRIBUTION OF ABSOLUTE BURDENS OF PM2.5 EMISSIONS FROM NEARBY FACILITIES IN THE 2011 NATIONAL EMISSIONS INVENTORY, STRATIFIED BY RACE/ETHNICITY AND POVERTY STATUS: AMERICAN COMMUNITY SURVEY, UNITED STATES, 2009–2013



Note. PM2.5 = particulate matter of 2.5 micrometers in diameter or less. Burden scale (y-axis) is displayed logarithmically. Poverty level determined by the US Census Bureau in 2013.

Am J Public Health. 2018 April; 108(4): 480–485.

TABLE 1—Mean Absolute and Proportional Burdens From Facilities Emitting PM in the 2011 National Emissions Inventory, Selected Subgroups: American Community Survey, United States, 2009–2013

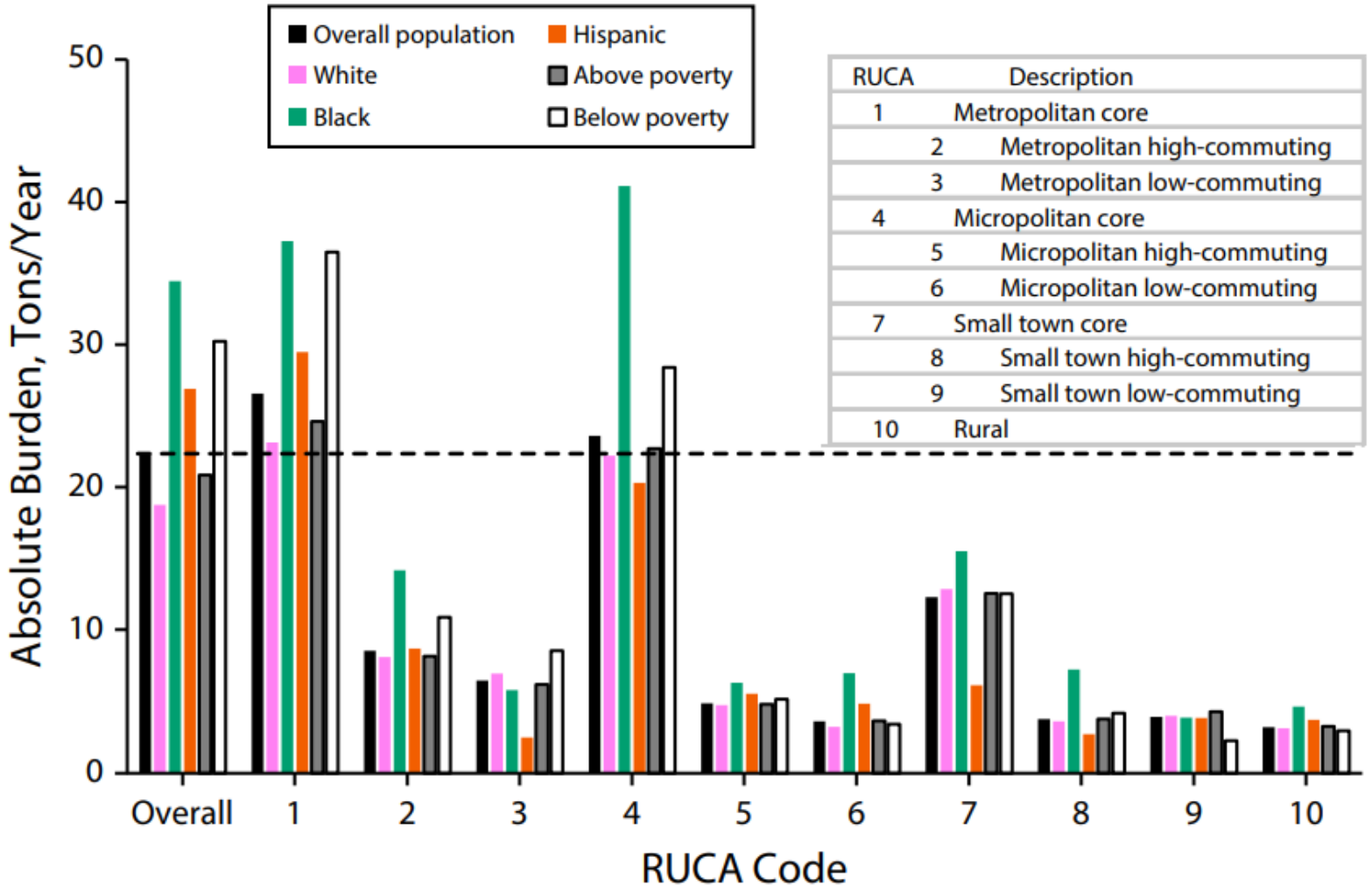
Variable	Proportion of Population, %	$PM_{2.5}$ Burden, Absolute (Proportional)	PM_{10} Burden, Absolute (Proportional)	Facility Burden, Absolute (Proportional)
Overall population	1.00	22.4 (. . .)	29.2 (. . .)	5.7 (. . .)
Race/ethnicity[a]				
White	0.63	18.8 (0.84)	24.7 (0.85)	4.1 (0.72)
Non-White	0.37	28.6 (1.28)	37.0 (1.27)	8.5 (1.49)
Black	0.12	34.5 (1.54)	43.6 (1.49)	6.2 (1.09)
Hispanic	0.17	26.9 (1.20)	35.9 (1.23)	9.8 (1.70)
Poverty level				
Above poverty	0.85	20.9 (0.93)	27.2 (0.93)	5.5 (0.95)
Below poverty	0.15	30.3 (1.35)	39.3 (1.35)	7.2 (1.26)

Note. PM = particulate matter; PM2.5 = PM of ≤ 2.5 μm in diameter; PM10 = PM of ≤ 10 μm in diameter. Poverty level determined by the US Census Bureau in 2013. Burdens represent the PM emissions or the number of facilities in the 2011 National Emissions Inventory that are near the block group of residence for an average individual in the 2009–2013 American Community Survey population. Absolute burden units for PM emissions are tons/year; for facilities, they are the total number. Proportional burden is the ratio of subgroup burden to overall population burden.

[a]"White" refers to only non-Hispanic Whites; "non-White" refers to all others. Included in the latter group are Black (non-Hispanic) and Hispanic (any race).

Am J Public Health. 2018 April; 108(4): 480–485.

RUCA-STRATIFIED ABSOLUTE BURDENS OF PM2.5 EMISSIONS FROM NEARBY FACILITIES IN THE 2011 NATIONAL EMISSIONS INVENTORY, FURTHER STRATIFIED BY RACE/ETHNICITY AND POVERTY STATUS: AMERICAN COMMUNITY SURVEY, UNITED STATES, 2009–2013



RUCA	Description
1	Metropolitan core
2	Metropolitan high-commuting
3	Metropolitan low-commuting
4	Micropolitan core
5	Micropolitan high-commuting
6	Micropolitan low-commuting
7	Small town core
8	Small town high-commuting
9	Small town low-commuting
10	Rural

Am J Public Health. 2018 April; 108(4): 480–485.

EXTREME WEATHER

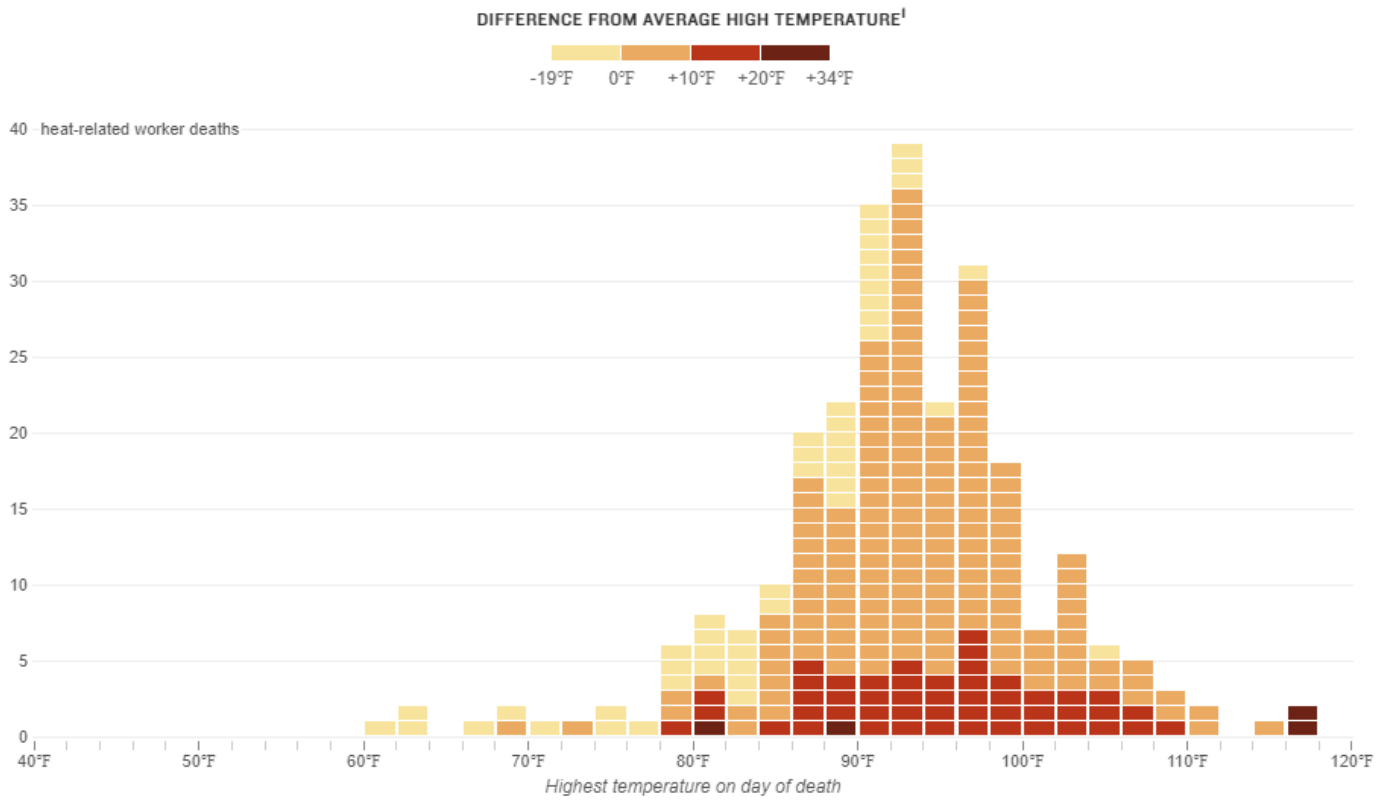
- Increased extreme events like heat waves & hurricanes are expected even in the US
  - Many communities of color live in low-lying areas more prone to flooding
- Currently, counties w/large black populations are exposed to 2-3x more extreme heat days per year on average compared to counties w/fewer black populations
  - By midcentury, extreme heat days estimated to increase to >20x

Kristina Dahl et al 2019 Environ. Res. Commun. 1 075002

HEAT

Most Heat-Related Worker Deaths Happened On 90°-Plus, Hotter-Than-Average Days

The deaths of 267 workers from heat-related causes in the U.S. from 2010 to 2020 show a link to unusually hot days. Each block represents one such death.



Notes

1. Difference between the highest area temperature recorded on day of death and the average high area temperature around that date for the past 40 years.

Source: U.S. Occupational Safety and Health Administration and PRISM Climate Group

Credit: Data analysis by Robert Benincasa/NPR, Cascade Tuholske and David Nickerson/Columbia University. Graphic by Duy Nguyen and Ruth Talbot/NPR.

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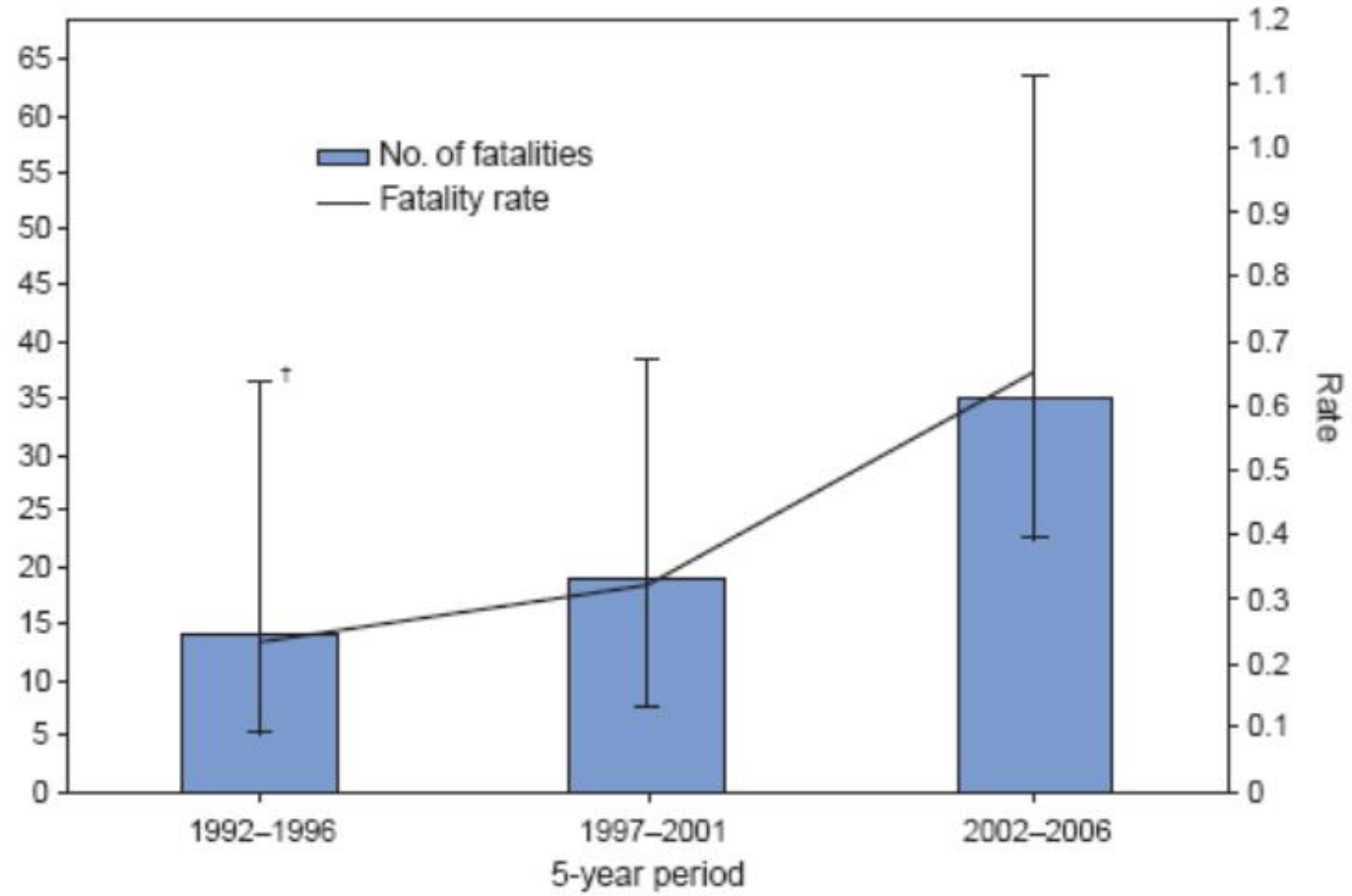
FIGURE. Number and rate* of heat-related deaths among crop workers, by 5-year period — United States, 1992–2006

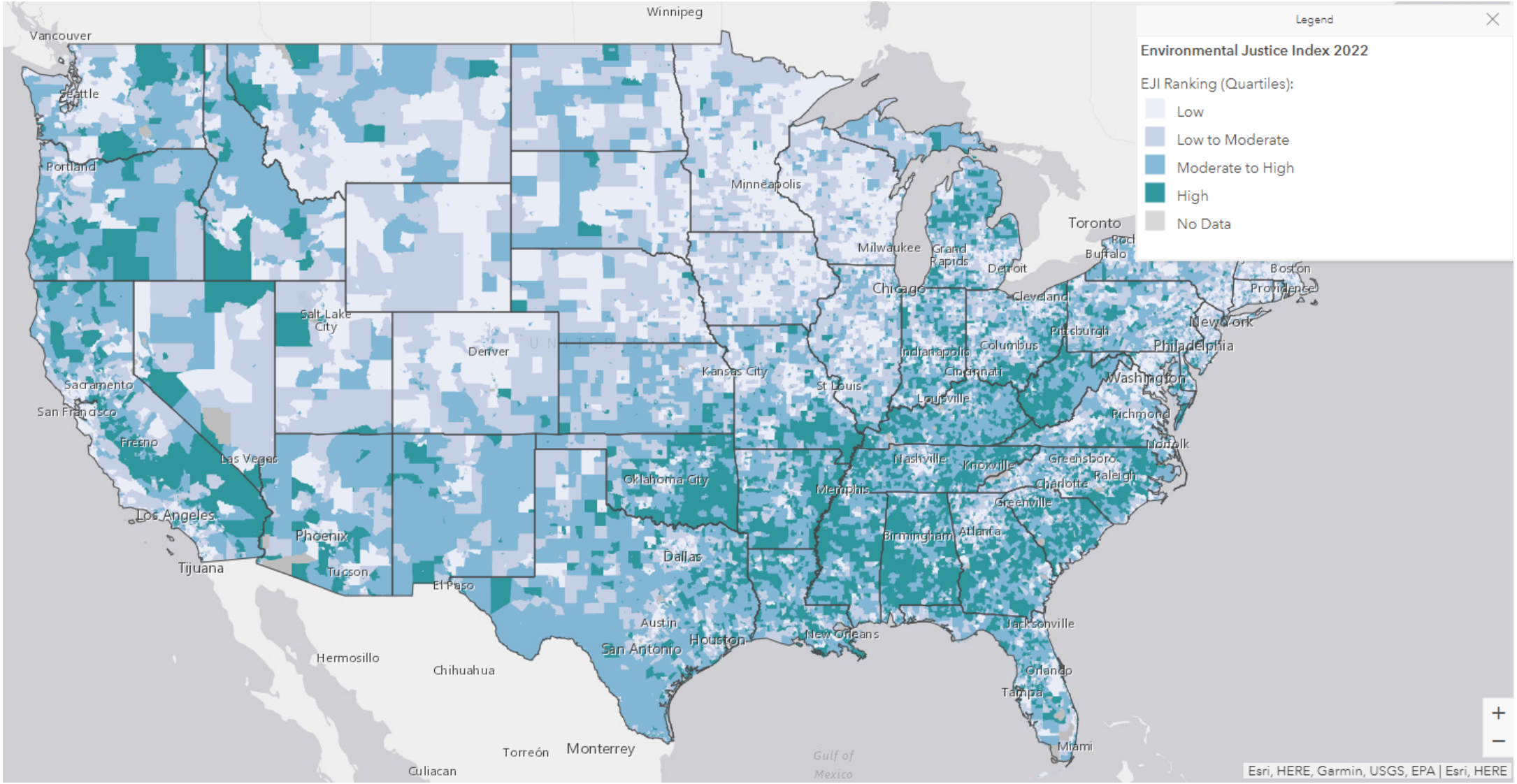


* Per 100,000 workers. Rates calculated using annual national average estimates of employed civilians aged ≥15 years based on the Current Population Survey.

† 95% confidence interval for fatality rate.

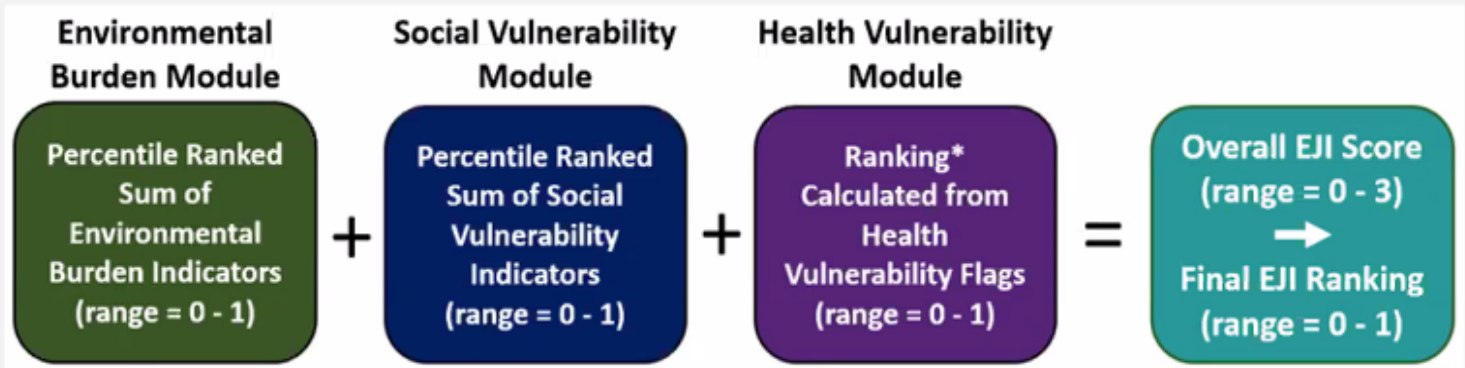
CDC ENVIRONMENTAL JUSTICE INDEX

CDC ENVIRONMENTAL JUSTICE INDEX 2022



EJI Model Methods

- Unit of analysis – U.S. census tract
- Percentile ranking methods:
  - Peer-reviewed and tested
  - Simple and effective
  - Easy to communicate and adapt to meet user needs
- **EJI = SVM + EBM + HVM**



**Ranking calculated by multiplying the sum of health vulnerability flags (n = 5) by 0.2 to produce a number between 0 - 1.*

Slide courtesy of CDC.gov

HEALTH VULNERABILITY MODULE

Health Vulnerability	Pre-existing Chronic Disease Burden	Asthma*
		Cancer*
		High Blood Pressure*
		Diabetes*
		Poor Mental Health*

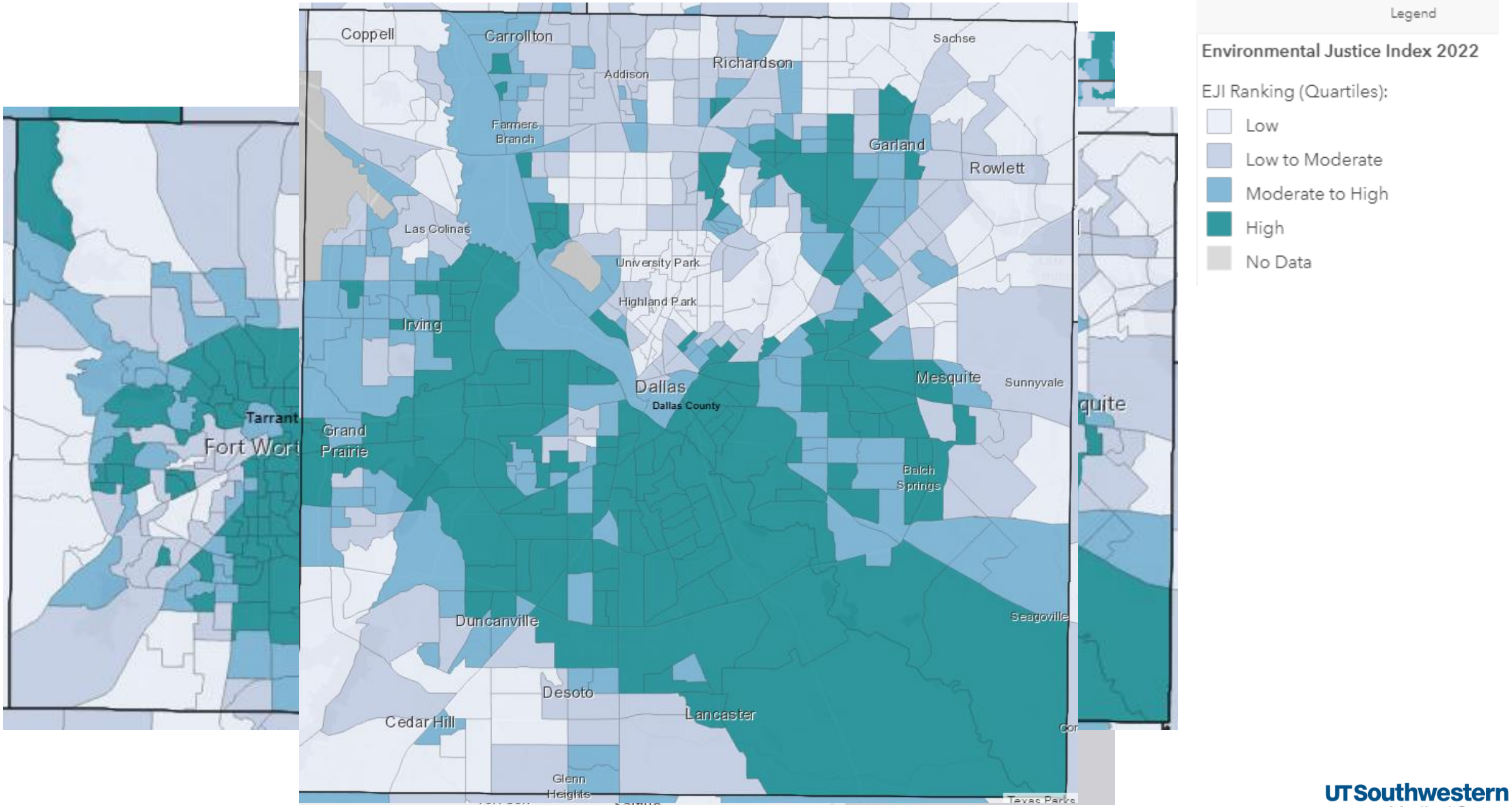
*These indicators represent high estimated prevalence of each chronic disease – with high estimated prevalence defined here as higher prevalence than 66% of all US census tracts for a given measure.

SOCIAL VULNERABILITY MODULE

Social Vulnerability	Racial/ Ethnic Minority Status	Minority Status
	Socioeconomic Status	Poverty
		No High School Diploma
		Unemployment
		Housing Tenure
		Housing Burdened Lower-Income Households
		Lack of Health Insurance
		Lack of Broadband Access
	Household Characteristics	Age 65 and Older
		Age 17 and Younger
		Civilian with a Disability
		Speaks English "Less than Well"
	Housing Type	Group Quarters
		Mobile Homes

ENVIRONMENTAL BURDEN MODULE

cdc.gov



cdc.gov

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TEXAS & DFW

THE TREND CONTINUES

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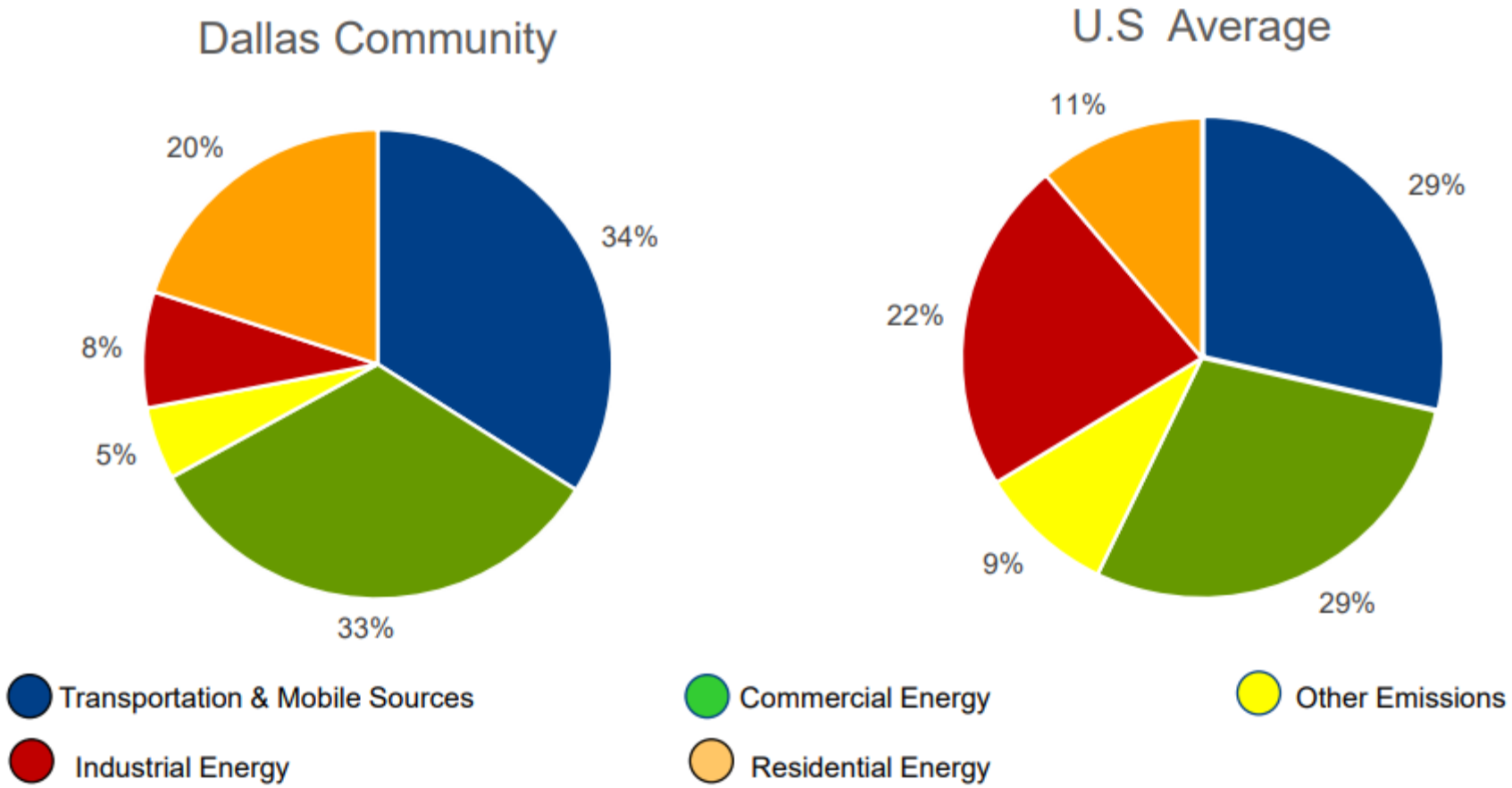
AIR POLLUTION DFW

DFW AREA

- Ranked 17 for high ozone days out of 226 metropolitan areas
- Ranked 42 for 24-hour particle pollution out of 216 metropolitan areas
- Ranked 50 for annual particle pollution out of 199 metropolitan areas
- 9.5% of Dallas ISD students has asthma.
  - The national average is 8.3%
- Dallas County leads the region for hospitalizations for childhood asthma

American Lung Association “State of the Air” report card

Dallas' Community Emissions



ZIP CODE MATTERS

THE TREND CONTINUES EVEN WITHIN THE CITY ITSELF

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ZIP CODE MATTERS

- In the City of Dallas there is a 15-year difference in life expectancy depending on the zip code
- Nearly 300 industrial sites emit pollution in Black & Latino communities in Dallas
- In Joppa (a section of the city settled by formerly enslaved people in 1872), it is estimated 0.42 tons of air pollution per person per year
- In Floral Farms, it is estimated 4.48 tons of air pollution per person per year
- In District 8, where particulate matter is highest, the life expectancy in one of its zip codes is 70.8yrs overall compared to 82 years in University Park

GAF and Browder Yard, West Dallas District 6

McCommas Landfill, Floral Farms Distrct 8

Union Pacific Miller Yard, Joppa District 7

Paul Quinn College, Spring 2020: Poisoned by Zip Code

Daniel Beshara P.C., September 2020: Industrial Zoning in Residential Areas of Dallas

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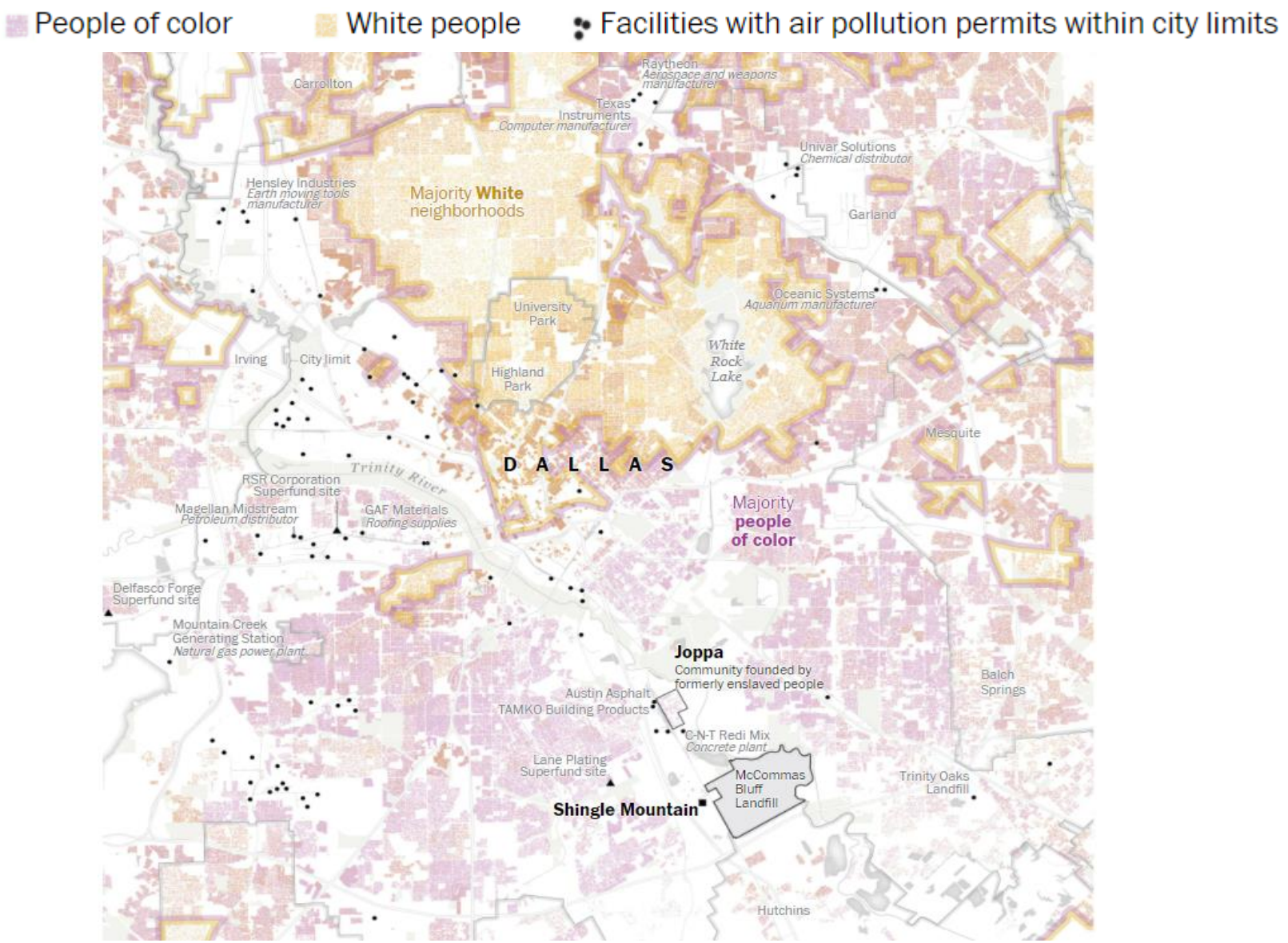
Nearly all permitted polluters in Dallas are in minority neighborhoods



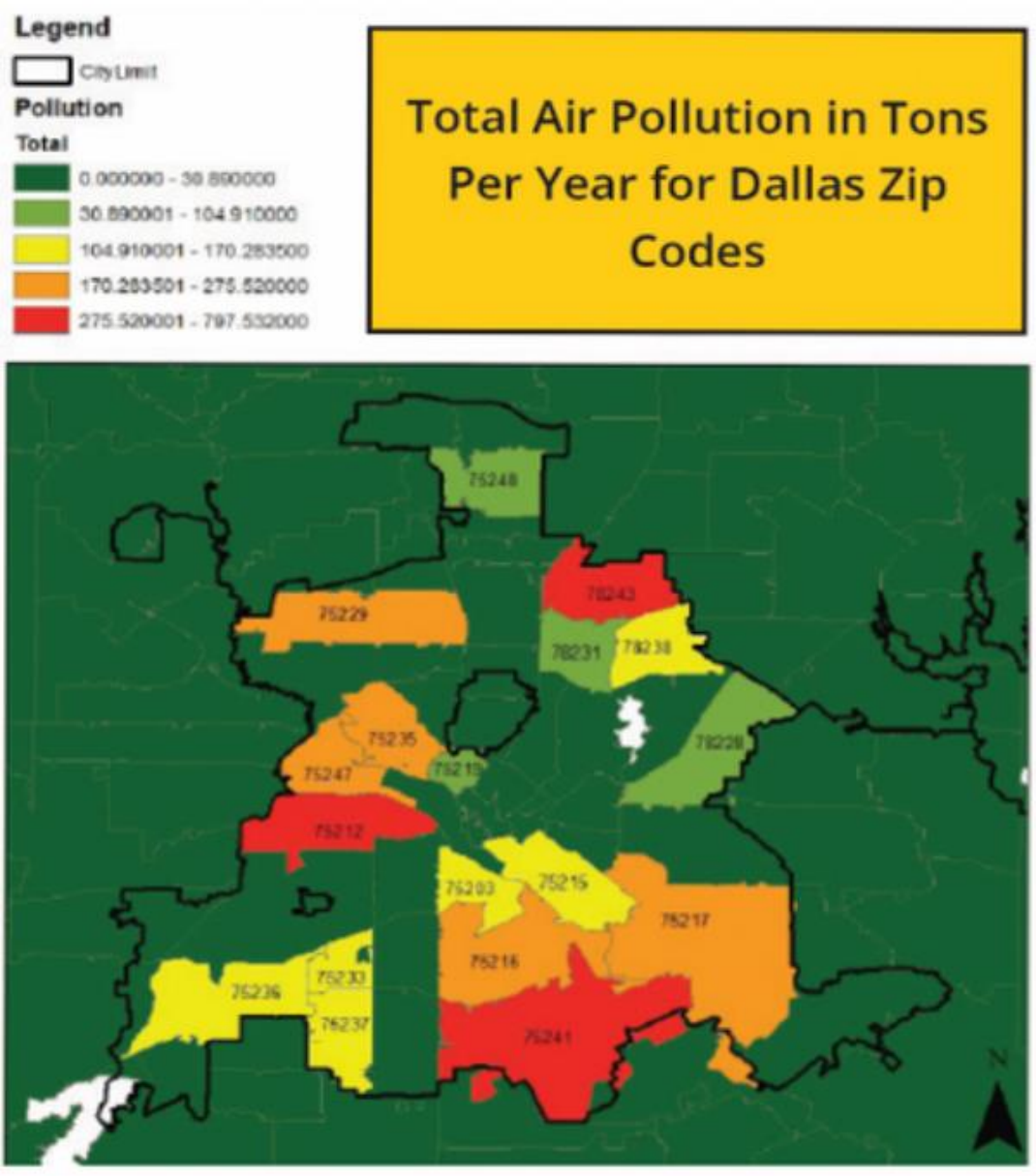


Figure 7. Air pollution burden by zip code in Dallas.

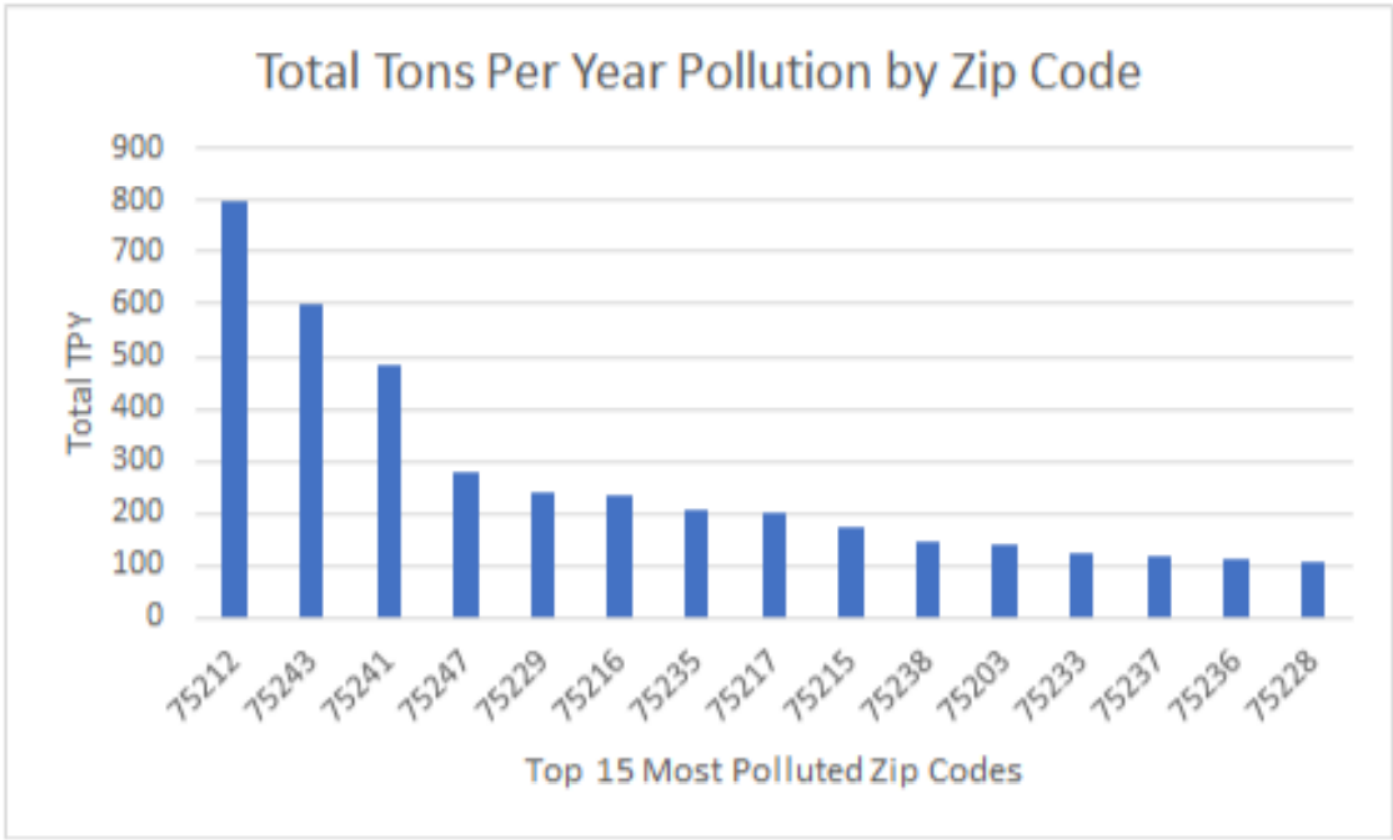


Figure 8. Shows the tons per year of air pollution by zip code in the City of Dallas.

Data from Paul Quinn College: Urban Research Initiative Annual Emissions Inventory Report 2020. Figures from GAF's Gotta Go: Case for City Amortization document.

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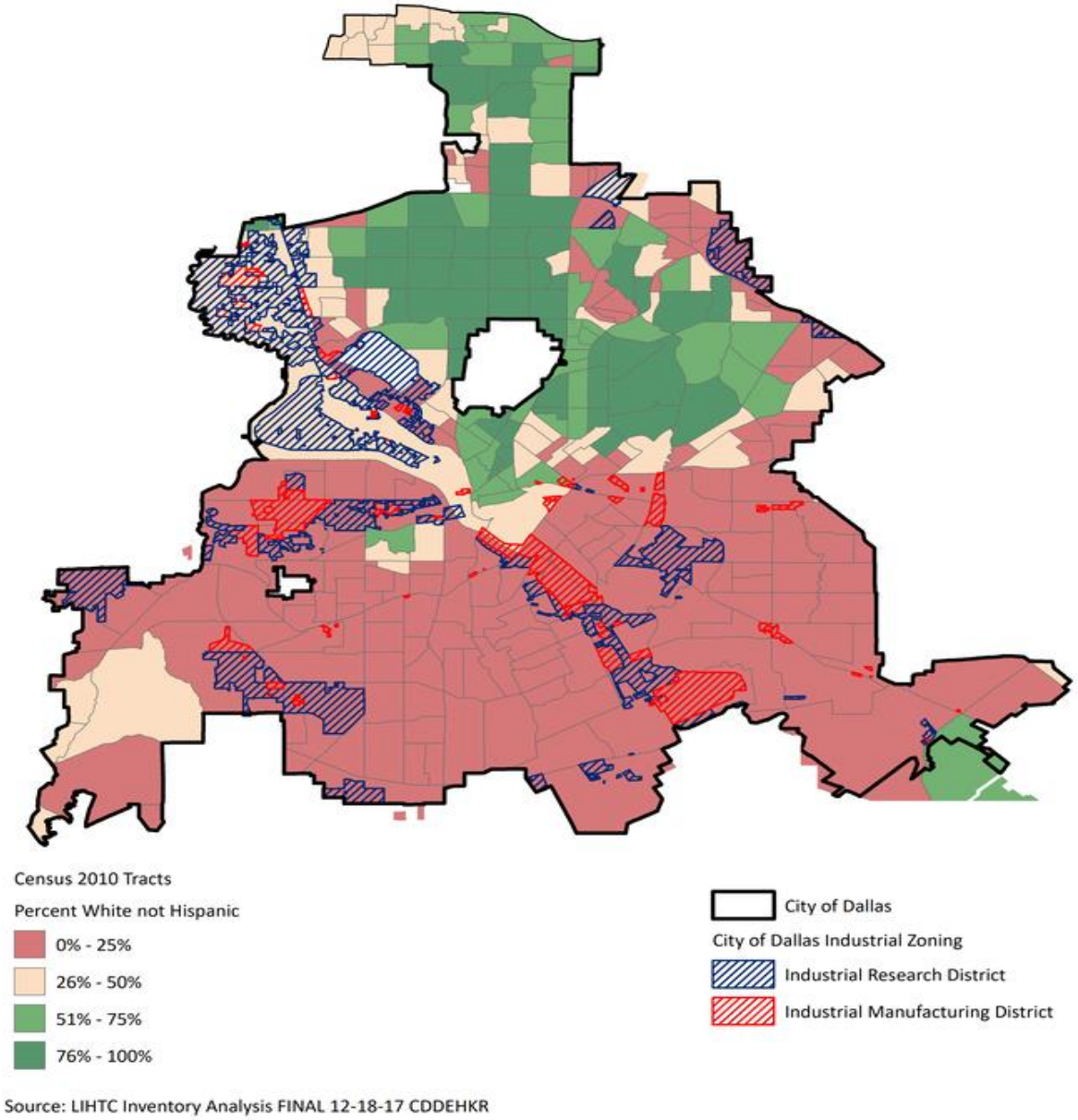
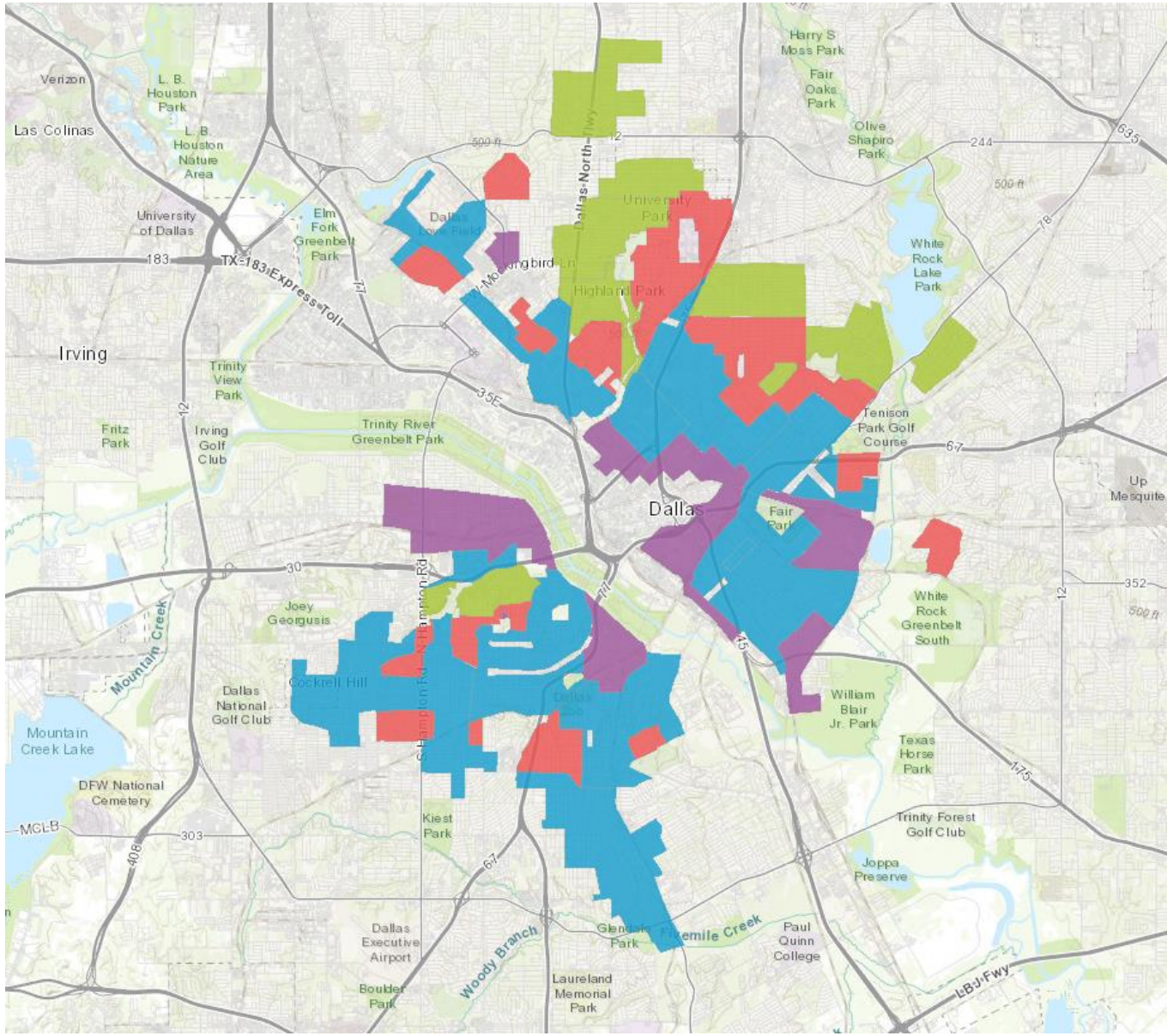
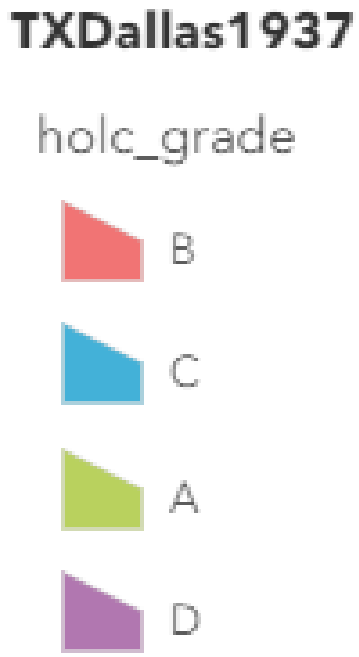
INDUSTRIAL ZONING & POPULATION DEMOGRAPHICS



HOMEOWNERS LOAN CORPORATION RISK MAP - 1937





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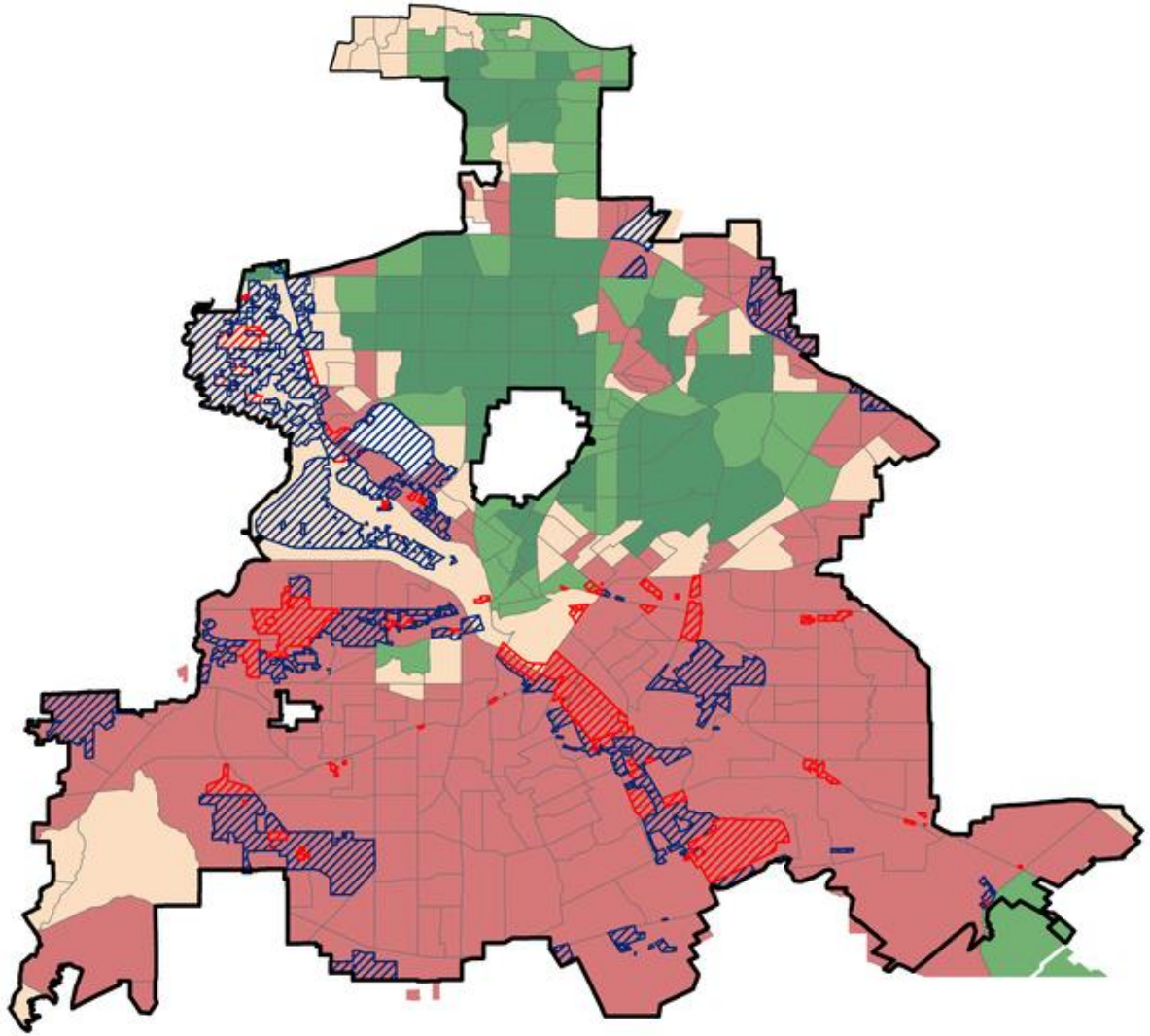


Census 2010 Tracts

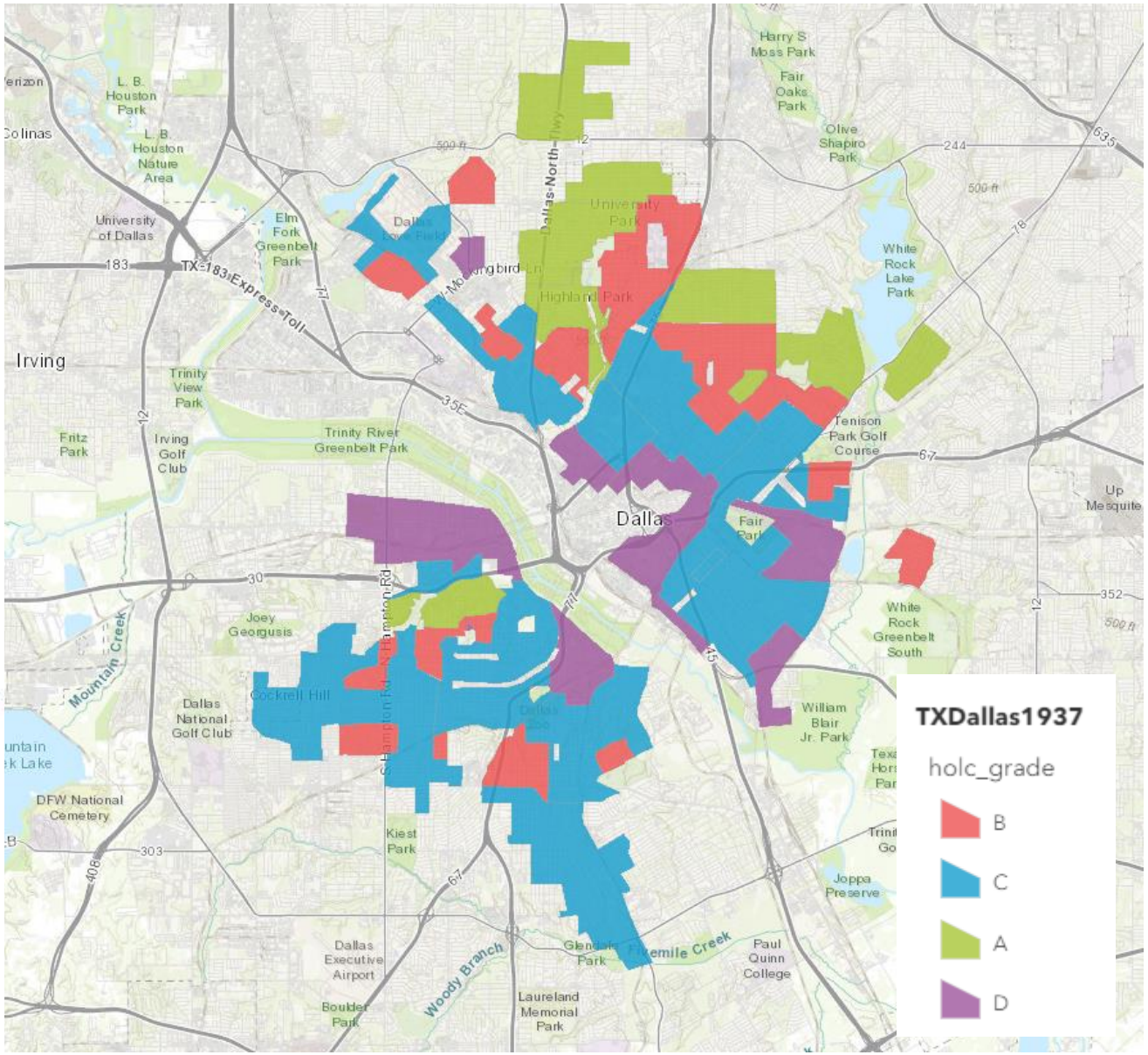
Percent White not Hispanic

- 0% - 25%
- 26% - 50%
- 51% - 75%
- 76% - 100%

- City of Dallas

City of Dallas Industrial Zoning

- Industrial Research District
- Industrial Manufacturing District



Source: LIHTC Inventory Analysis FINAL 12-18-17 CDDEHKR

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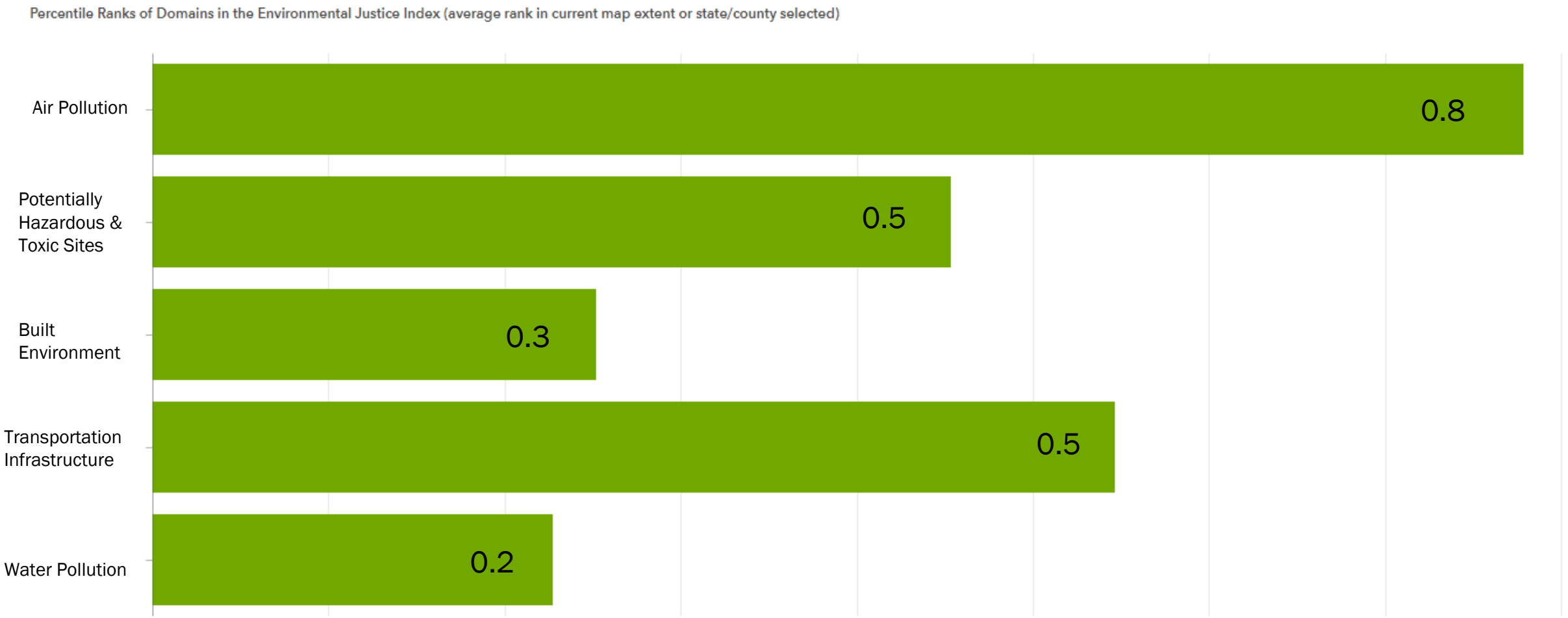
PERCENTILE RANK OF DOMAINS IN EJI – DALLAS COUNTY



ZIP CODE MATTERS: WEST DALLAS

- Zip code 75212 has the largest amount of permitted air pollution in Dallas,
- Of the >26,000 people living in 75212, ~¼ live below the poverty line, and most are Hispanic &/or Black.

Texas Commission on Environmental Quality and Environmental Protection Agency data

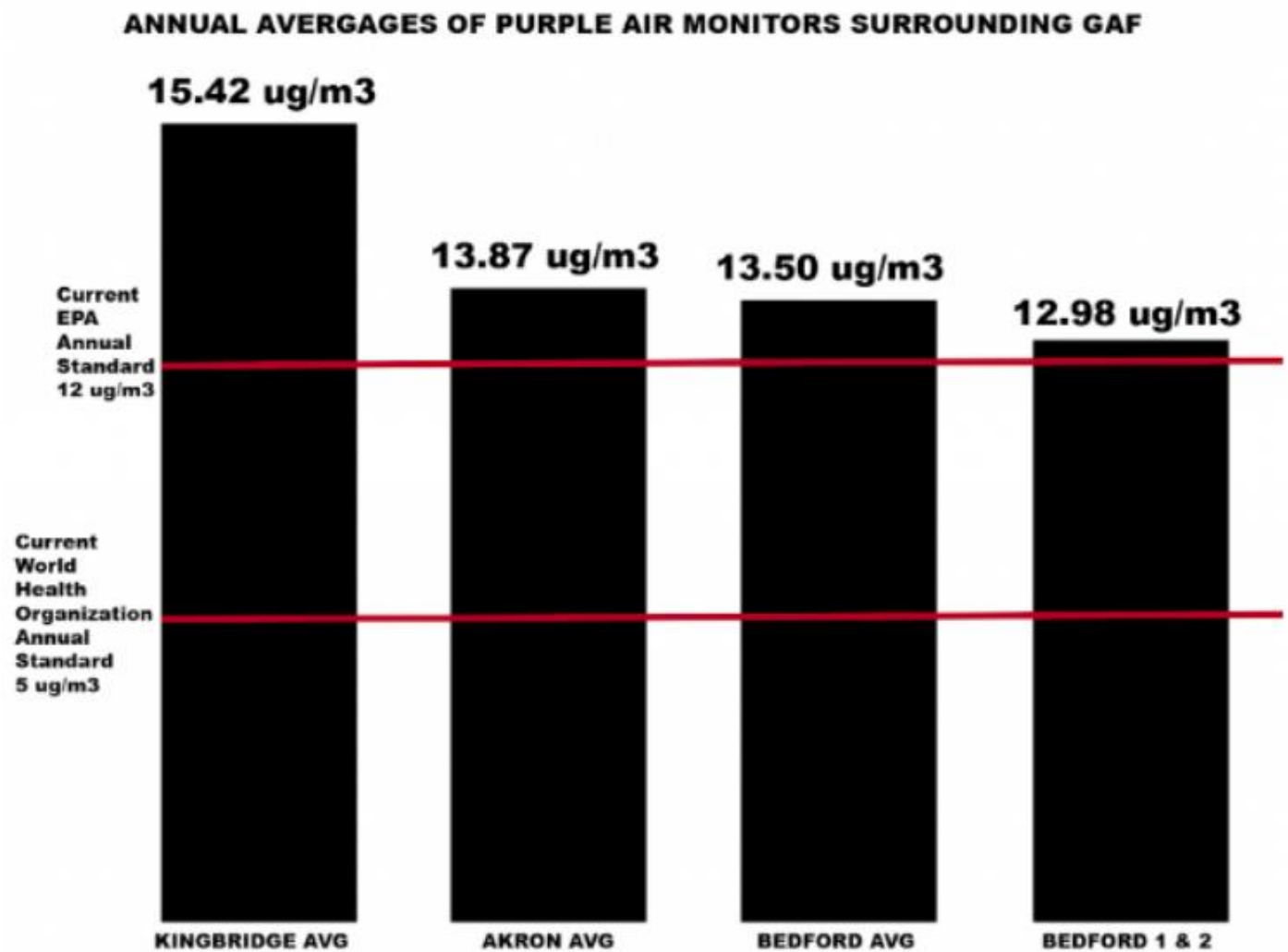
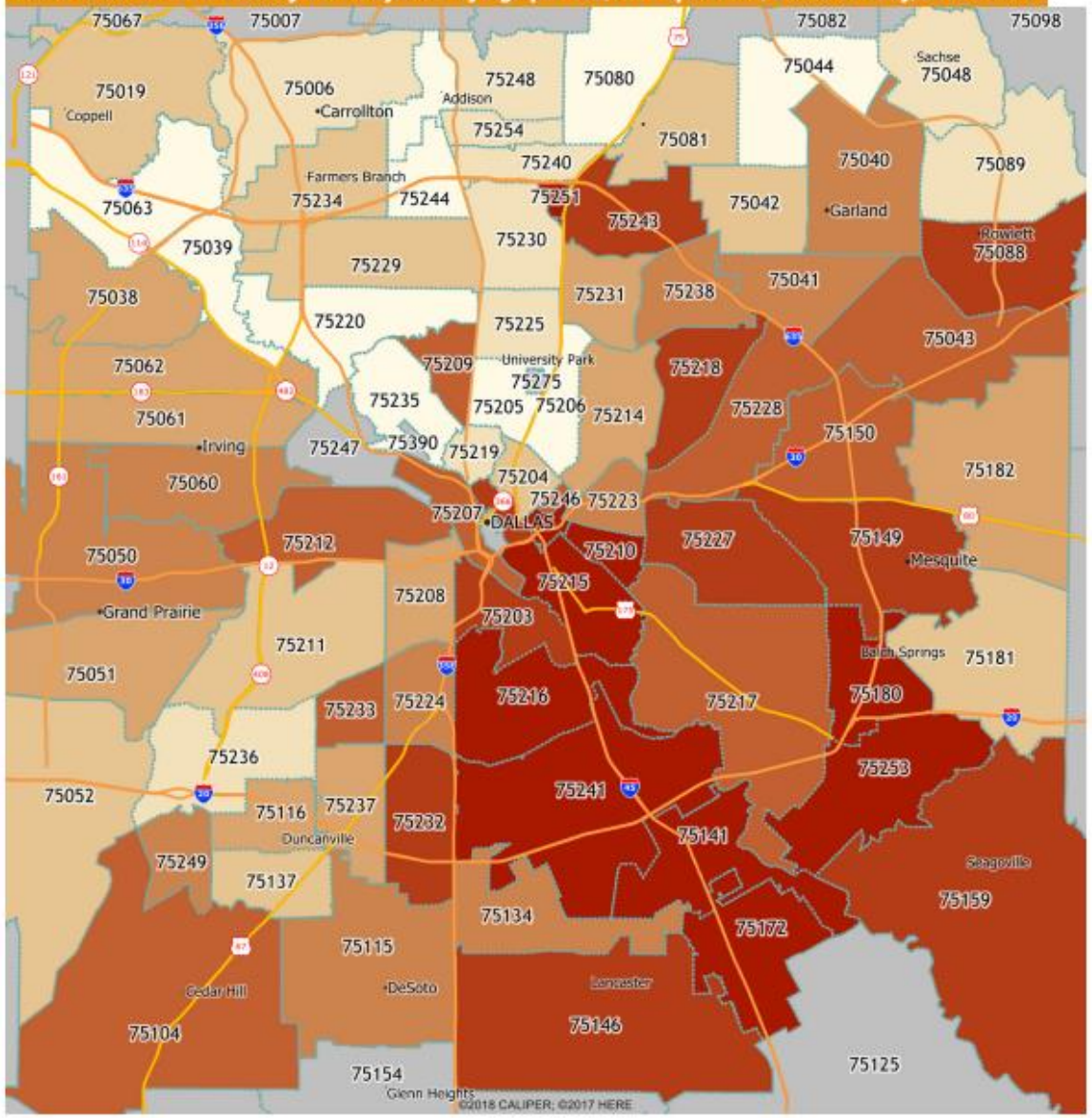


Figure 20. Annual averages of PM pollution levels by monitor in relation to WHO and EPA standards.

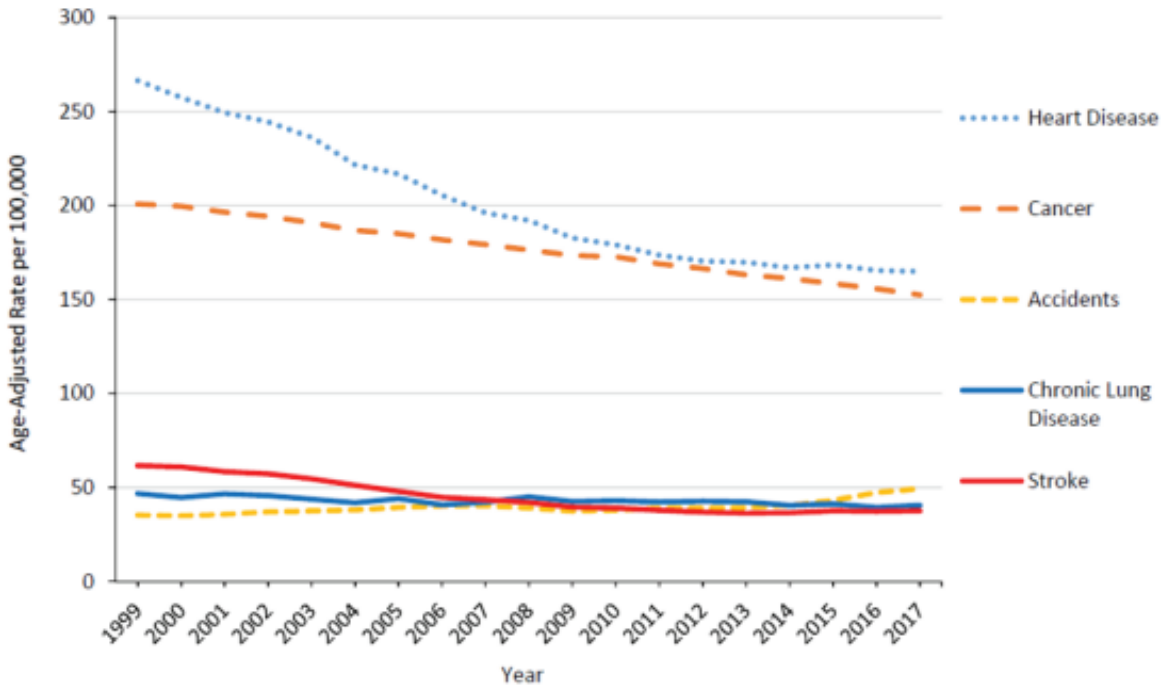
PARKLAND COMMUNITY HEALTH NEEDS ASSESSMENT 2019

FIGURE 19. All-Cause Mortality Rate Adjusted by Age per 100,000 Population, Dallas County, 2012 – 2016



Age Adjustment uses 2000 Standard Population
Data Source: Texas Department of State Health Services

FIGURE 18. Top Five Leading Causes of Death Mortality Rates Trends, United States, 1999 - 2017



Age Adjustment uses 2000 Standard Population

Data Source: CDC Wonder

5-Digit ZIP Code
County

Age Adjusted Accident Mortality Rate

- 25.00 and below
- 25.00 to 28.80
- 28.80 to 31.60
- 31.60 to 35.60
- 35.60 to 38.20
- 38.20 to 40.00
- 40.00 to 46.80
- 46.80 and above
- Insufficient Data

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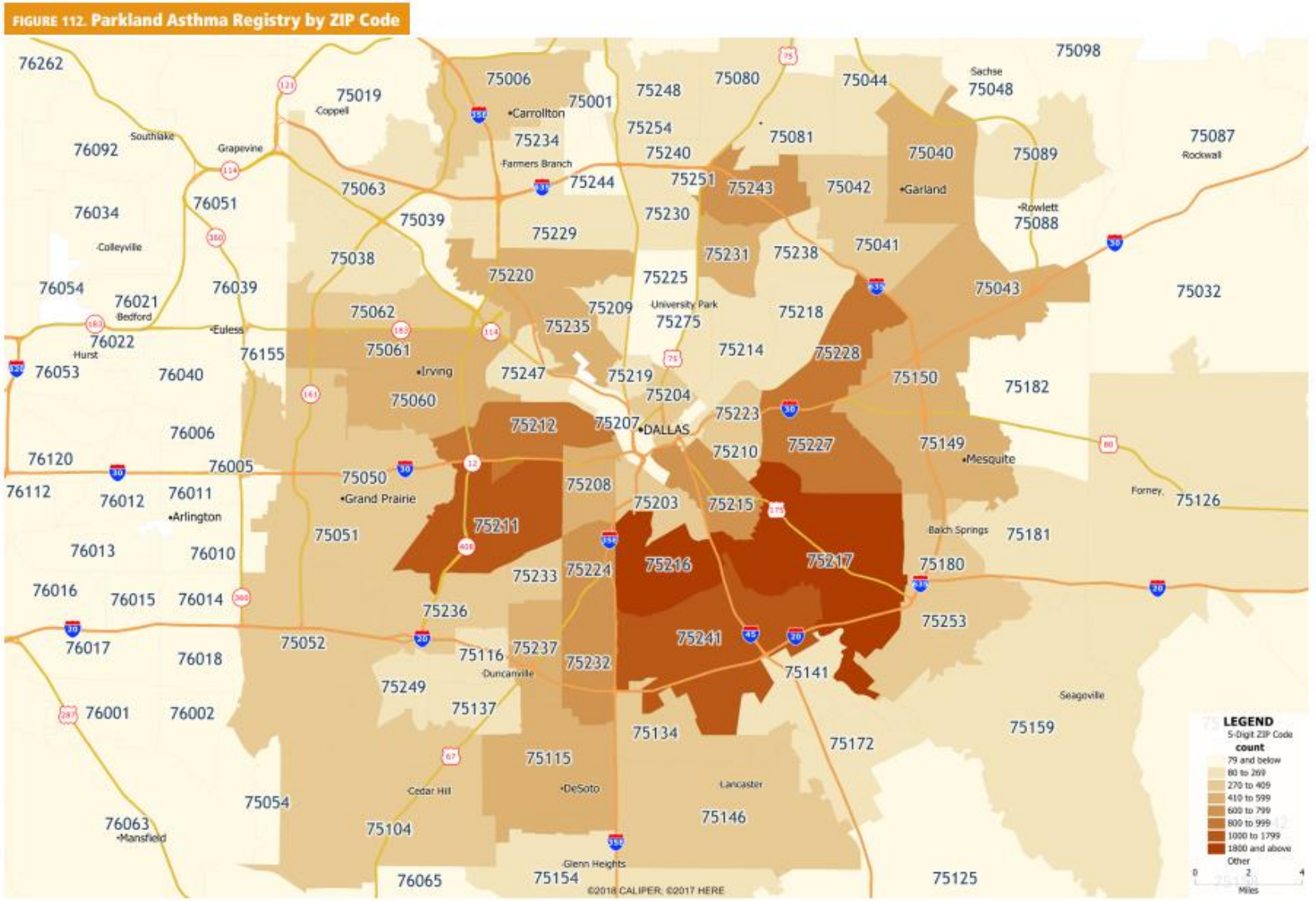
PARKLAND CHNA – ASTHMA REGISTRY



Data Source: Parkland Asthma Registry

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Pediatric Asthma Surveillance System (PASS)

PCCI | DCHHS | Parkland

Select Indicator

Pediatric Asthma Vulner...

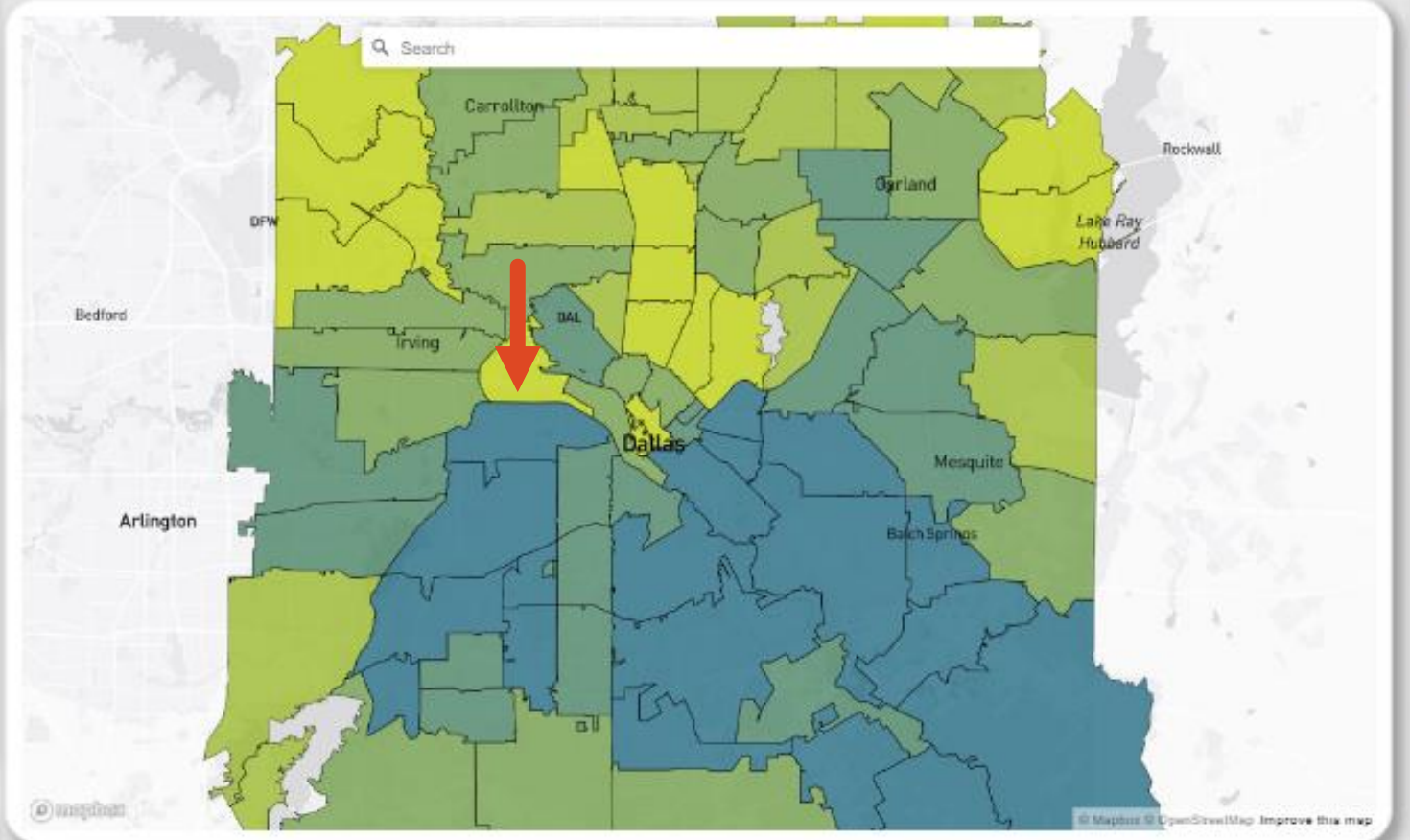
- Pediatric Asthma Vulnerability I...
- 15-17 yo Female
- 18-19 yo Female
- Air Quality (PM 2.5)
- Automobiles per Household
- Black (Non-Hispanic)
- COPD Population
- Emergency Dept Visits (90d)
- Hispanic

Geo Name	Score
75125	0.61
75227	0.61
75172	0.61
75212	0.61
75210	0.60
75217	0.60
75233	0.58
75236	0.55

3.01M
Total Population

Zip Code | Census Tract

Pediatric Asthma Vulnerability Index - Census Zip Code Tabulation Area Level



Vulnerability Level

Very Low | Low | Moderate | High | Very High

18-19 yo Female	0.65
Air Quality (PM 2.5)	0.58
15-17 yo Female	0.45
COPD Population	0.44
Hispanic	0.40
Automobiles per Household	0.33
Emergency Dept Visits (90d)	0.34
Black (Non-Hispanic)	0.29

Pediatric Asthma Surveillance System (PASS)

PCCI | DCHHS | Parkland

Select Indicator

Pediatric Asthma Vulner...

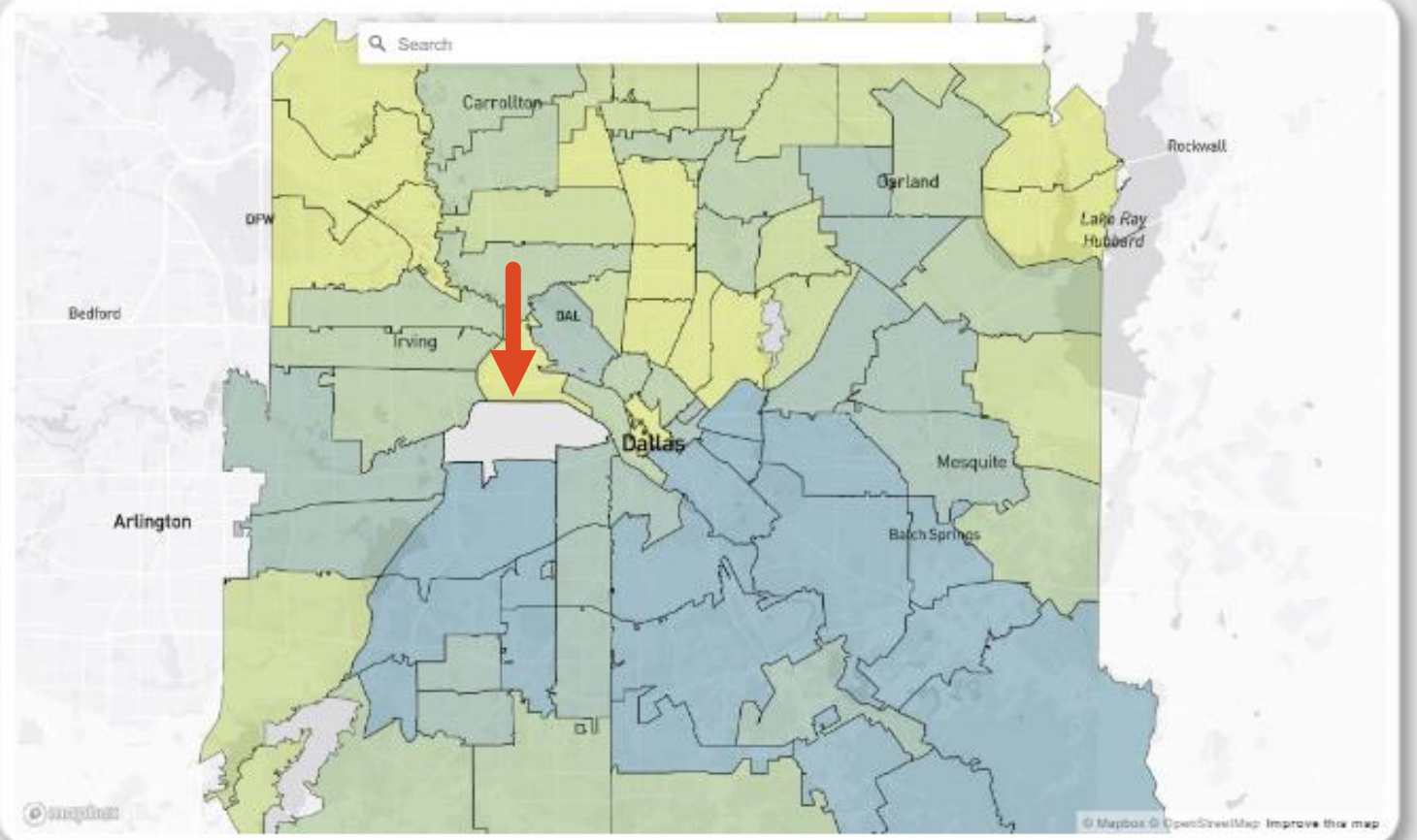
- Pediatric Asthma Vulnerability I...
- 15-17 yo Female
- 18-19 yo Female
- Air Quality (PM 2.5)
- Automobiles per Household
- Black (Non-Hispanic)
- COPD Population
- Emergency Dept Visits (90d)
- Hispanic

Geo Name	Score
75212	0.61

26.72K
Total Population

Zip Code | Census Tract

Pediatric Asthma Vulnerability Index - Census Zip Code Tabulation Area Level



Vulnerability Level

Very Low | Low | Moderate | High | Very High

Air Quality (PM 2.5)	0.89
Emergency Dept Visits (90d)	0.76
Hispanic	0.68
COPD Population	0.64
Black (Non-Hispanic)	0.40
18-19 yo Female	0.36
Automobiles per Household	0.29
15-17 yo Female	0.27

BACK TO CLIMATE

DALLAS

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CLIMATE CHANGE IN CITIES

Urban Heat Island (UHI) Effect

- Caused by displacement of trees/natural vegetation, by construction materials & impervious surfaces, that ultimately increases the amount of heat energy **absorbed and stored** on surfaces
- Defined as an urban/metro area with significantly higher temperatures than surrounding rural areas due to human activities.
- Can be felt differently within different urban neighborhoods with various levels of mitigation strategies in place

URBAN HEAT ISLAND

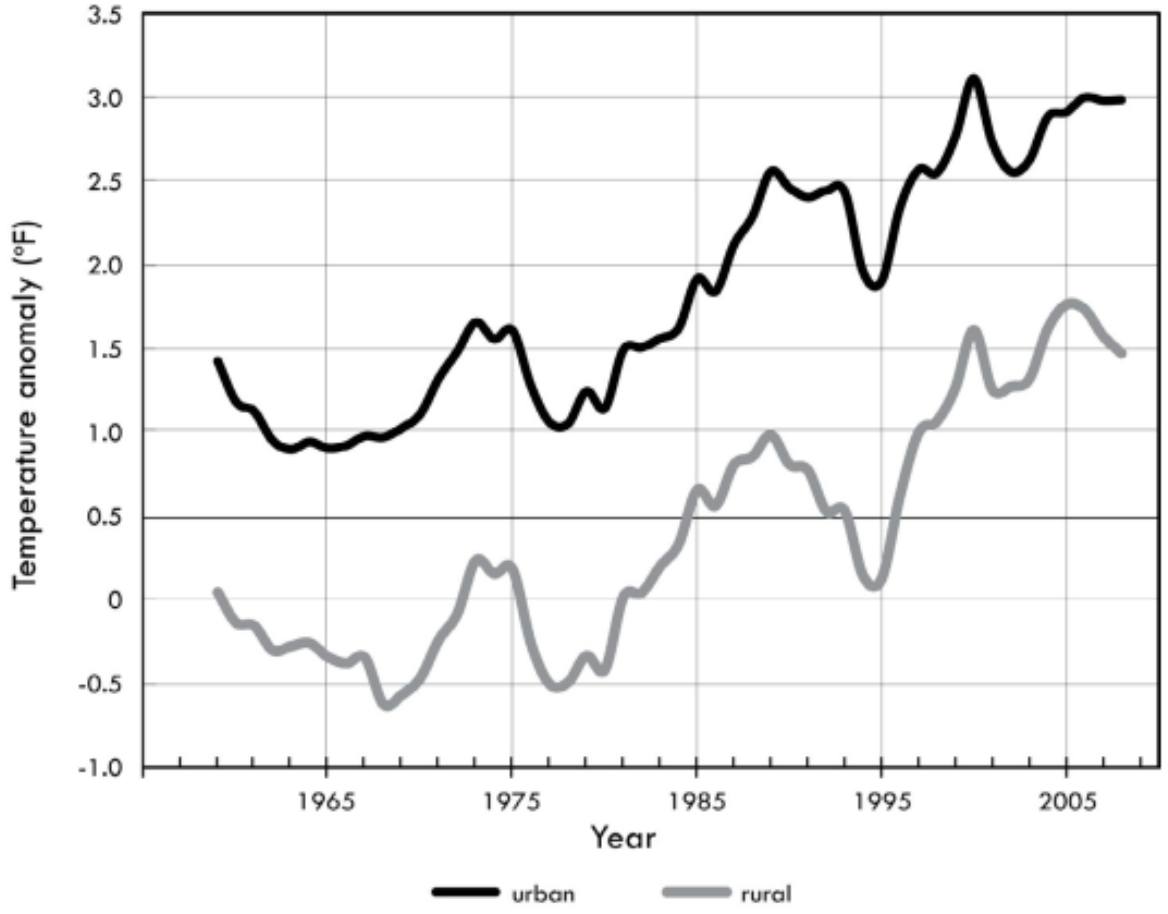

Figure 1.3 Urban and rural temperature trends in proximity to 50 large US cities (1961-2010)

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URBAN HEAT ISLAND

DALLAS

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THE DALLAS URBAN HEAT ISLAND MANAGEMENT STUDY 2017

- This study assessed the extent to which the Dallas area is warming due to urban development and deforestation, estimated the extent to which rising temperatures are impacting public health, and provided a scientific foundation for the development of urban heat management plans and programs.

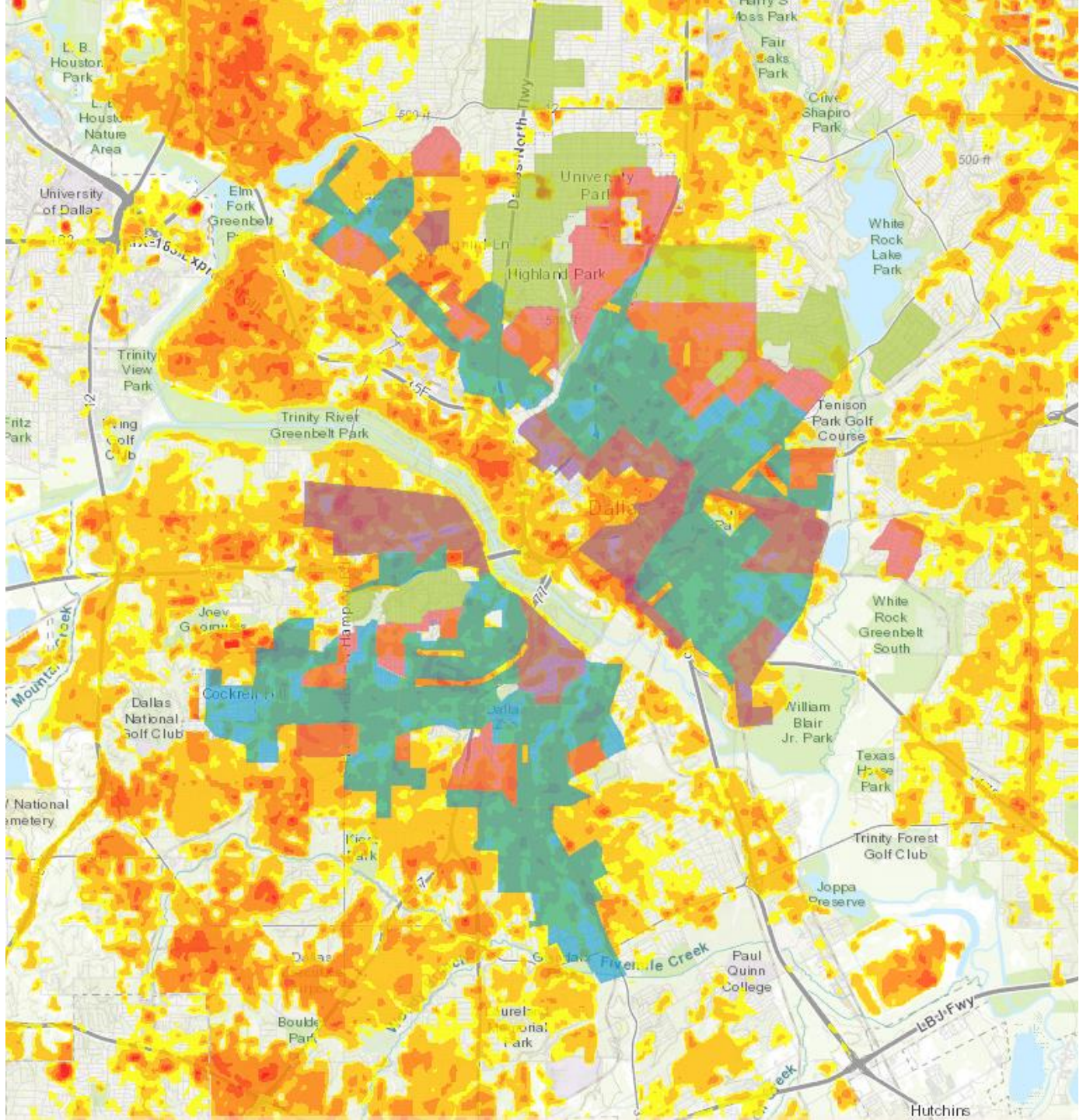
- Data from more than 4000 points across the city

- Models heat exposure and the potential impact from various heat management strategies.

HEAT ISLAND

- **Dallas**
  - >35% of Dallas is made up of impervious surfaces (rooftops, parking lots, highways, etc.)
    - Currently, the 23,464 park-land acres, & the Trinity Forest, do not provide enough shade to lower ambient air temperatures and mitigate the urban heat island effect
    - The area retains heat in buildings & pavement, and is up to 15ºF warmer than rural areas w/more trees & open space
  - The hottest areas of Dallas had an average high of 101ºF and low of 80ºF for 5 mos/yr.
  - Dallas County heat-related deaths peaked in 2011 at 52

Dallas Urban Heat Island Management Study. Texas Tree Foundation. 2017



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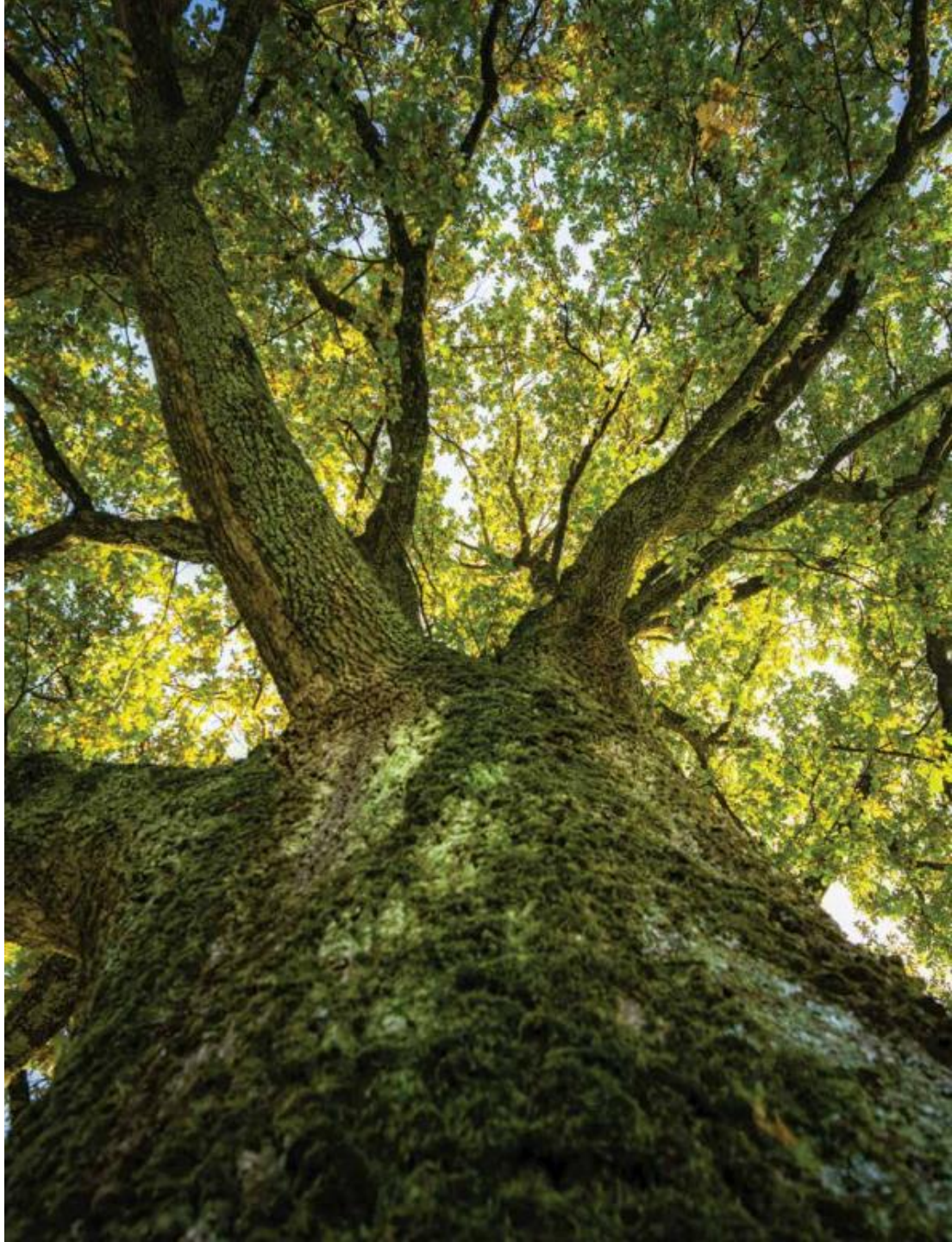
UHI MITIGATING STRATEGIES

- Trees & vegetations (preservation & planting)
  - A 40% increase in urban tree cover decreased air temperatures by ~1.8 to 3.6°F, with some areas reductions >10°F
- Engineering of roofing & surface paving materials to **reflect** incoming solar radiation
  - Surface temperatures of green roofs can be up to 90°F cooler than conventional roofs during the summer
- Redesign built environment to increase area surface water & wind ventilation



Dallas Urban Heat Island Management Study. Texas Tree Foundation. 2017

THANK YOU

QUESTIONS?

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Environmental & Climate Equity: A local perspective

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