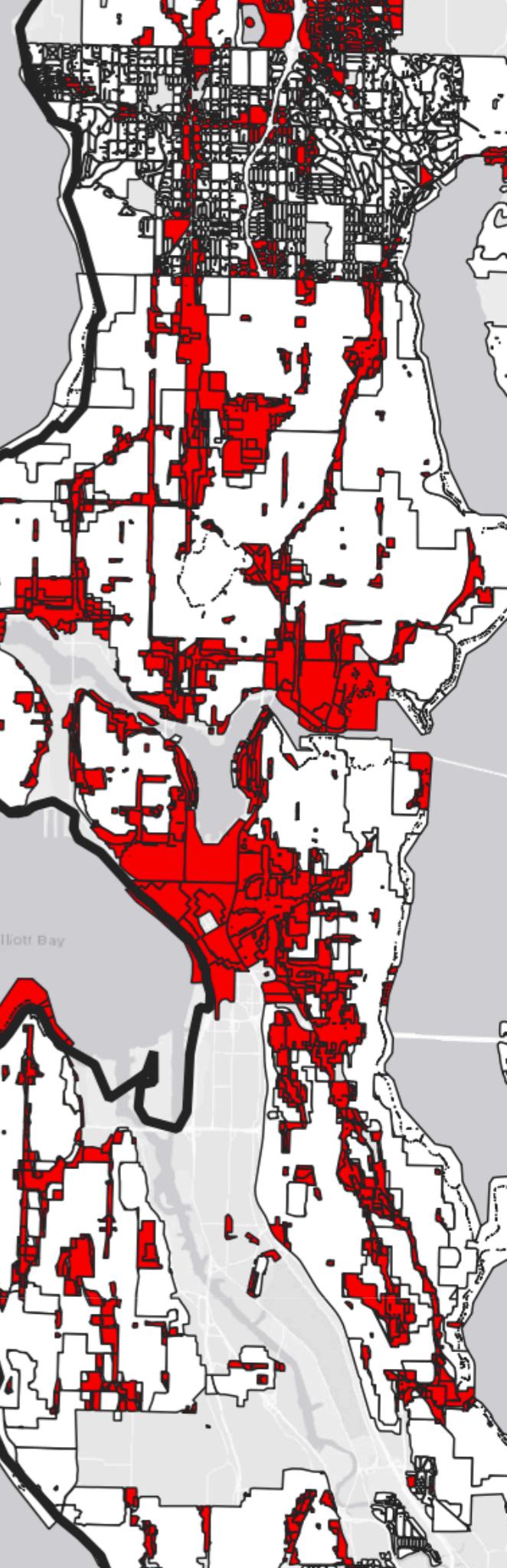


May 17th, 2024

The Zoning TRAP:

Land use and air
pollution exposure
disparities in the
Seattle area

Mackey Guenther
North Seattle College

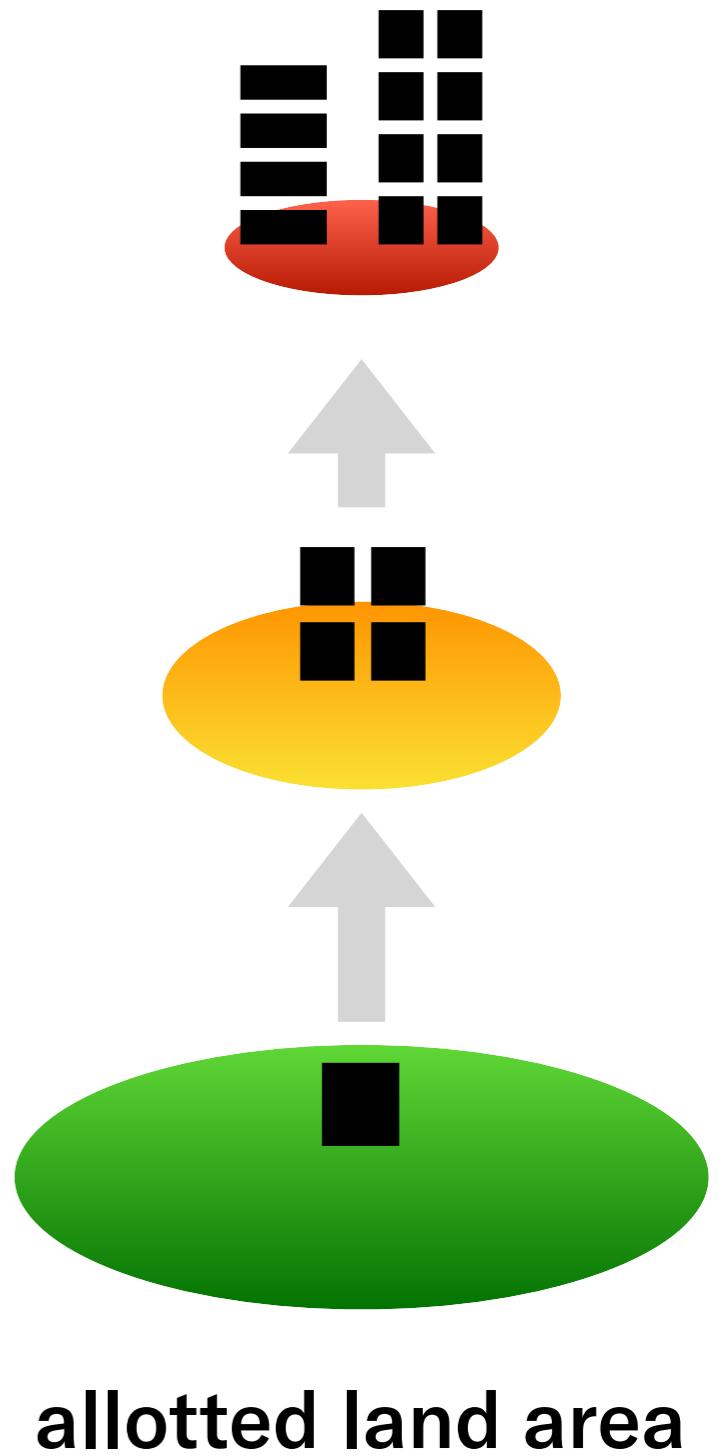


1

Background

Zoning: geographic production quotas for homes

- “What you can build, where”
- Unique to USA; born in 1920s
- Intended to limit apartments & segregate cities by income



WOULD YOU LIKE THIS CONDITION
NEXT YOUR HOME?

EIGHT COTTAGES ON ONE 60FT. LOT



ZONING WOULD PREVENT IT

CITY OF SEATTLE ZONING COMMISSION

**Seattle Zoning
Commission poster
1922**

“Apartment houses are the bane of the owner of the single-family dwelling.

They shut off light and air and completely change the character of the neighborhood.” [emphasis added]

Frank Cornish, City Attorney of Berkeley, CA (1915)

TRAP: traffic-related air pollution

(Also, “a trick by which someone is misled into acting contrary to their interests or intentions.”)

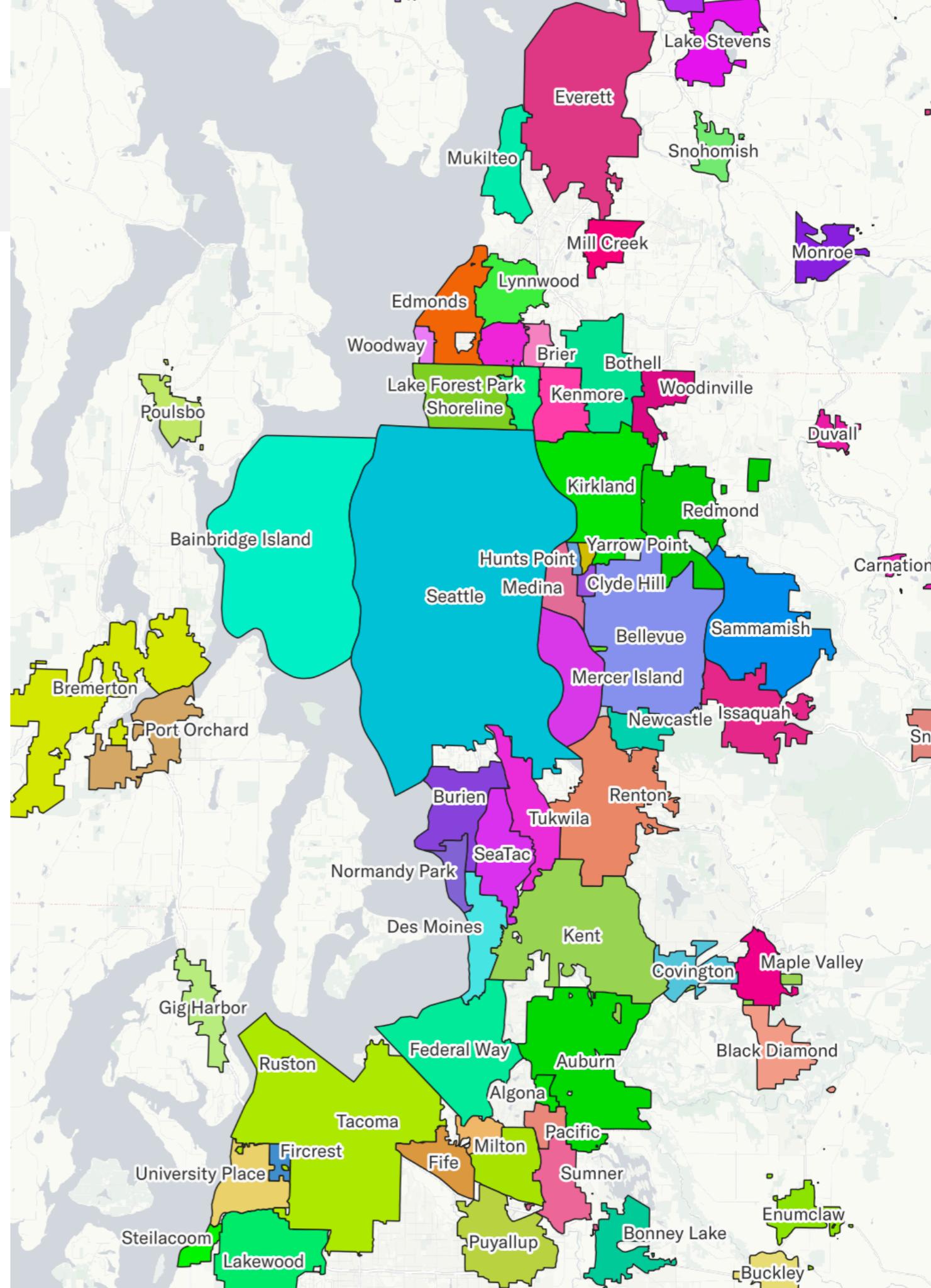
1

Background

1

Background

**Metropolitan
fragmentation
Greater Seattle area**



Background

- Long-term exposure to air pollution is associated with adverse health effects (EPA, 2019).
- Air pollution exposure is **not** equitably distributed by **race** or **income** in Seattle (Bramble et al., 2023).
- Zoning maps are primarily political – not technical – documents (Gabbe, 2017).
- Metropolitan fragmentation can constrain the areas where multi-dwelling homes are legal (Freemark et al., 2020).

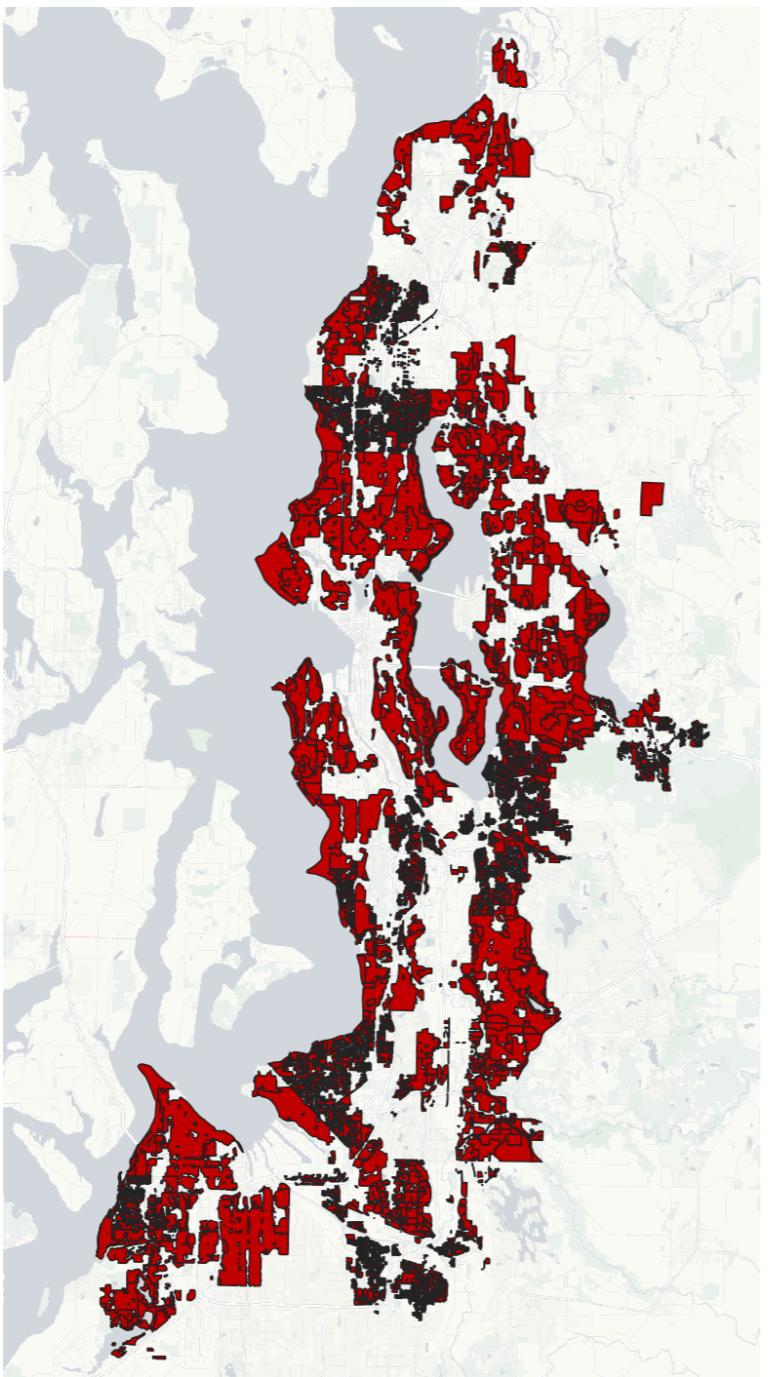
2

Research Question

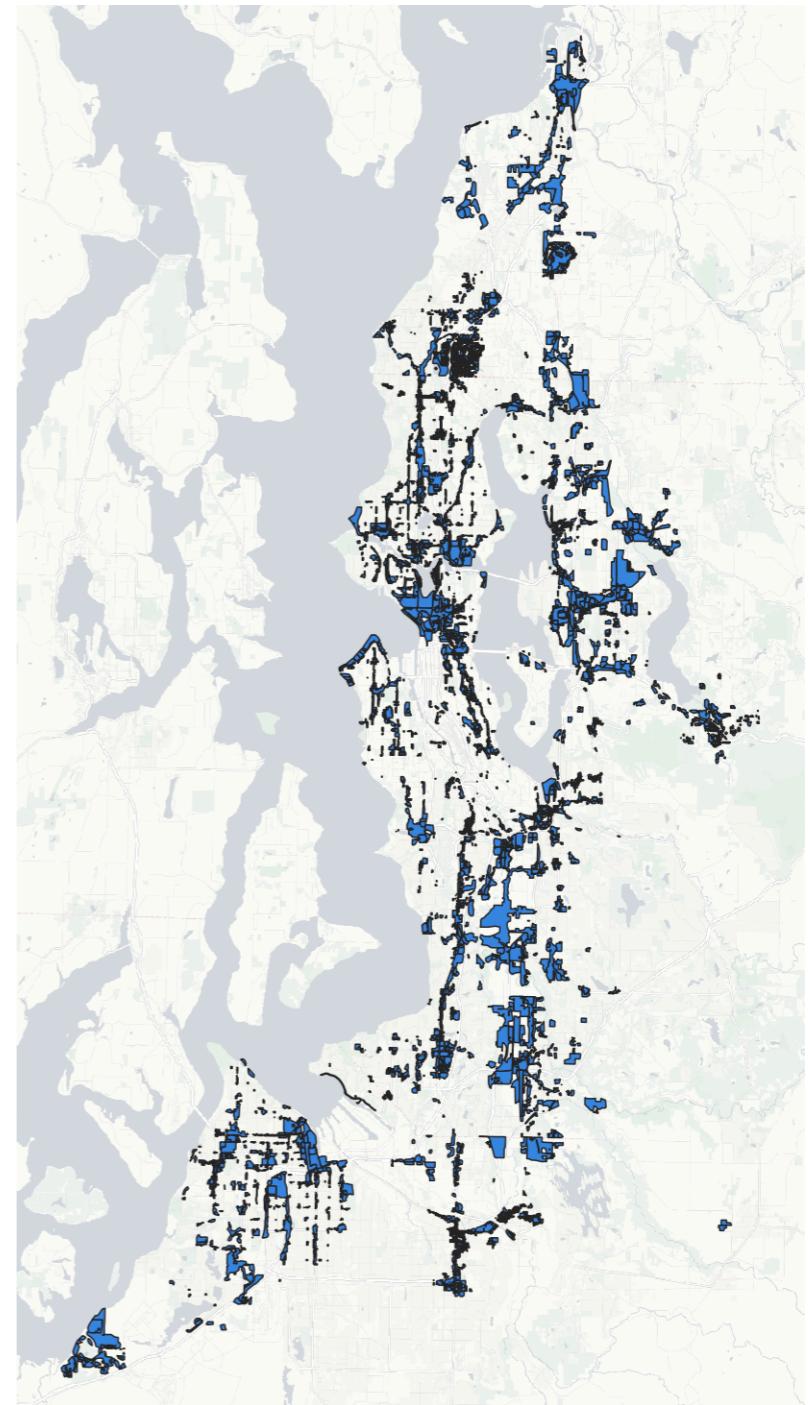
How do TRAP exposure burdens
vary between **exclusive** and **open**
residential zones?

2

Research Question



exclusive (≤ 6 homes/lot)



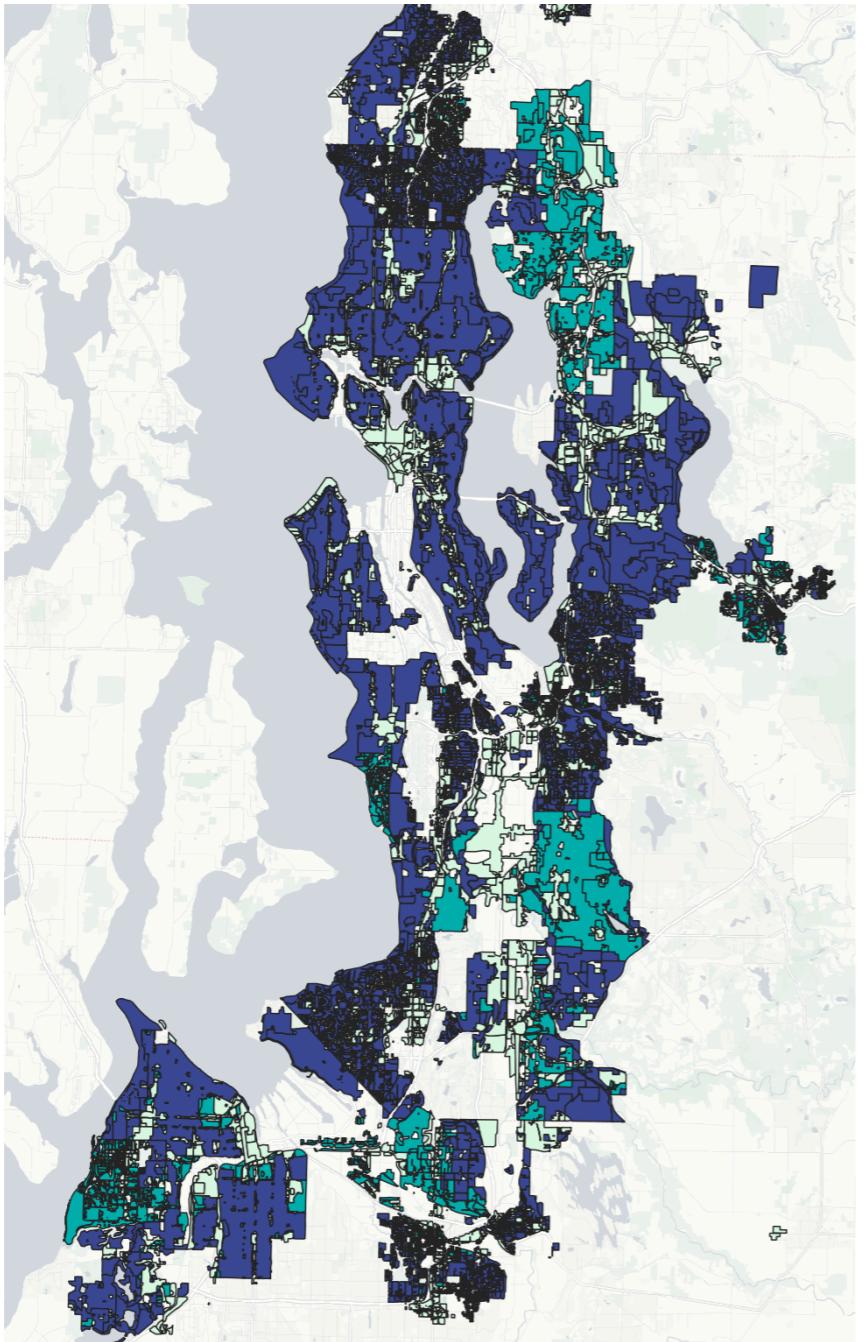
open (> 6 homes/lot)

2

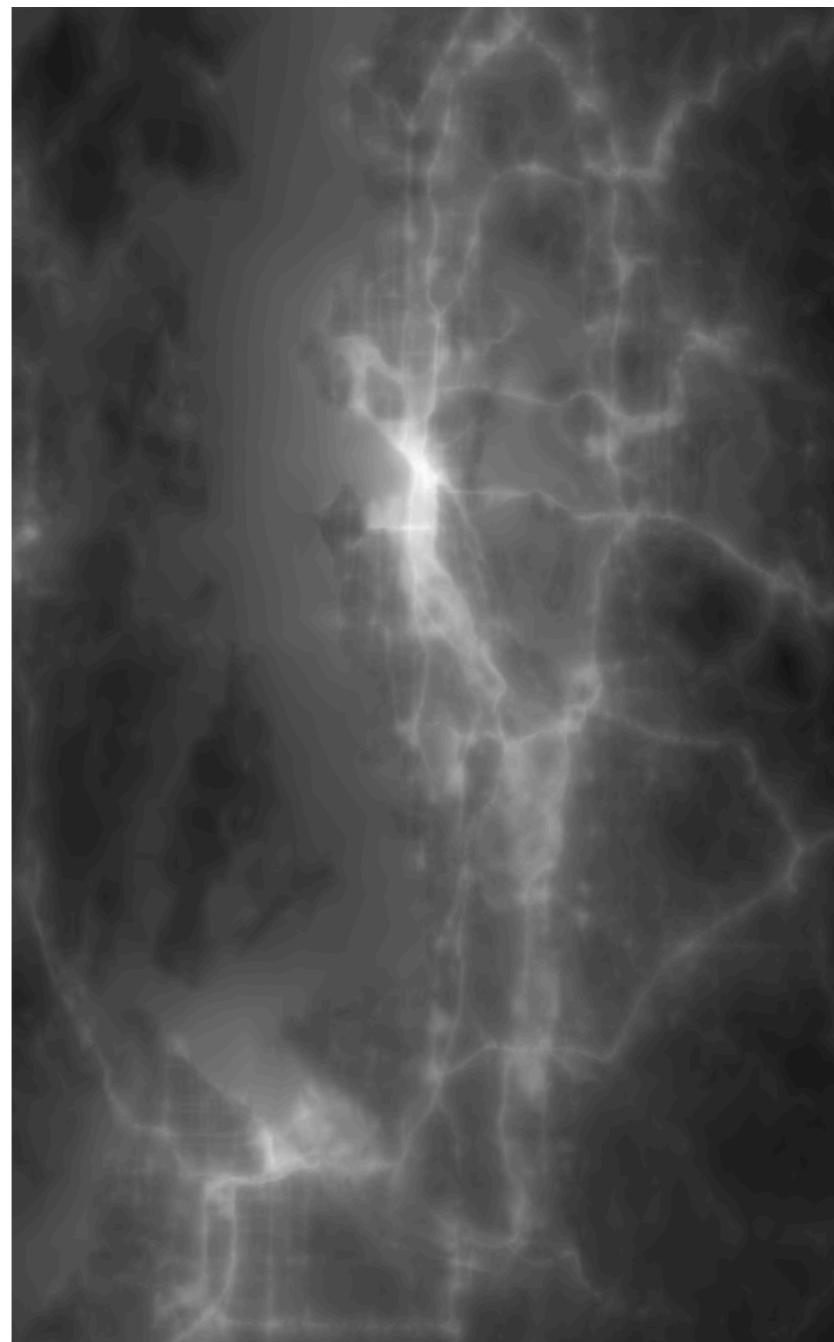
Research Question

3

Methods



Puget Sound zoning atlas
Urban Institute, 2023



Predicted annual exposure (NO₂)
Blanco et al., 2022

3

Methods

Methods

1. Combine Puget Sound zoning atlas (Urban Institute, 2023) with annual exposure predictions for UFP, NO₂, and black carbon (Magali et al., 2022)
2. Calculate population-weighted mean pollutant exposure for each Census block (2020) within coverage area
3. Analyze disparities at regional and municipal scale

4

Results

Region-wide results

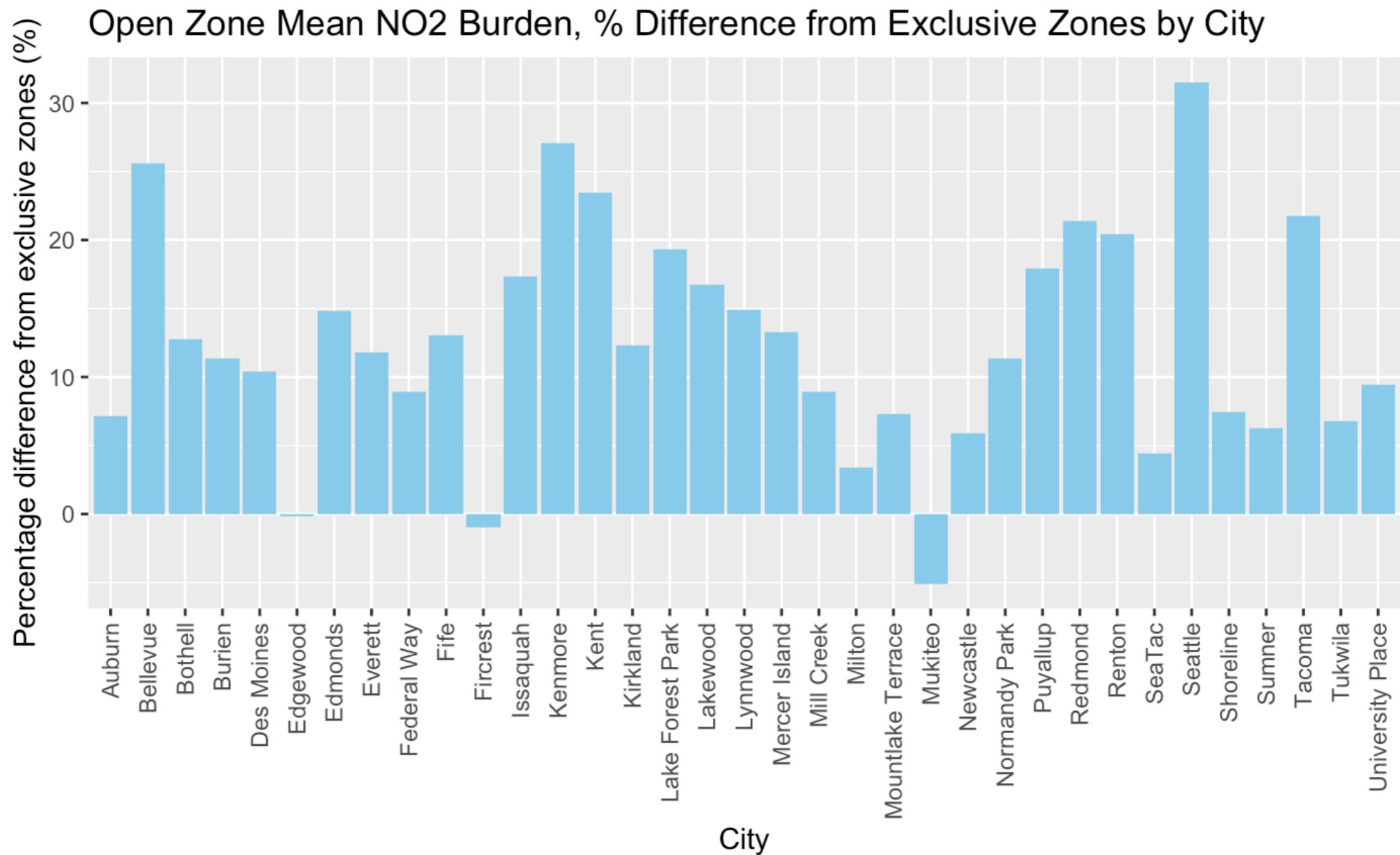
Residential zone type	Population	Land area (sq. mi.)	BC (ng/m ³)	NO ₂ (ppb)	UFP (pt/cm ³)
Exclusive	1,669,288 (64.3%)	390 (78.4%)	498	8.2	6389
Open	925,963 (35.7%)	108 (21.6%)	599	10.3	7481
Difference	-	-	20.3%	25.6%	17.1%

BC: black carbon; NO₂: nitrogen dioxide; UFP: ultra-fine particles

4

Results

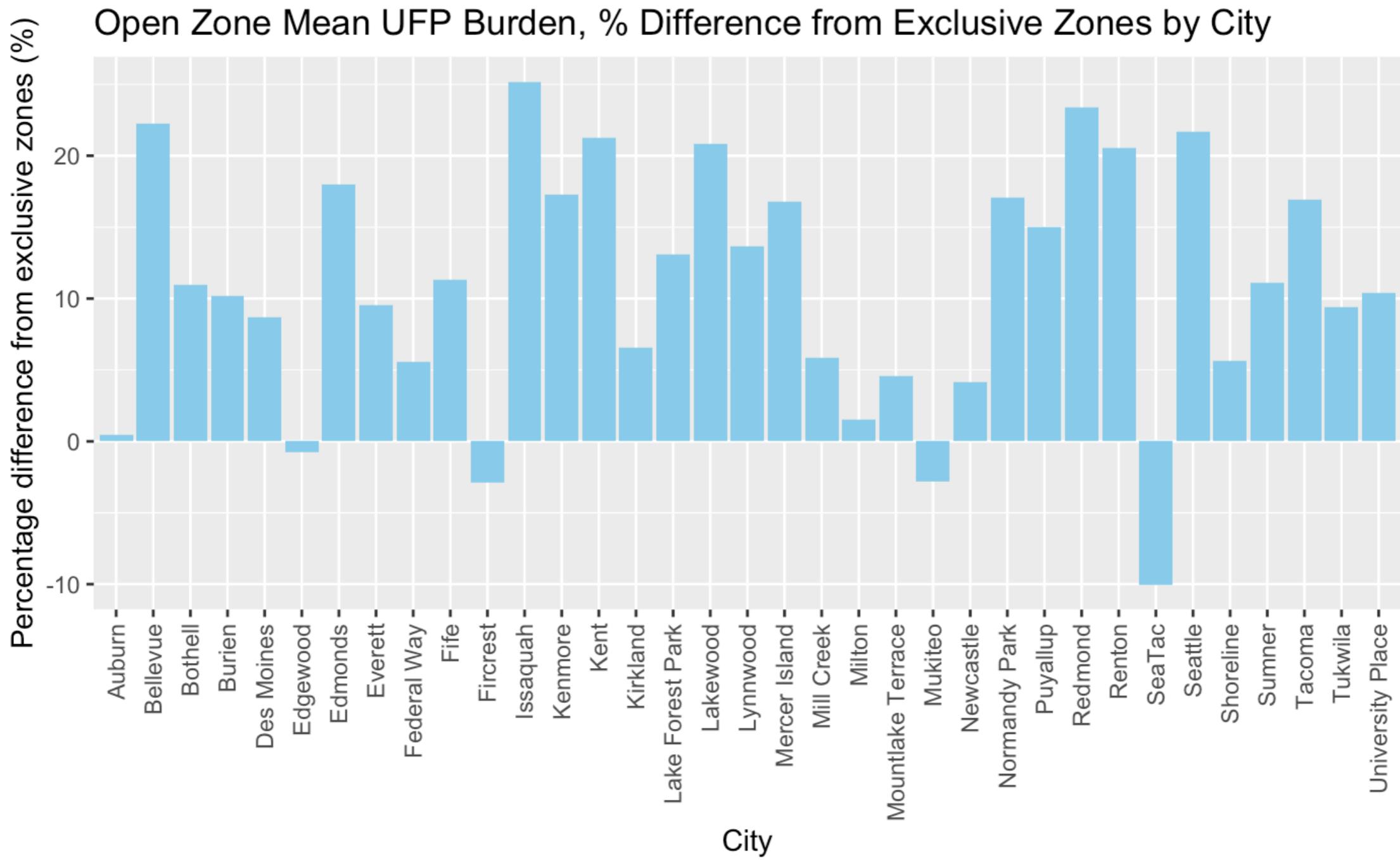
NO₂ Particle Disparity



4

Results

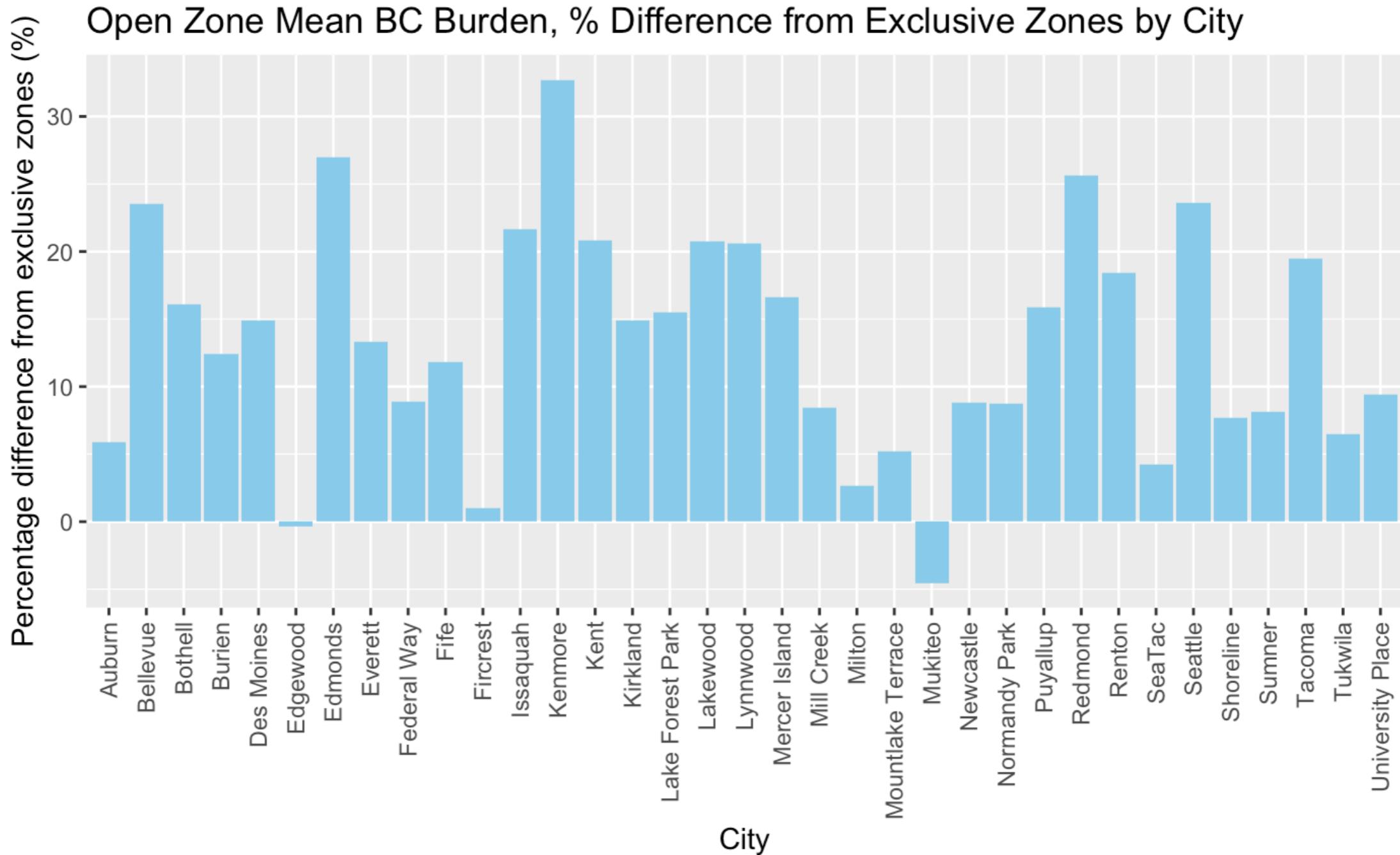
Ultra-Fine Particle Disparity



4

Results

Black Carbon



5

Conclusion

Conclusions

- Across nearly all regional cities, residents of open zones are subject to higher NO₂, BC, and UFP burdens than those of exclusive zones.
- Exclusionary zoning does not appear to have a public-interest benefit for air quality – unless you live in an exclusive zone!

Further directions

- Quantifying the explanatory effect of roadway proximity
- Creating tooling to allow policymakers to model net exposure burden changes from changes to “spatial logic” of zoning maps

References

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Thank you!

Questions?