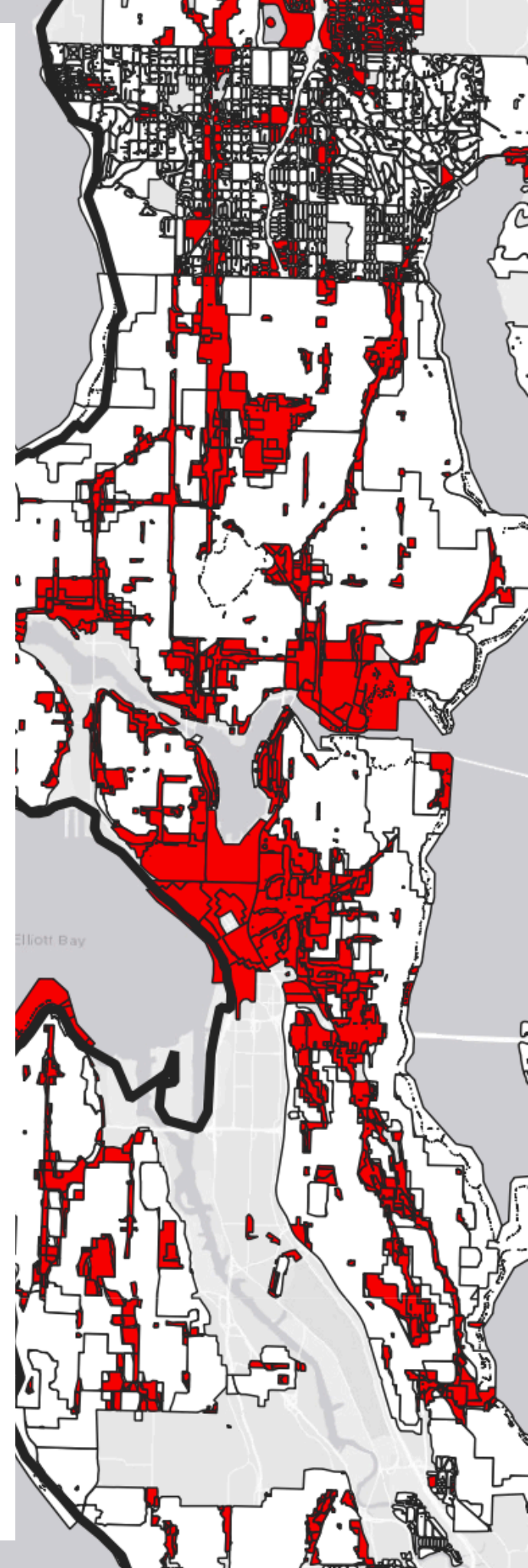


May 17th, 2024

The Zoning TRAP:

Land use and air
pollution exposure
disparities in the
Seattle area

Mackey Guenther
North Seattle College

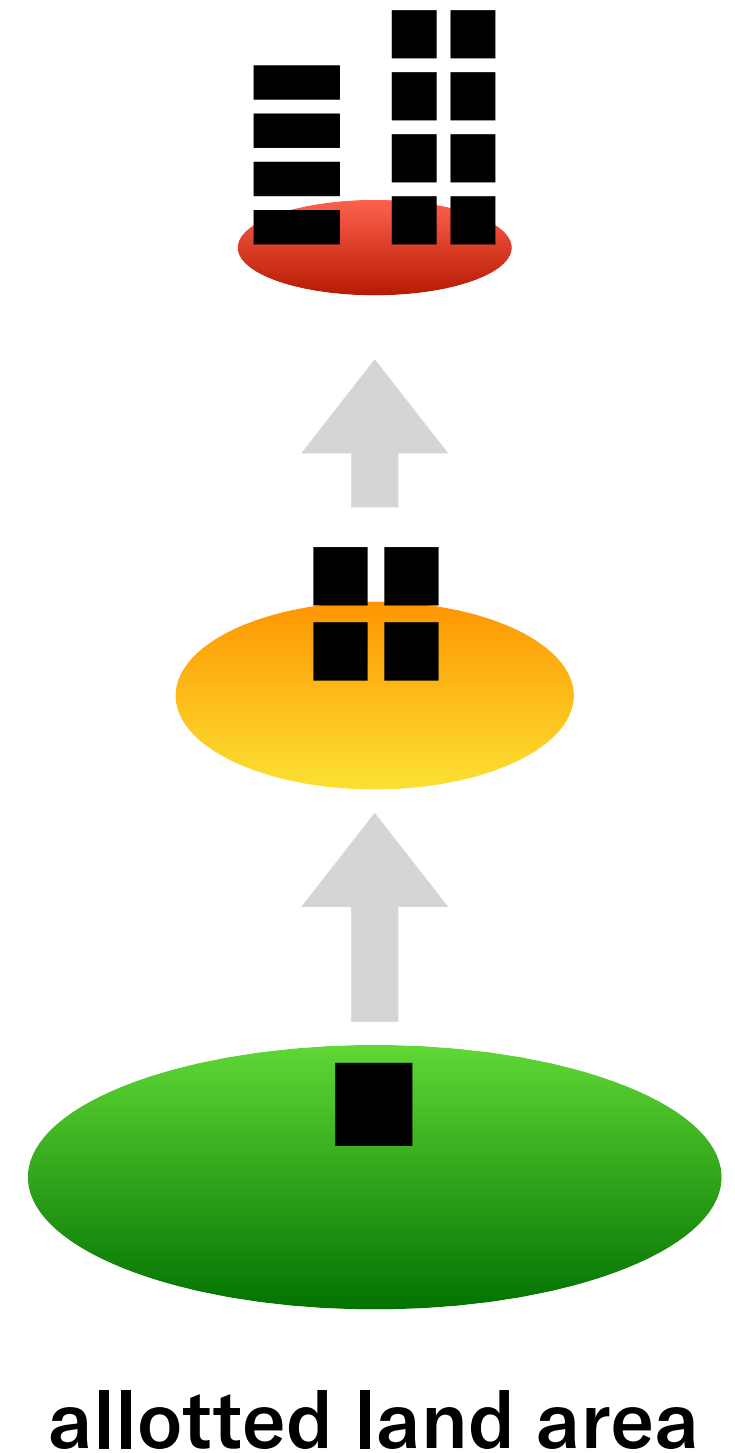




Background

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**

1 Background

“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]

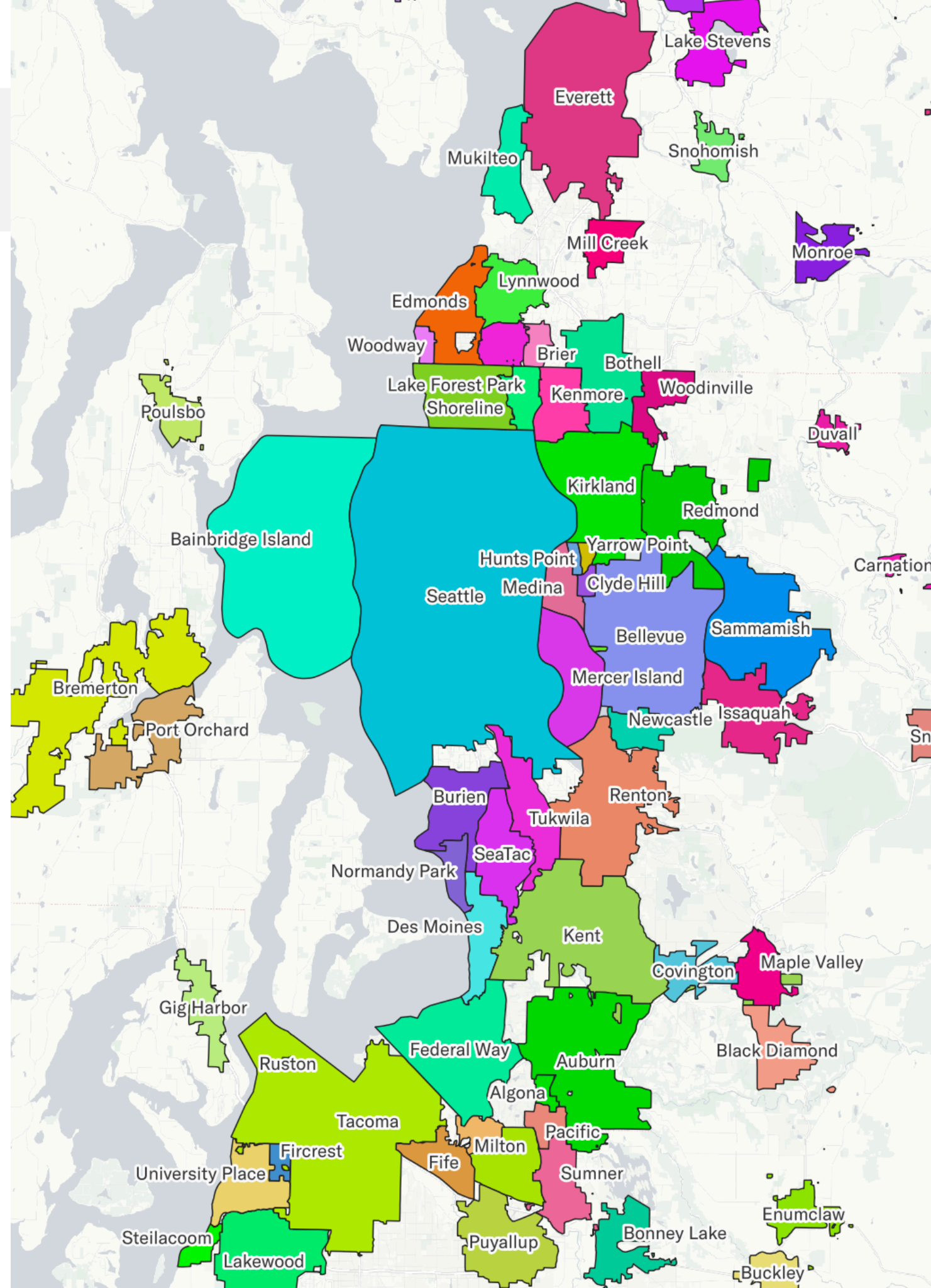
Frank Cornish, City Attorney of Berkeley, CA (1915)

TRAP: traffic-related air pollution

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

1 Background

Metropolitan
fragmentation
Greater Seattle area



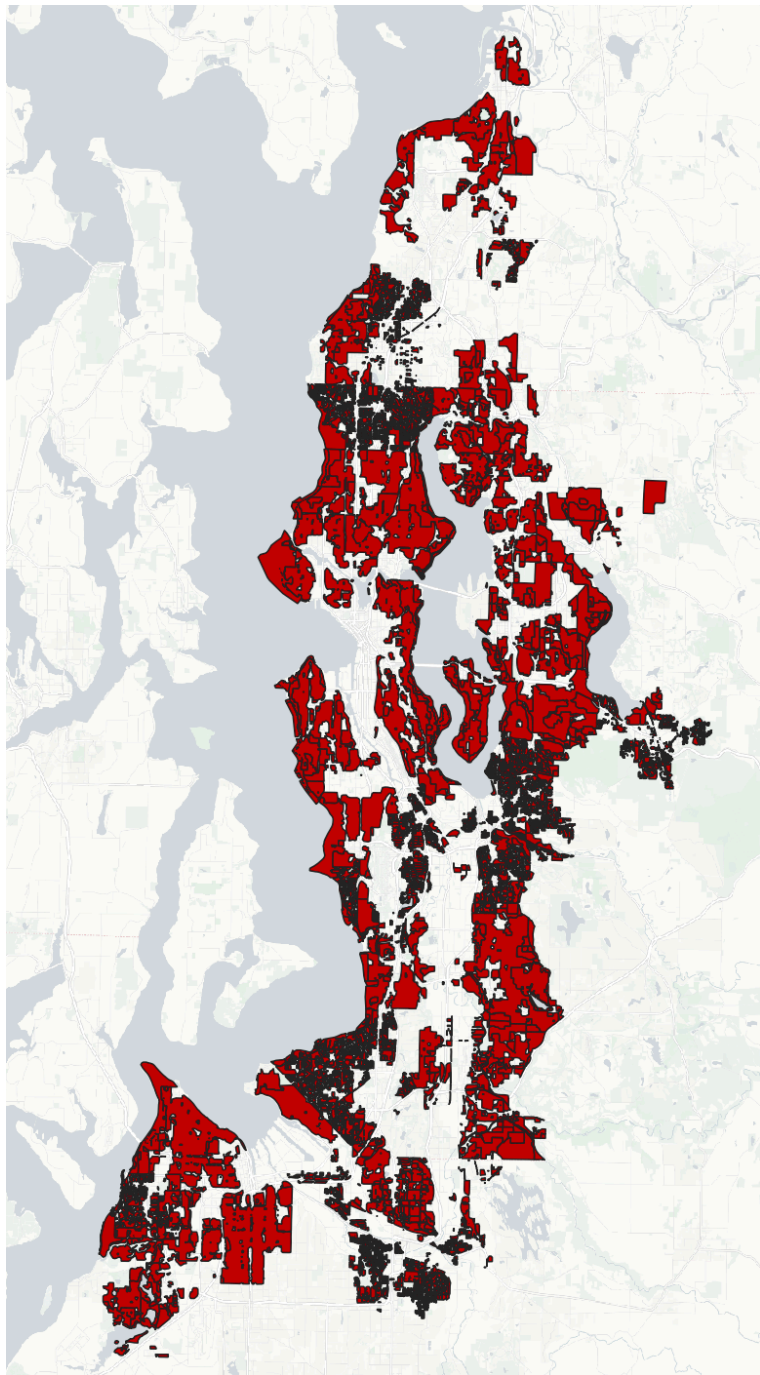
Background

- 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).

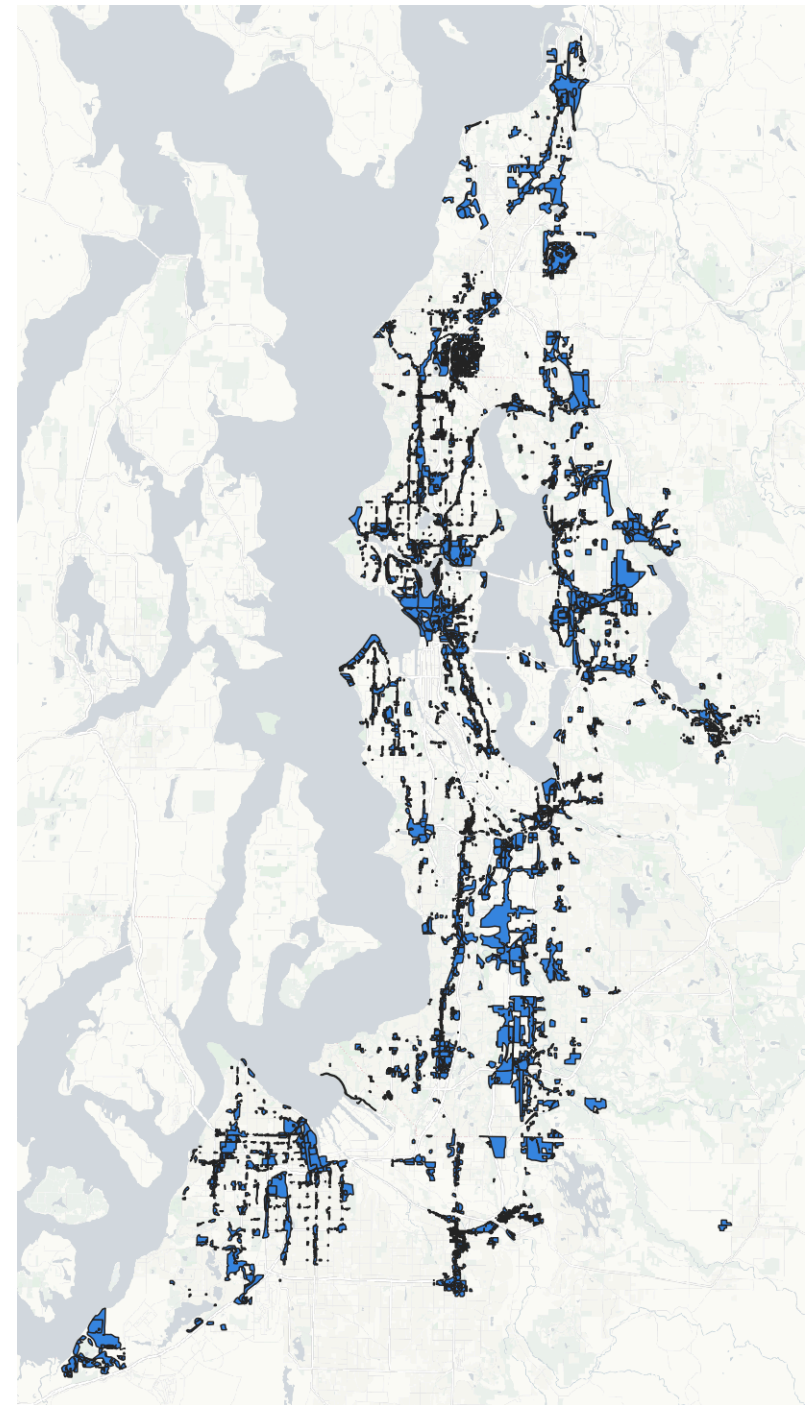
2

Research Question

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



exclusive (≤ 6 homes/lot)

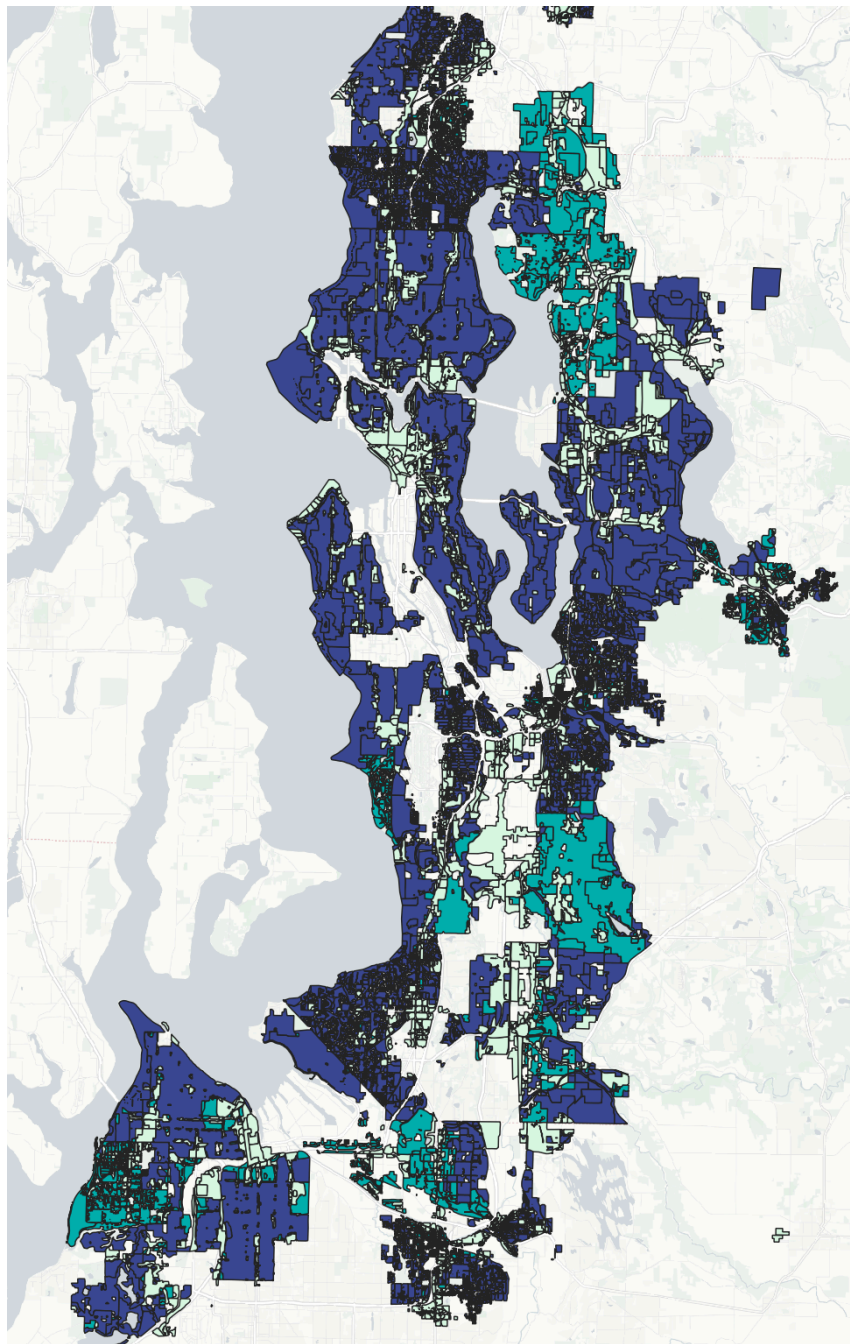


open (> 6 homes/lot)

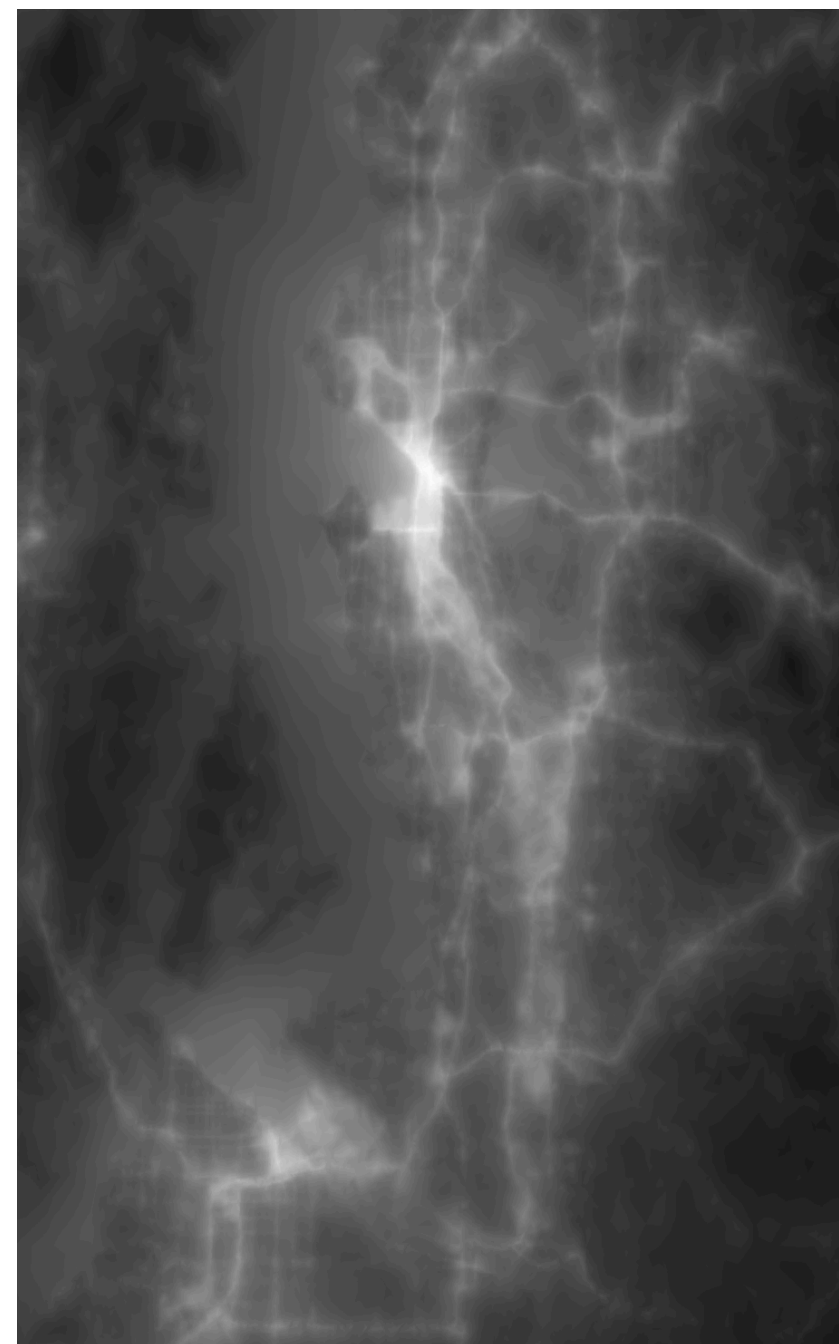
2 Research Question



Methods



Puget Sound zoning atlas
Urban Institute, 2023



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

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



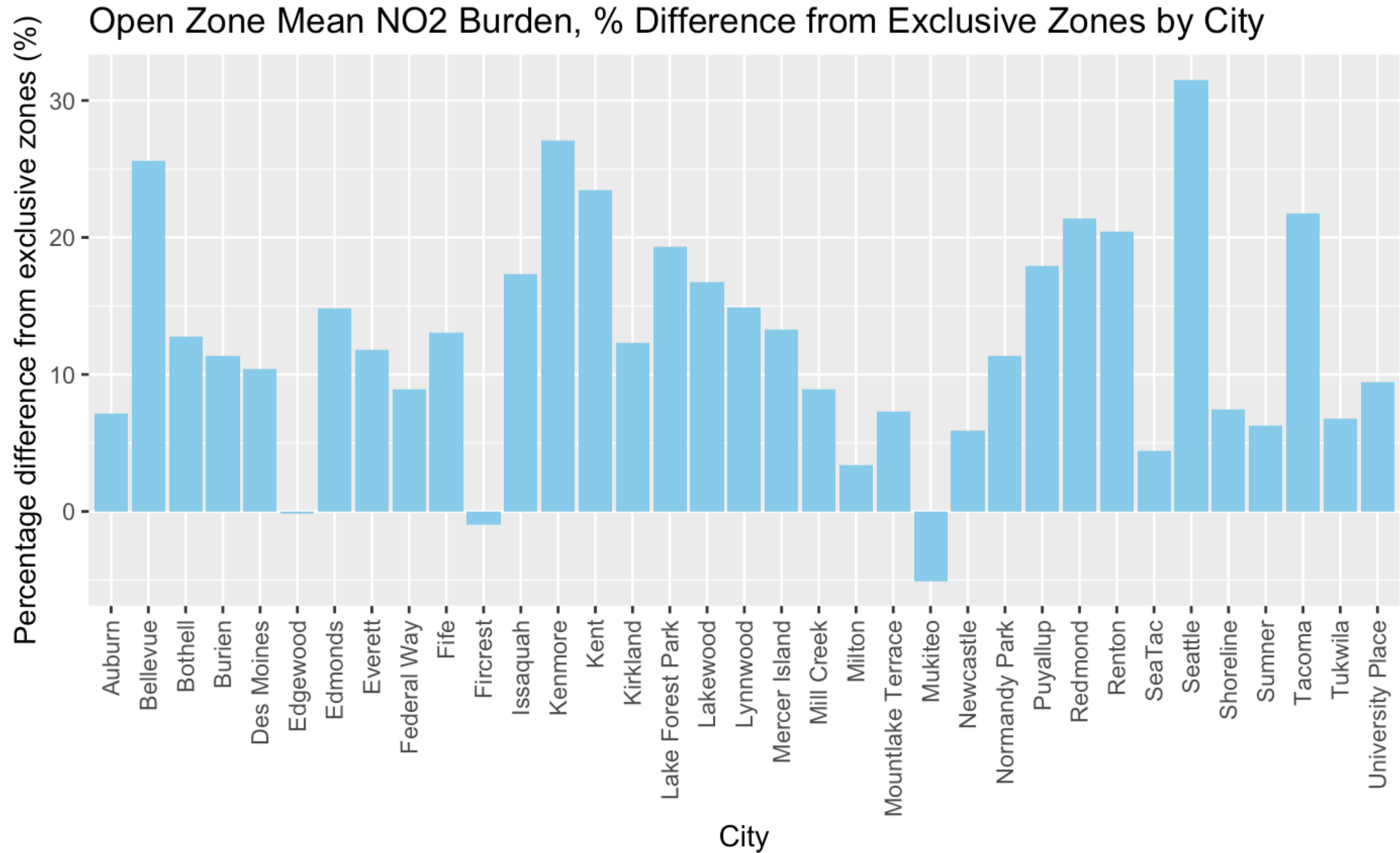
Results

Region-wide results

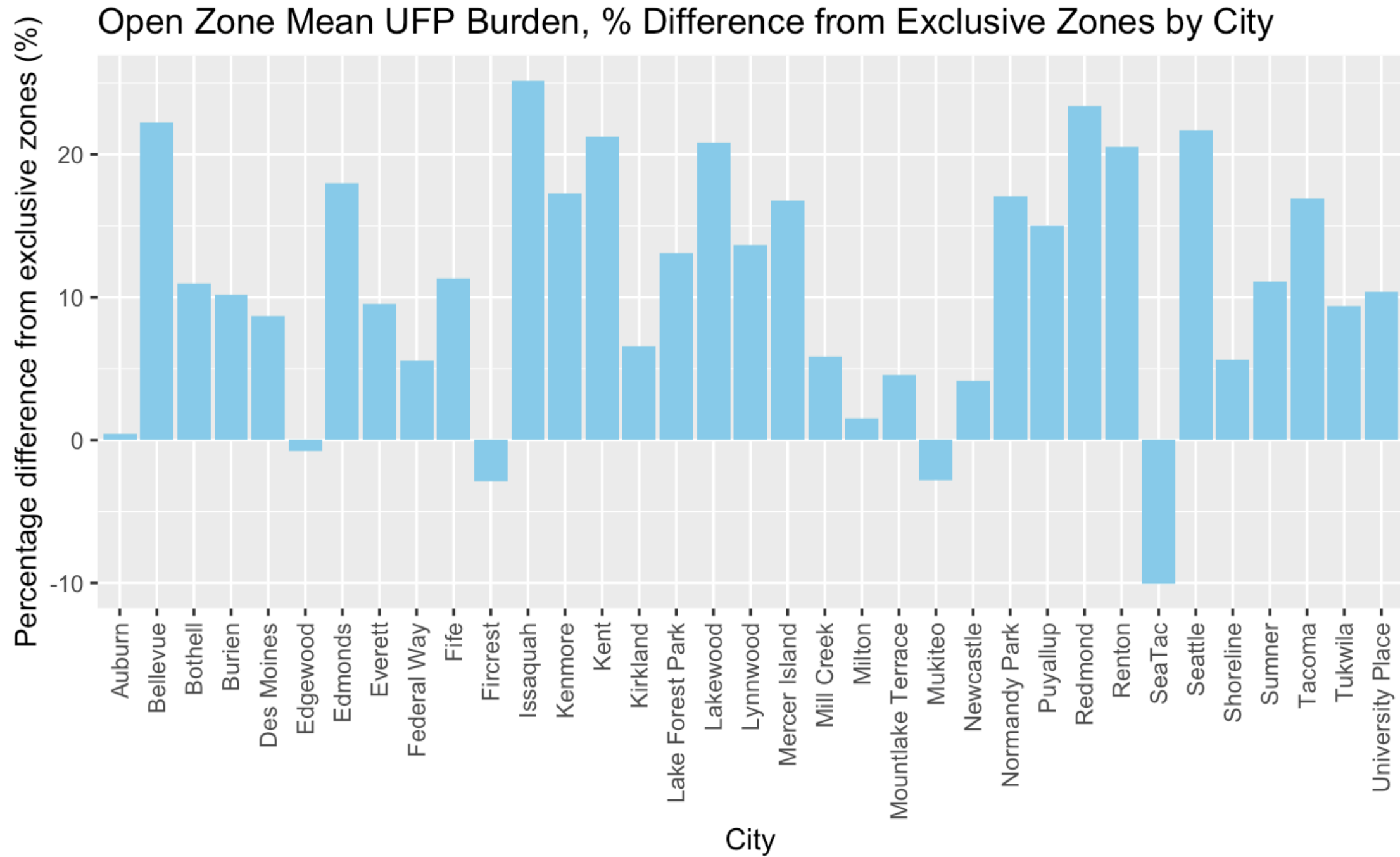
Residential zone type	Population	Land area (sq. mi.)	BC (ng/m ³)	NO ₂ (ppb)	UFP (pt/cm ³)
Exclusive	1,669,288 (64.3%)	390 (78.4%)	498	8.2	6389
Open	925,963 (35.7%)	108 (21.6%)	599	10.3	7481
Difference	-	-	20.3%	25.6%	17.1%

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

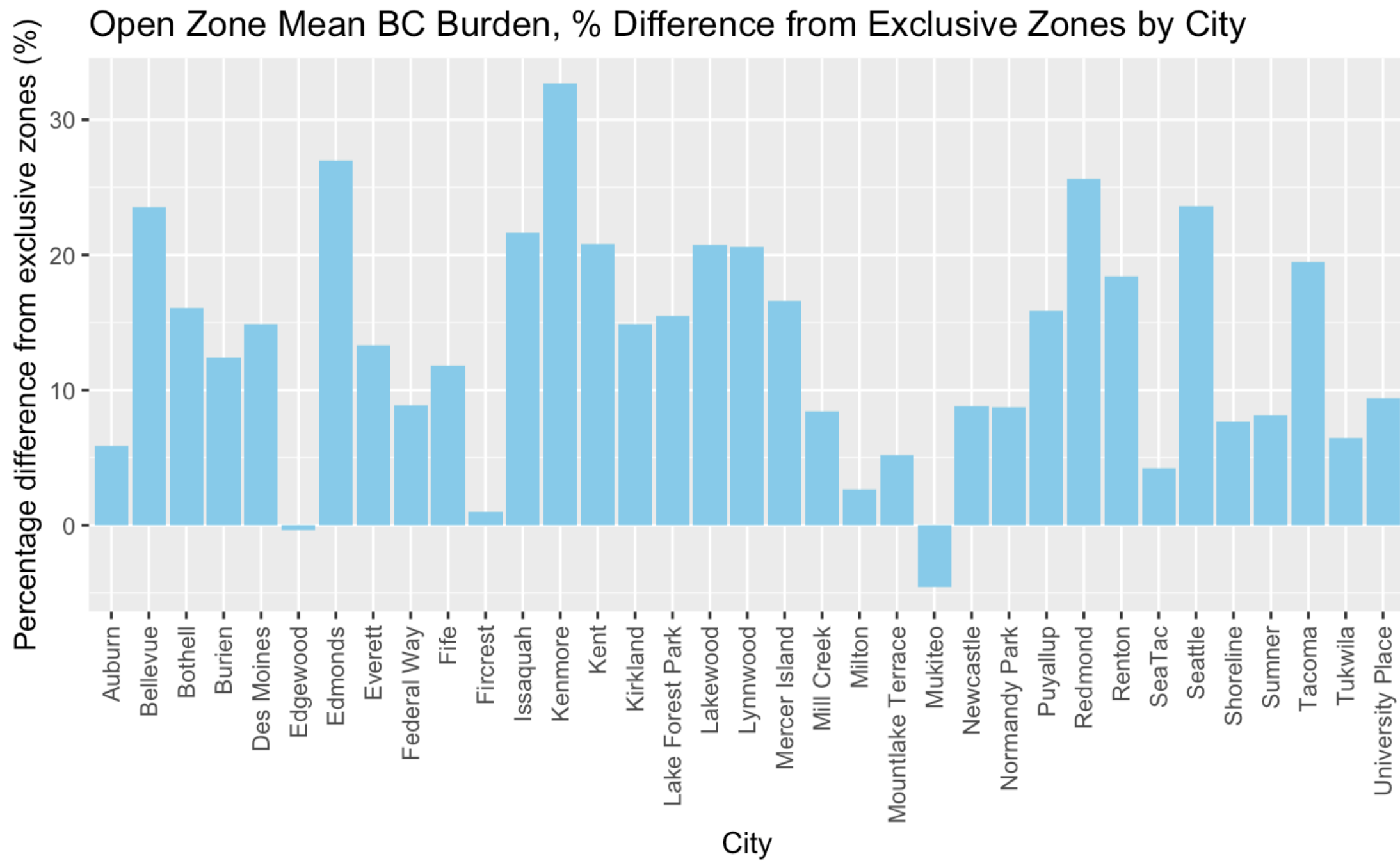
NO₂ Particle Disparity



Ultra-Fine Particle Disparity



Black Carbon





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?