

Inequity in consumption widens racial-ethnic disparities in air pollution exposure

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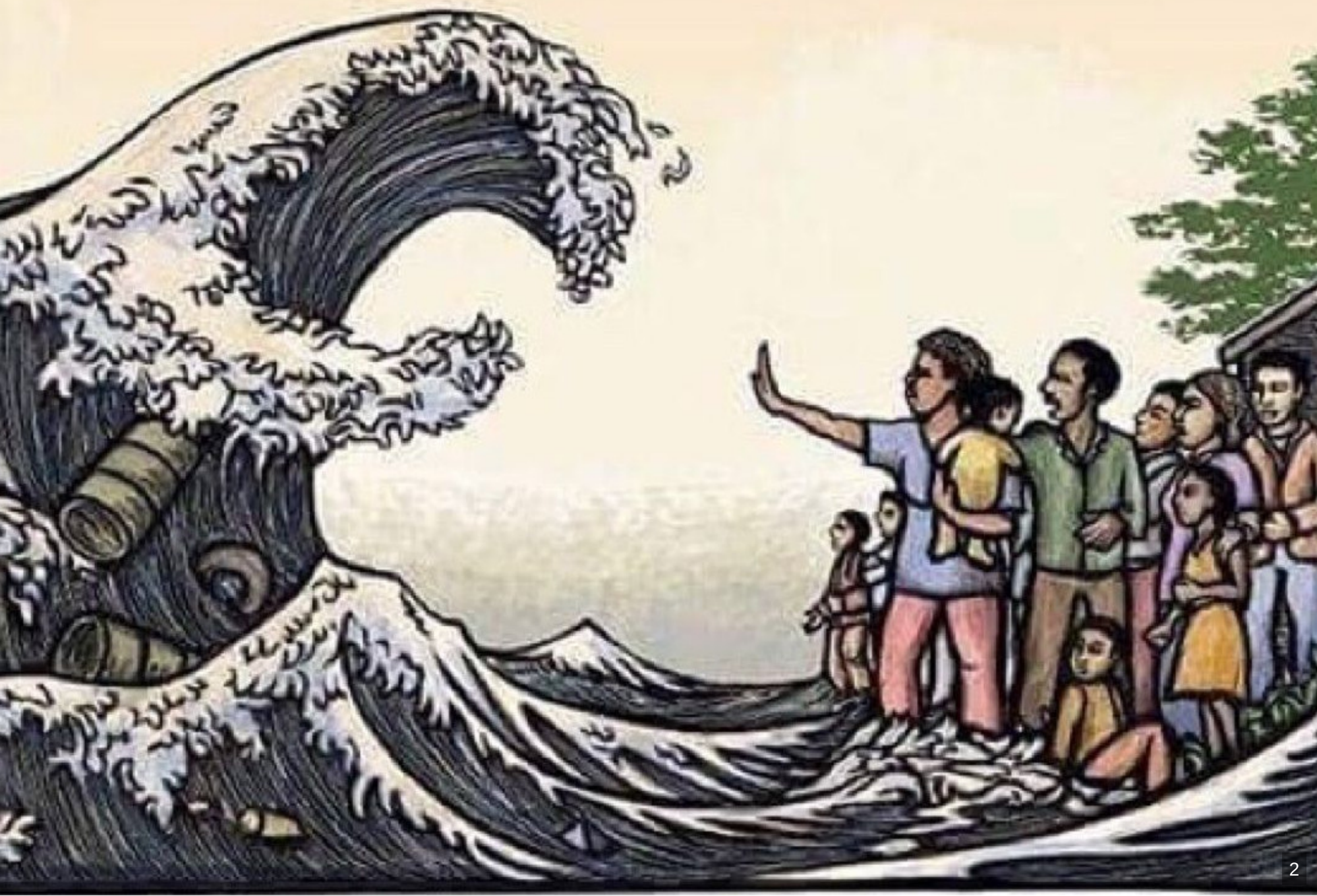
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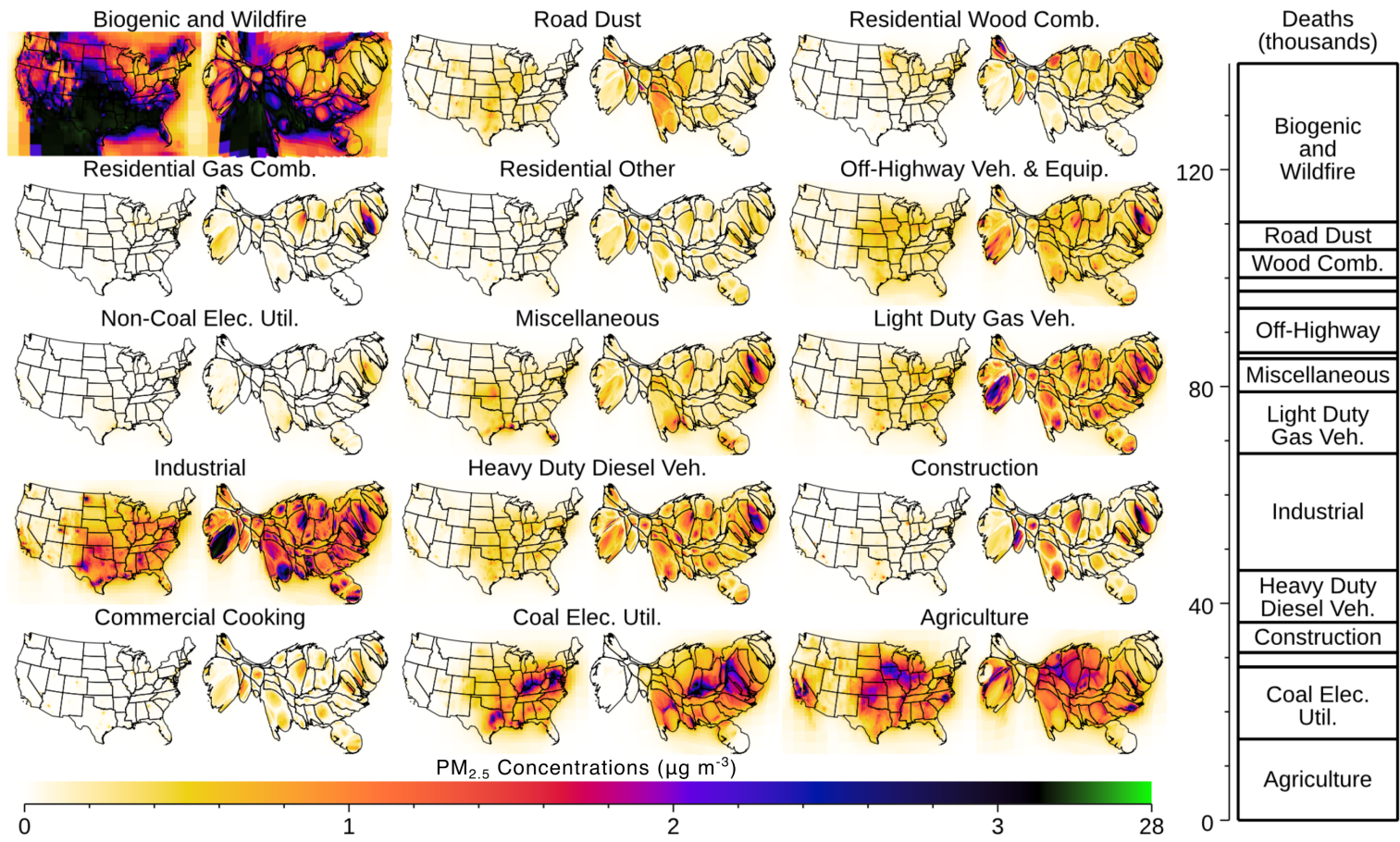




Racial-ethnic minorities are exposed to higher levels of air pollution than whites.

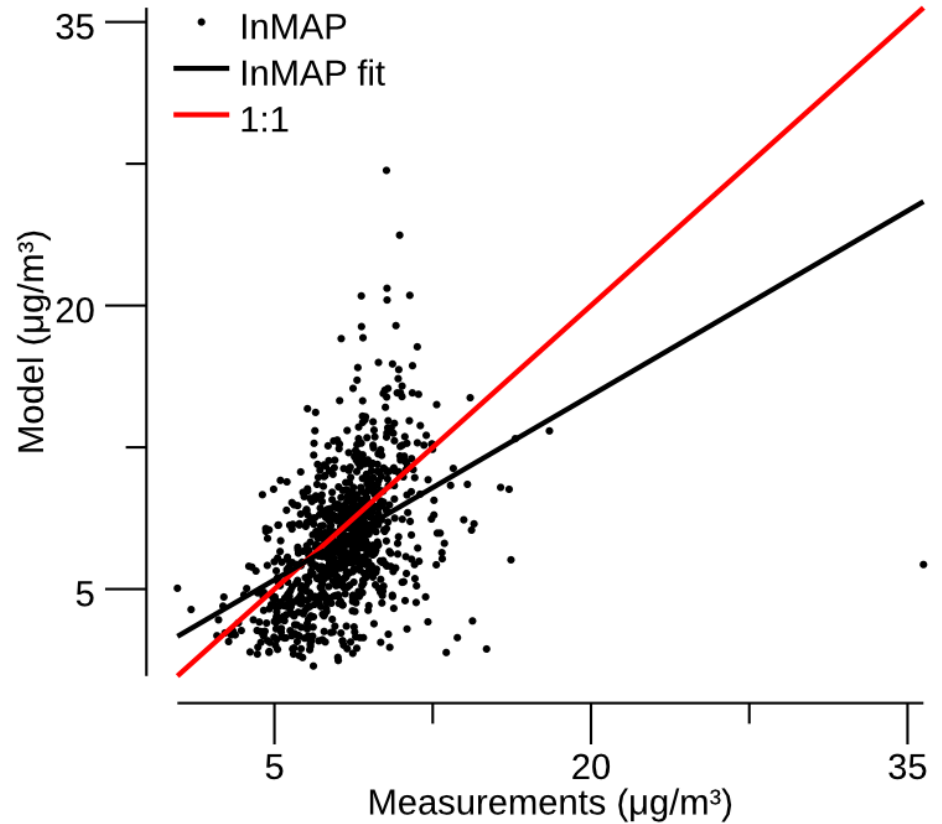
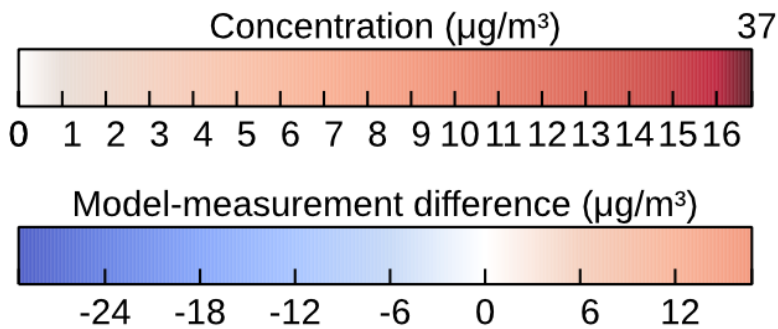
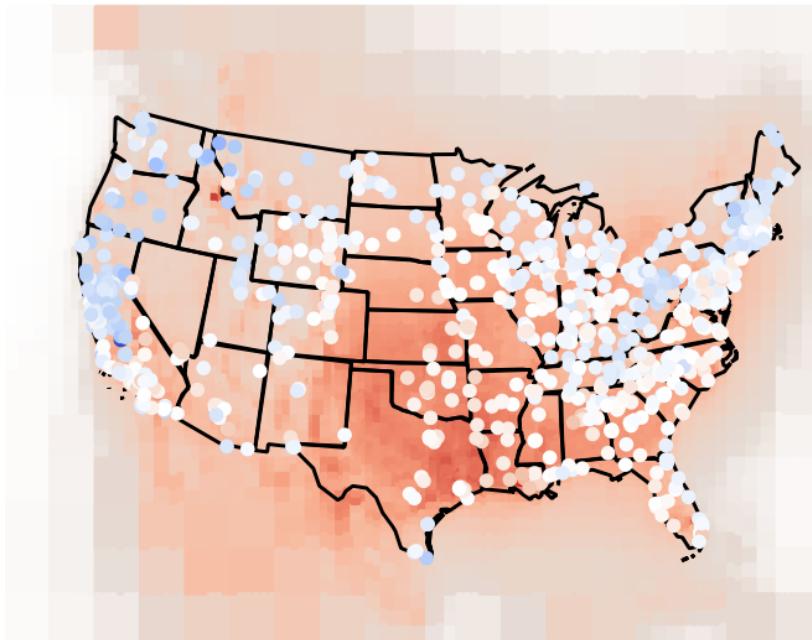
But who is responsible for that increased exposure?

To find out, we link personal economic consumption to emissions and the health impacts that they cause.



PM_{2.5} concentrations and health impacts resulting from emissions from each emitter group. The bar plot on the right shows deaths caused by each group. To focus on human exposure, one of each pair of maps is distorted so that area is proportional to population density. The color map includes a discontinuity at the 99th percentile of concentrations (*i.e.*, 3.1 µg m⁻³).

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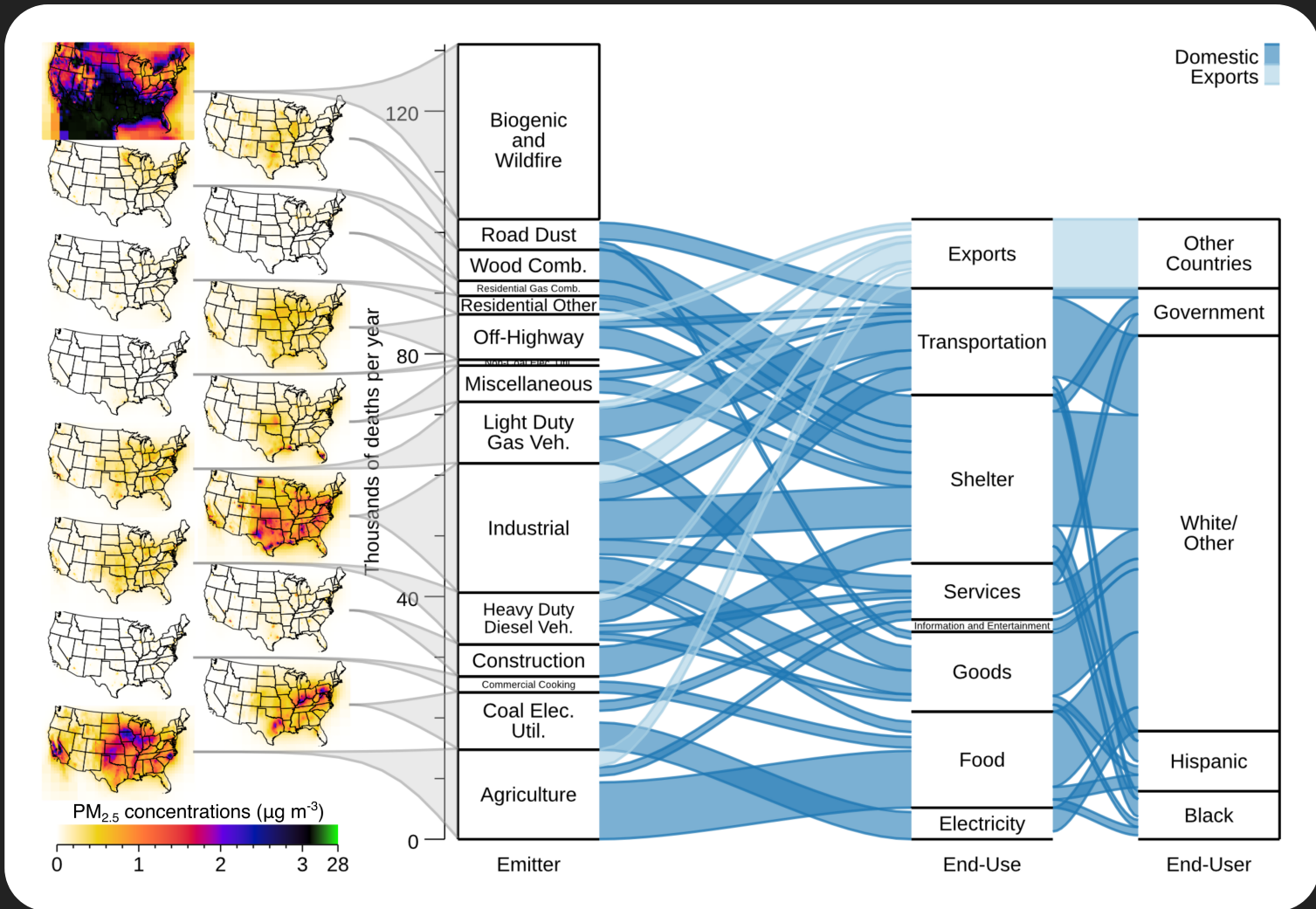
	MFB	MFE	MB	ME	S	R ²
InMAP	-15%	33%	-0.7	2.4	0.65	0.19

Predicted vs. observed 2015 total PM_{2.5} concentrations

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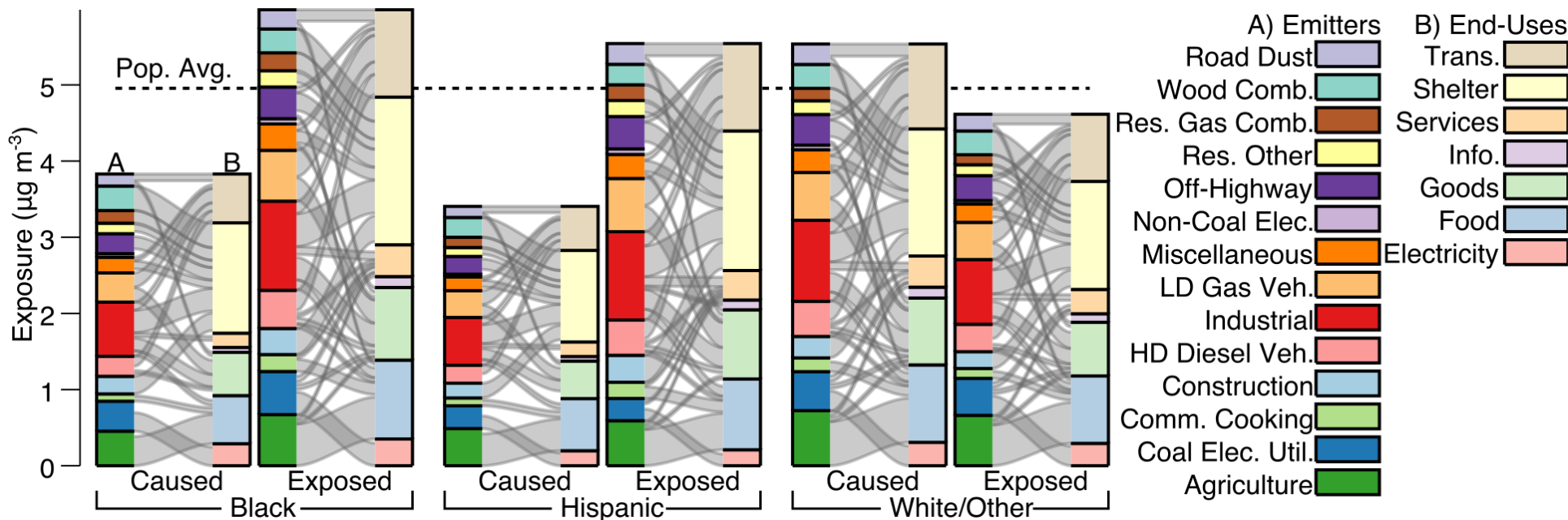
Total PM_{2.5} performance evaluation: 1997–2015

Year	N	MB	ME	MFB (%)	MFE (%)	S	R ²
1997	3	2.8	3.1	14	16	3.4	0.71
1998	22	-11.0	12.7	-58	71	0.1	0.10
1999	929	2.6	4.8	10	32	1.0	0.30
2000	1084	2.1	4.4	6	31	1.2	0.37
2001	1113	1.7	4.2	3	31	1.3	0.38
2002	1110	1.7	4.1	4	33	1.1	0.34
2003	1103	1.9	3.9	5	32	1.3	0.42
2004	1026	1.9	4.0	6	33	1.2	0.34
2005	1045	0.9	3.7	-1	30	1.1	0.39
2006	978	1.4	3.5	3	30	1.2	0.36
2007	944	0.4	3.3	-5	30	1.1	0.35
2008	924	0.6	3.2	-3	31	1.1	0.30
2009	929	1.0	3.1	2	32	1.0	0.25
2010	923	0.2	2.8	-5	30	0.8	0.24
2011	839	-0.3	2.7	-10	31	0.8	0.22
2012	846	-0.3	2.6	-11	31	0.7	0.19
2013	879	-0.5	2.7	-13	33	0.6	0.13
2014	932	-0.6	2.4	-14	31	0.8	0.26
2015	946	-0.7	2.4	-15	33	0.7	0.19



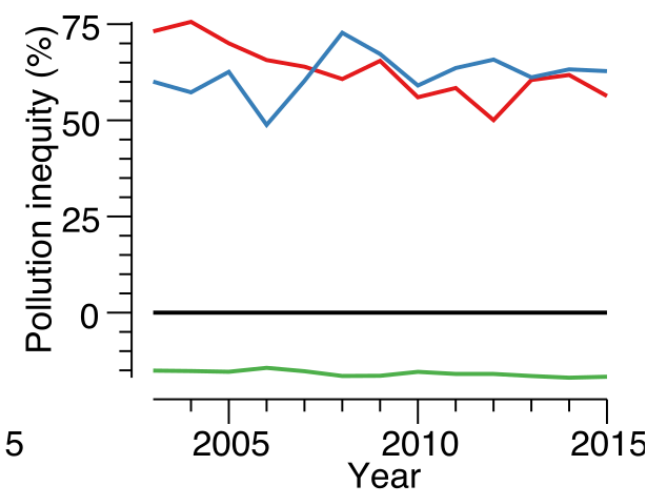
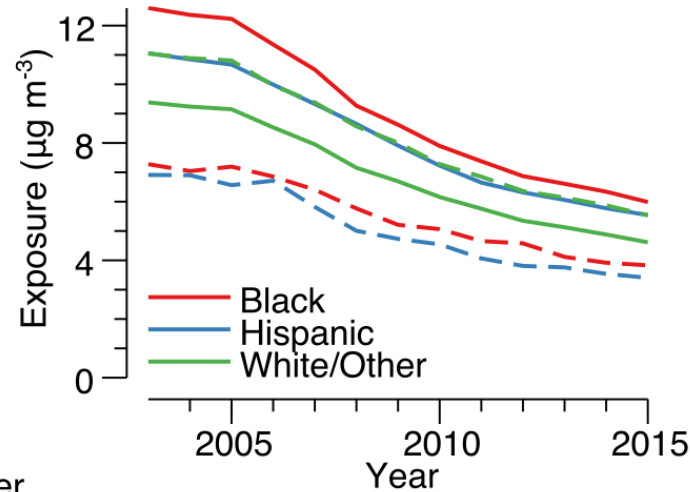
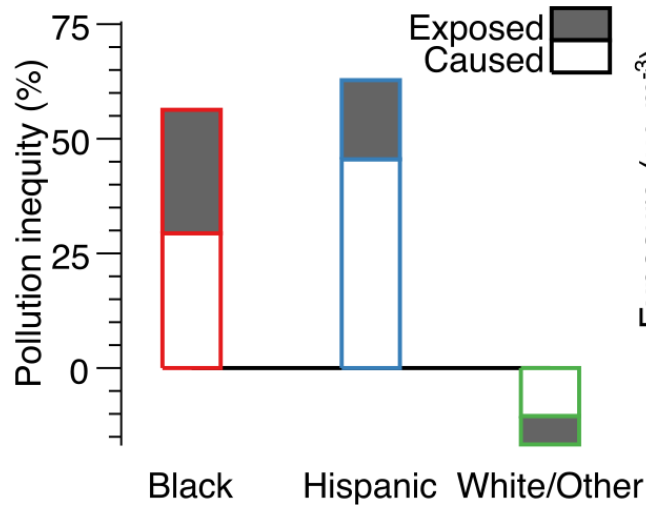
Sources of U.S. mortality from PM_{2.5}. PM_{2.5} concentrations resulting from emissions from each emitter group (maps on left); relationships among health impacts as attributed to emitters (left bar), end-uses (middle bar), and end-users (right bar).

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Average PM_{2.5} exposure experienced and caused by racial-ethnic groups. Total exposure to PM_{2.5} caused by population-adjusted group consumption ("caused") and group exposure to PM_{2.5} caused by total personal consumption ("exposed") by racial-ethnic group. Pollution inequity is the percent difference between a group's "exposed" and "caused" bars. Each group of bars shows the emitters (A) and end-uses (B) responsible for the exposure, with gray connecting lines showing relationships among emitters and end-uses. Connecting lines representing <math> < 0.04 \mu\text{g m}^{-3}</math> are not shown.

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Pollution inequity contributions and trends. A) Contributions of differences in consumption ("caused") and location-of-residence ("exposed") to pollution inequity. B) Exposure of each racial-ethnic group to PM_{2.5} caused by the total combined personal consumption of all groups (*i.e.*, solid lines) and total-population exposure to PM_{2.5} caused by each group's population-adjusted consumption (dashed lines), 2003–2015. C) Pollution inequity, 2003–2015.

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Conclusions

- Blacks and Hispanics exposed to more PM_{2.5} than non-Hispanic whites
- ...but contribute less to exposure
- Disparity is caused as much by how much people consume as by where people live
- All groups exposed to less air pollution in 2015 than in 2003
- ...but pollution inequity remains high

Thank you

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