Shifting Exposures: Diesel Emission Reductions and Environmental Justice

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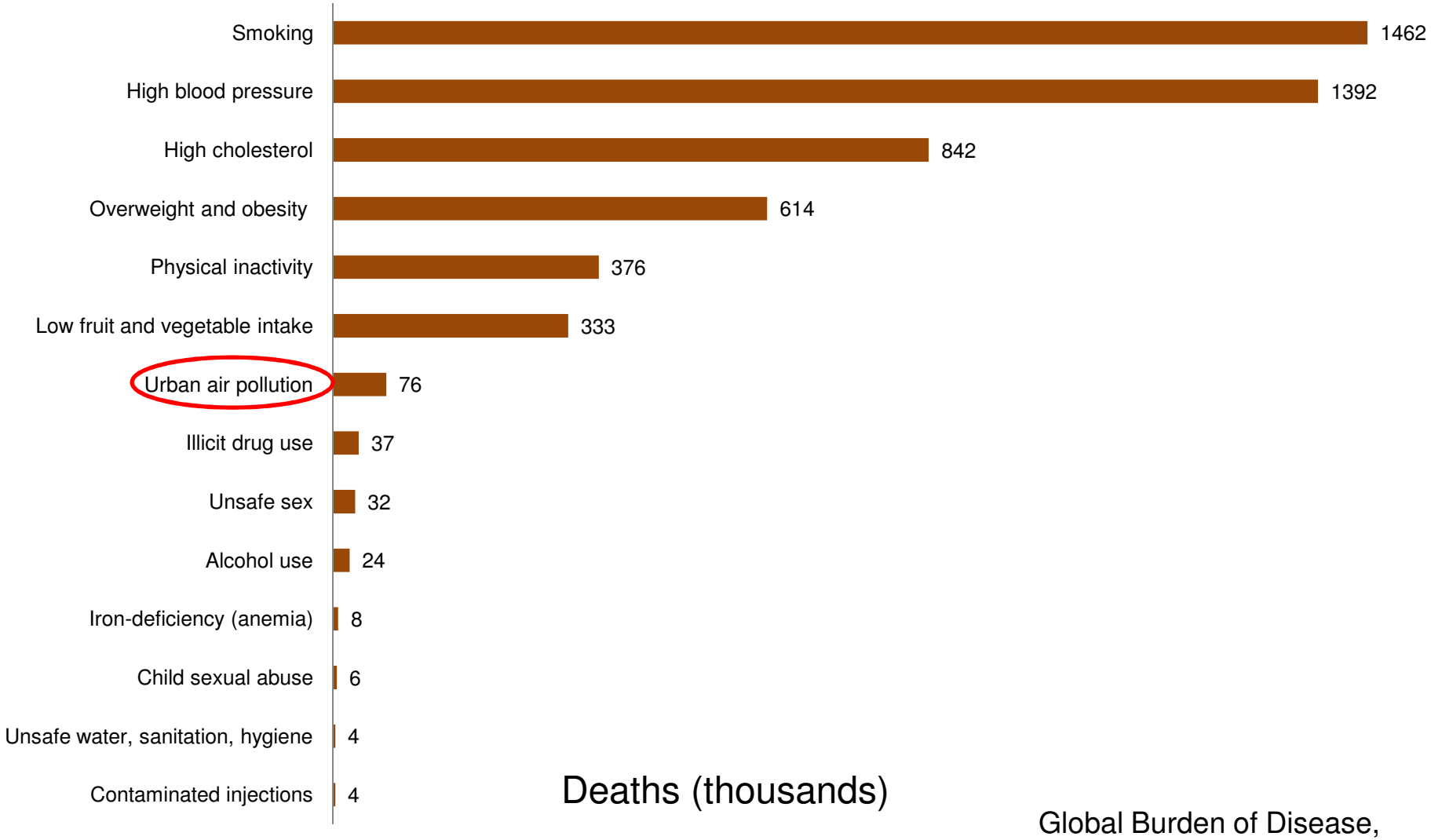
EJ Symposium, Washington, DC March 18, 2010

Issue: Protect Environmental Health

- Ambient air pollution harms human health
- Problems are best controlled at the source

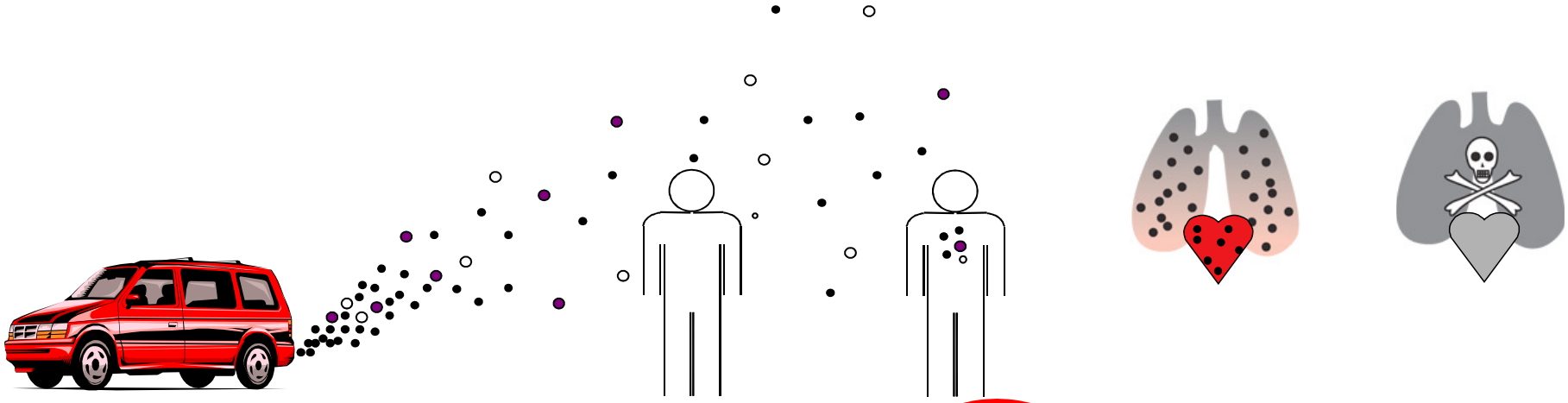
- Prioritize emission reductions
- Environmental justice

High-Income Burden of Disease



Global Burden of Disease, WHO, 2006

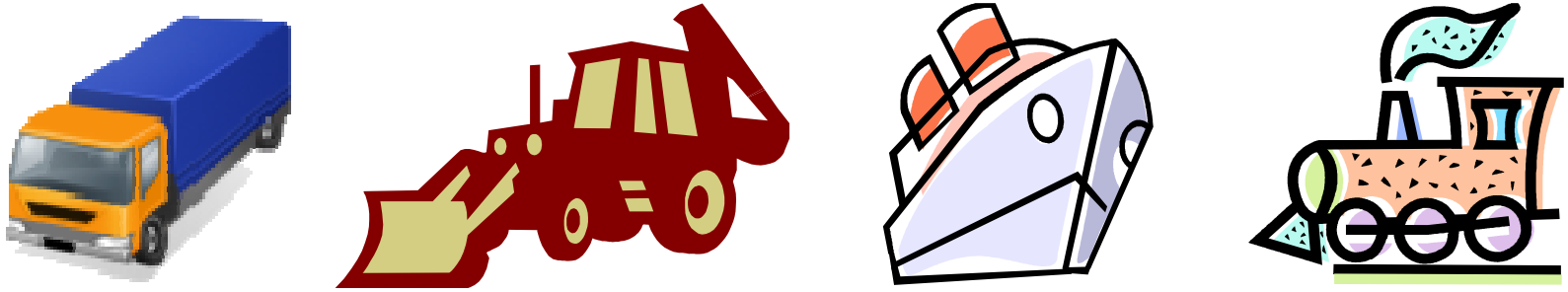
Approach: Air-pollution health-effects paradigm



emissions → concentration → exposure → intake → dose → health effects

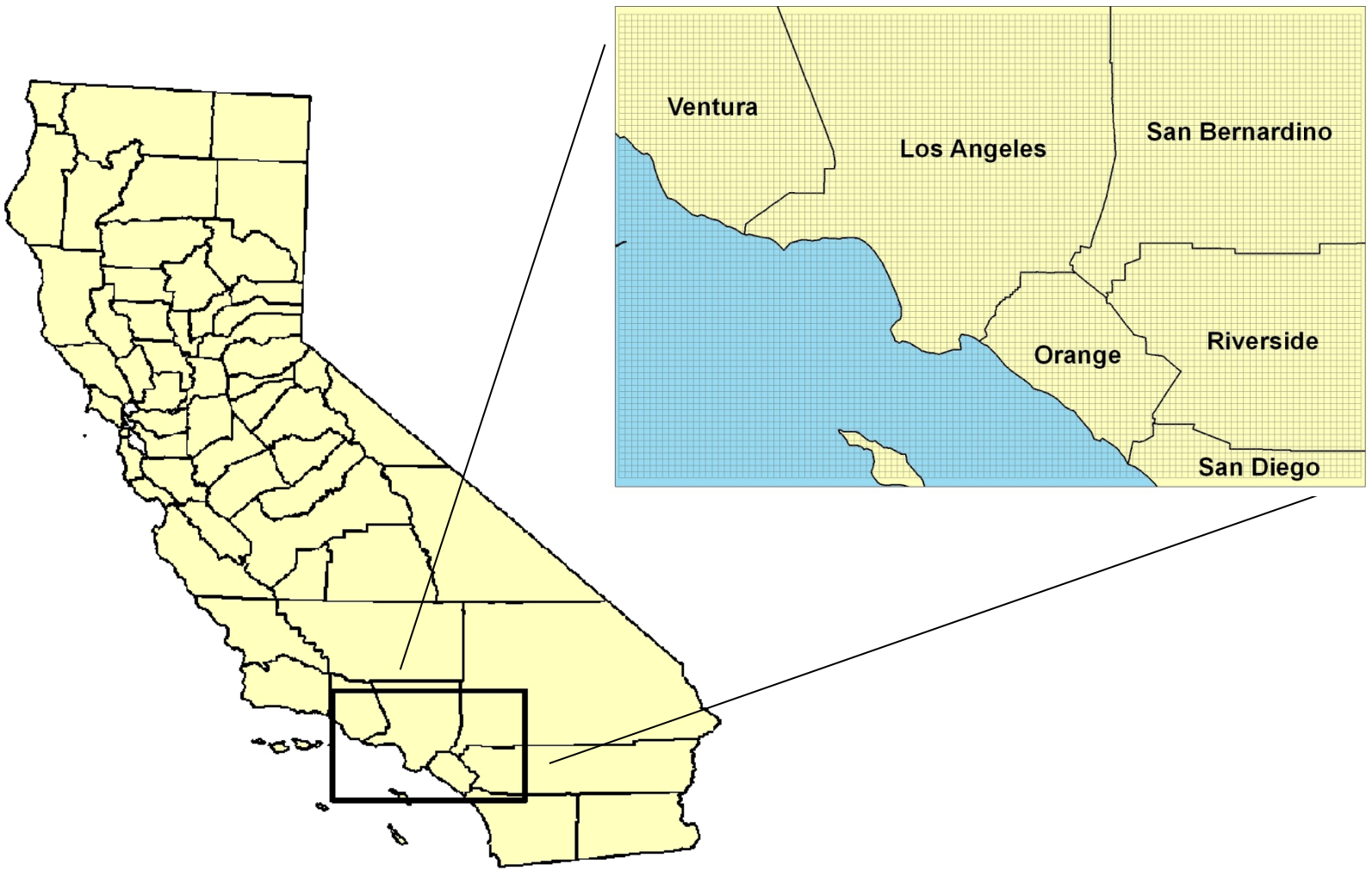
Hypothesis

- Exposure impacts of strategy will vary
  - Emissions source



  - Location within urban area

Case study location: South Coast



Ports (Los Angeles and Long Beach)

Combined: 5th busiest port complex in the world

(1st and 2nd largest ports, respectively, in the U.S.

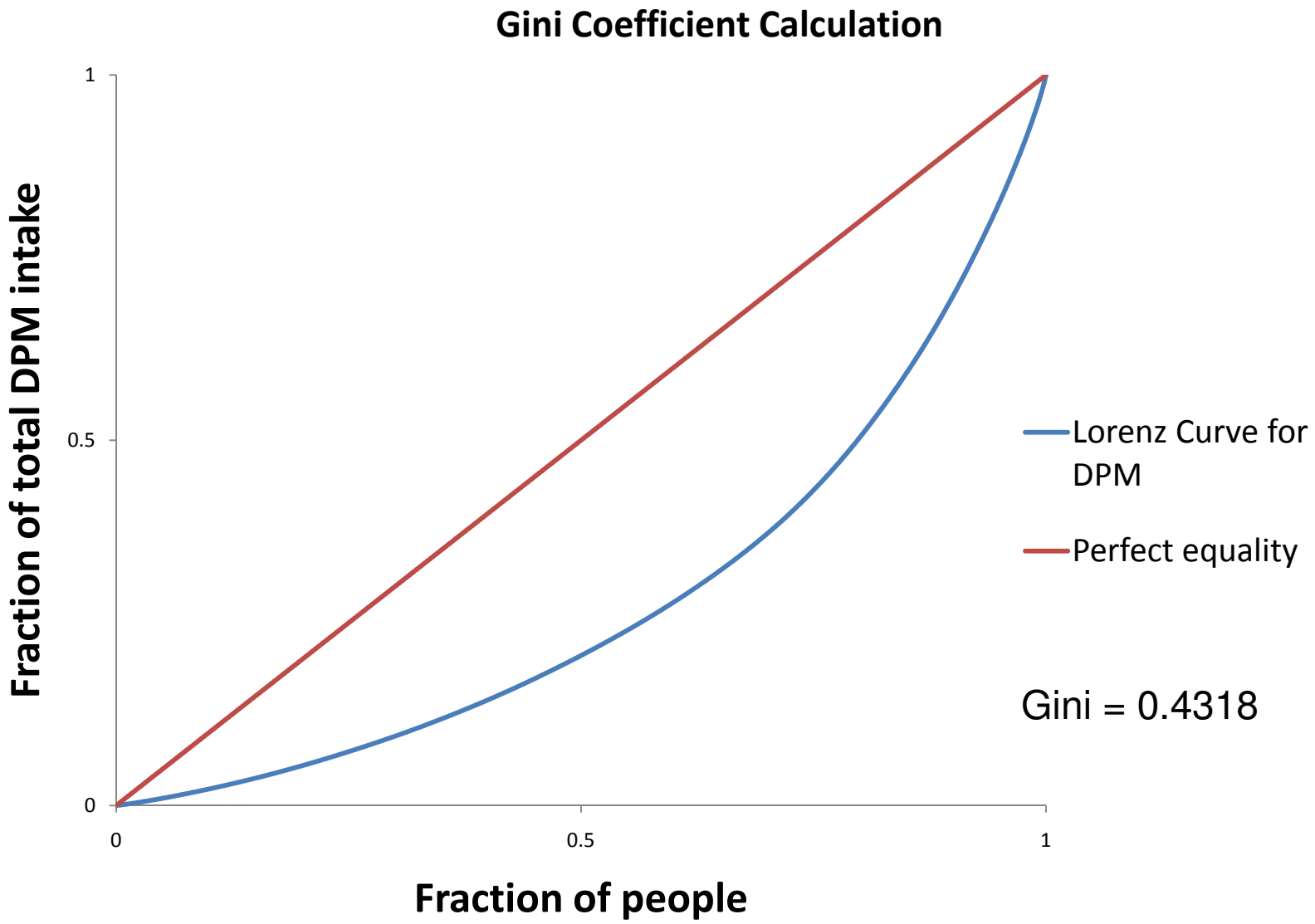
Methods – Ambient Concentration

- Ambient concentrations for one year (CAMx model)
  - 3-D Eulerian photochemical dispersion model
  - Emissions inventory from Multiple Air Toxics Exposure Study (MATES III) – year 2005
  - Fine particulate matter from diesel ($DPM_{2.5}$)

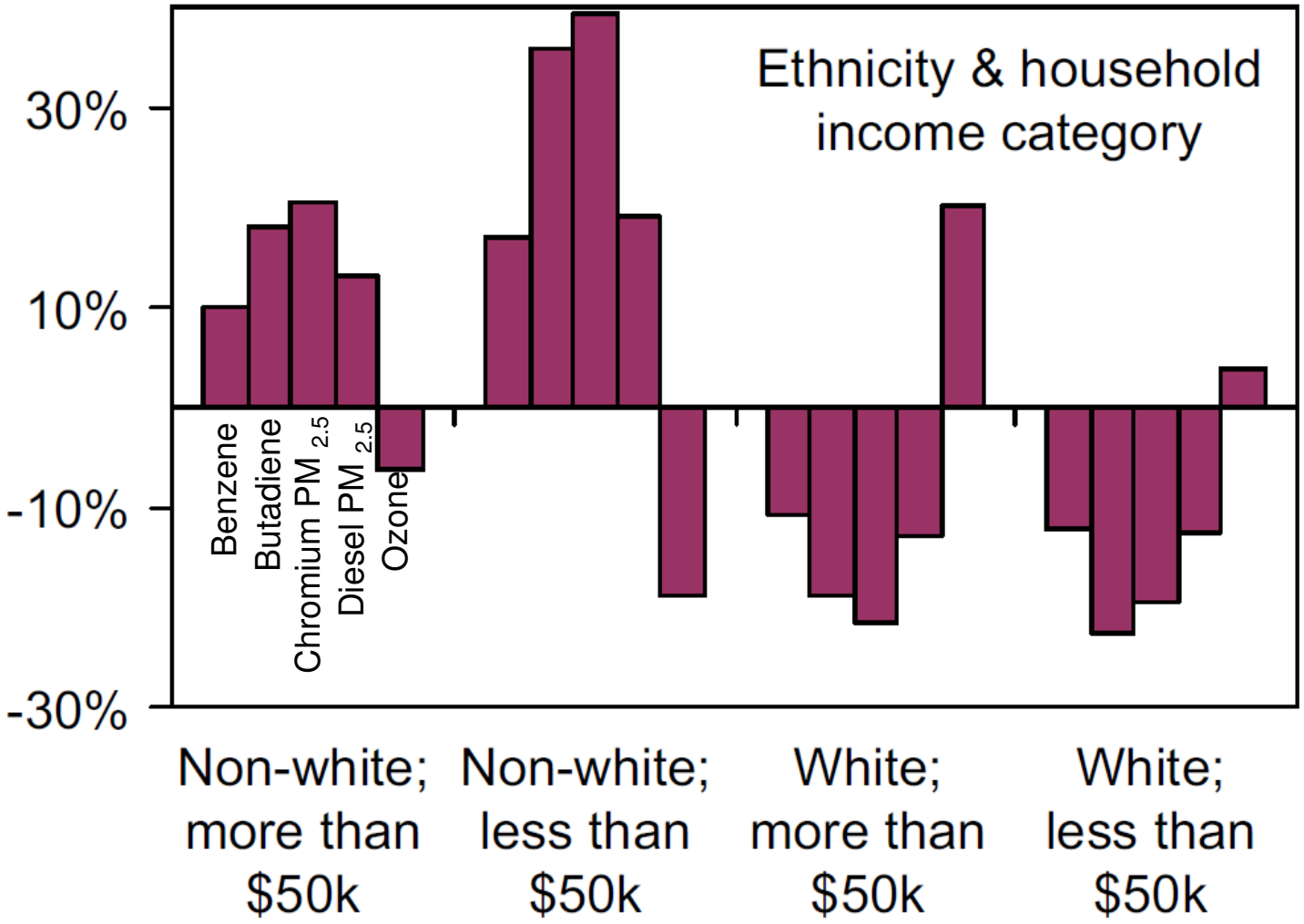
Environmental Goals

1. Impact
2. Efficiency
3. Environmental Equality
   - Gini Coefficient
4. Environmental Justice
   - High-SES (high-income whites) versus low-SES (low-income non-whites)

Environmental Equality



Environmental Justice



Marshall, 2008

Outcomes

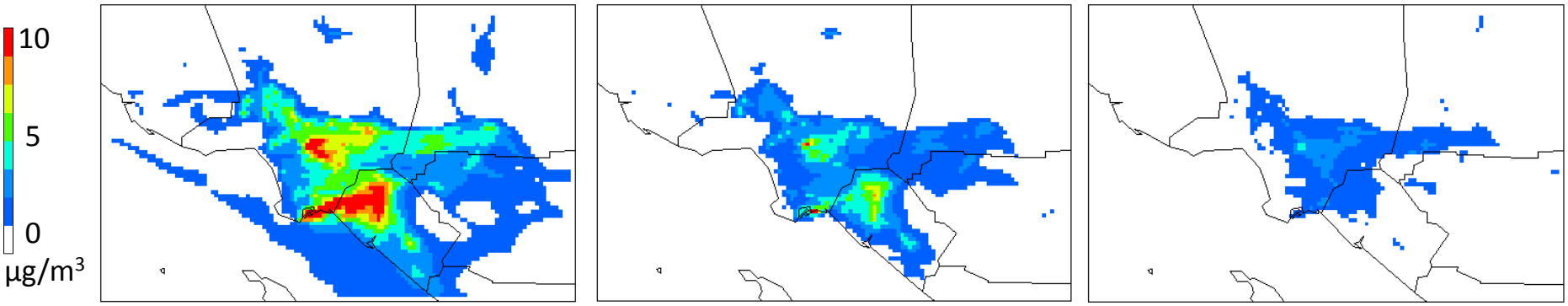
1. Mean Intake: mass inhaled per person (µg/day)

2. Intake Fraction (iF): mass inhaled per mass emitted (-)

3. Environmental Equality
   - Gini coefficient

4. Environmental Justice
   - High-SES (high-income whites) versus low-SES (low-income non-whites) intake

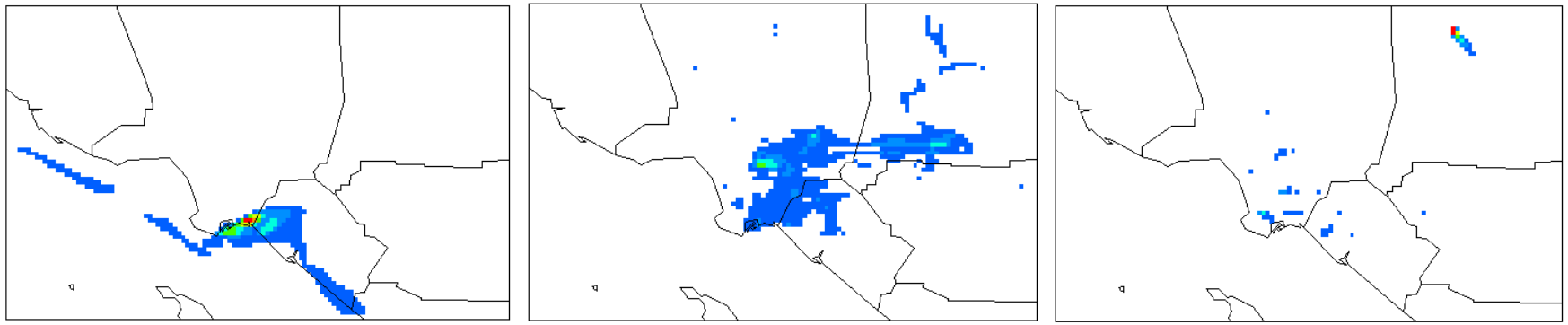
Ambient Concentrations



All Sources – 100%

Off-road – 40%

On-road – 36%

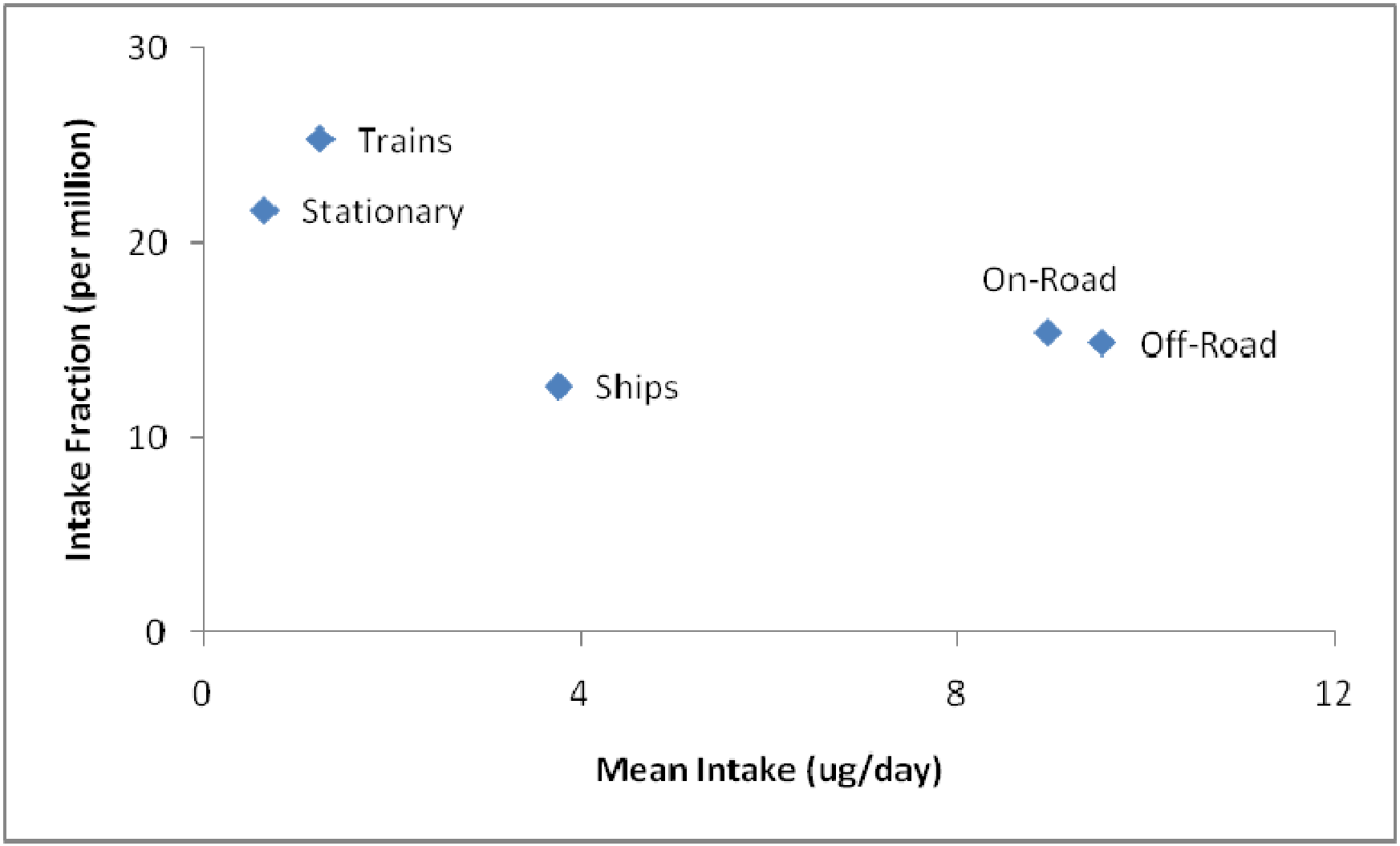


Ships – 19%

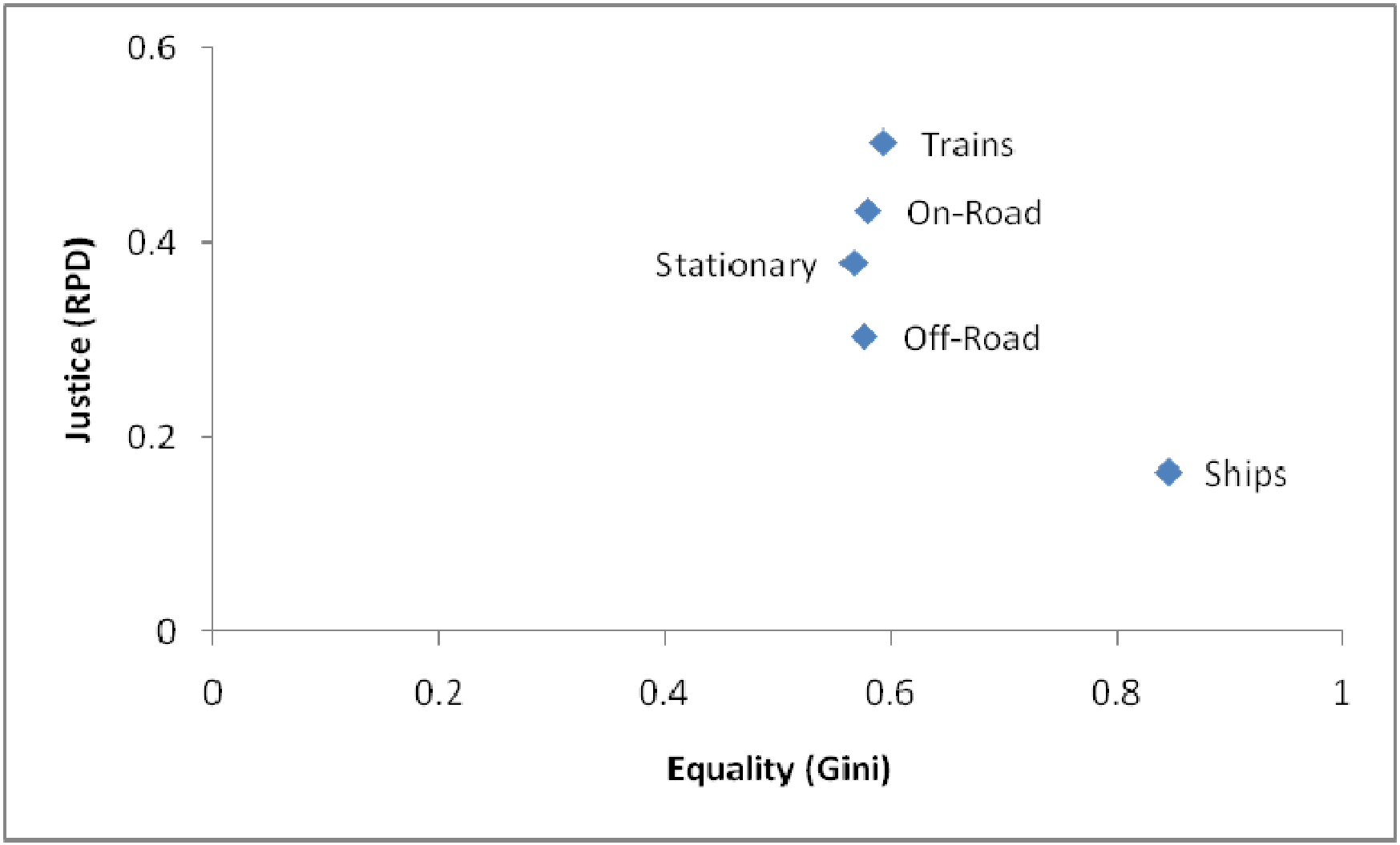
Trains – 3%
(10x)

Stationary – 2%
(10x)

Results: Impact and Efficiency



Results: Equality and Justice



Results: Cumulative Rankings

	Off-Road	On-Road	Ships	Trains	Stationary
Impact	1	2	3	4	5
Efficiency	4	3	5	1	2
Equality	3	4	1	2	5
Justice	4	2	5	1	3

Future Work

- Costs $

- Other pollutants

- Spatial variability

Summary

- Use air dispersion modeling to estimate concentration impacts of hypothetical emission reduction strategies

- Target sources to improve overall intake (off-road mobile sources or trains) and ameliorate environmental injustice (trains or ships)

Acknowledgements

Marshall Research Group

This research has been supported by a grant from the U.S. Environmental Protection Agency's Science to Achieve Results (STAR) program.

Thank you.