Effect of Emissions Reductions by Source or Location

Kathryn R. Lundquist, Julian D. Marshall
University of Minnesota
Environmental Public Health Indicators Conference
September 26, 2011

Issue: Protect Environmental Health

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

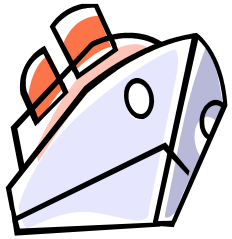
- Prioritize emission reductions
- Environmental justice

Approach: emission and exposure models

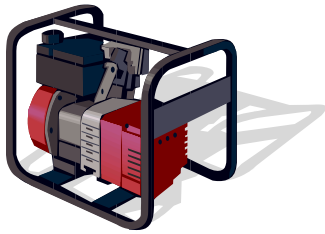
- Emissions: Year-2005 toxics emissions inventory
  - Diesel PM 2.5 (DPM)


Off-Road


On-Road


Ships


Trains

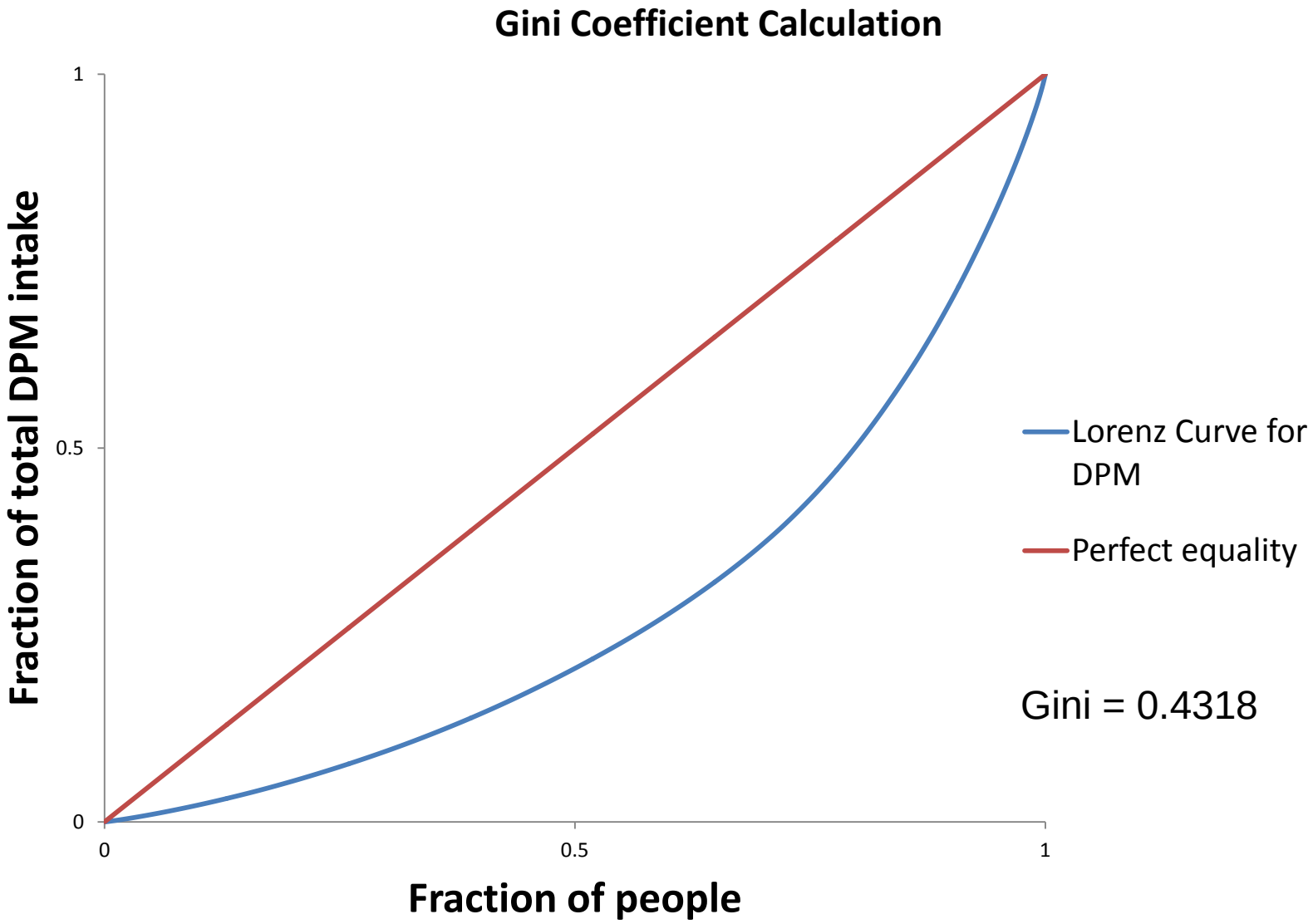

Stationary

- Dispersion: CAMx air dispersion model
  - South Coast Air Basin (36,000 km^2), 2 km x 2 km grid cells
  - Jan 1, 2005 – Dec 31, 2005, 1-hour time steps
- Exposures
  - Combine concentrations with population demographic information for everyone in the domain

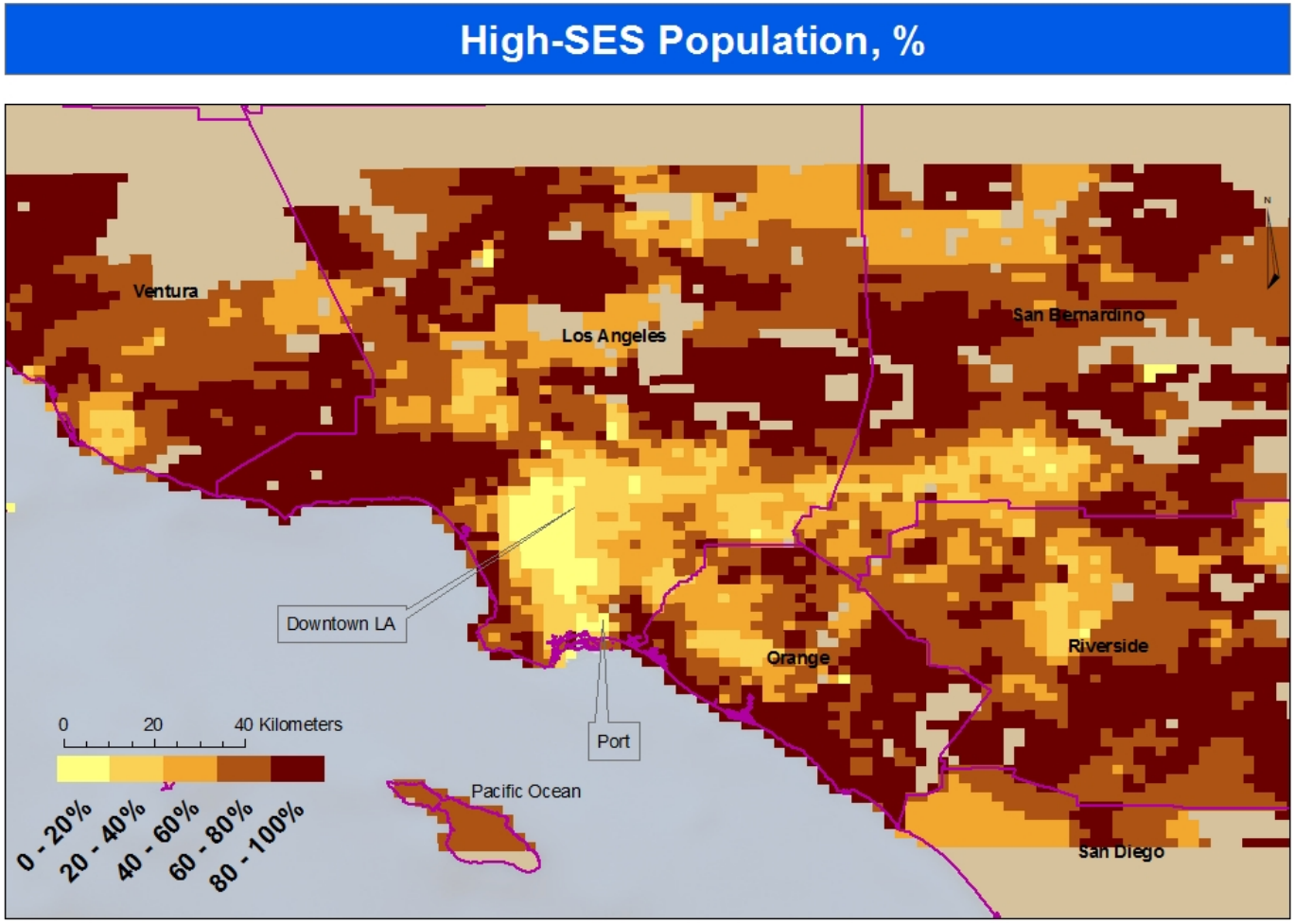
Environmental goals

1. Impact
   - Mean intake (μg/day)
2. Efficiency
   - Intake fraction (μg inhaled per g emitted)
3. Environmental Equality
   - Gini coefficient
4. Environmental Justice
   - High-SES (high-income whites) versus low-SES (low-income non-whites)

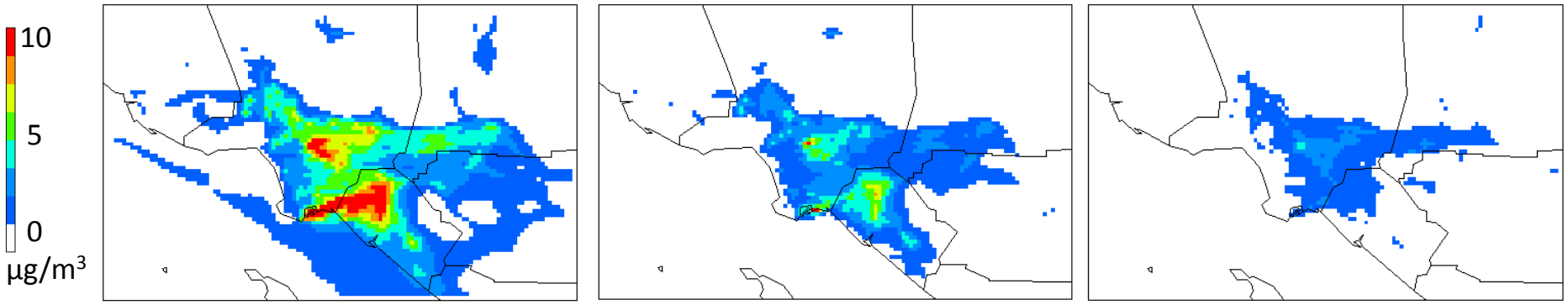
Environmental equality



South Coast demographics



Ambient concentrations



All sources – 100%

Off-road – 40%

On-road – 36%

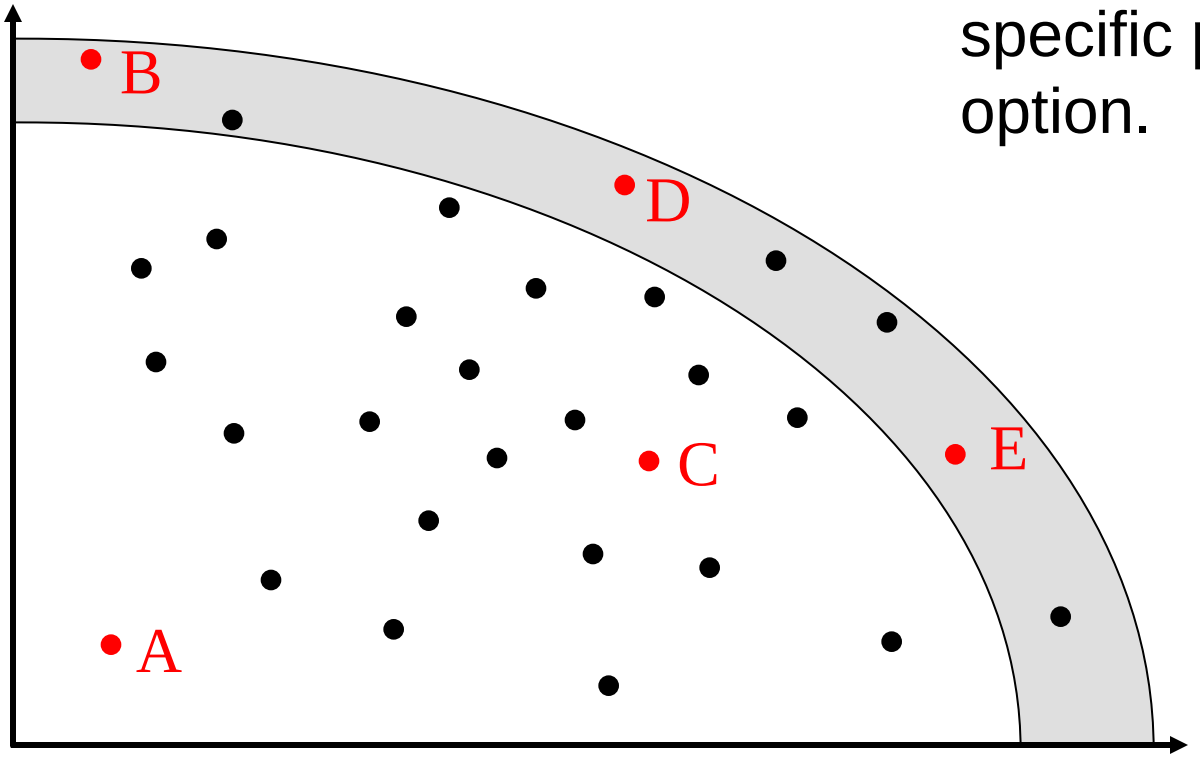
Ships – 19%

Trains – 3%
(10x)

Stationary – 2%
(10x)

Theory: Pareto-optimal strategies

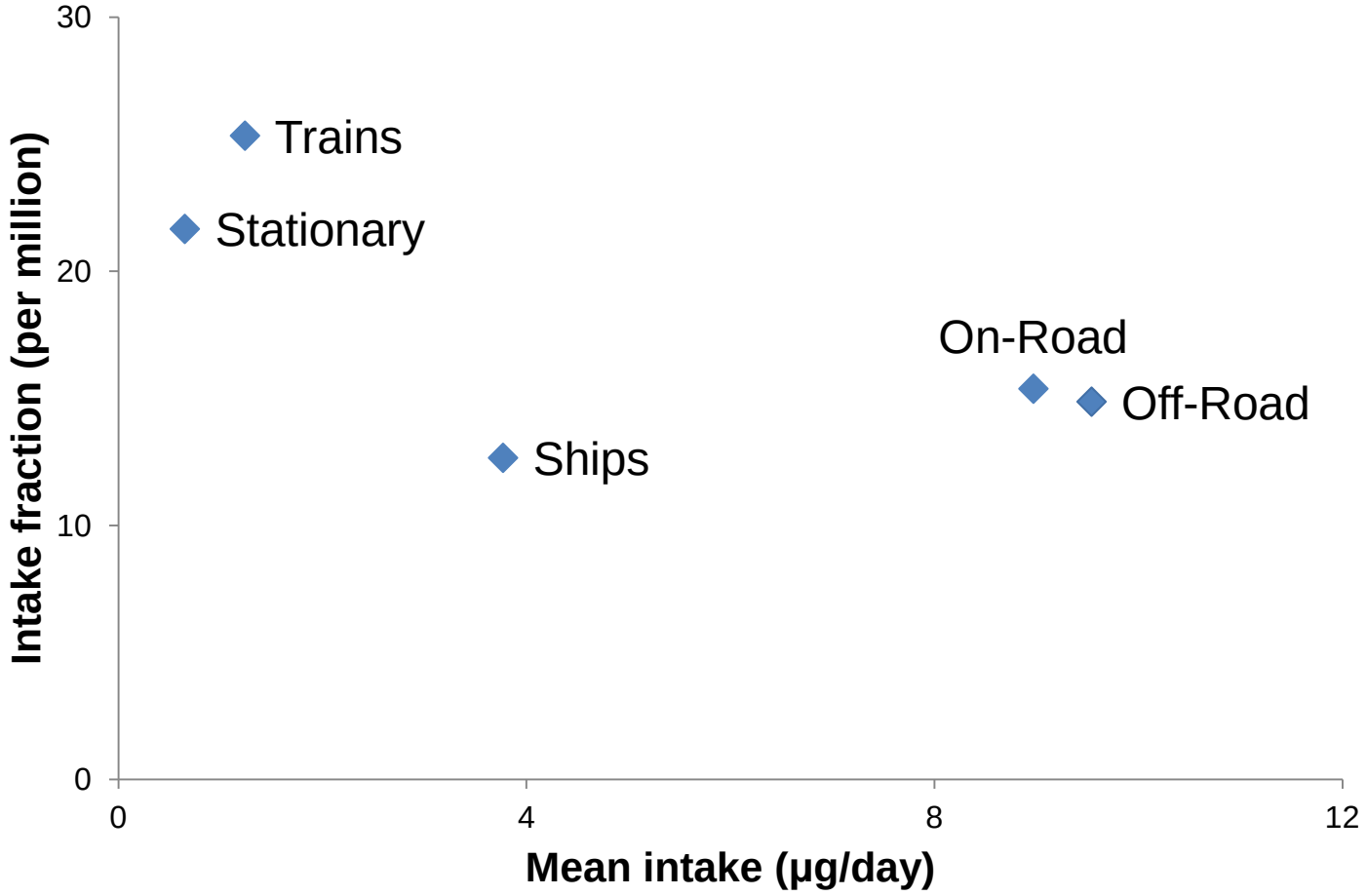
Each dot is a specific policy option.



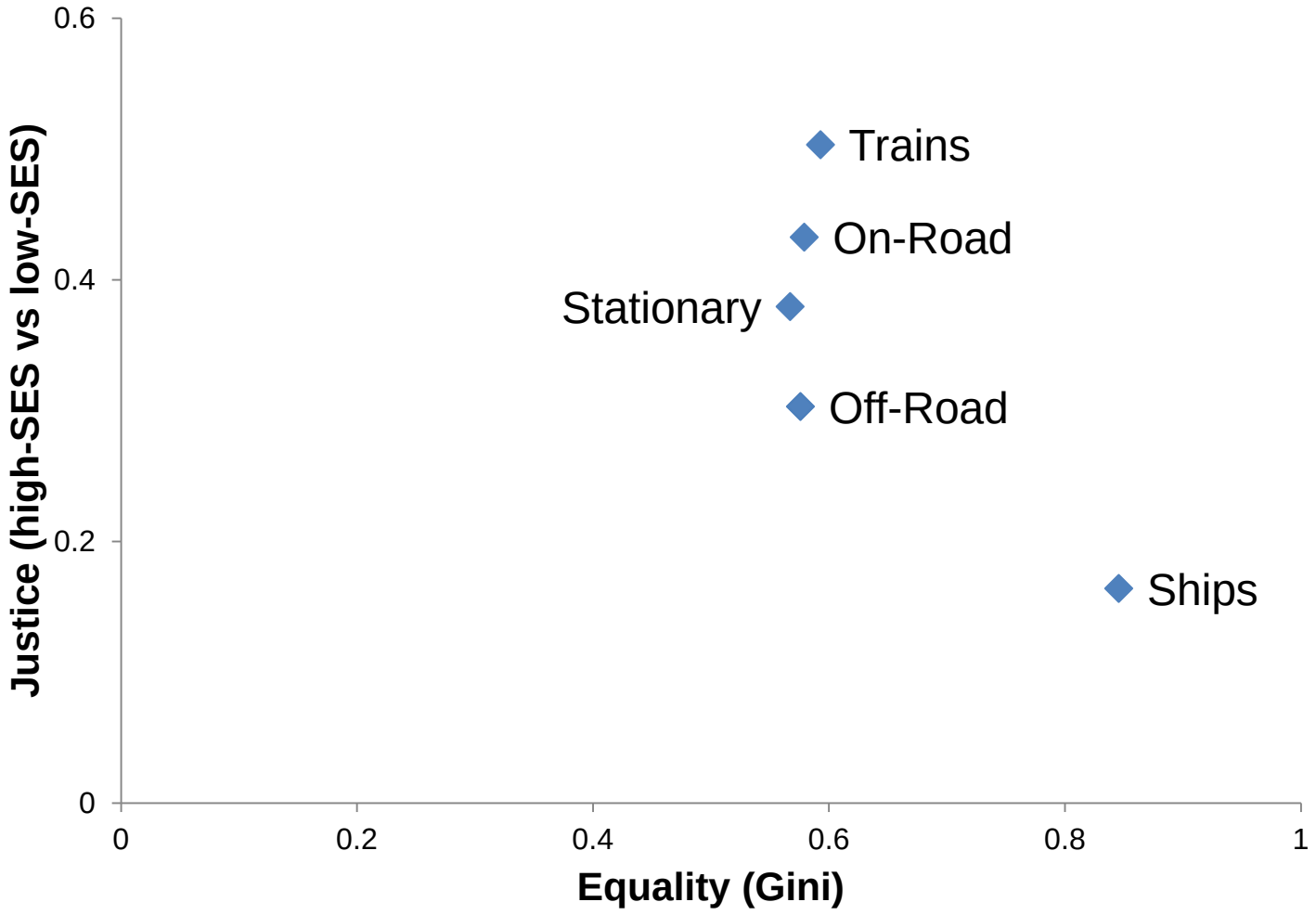
Reduction in exposure inequity

Reduction in average exposure

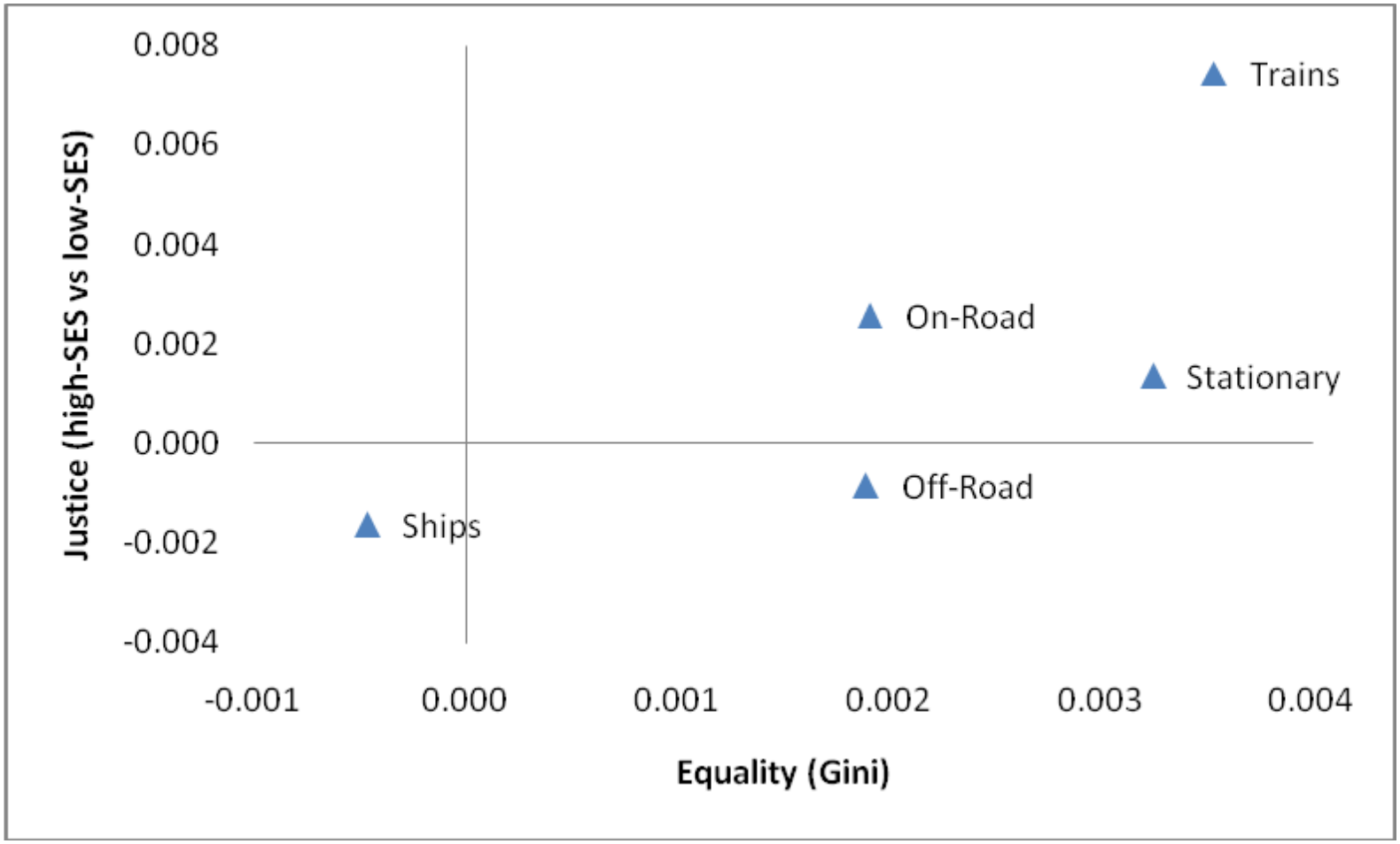
Results: impact and efficiency



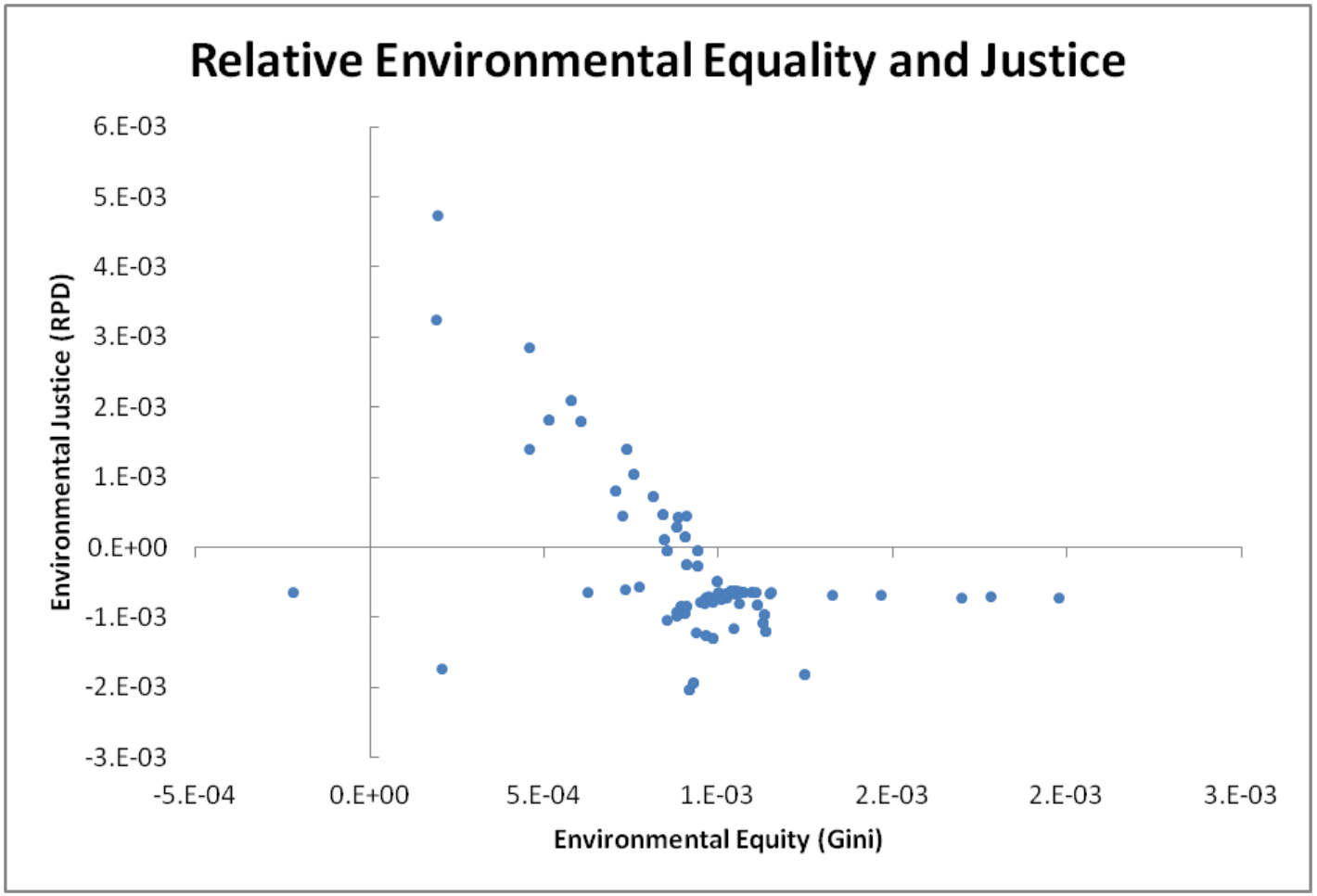
Results: equality and justice (1)



Results: equality and justice (2)



Results: by spatial location



Summary

- Choice of metric matters

- Using air dispersion modeling to estimate concentration and exposure modeling to estimate population intake allows policymakers to model the impacts of hypothetical emission reduction strategies

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.