

Assessing Health Impacts of Major Air Pollutants

Patrick L. Kinney

Associate Professor

Department of Environmental Health Sciences

Mailman School of Public Health, Columbia

October 21, 2008

“Criteria Pollutants”

Ubiquitous Pollutants of Human Health Concern

Carbon monoxide (CO)

Nitrogen dioxide (NO₂)

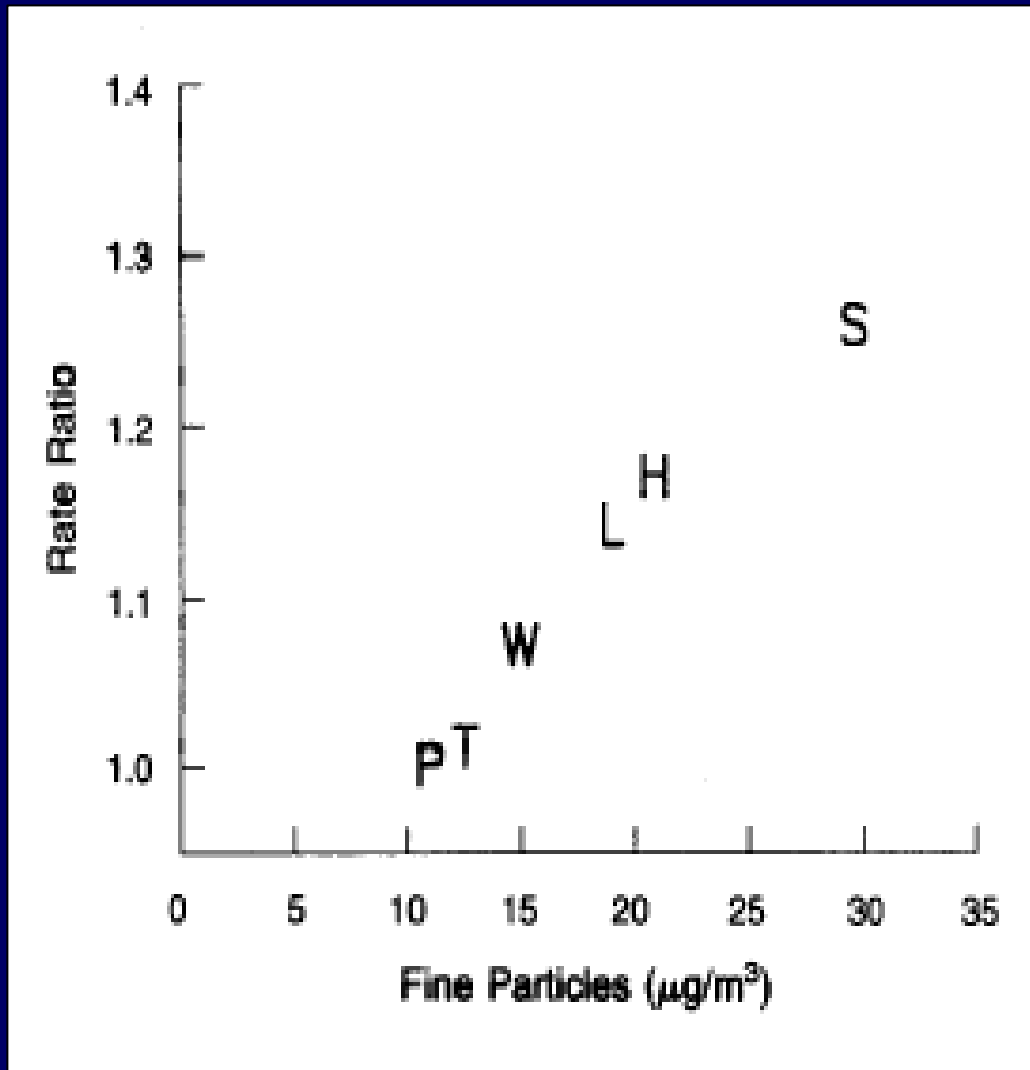
Lead (Pb)

Sulfur dioxide (SO₂)

Ozone (O₃)

Particulate matter (PM_{2.5}, PM₁₀)

Mortality Rate vs. Air Pollution

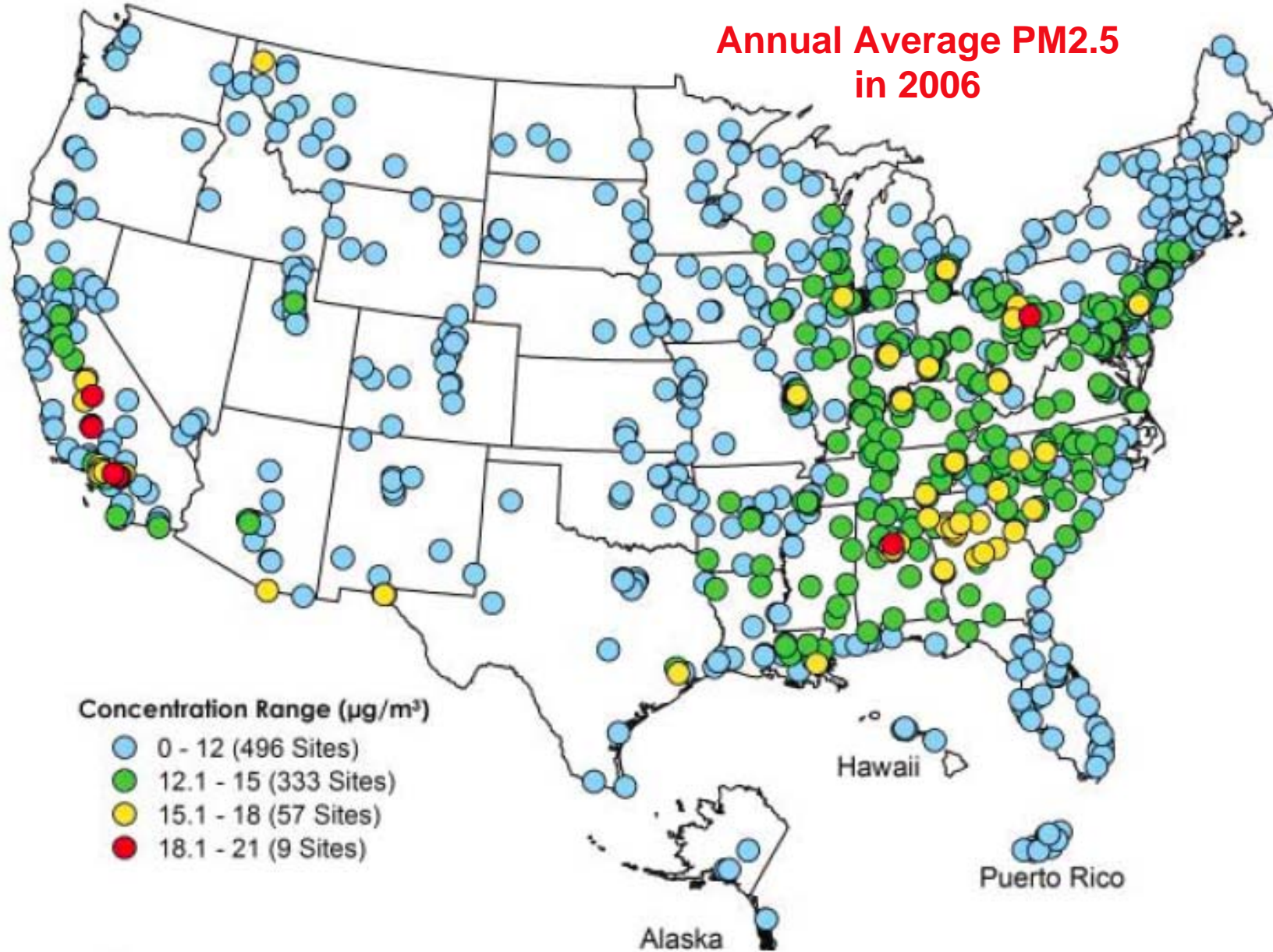


Mortality rates across six U.S. cities are related to long-term average fine particle levels, controlling for key covariates

Results from Harvard Six Cities Study. Dockery et al., NEJM, 1993.

Annual Average PM2.5 in 2006

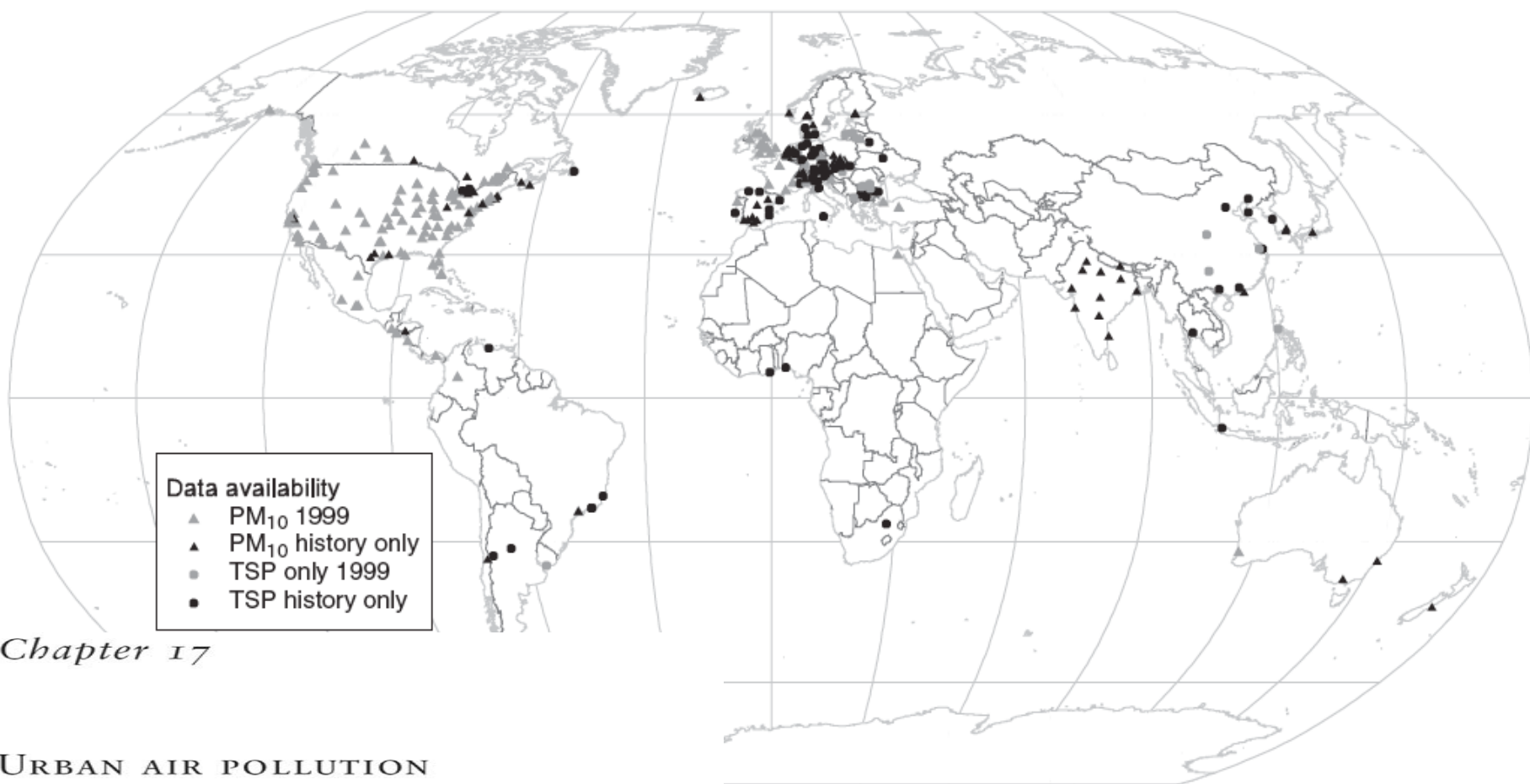
Annual



Major Sources of Fine Particles

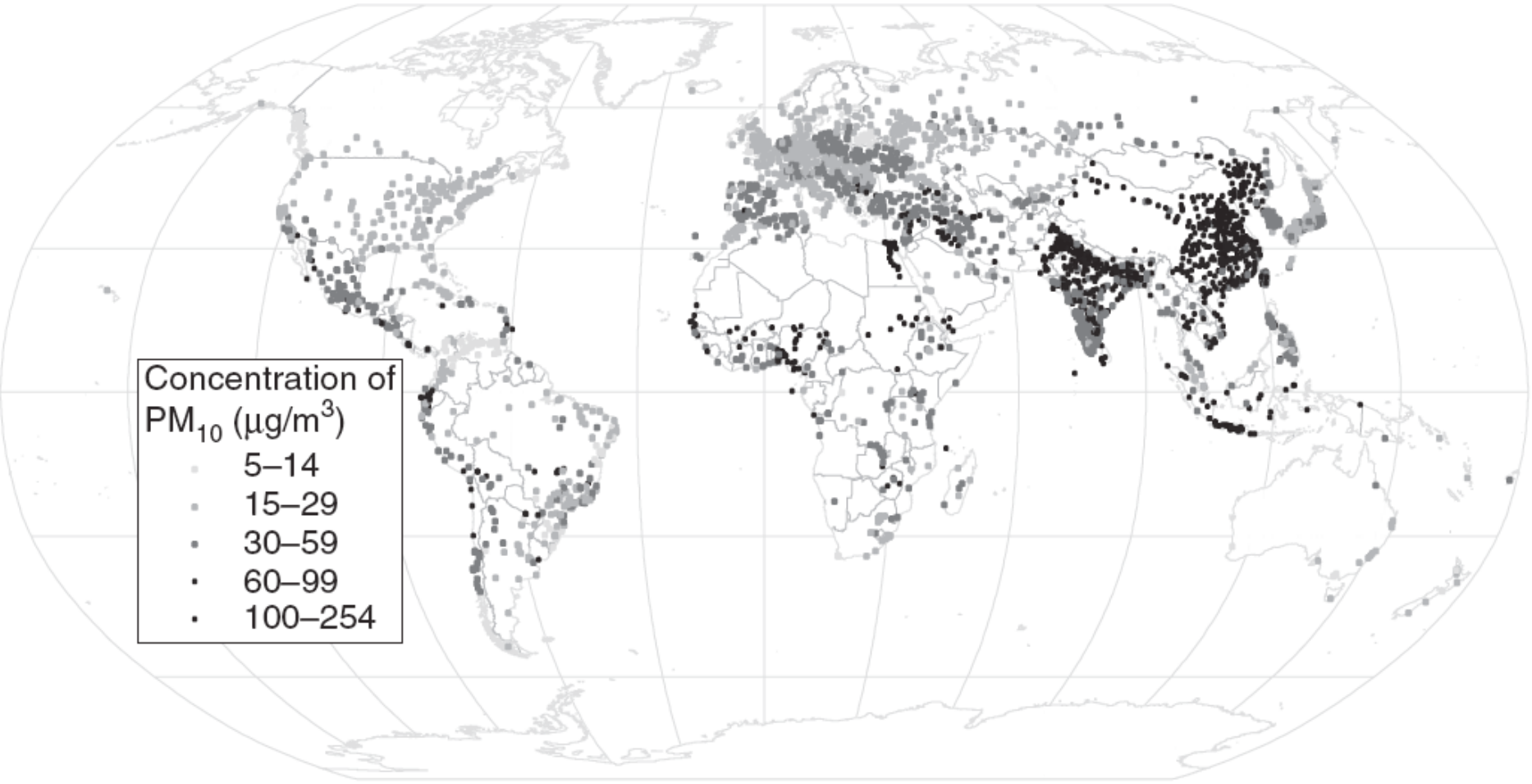
- **North America**
 - Motor Vehicles, especially diesel
 - Coal and Oil-Fired Power Plants
- **Africa**
 - Motor Vehicles, especially diesel
 - Open burning of refuse
 - Industry
 - Wind-blown dust

Figure 17.1 Cities from which data on exposure to PM_{10} or TSP during 1985–1999 are available from monitoring sites



AARON J. COHEN, H. ROSS ANDERSON, BART OSTRO,
KIRAN DEV PANDEY, MICHAL KRZYZANOWSKI,
NINO KÜNZLI, KERSTEN GUTSCHMIDT,
C. ARDEN POPE III, ISABELLE ROMIEU,
JONATHAN M. SAMET AND KIRK R. SMITH

Figure 17.2 Estimated annual average concentrations of PM₁₀ in cities with populations of >100 000 and in national capitals

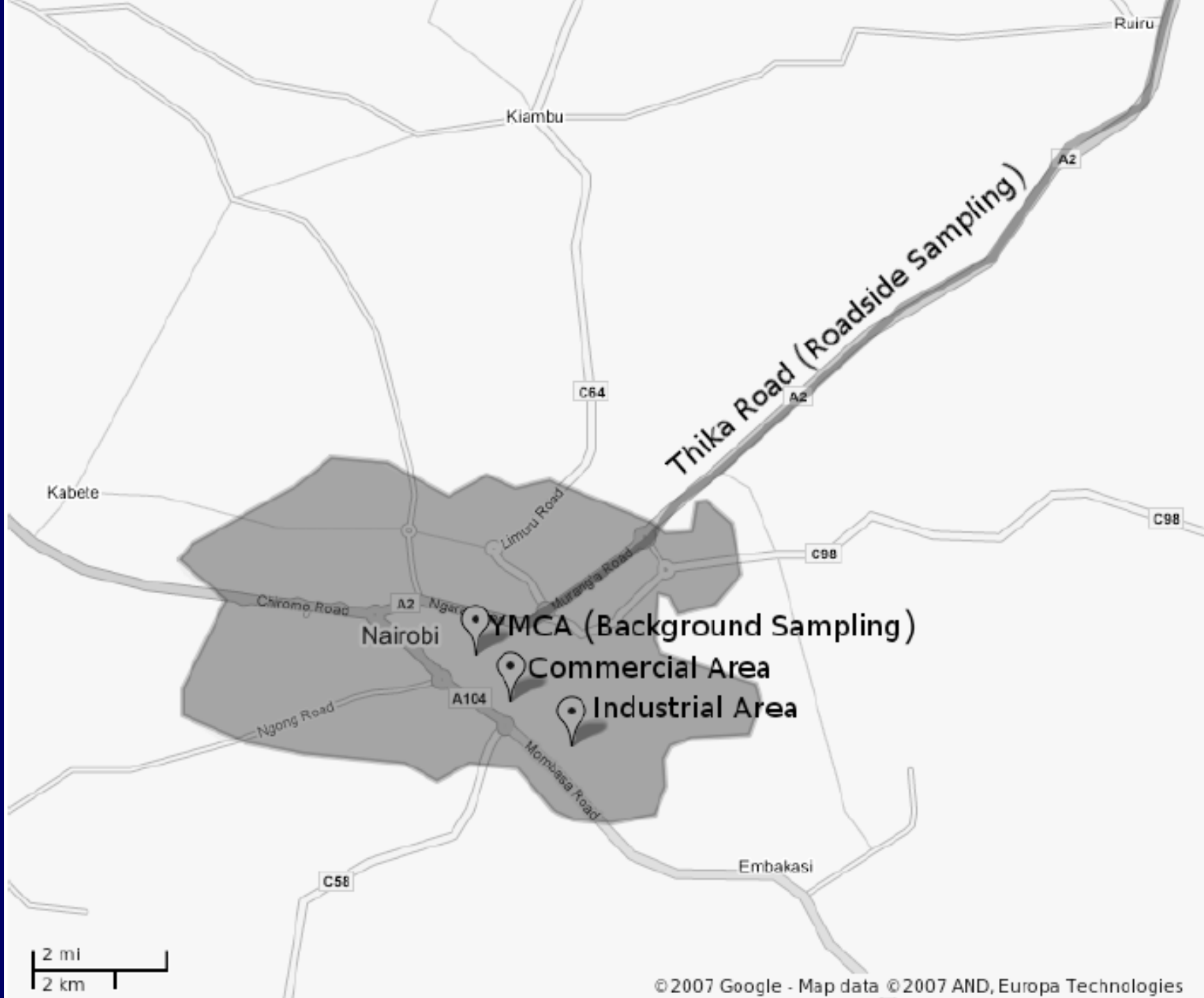


Challenges in Quantifying Health Risks due to Urban Air Pollution in Africa

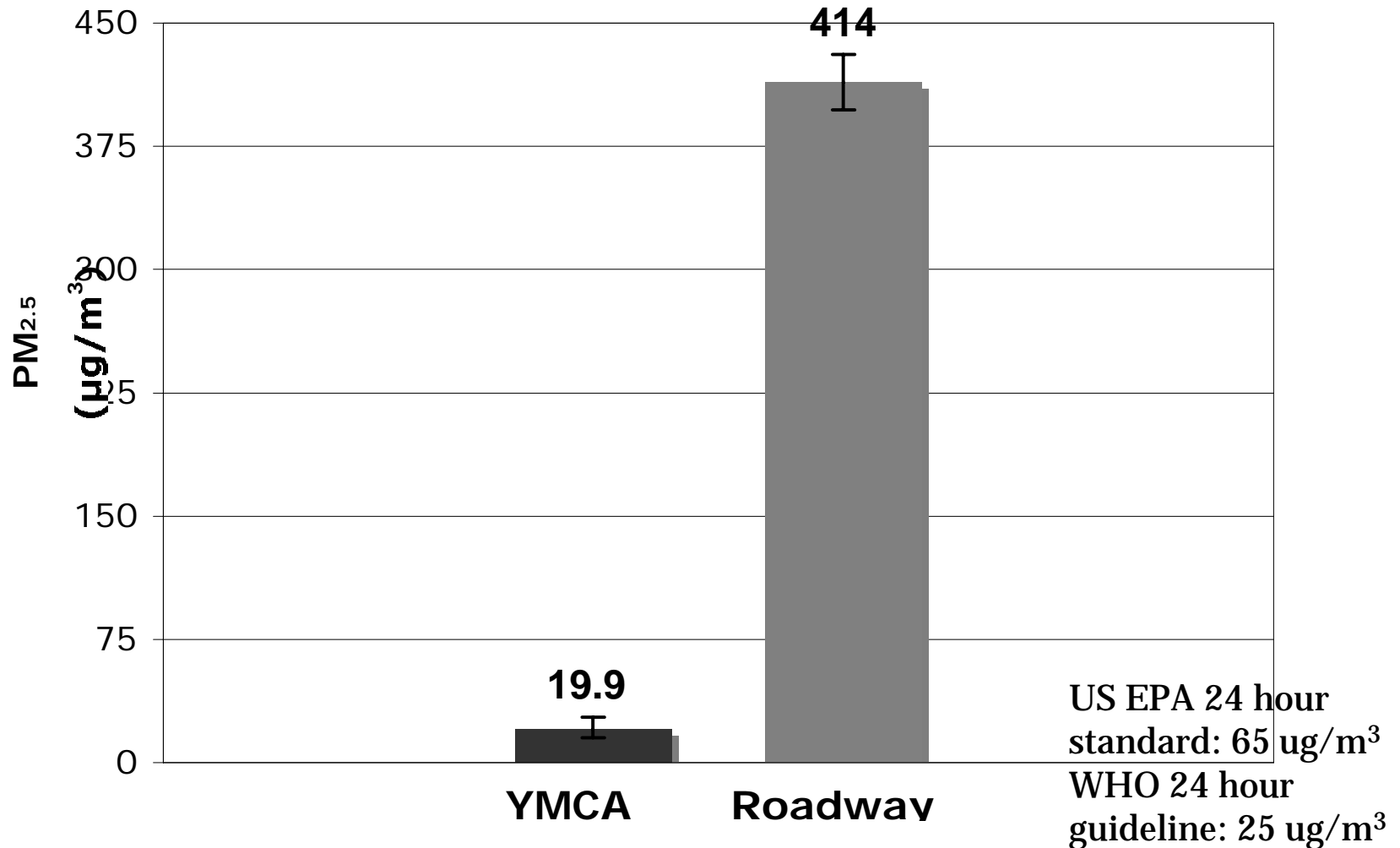
- **Lack of air monitoring data**
- **Difficulties in extrapolating concentration-response functions from North American health studies**
- **Unique urban context**
 - Populations
 - Built environments
 - Mixes of pollutants

PM_{2.5} and Black Carbon Monitoring Setup





Airborne Fine Particle Concentrations



Source: van Vliet and Kinney, Environmental Research Letters, 2007

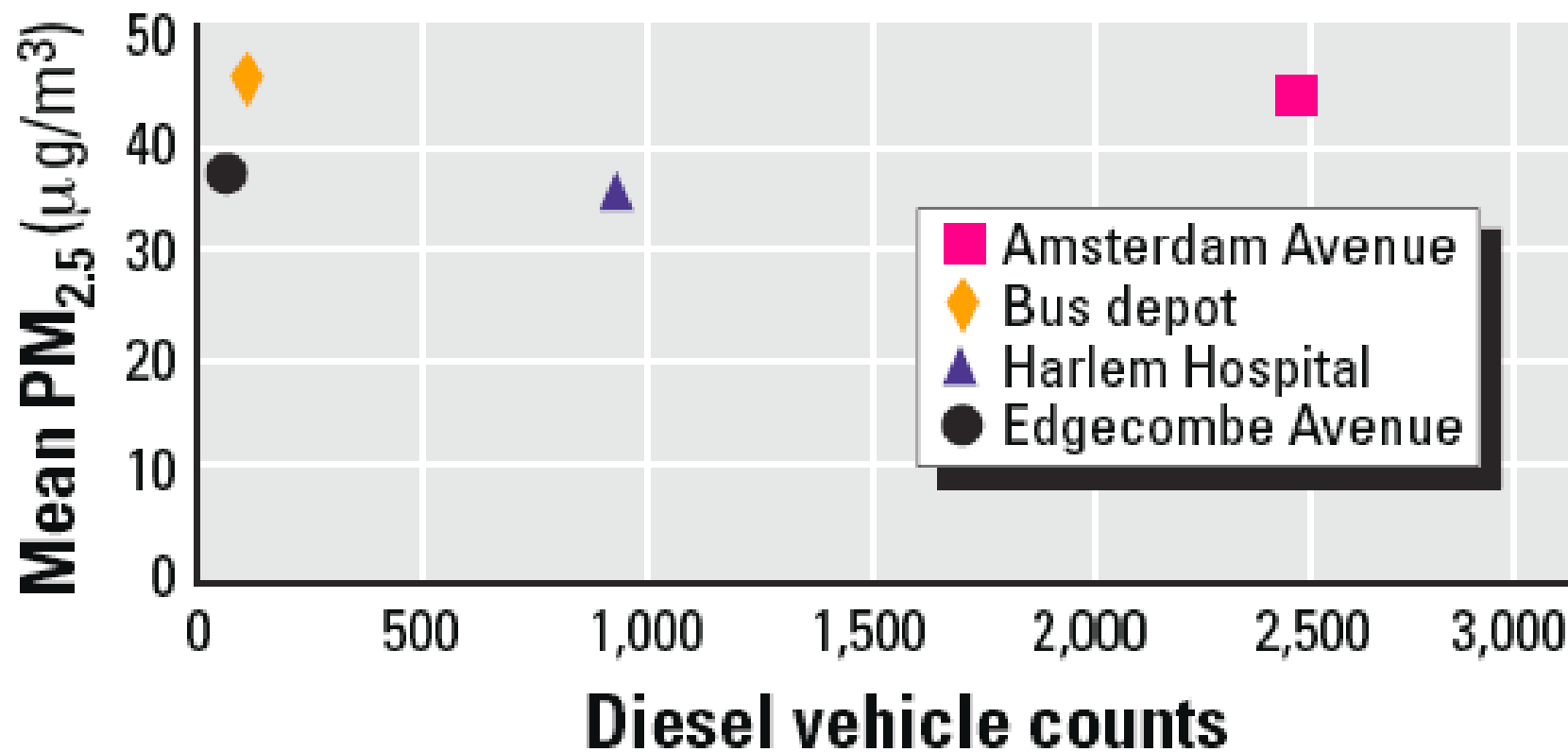


Figure 3. Scatterplot of mean PM_{2.5} concentrations and diesel vehicle counts (heavy duty trucks and buses) at four monitoring sites in Harlem.

Summary

- Health effects of major air pollutants are well known, but most evidence is from N. America and Europe
- Fine Particulate Matter (PM_{2.5}) represents a useful metric of air pollution risk
- Health risk assessment for air pollution in African cities is hampered by data gaps for both ambient air pollution and health impacts
- Rapid urbanization and corresponding growing air pollution emissions present major challenges for environmental managers in African cities
- Small-scale air monitoring and health studies can help to fill the need for local data