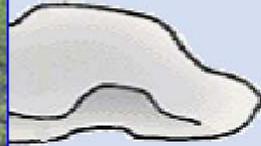


NAWQA – National Water Quality Assessment Program



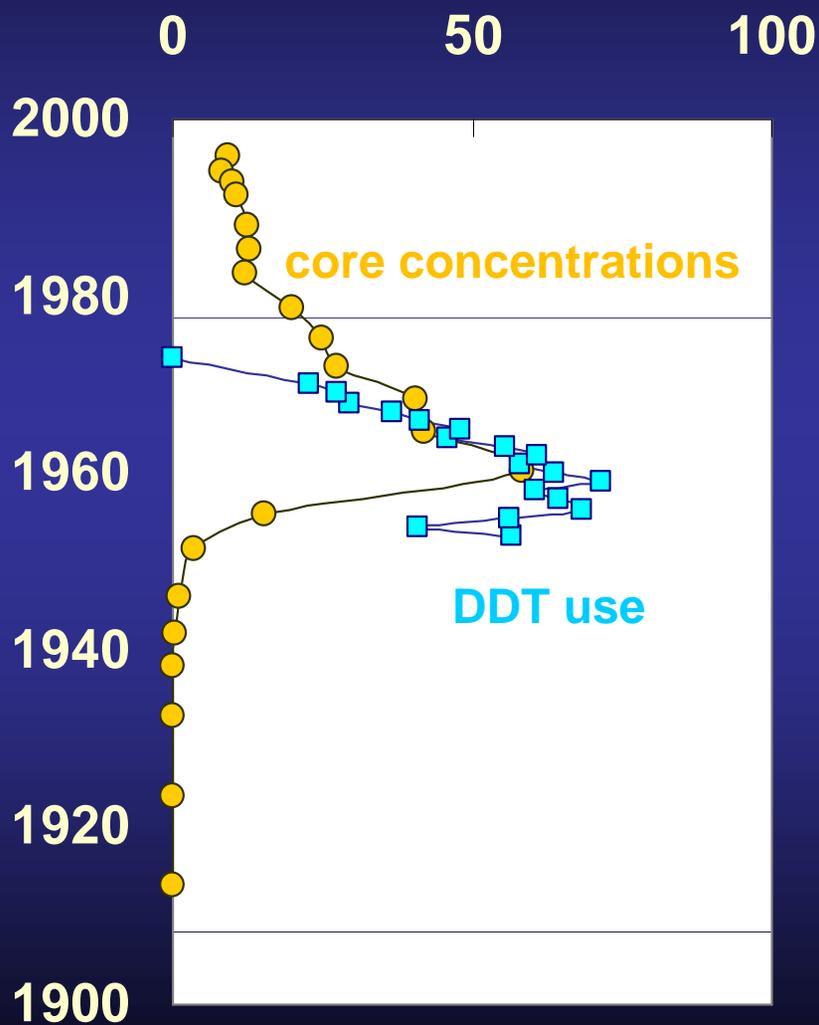
- ❑ STATUS – characterize water quality nationally
- ❑ TRENDS – describe trends, or lack of trends
- ❑ UNDERSTANDING – identify and explain major factors controlling water quality

Paleolimnology



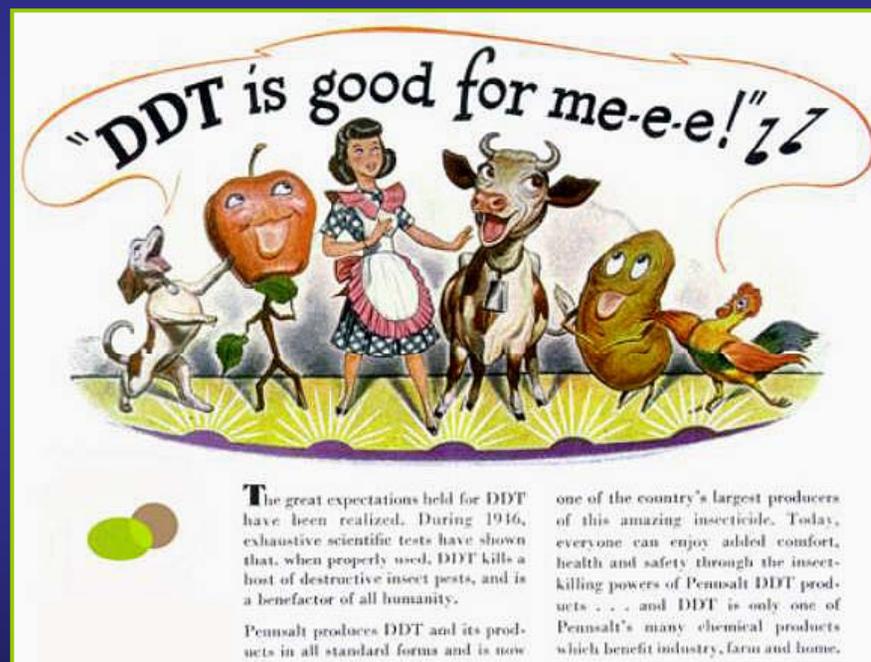
Some good news...

Total DDT (ppb)



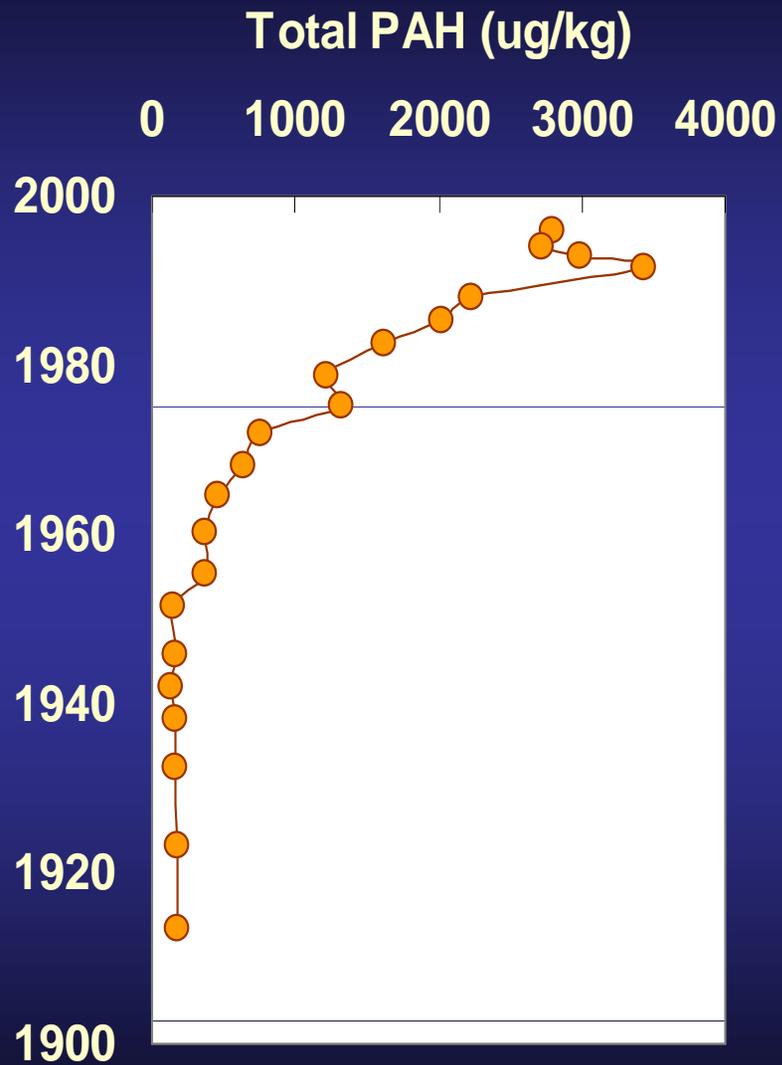
White Rock Lake, Dallas

Time Magazine Ad, 1950s

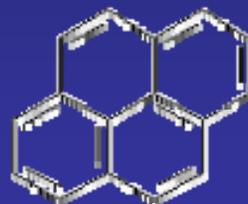


Van Metre et al., 1998,
Environmental Sci. & Tech.

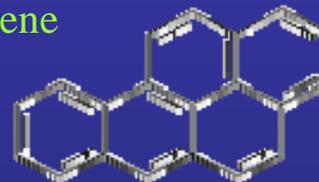
And some bad news



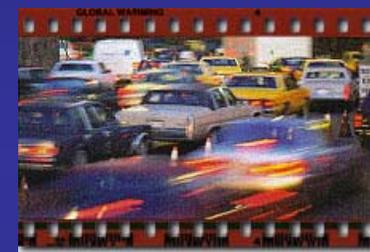
Phenanthrene



Pyrene

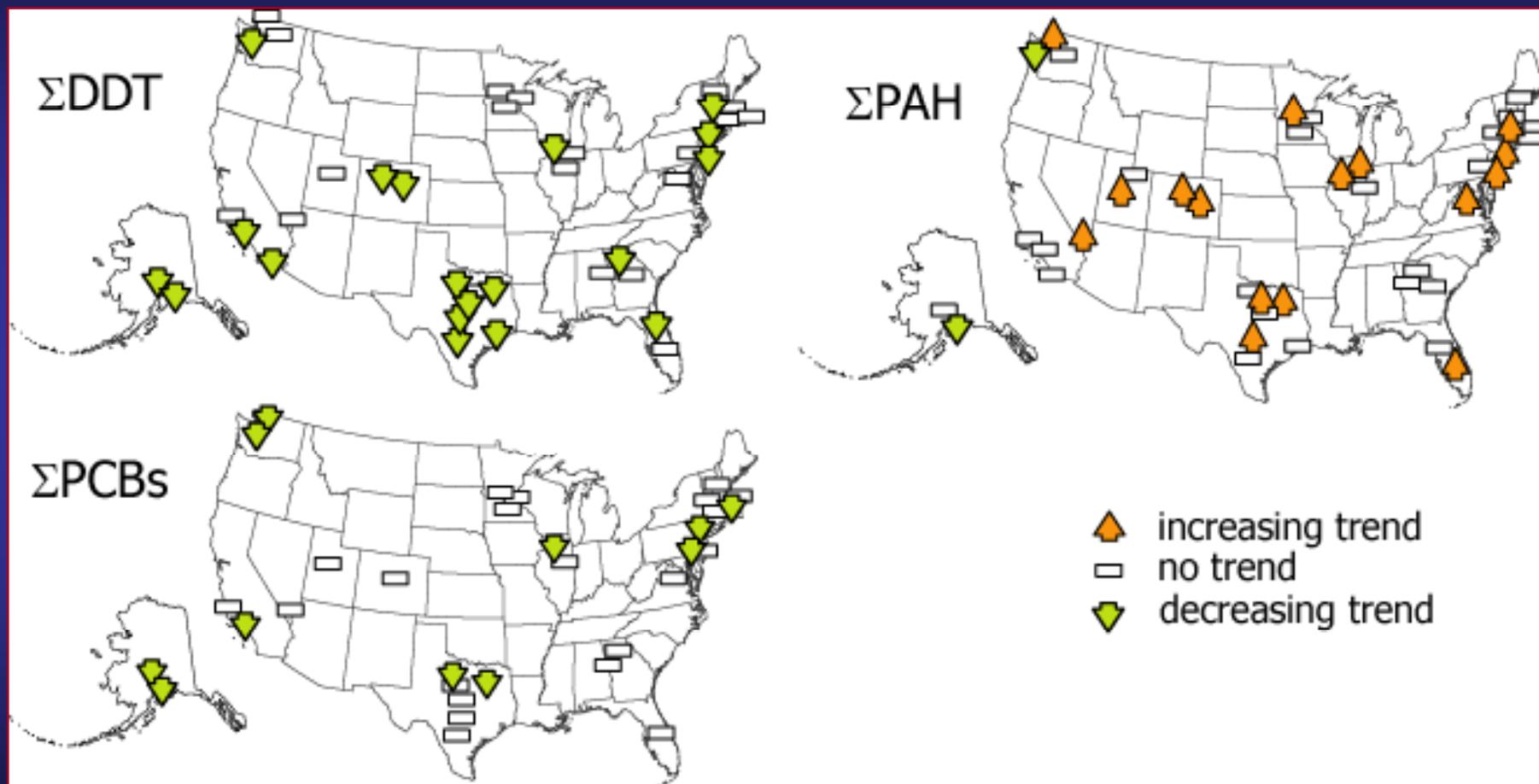


Benzo(a)pyrene



Van Metre et al., 2000, *Environmental Sci. & Tech.*

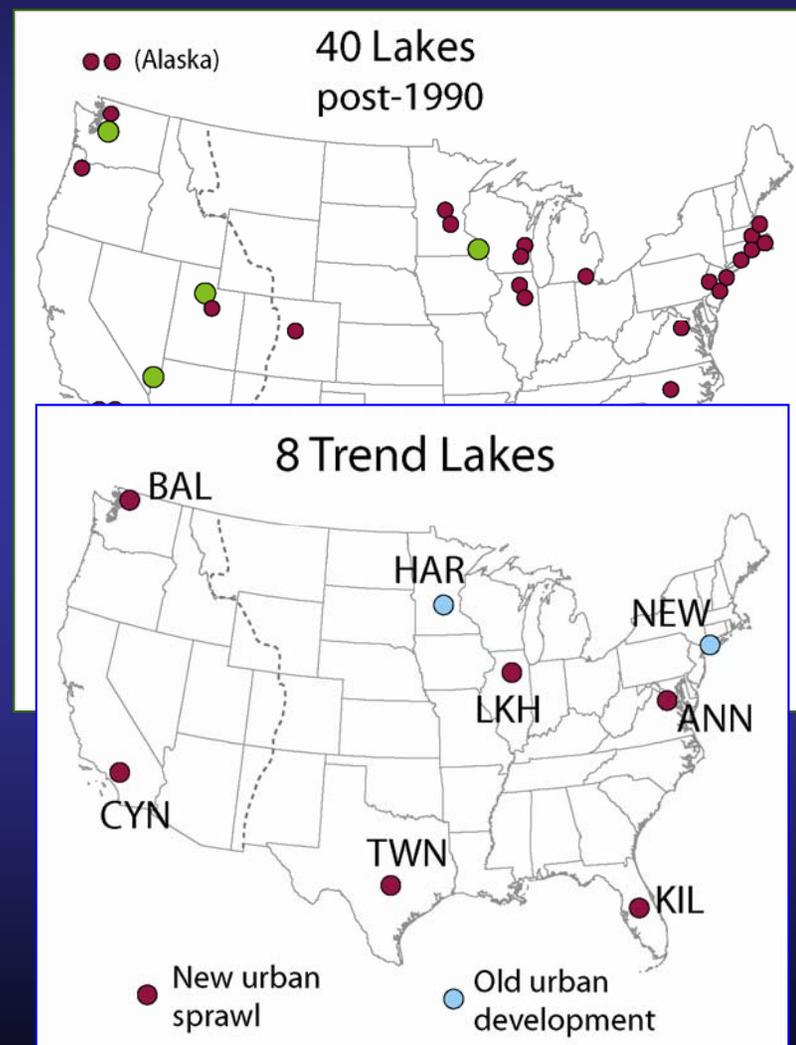
Patterns that repeat



PAH sources to 40 United States lakes



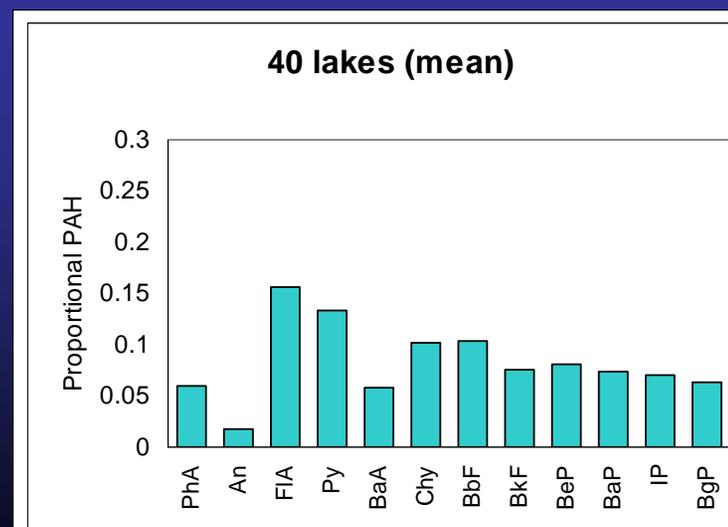
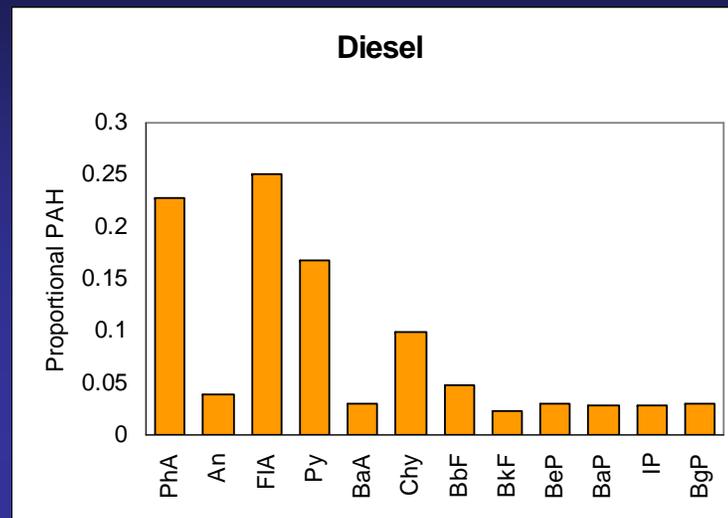
- Quantified PAH, post-1990, to 40 lakes using EPA **CMB*** receptor model
- Analyzed trends in PAH sources in eight urban lakes
- First such study at national scale and first to include **CT sealcoat**
- Paper is approved by USGS, in journal review



*Contaminant Mass Balance

How CMB works

- ❑ Uses proportional PAH profiles (12 PAH) in many sources
- ❑ Adds source contributions to get best match of receptor profile (lake sediment) by minimizing Chi-squared (X^2)
- ❑ Provides estimated mass loading and uncertainty for each source



PAH sources considered

- ❑ Vehicle/traffic related:

Gasoline and diesel soot and exhaust, tunnel air, used oil, tires

- ❑ Asphalt

- ❑ Coal combustion:

Residential, power plant, and coking

- ❑ Fuel oil combustion

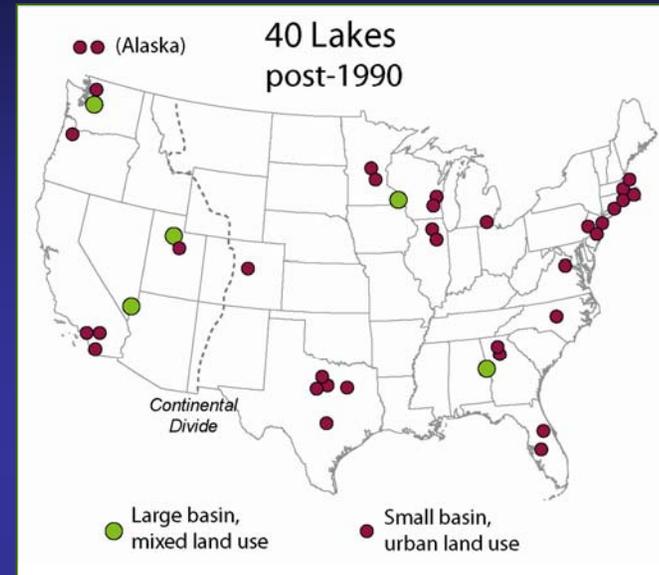
- ❑ Wood burning

- ❑ Coal-tar based sealcoat

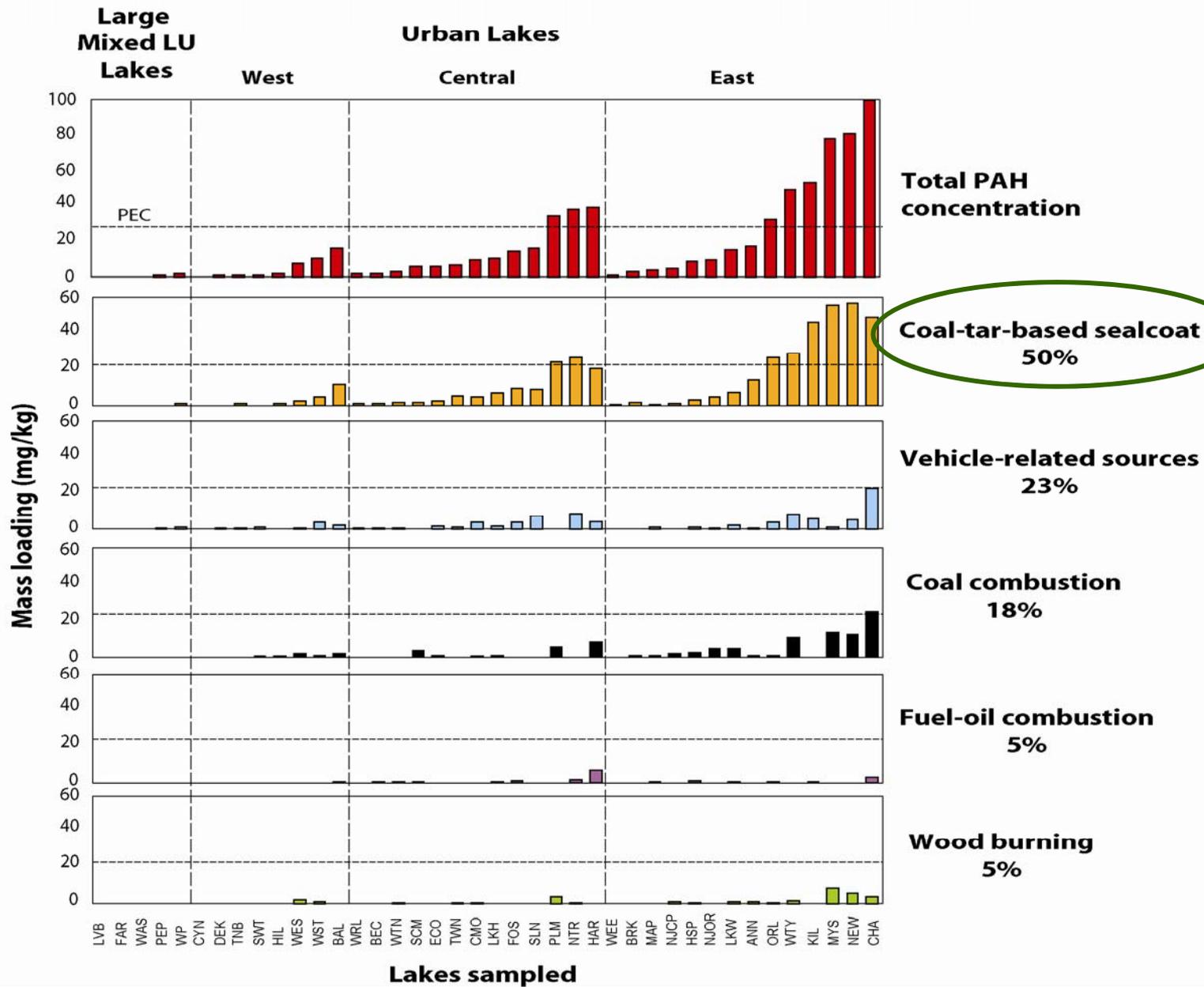


Modeling Process

- ❑ Over 200 modeling scenarios run
- ❑ Many combinations of sources, PAHs, and lakes tried
- ❑ Identified the 4 best performing models
- ❑ Summarized results by five general source types: **vehicles, coal, fuel oil, CT sealcoat, and wood**



Results of 4 best models

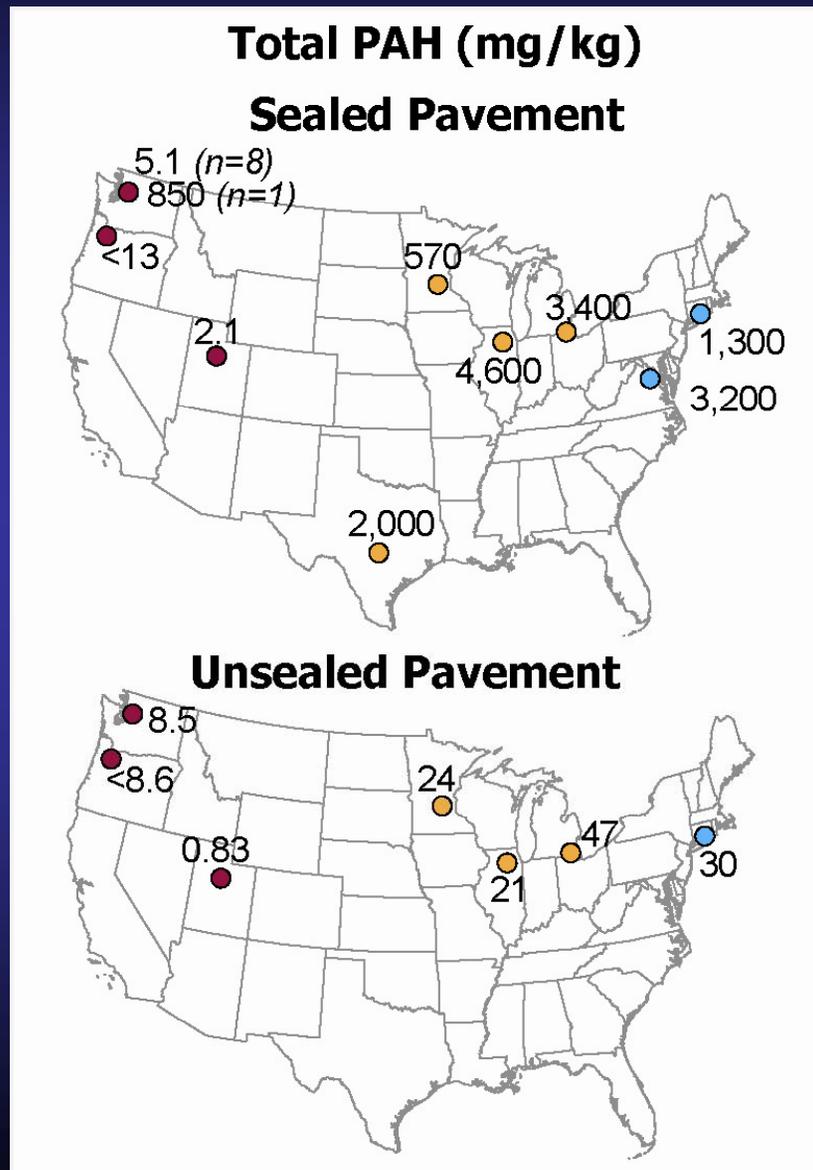


Regional Source Difference

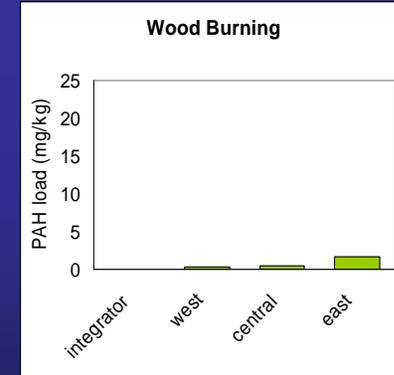
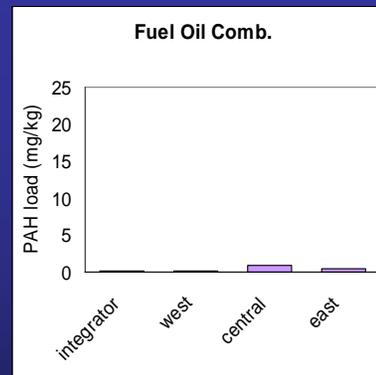
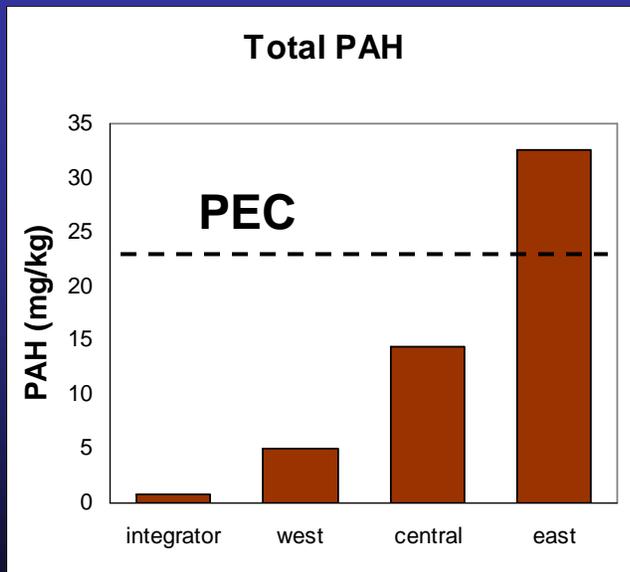
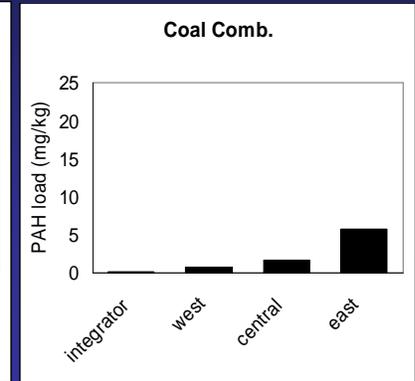
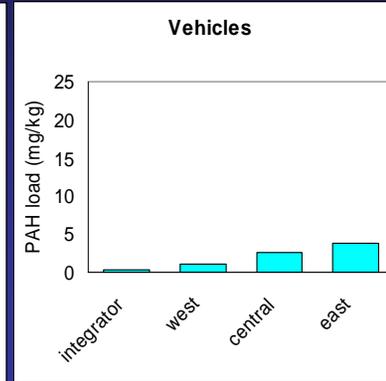
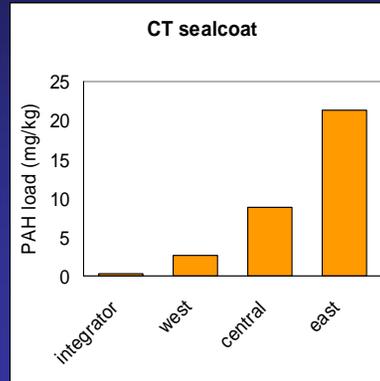
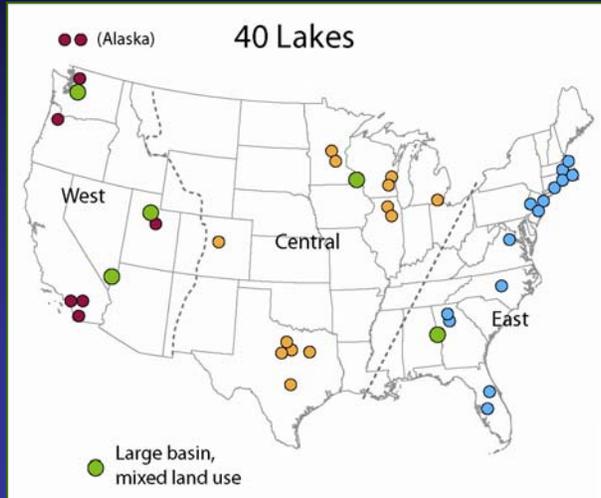


Dust from sealed and unsealed pavement shows a very strong regional gradient

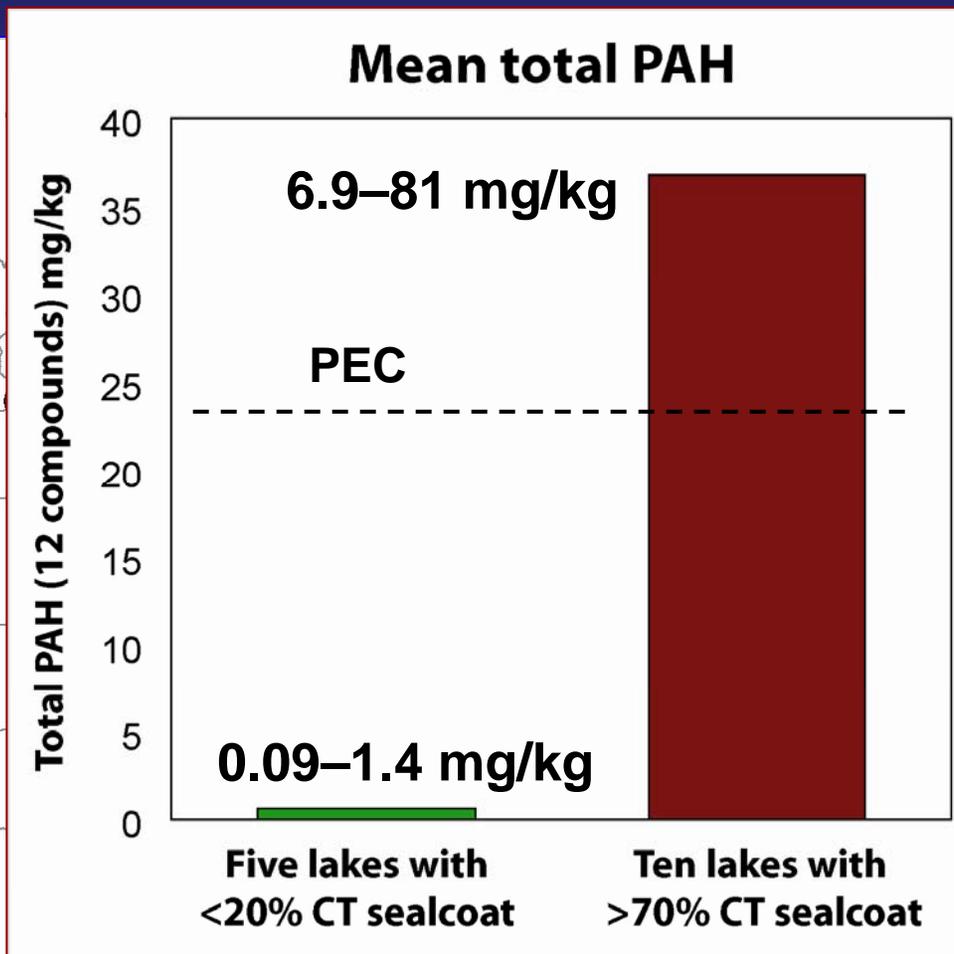
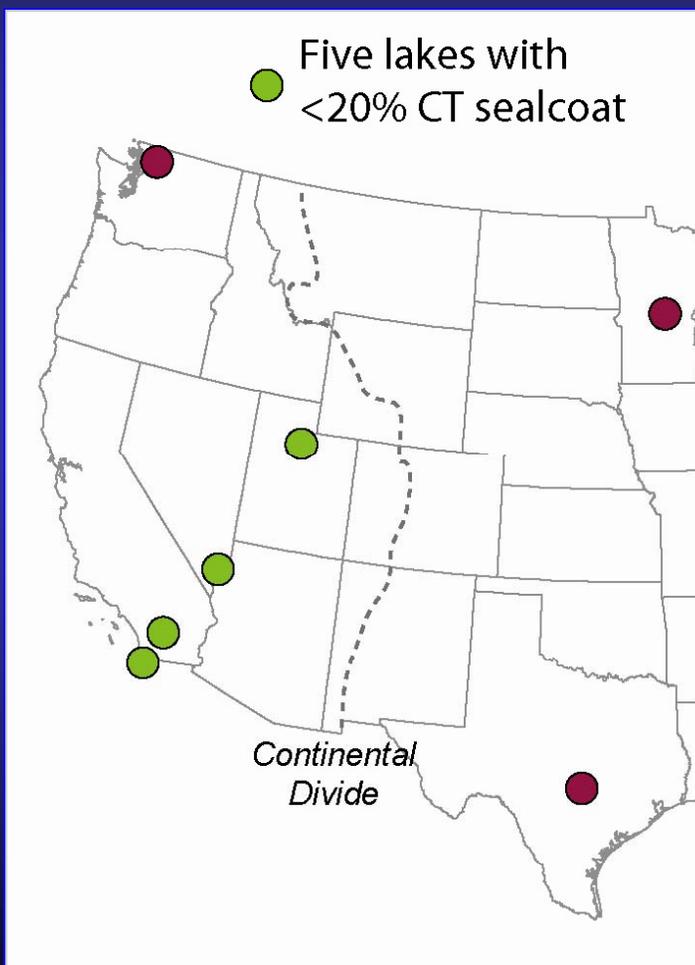
Van Metre et al., 2009, Environmental Sci. & Tech.



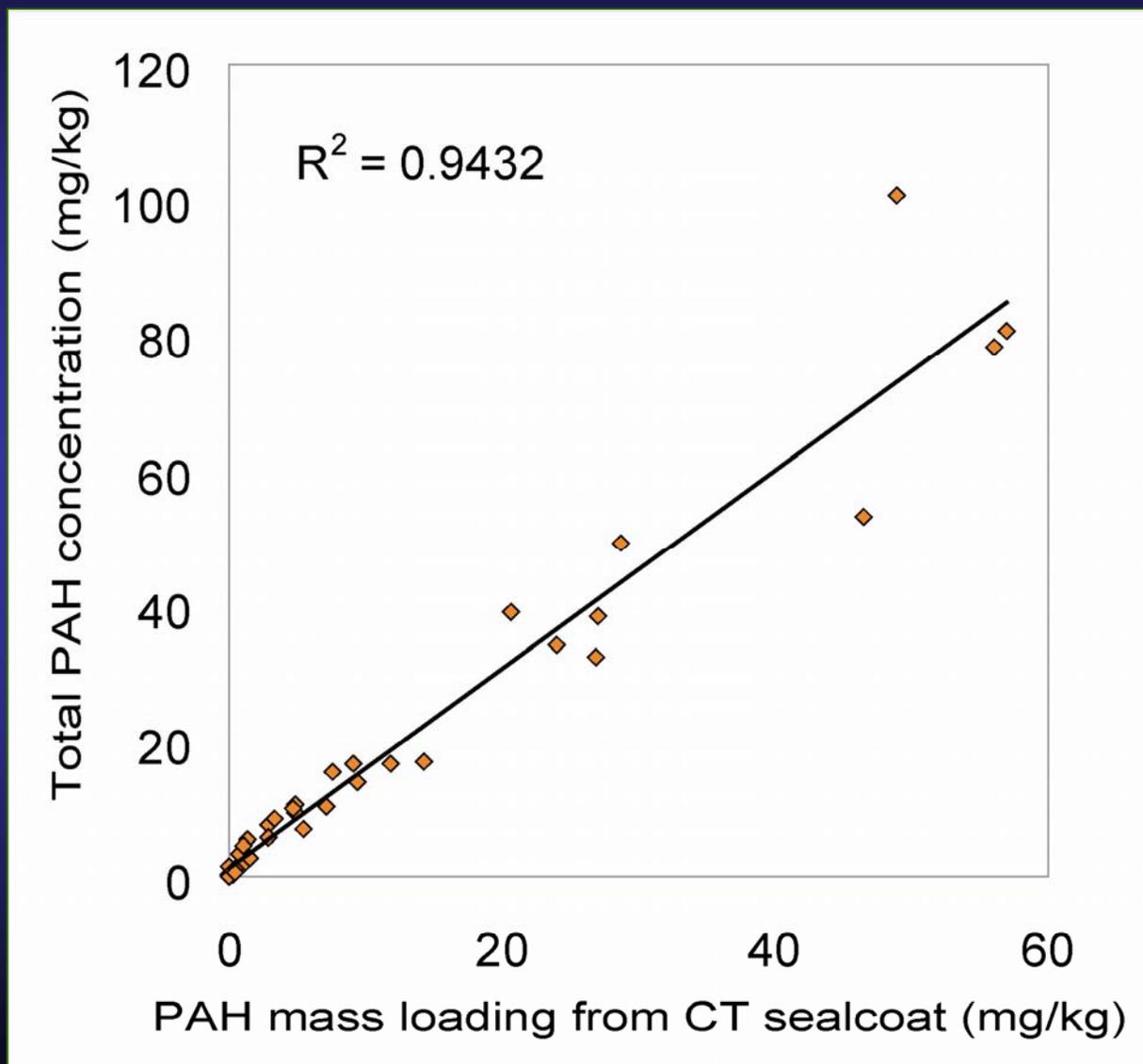
Source-Receptor Regionally



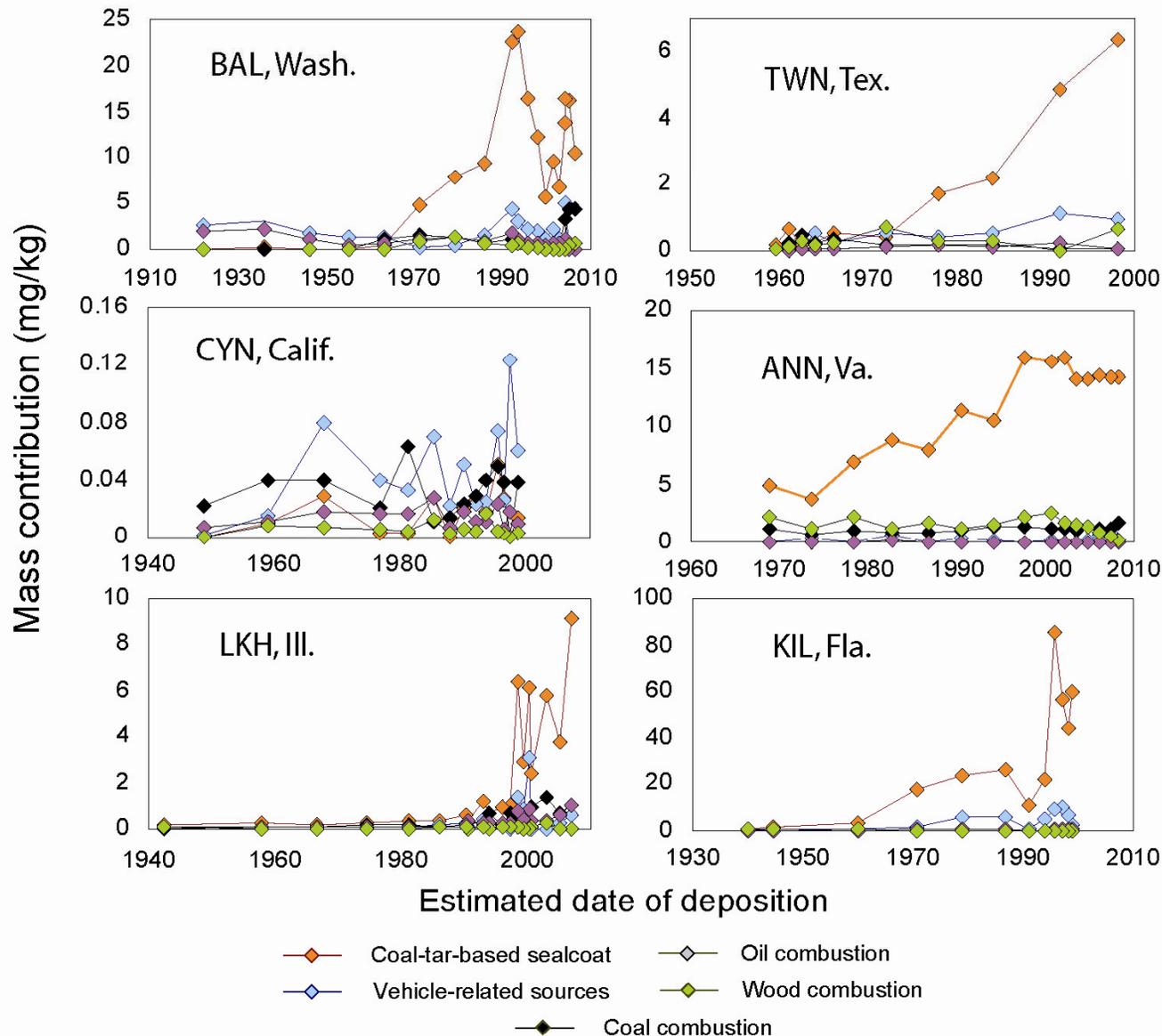
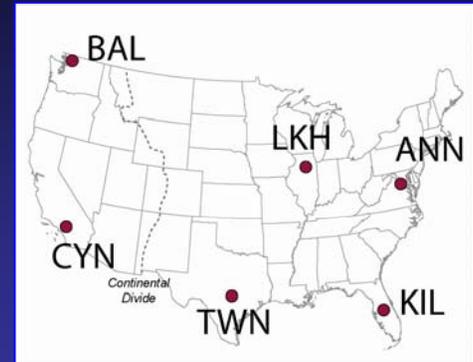
Does CT source affect concentrations?



PAH vs CT loading – 40 lakes



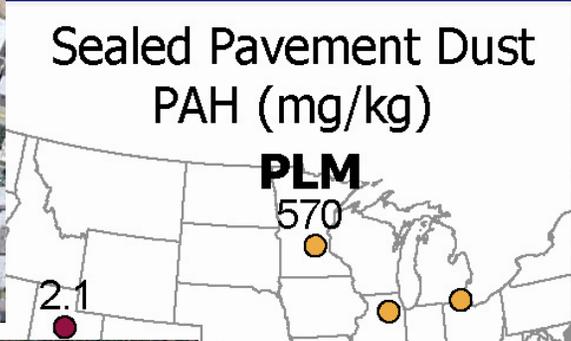
CT sealcoat role in PAH trends



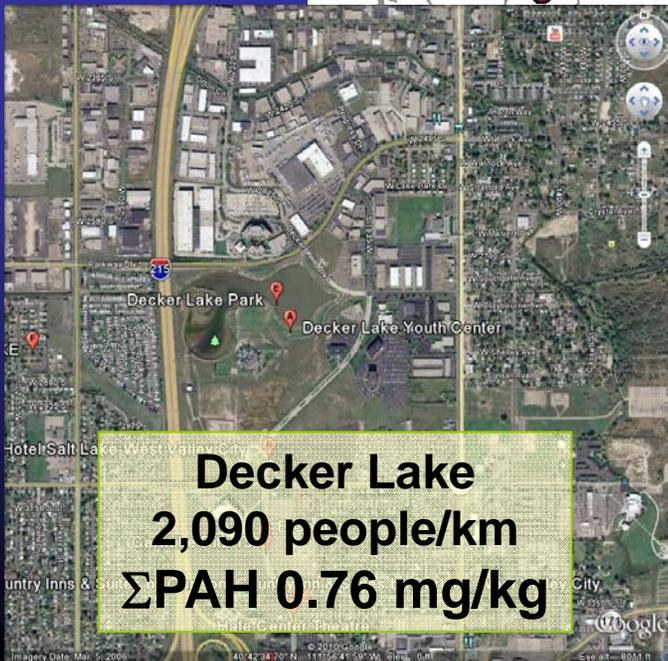
Urban is not equal



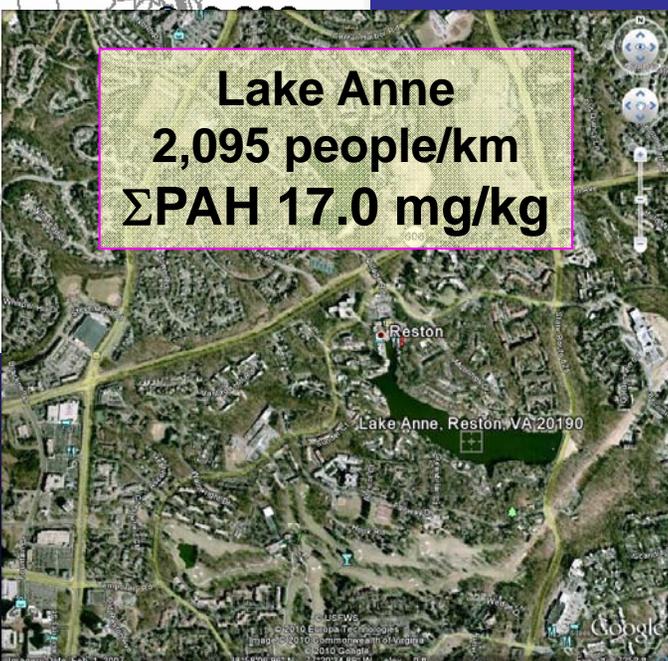
Tanasbrook Pond
844 people/km
 Σ PAH 1.34 mg/kg



Palmer Lake
939 people/km
 Σ PAH 34.1 mg/kg



Decker Lake
2,090 people/km
 Σ PAH 0.76 mg/kg



Lake Anne
2,095 people/km
 Σ PAH 17.0 mg/kg

PAHs in sources

How do they stack up?

- Tire wear particles
 - **175** (mean of 3 studies)
- Road dust
 - **59**
- Brake lining particles
 - **9**
- Air particles, major roadway
 - **104**
- Fresh asphalt
 - **2**
- Weathered asphalt
 - **9**
- Fresh motor oil
 - **7**
- Used motor oil
 - **726**
- Diesel engine
 - **304** (mean of 2 studies)
- Gasoline engine
 - **35**
- Coal-tar-based pavement sealcoat
 - **92,000** (mean of 6 products)

All concentrations in mg/kg