Elemental carbon deposition to urban tree canopies: magnitudes and spatial patterns

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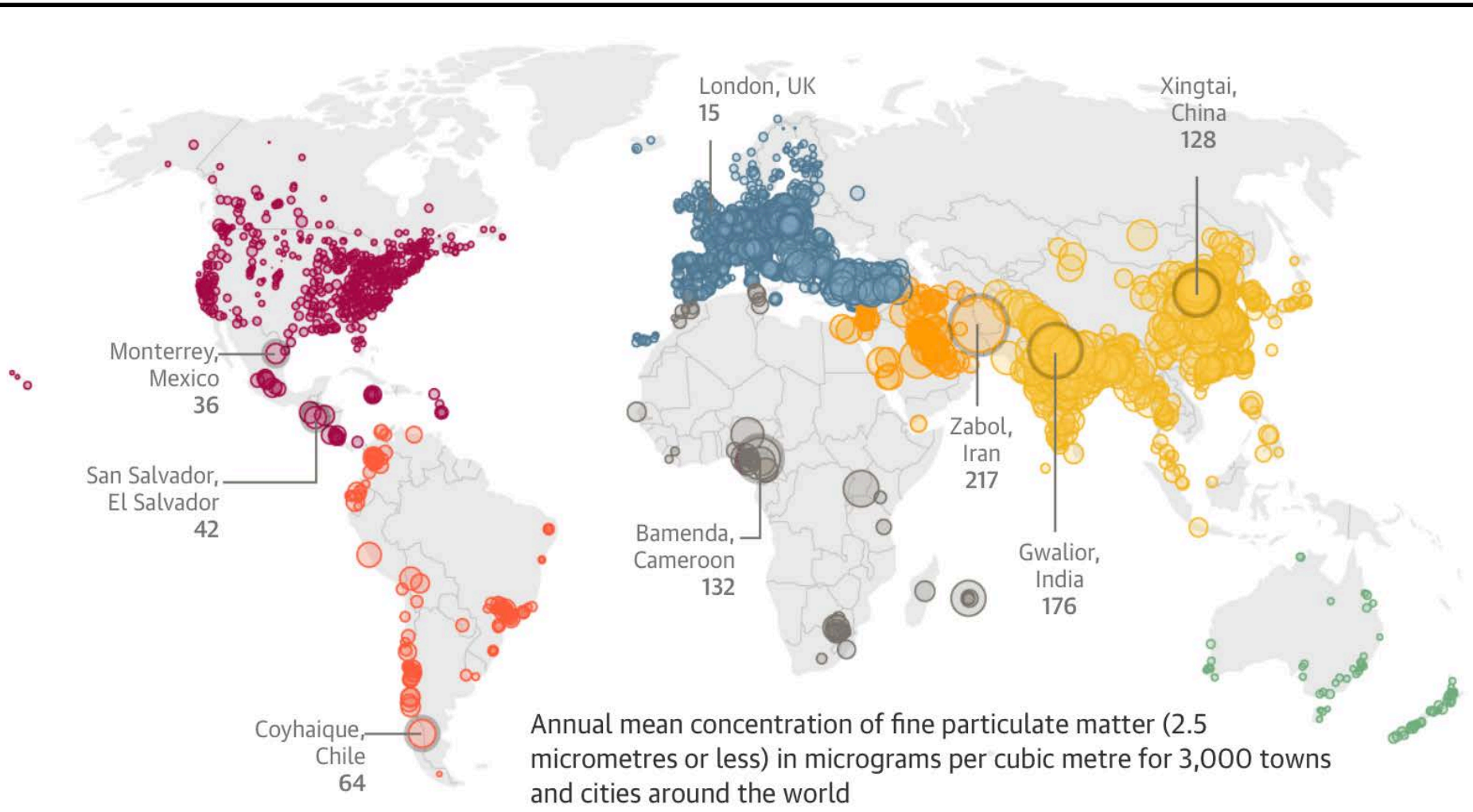
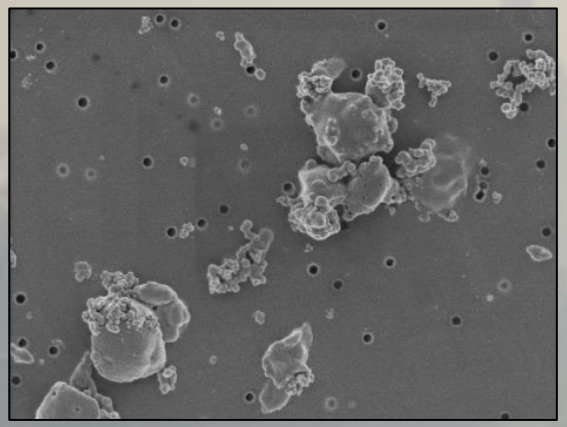
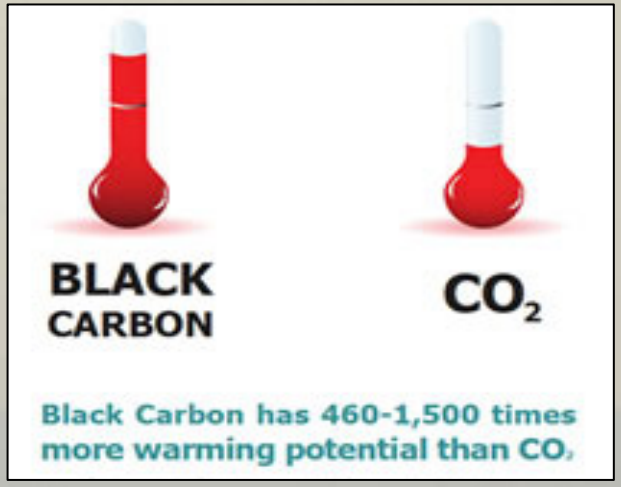
Fine particle pollution is a growing problem in cities worldwide



Credit: The Guardian

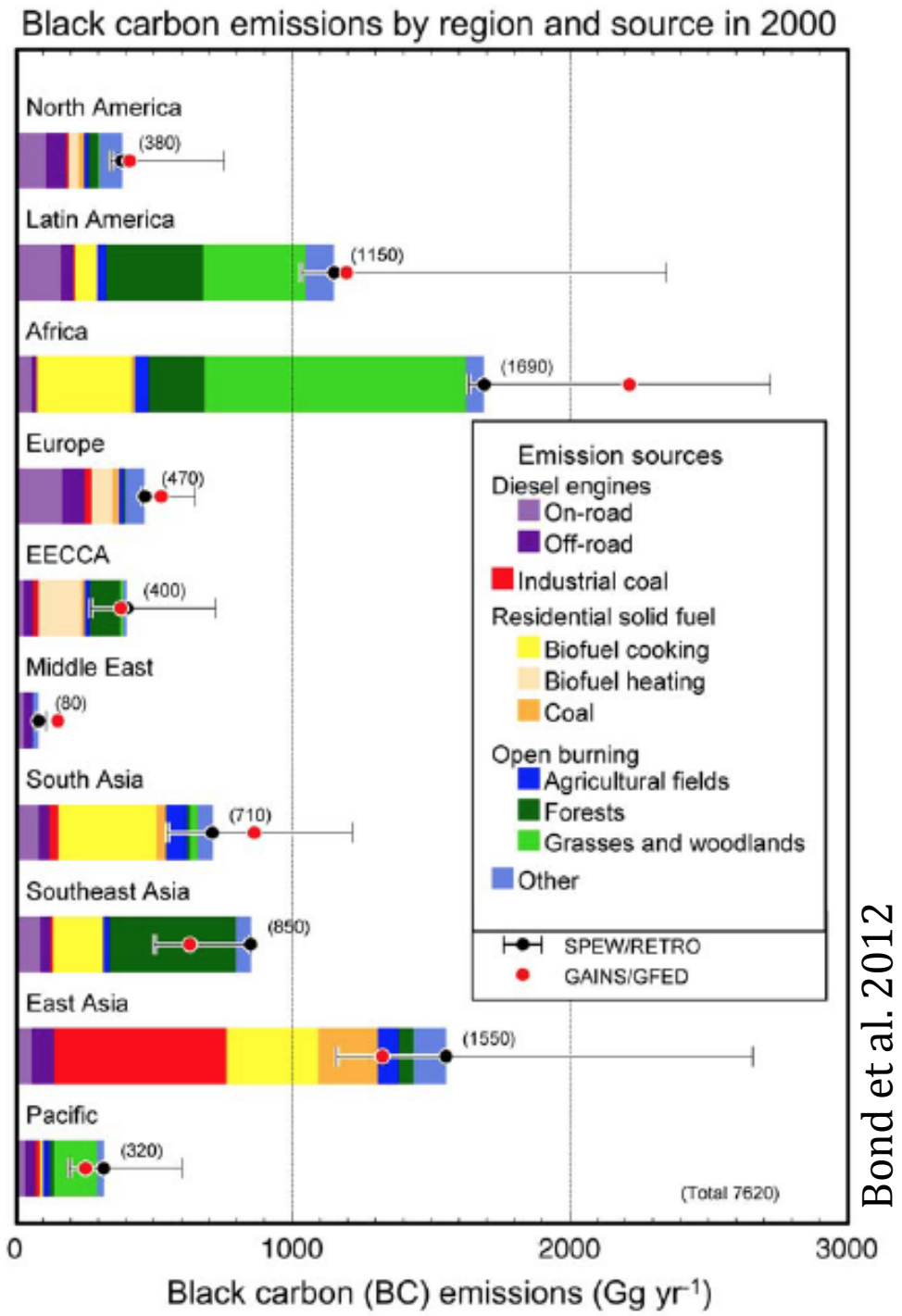
Black carbon





Credit: New York Times

National Museum of Health and Medicine,
http://www.medicalmuseum.mil/index.cfm?p=exhibits.past.visiblyhuman.page_03



Bond et al. 2012

In the U.S., diesel transport is a dominant source of BC emissions

In 2005, ~65% of total U.S. BC was emitted in urban counties

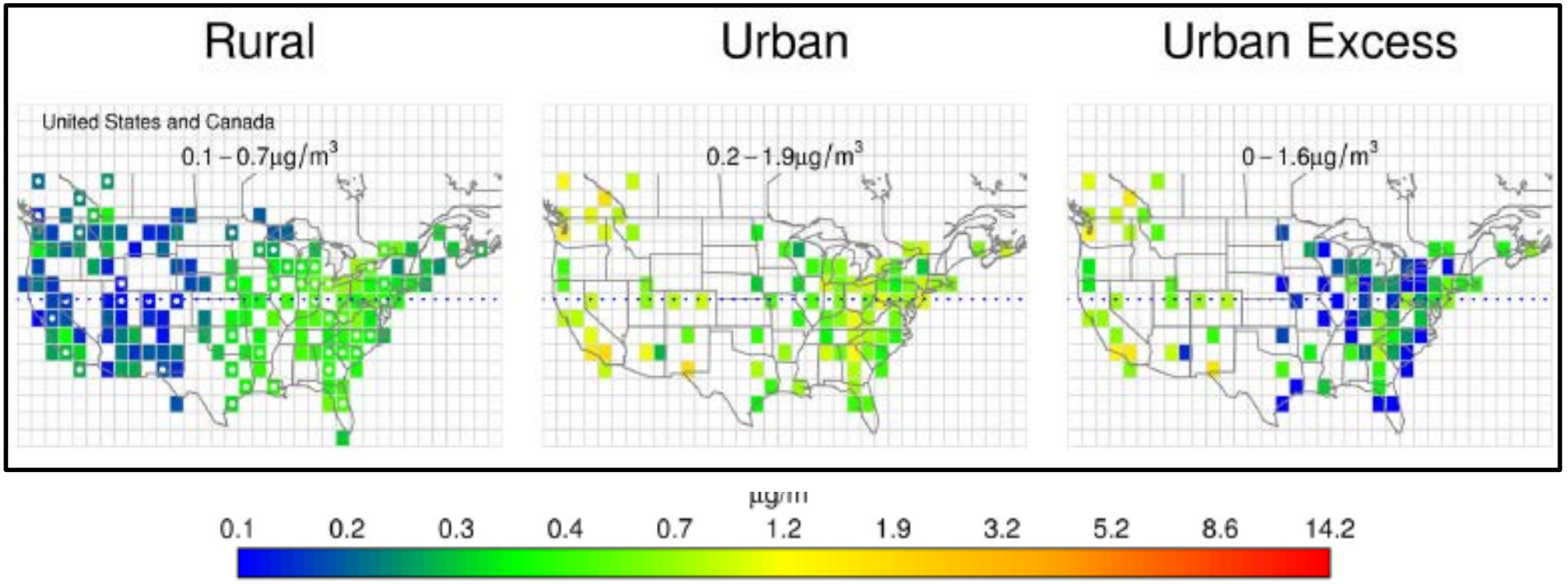
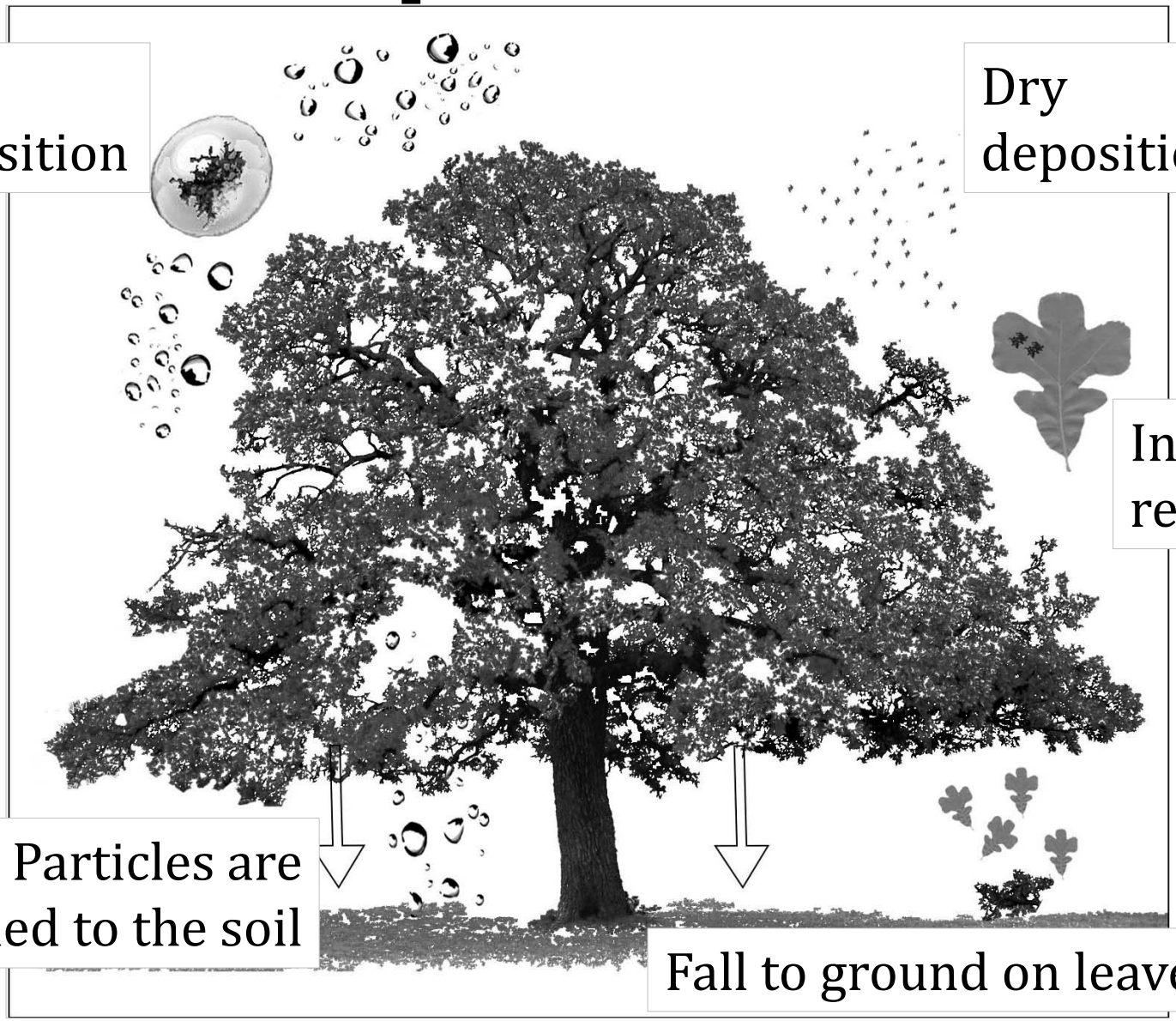


Figure 5-3. Spatial Distribution of Global BC Data. Rural, urban, and urban excess concentrations for 2005-2007. Grid squares with a white dot represent estimated rural concentrations from spatial interpolation of the nearest neighbors with measurement data. The 40th parallel is shown as a dotted line. (Source: U.S. EPA)

What role can urban trees play in atmospheric BC removal?



Objectives

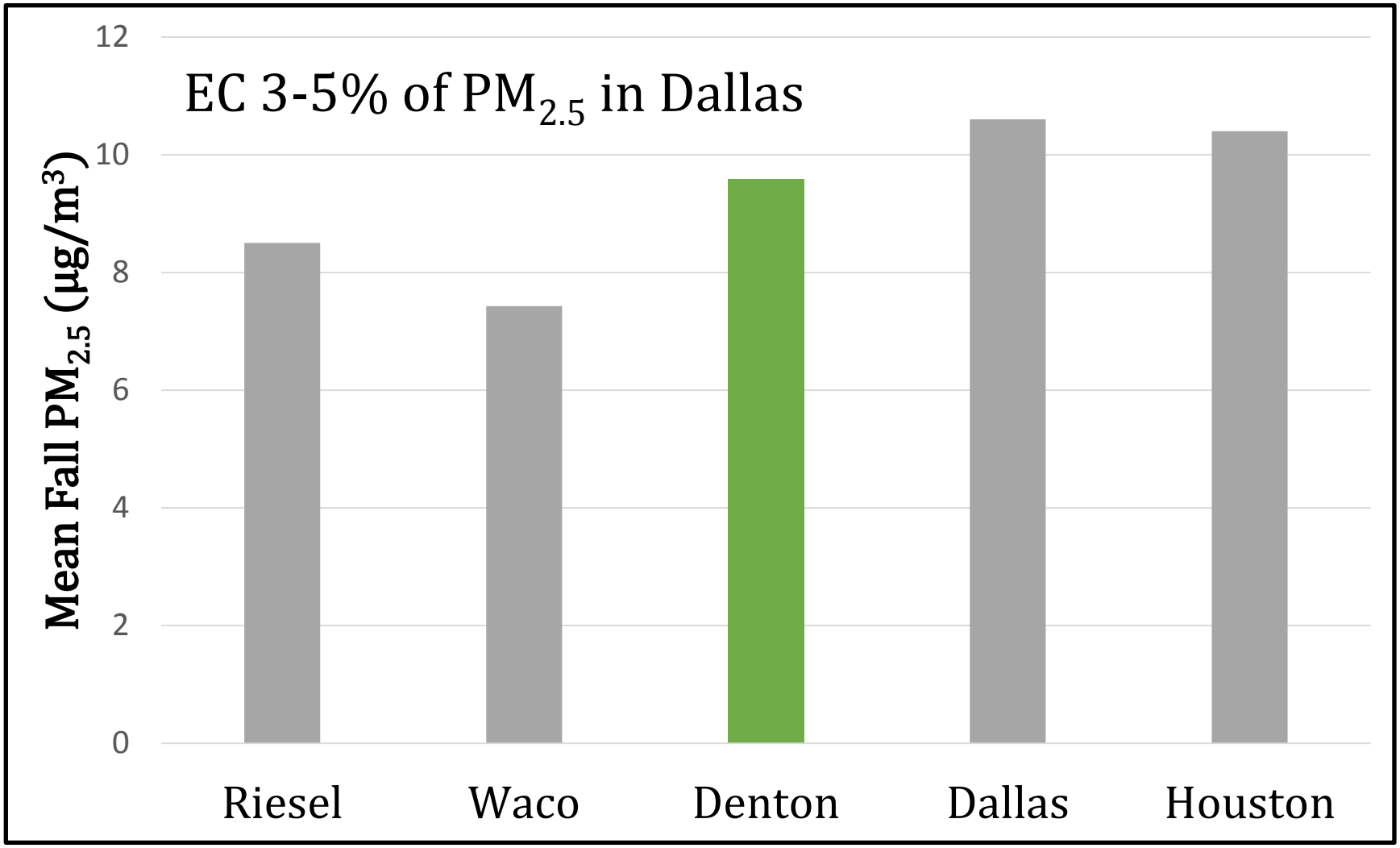
-Quantify the magnitude and spatial patterns of total (wet + dry) **EC** deposition to urban tree canopies;

-Determine the relative importance of throughfall and litterfall in the flux of EC to soil;

-Upscale up EC deposition fluxes from the site to the city scale using LiDAR remote sensing

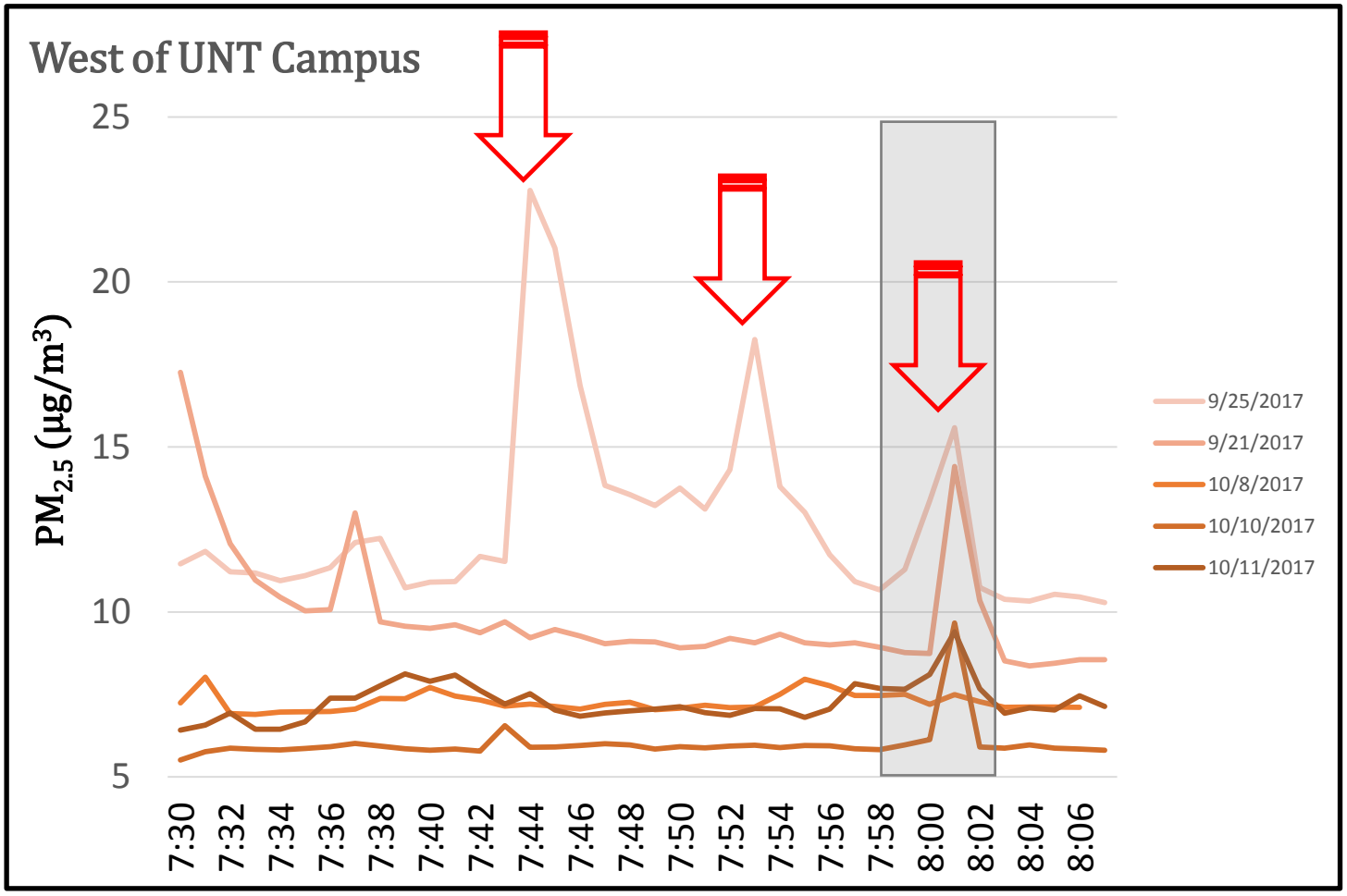
City of Denton, Dallas Fort Worth Metroplex

Fine particle pollution in Denton is similar to that in Dallas, Houston

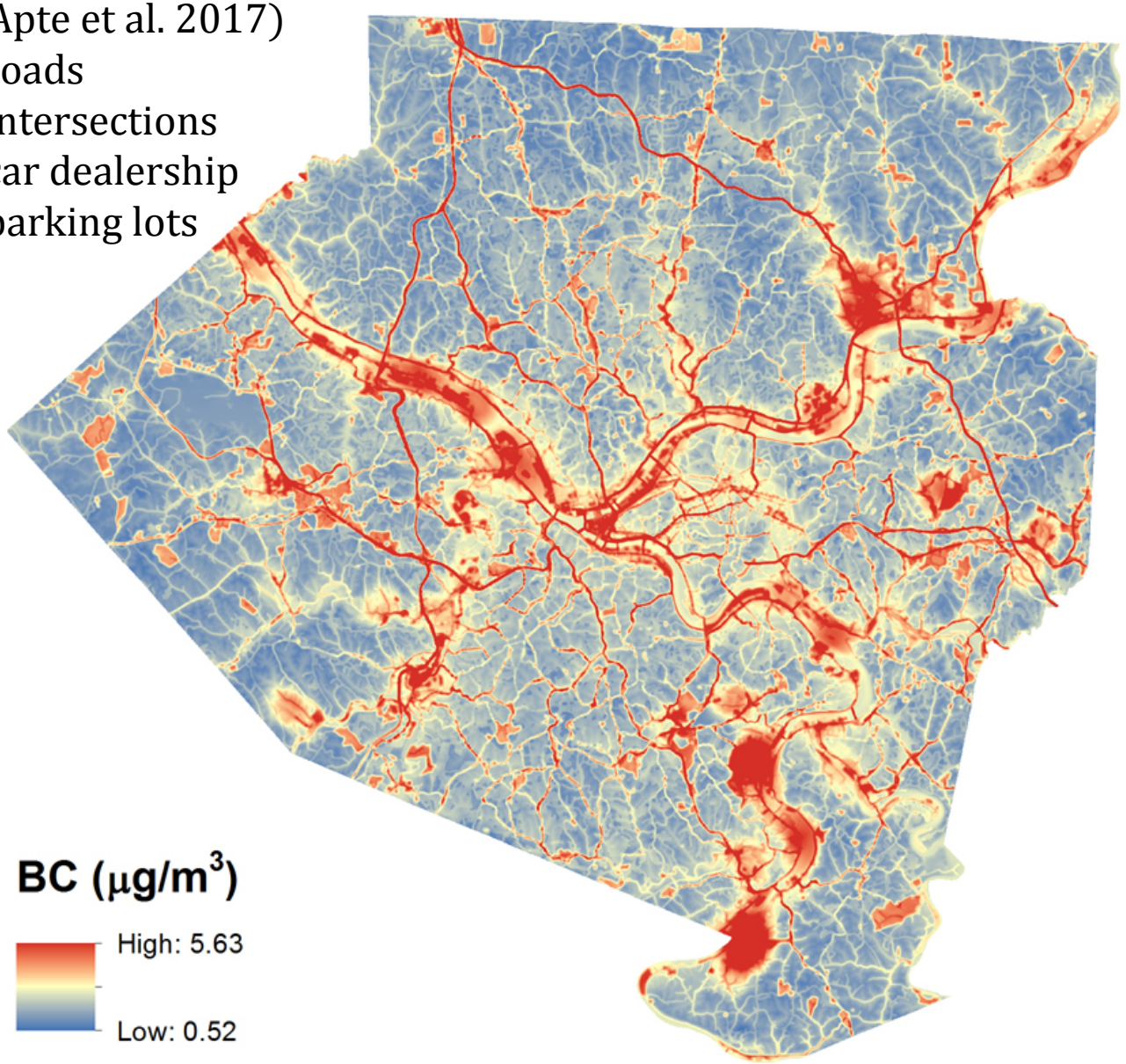


Barrett and Sheesley 2014

Fine particle pollution varies over space and time



Hotspots
(Apte et al. 2017)
-roads
-intersections
-car dealership
-parking lots

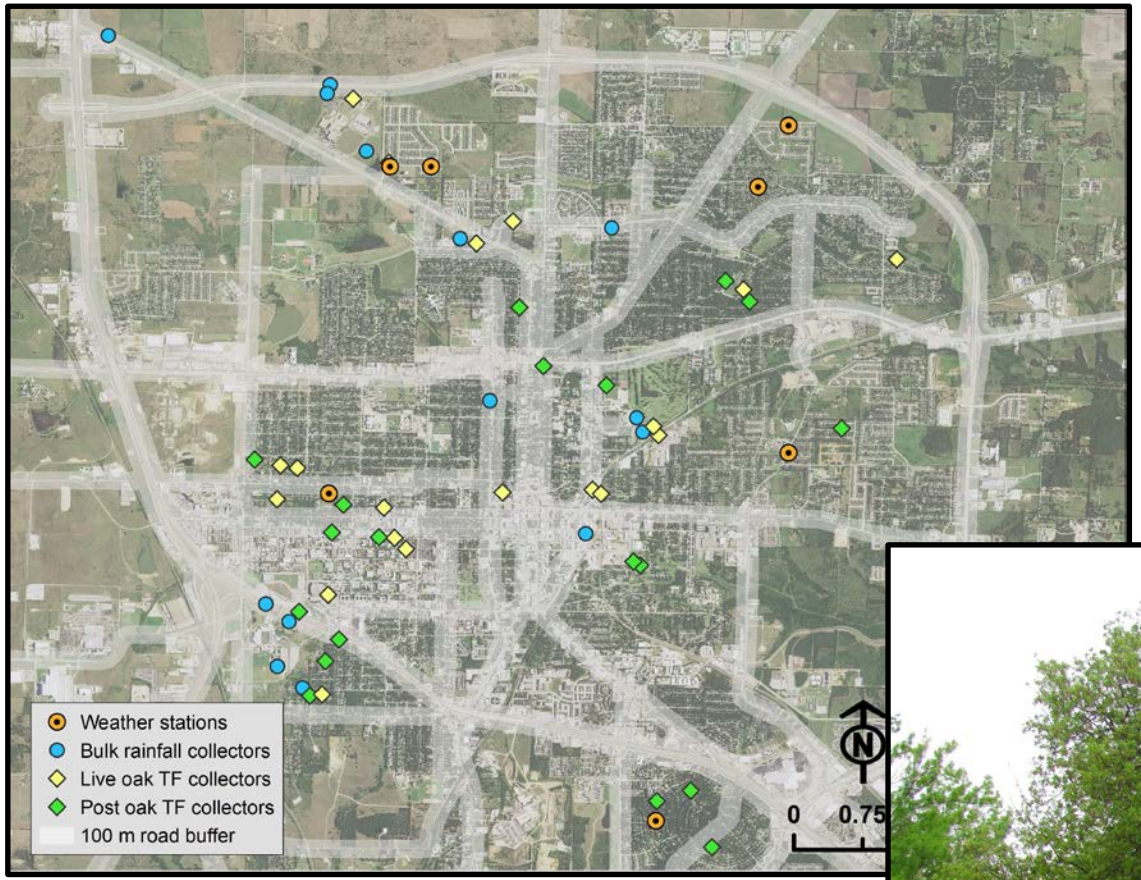


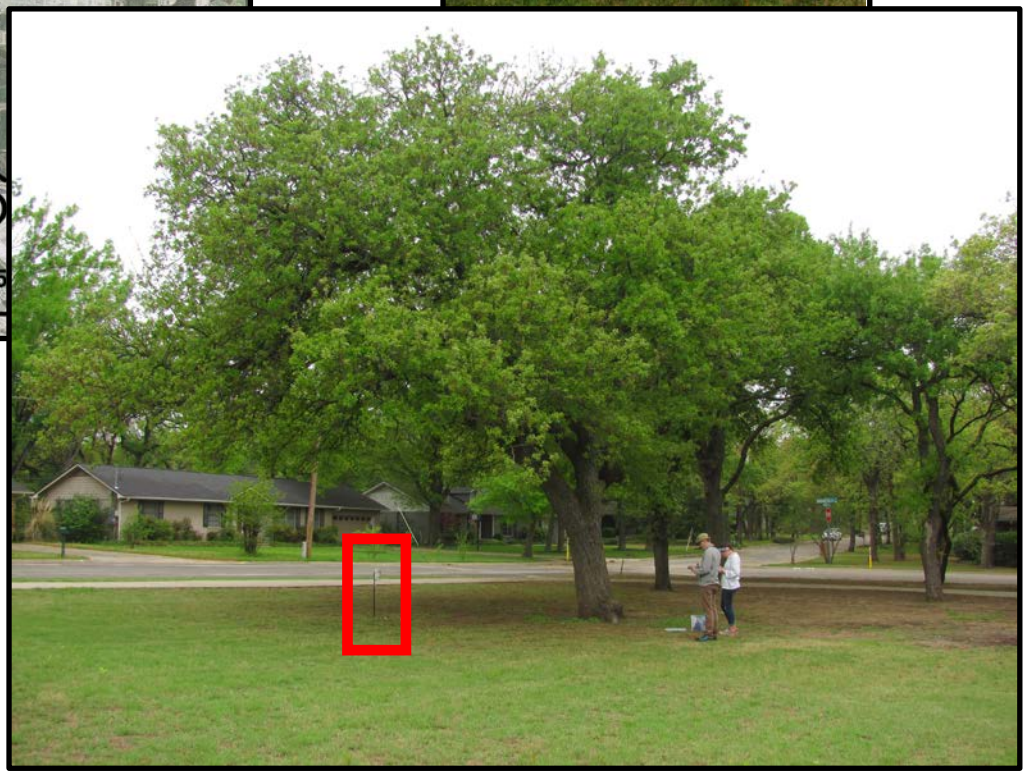
Predicted ground-level average BC concentrations (μg/m³) in the center of Pittsburgh during 2011–12, combining measurements and a land use regression model.

http://breatheproject.org/learn/pollution-maps/

Pandis et al. 2016

Bulk deposition and throughfall fluxes





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Measuring Organic Carbon and Black Carbon in Rainwater: Evaluation of Methods

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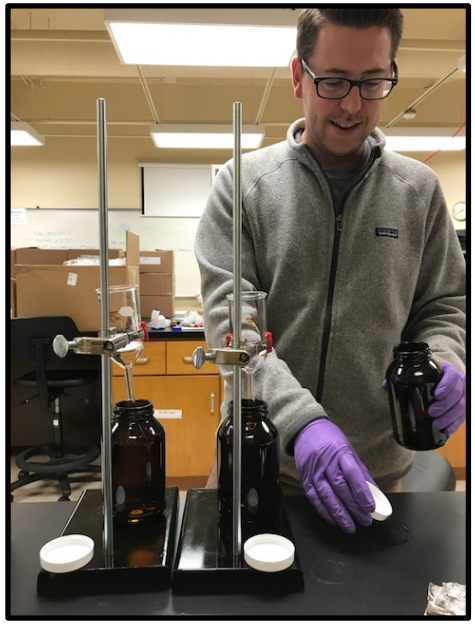
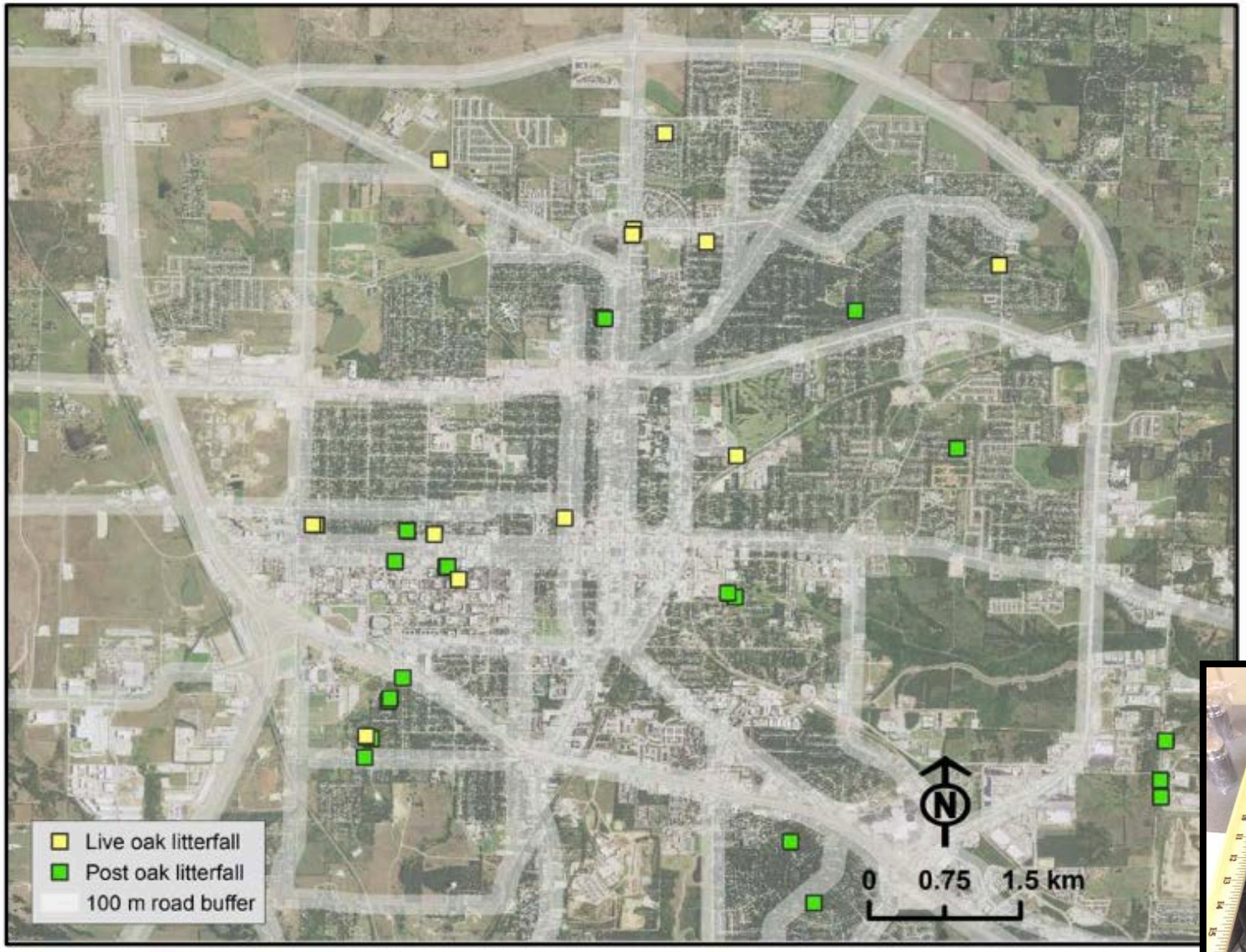


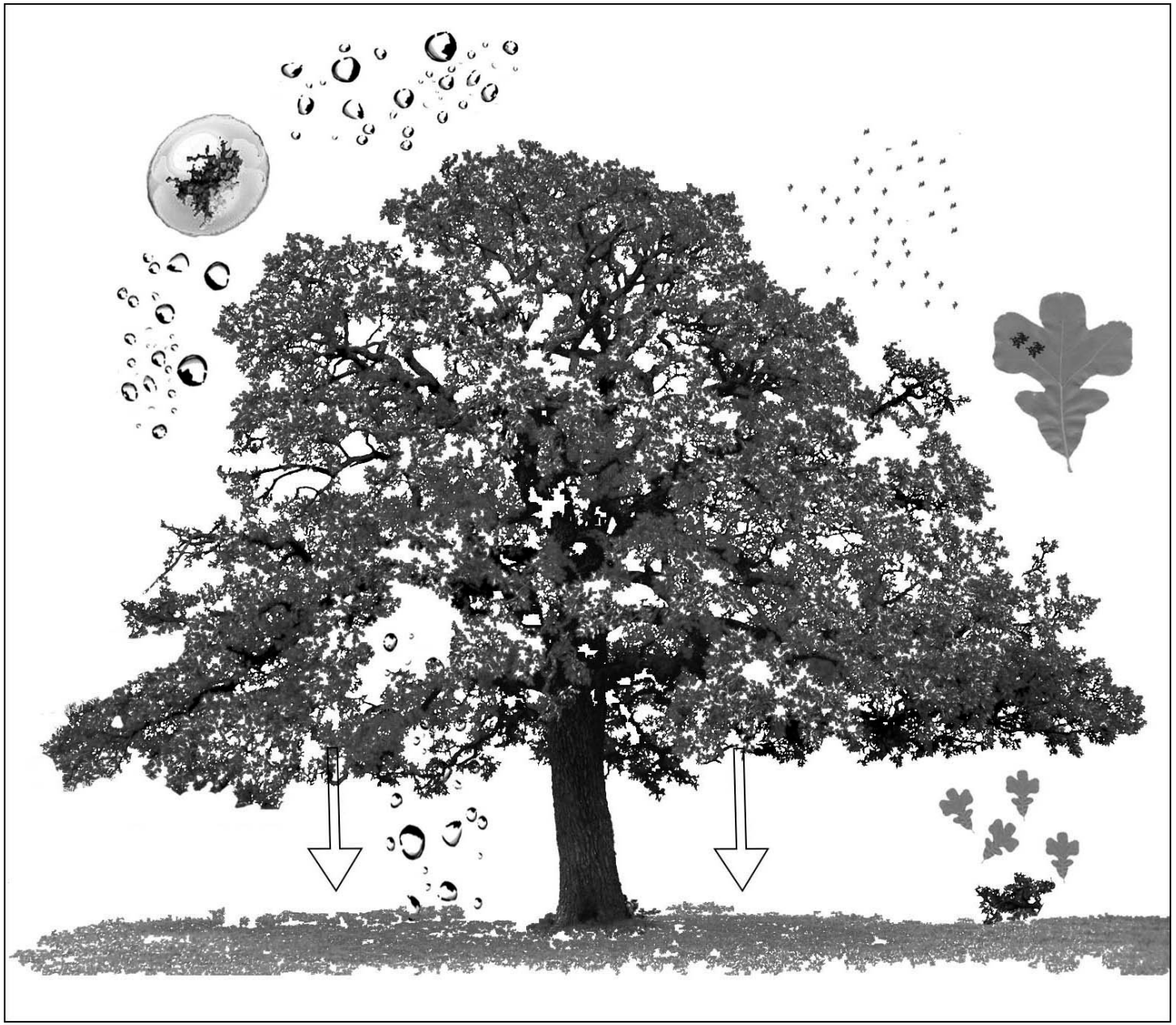
In-wax EC retention

Credit: Ahna Hubnik

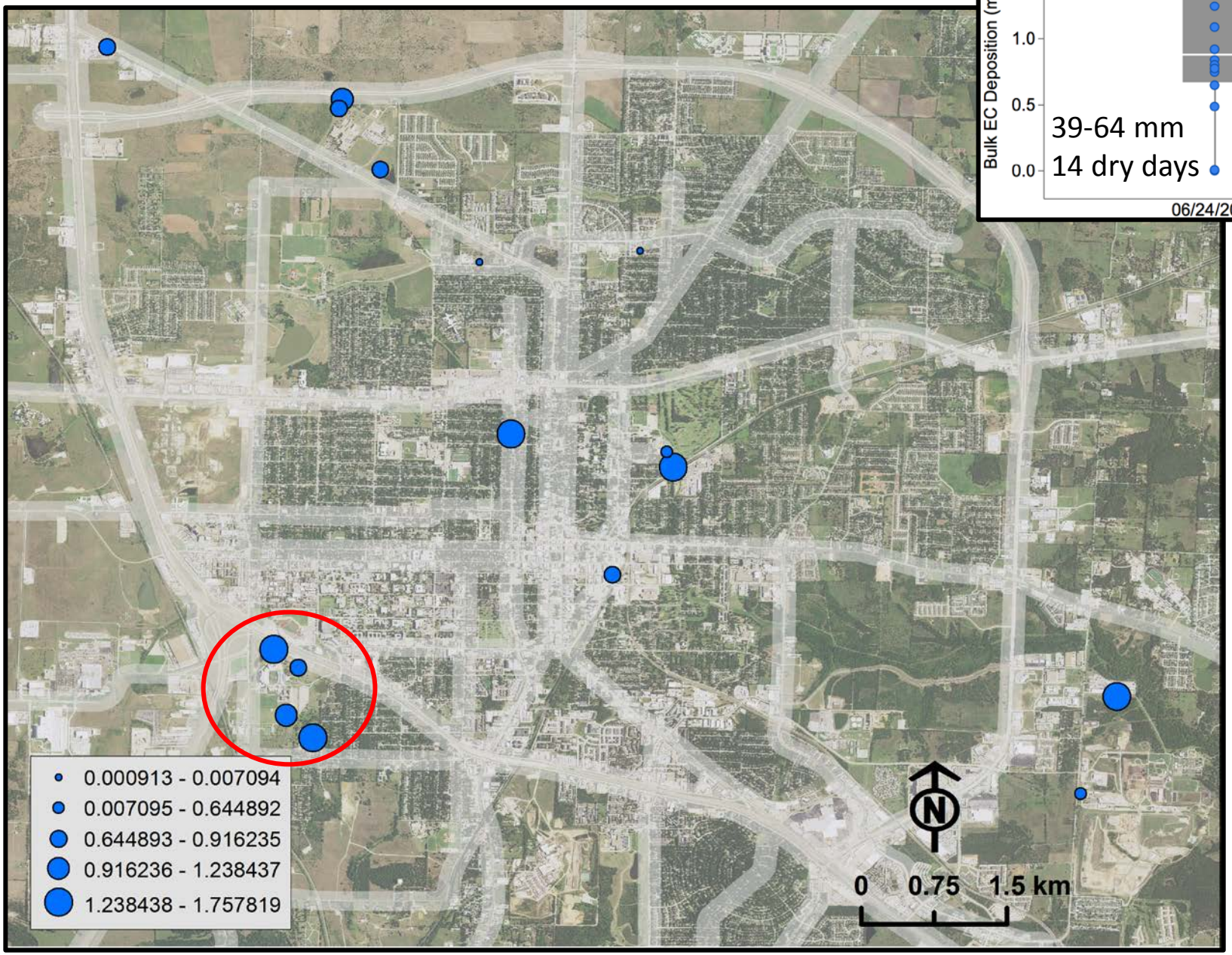
Litterfall EC Fluxes

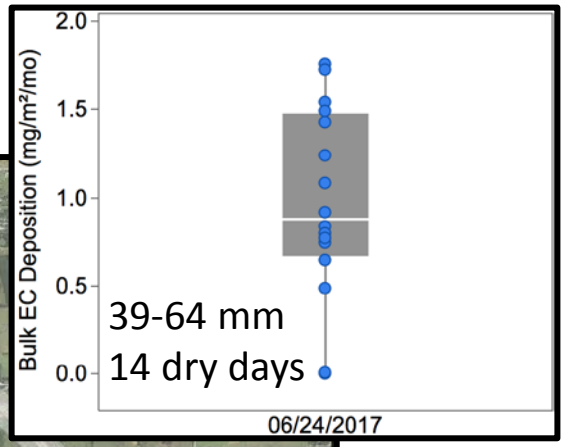


Preliminary Results

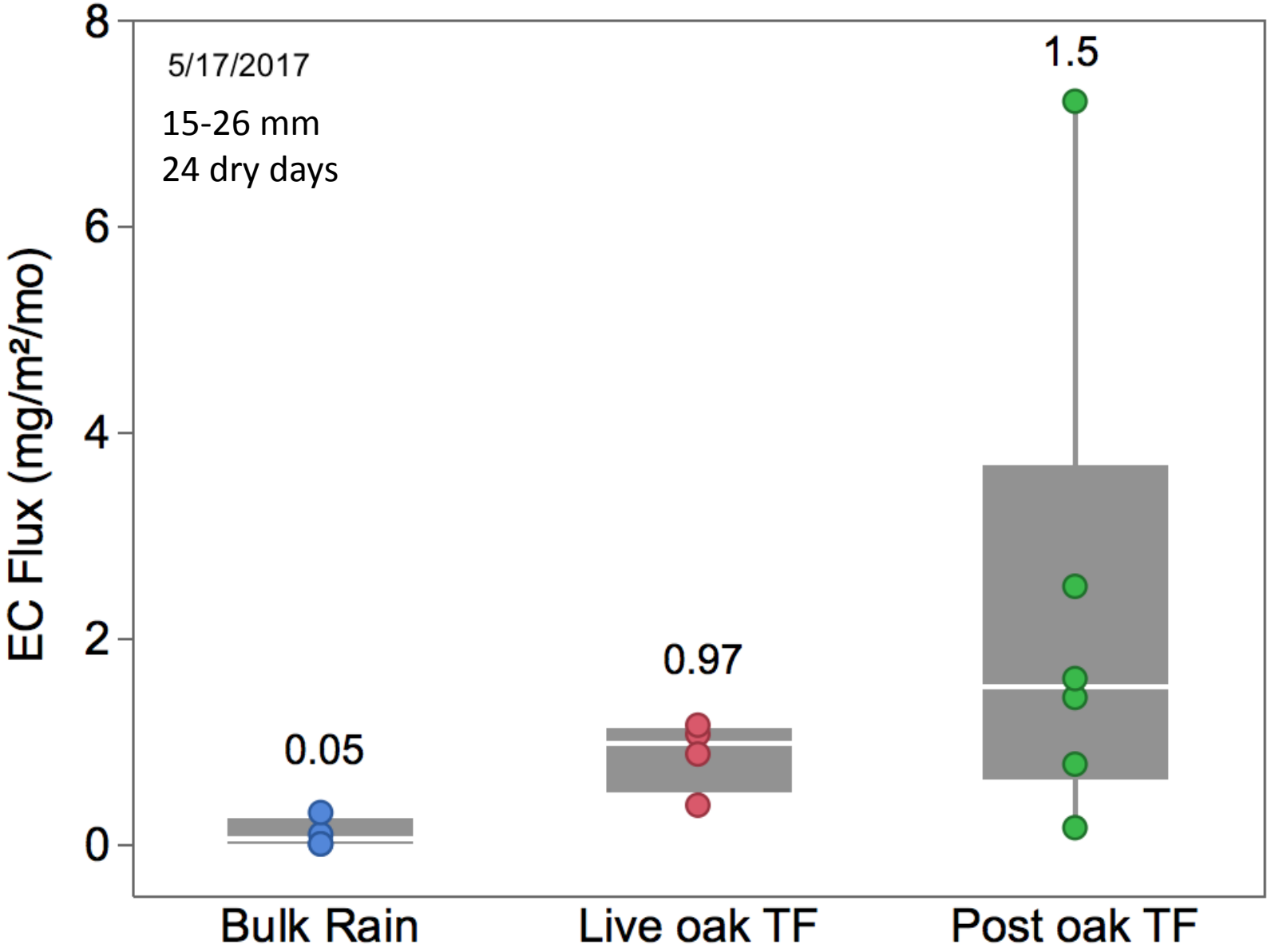


Bulk EC ranged 0-1.8 mg/m^2/mo

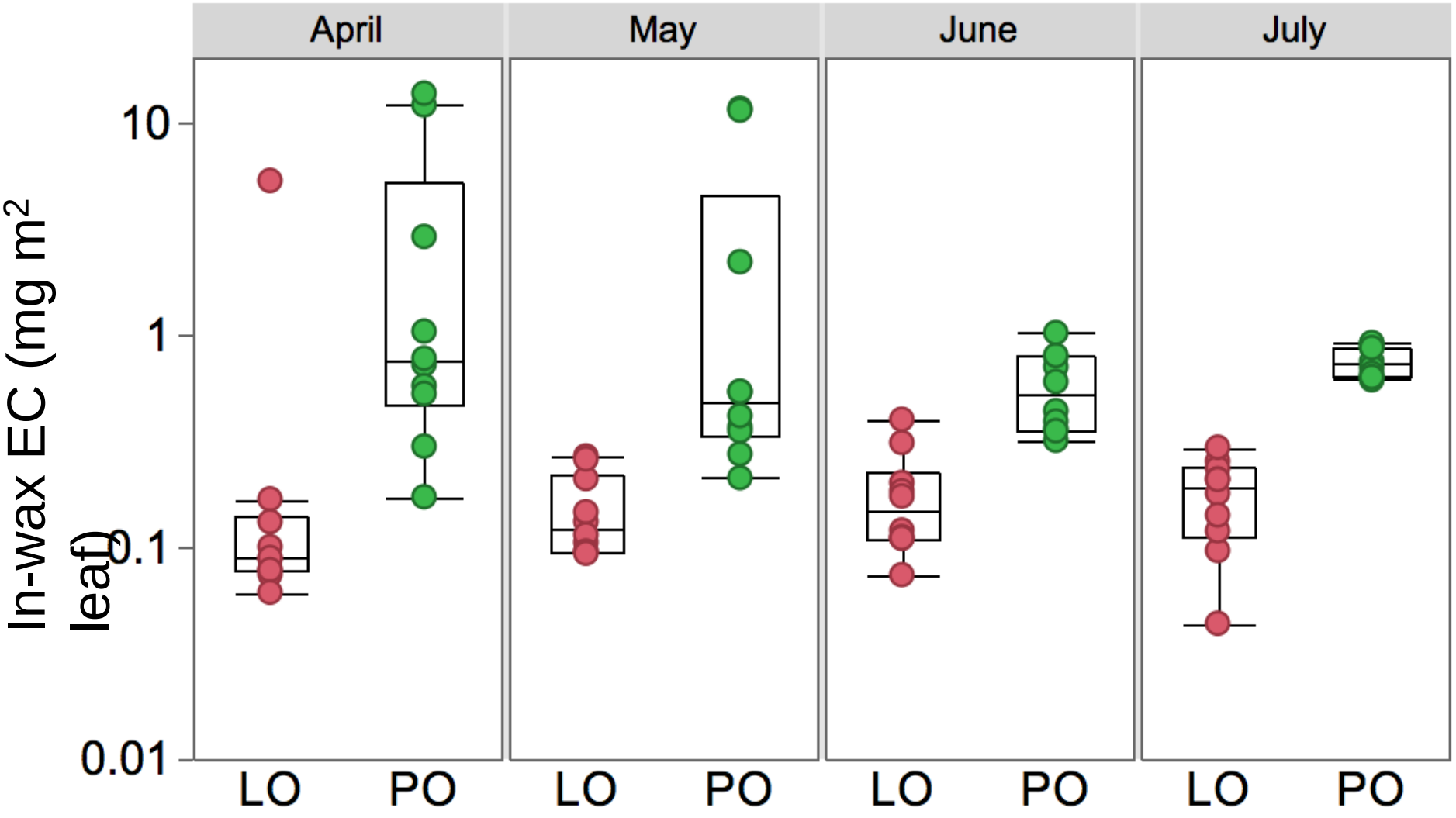




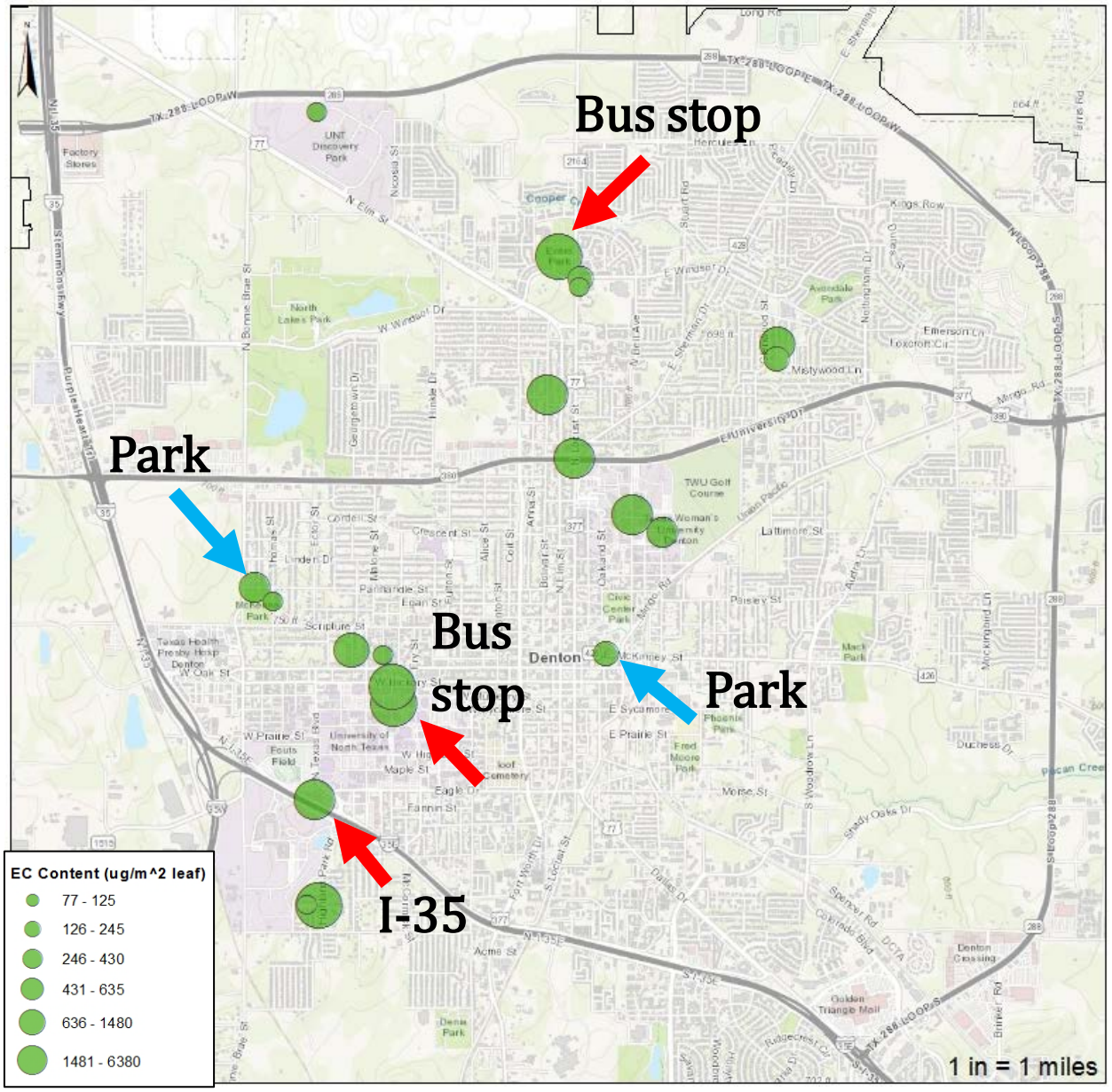
Throughfall EC differed by species



In-wax EC retention differed by species



In-wax EC in relation to EC sources



Summary

- Bulk EC concentrations and deposition within the range reported for other sites
- Post oak has higher throughfall EC flux and in-wax retention than live oak
- Fine-scale variability in EC deposition to urban tree canopies

Acknowledgements

- Denton residents
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