

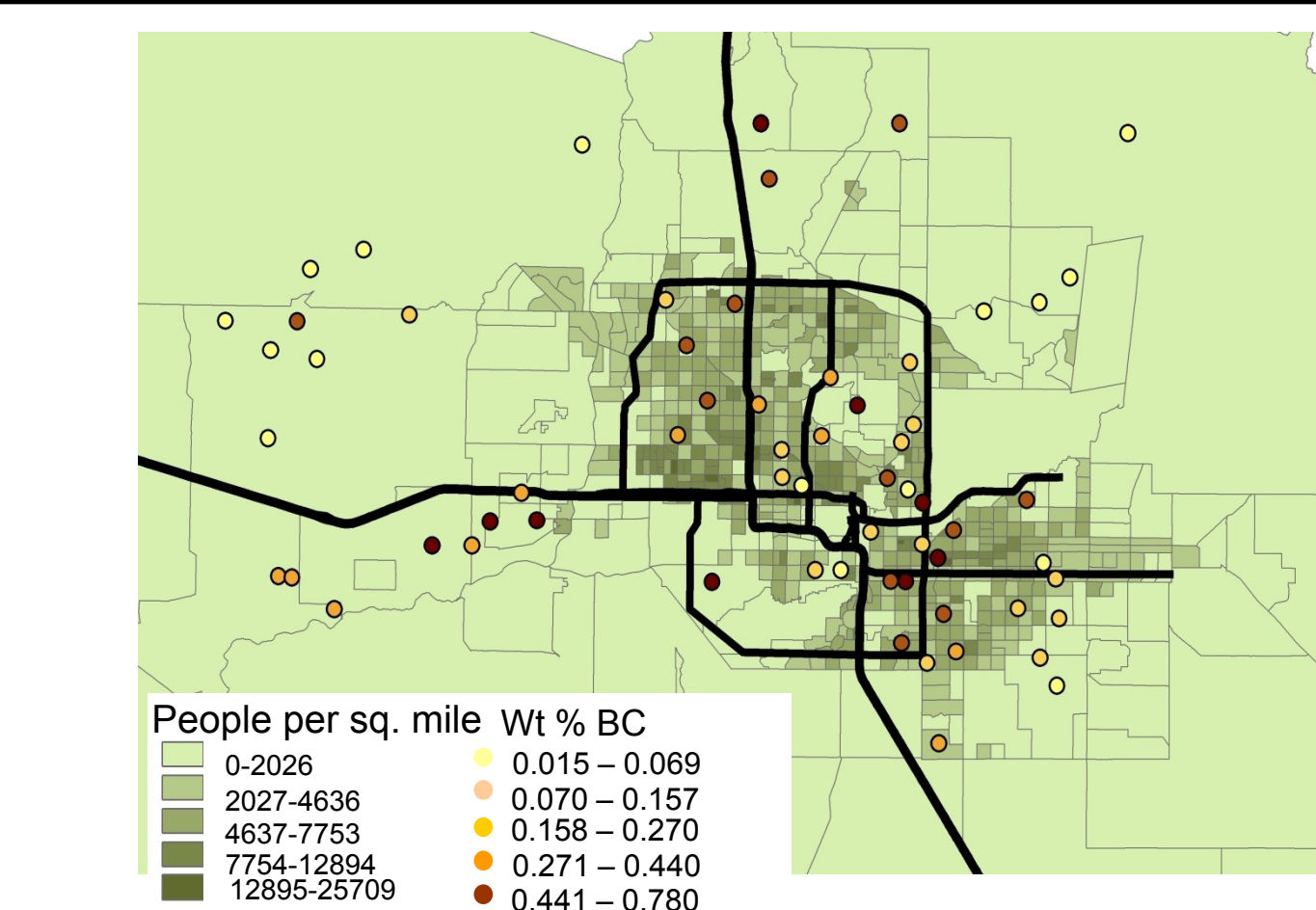
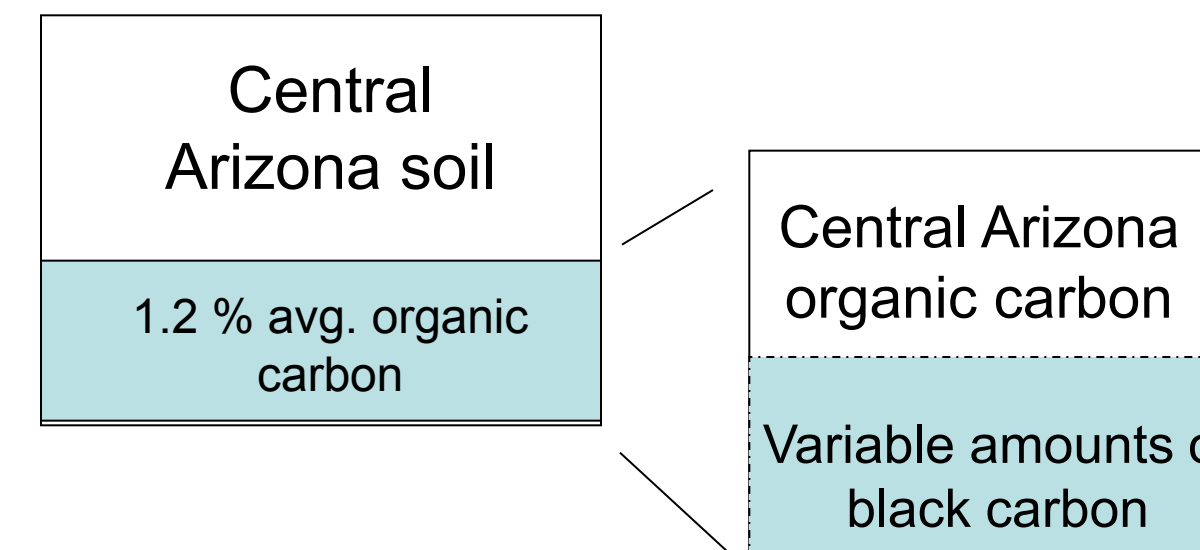
Soot black carbon (BC) is the product of incomplete combustion of fossil fuels and biomass. This poster highlights two datasets that investigate soot BC degradation rates:

- 1) Trends between soot BC concentration at urban sites and current and historical land use data indicate the main input of soot BC to soil is the actual *changing* of land use from desert to urban.
- 2) Organic and soot BC can be degraded by photo-oxidation on short time scales (monthly). Oxygenated functional groups are included in post photo-oxidized soot BC samples that are not found in the pre photo-oxidized samples suggesting that photo-oxidation not only decreases soot BC concentration but also changes its inherent chemical composition.

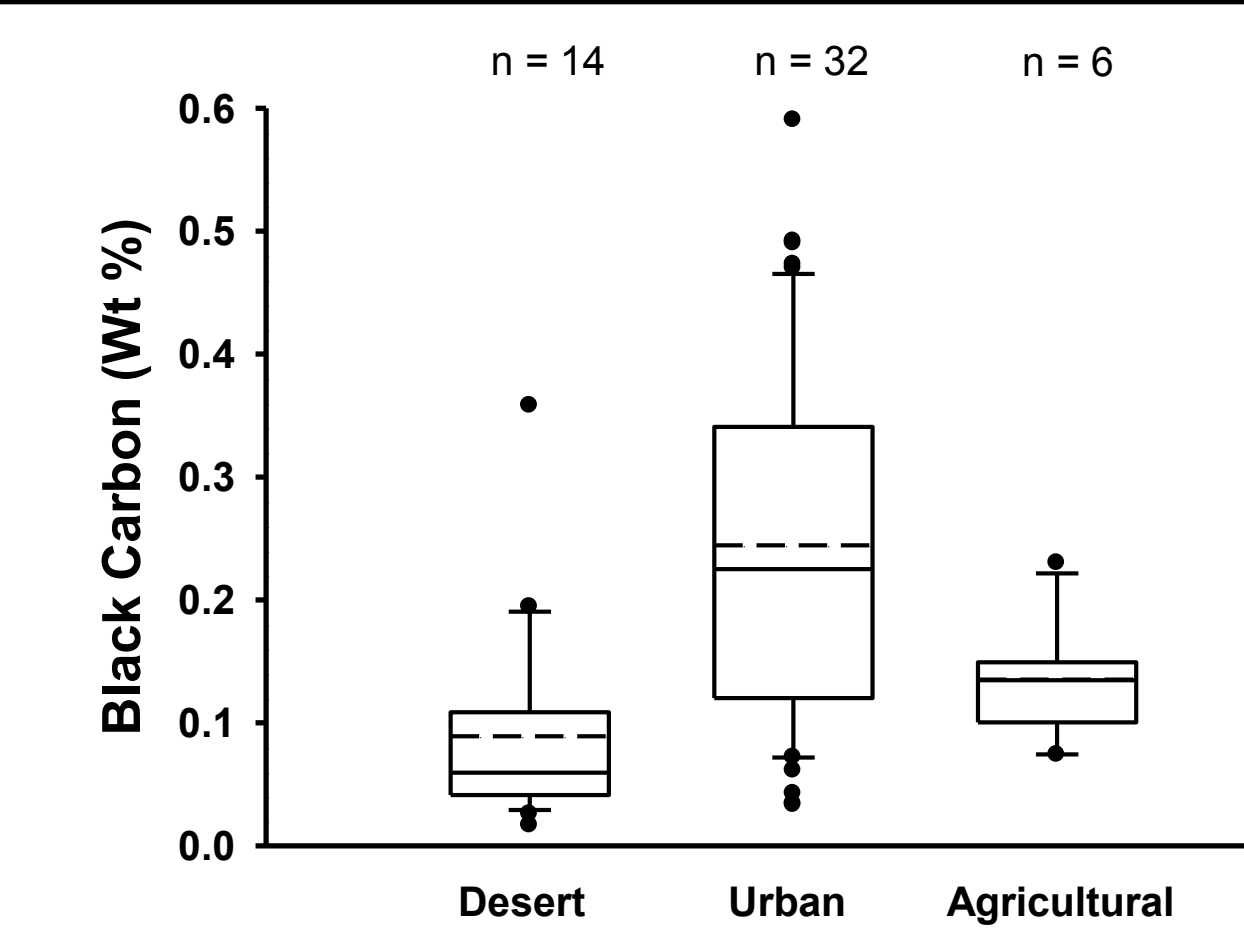
Background information

Summary of Survey 200 soils AVG (n = 63)

Wt % OC (g OC/g soil)	1.2 ± 0.9
Wt % BC (g BC/g soil)	0.2 ± 0.2
BC/OC (g BC/g OC * 100)	31 ± 24
Avg. Black Carbon δ ¹³ C (‰)	-18 ± 3



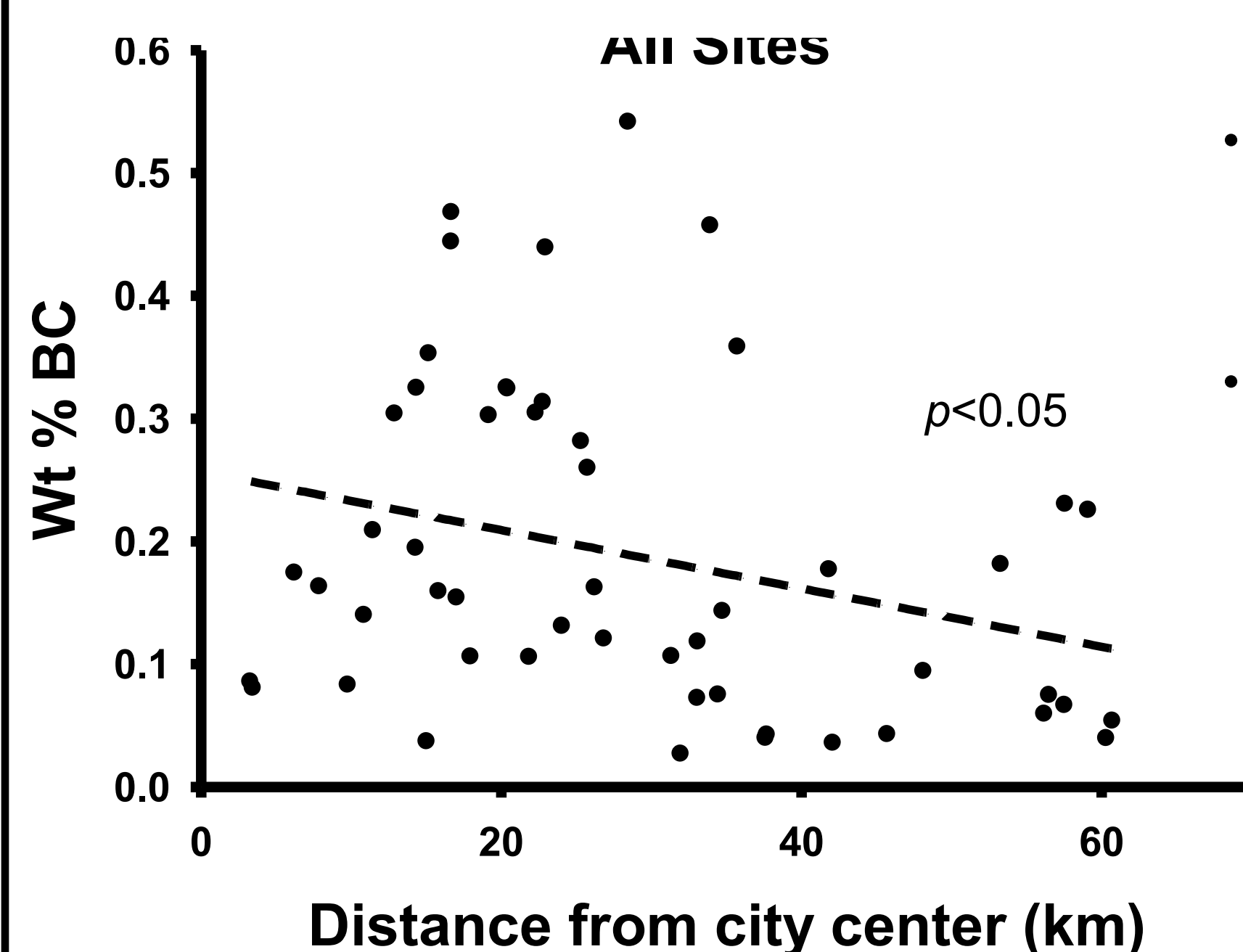
Soot BC is unevenly distributed across the city



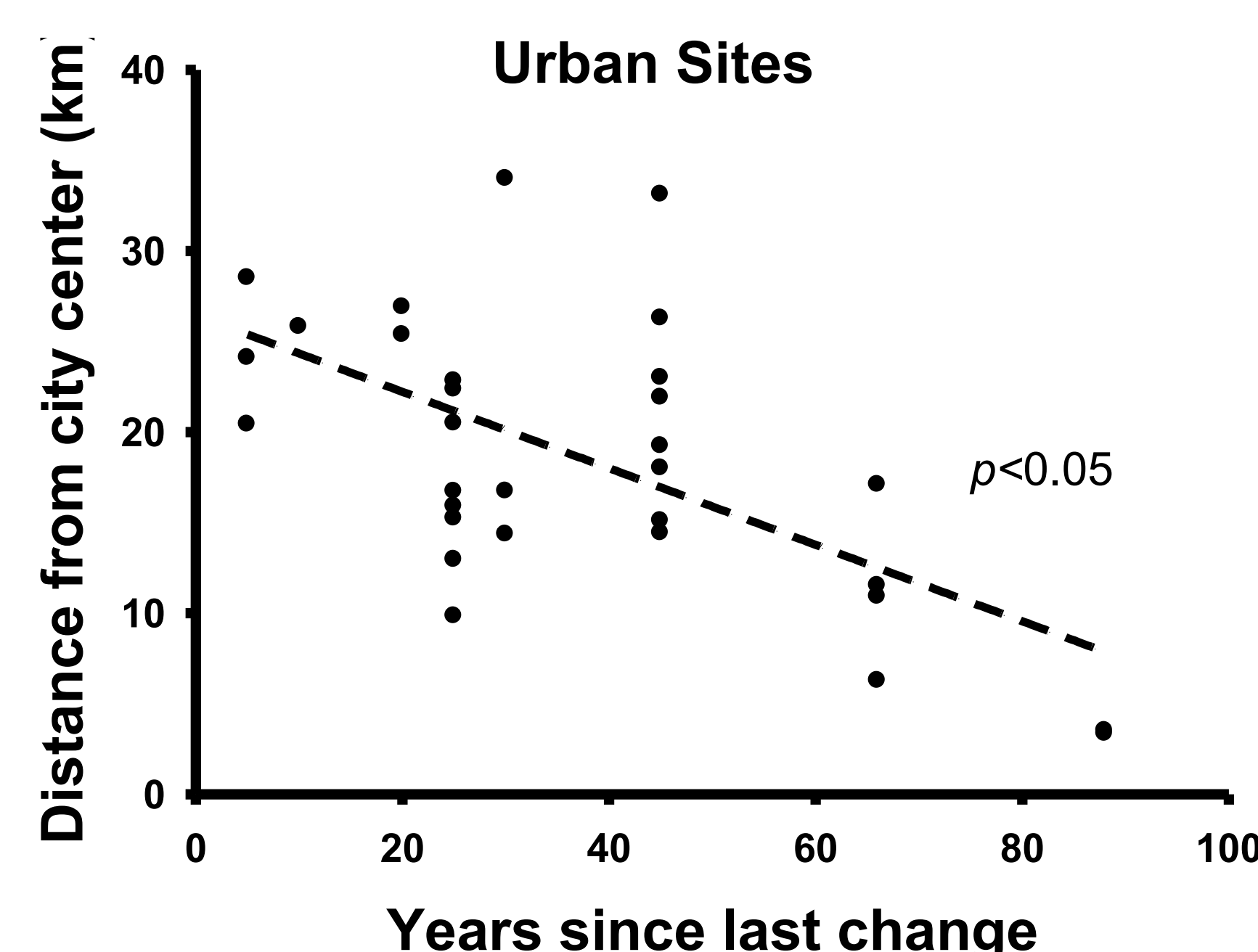
Soot BC varies by land use ($p < 0.05$, ANOVA)

HOW CAN WE BETTER UNDERSTAND INPUTS AND REACTIVITY OF SOOT BC IN SOIL?

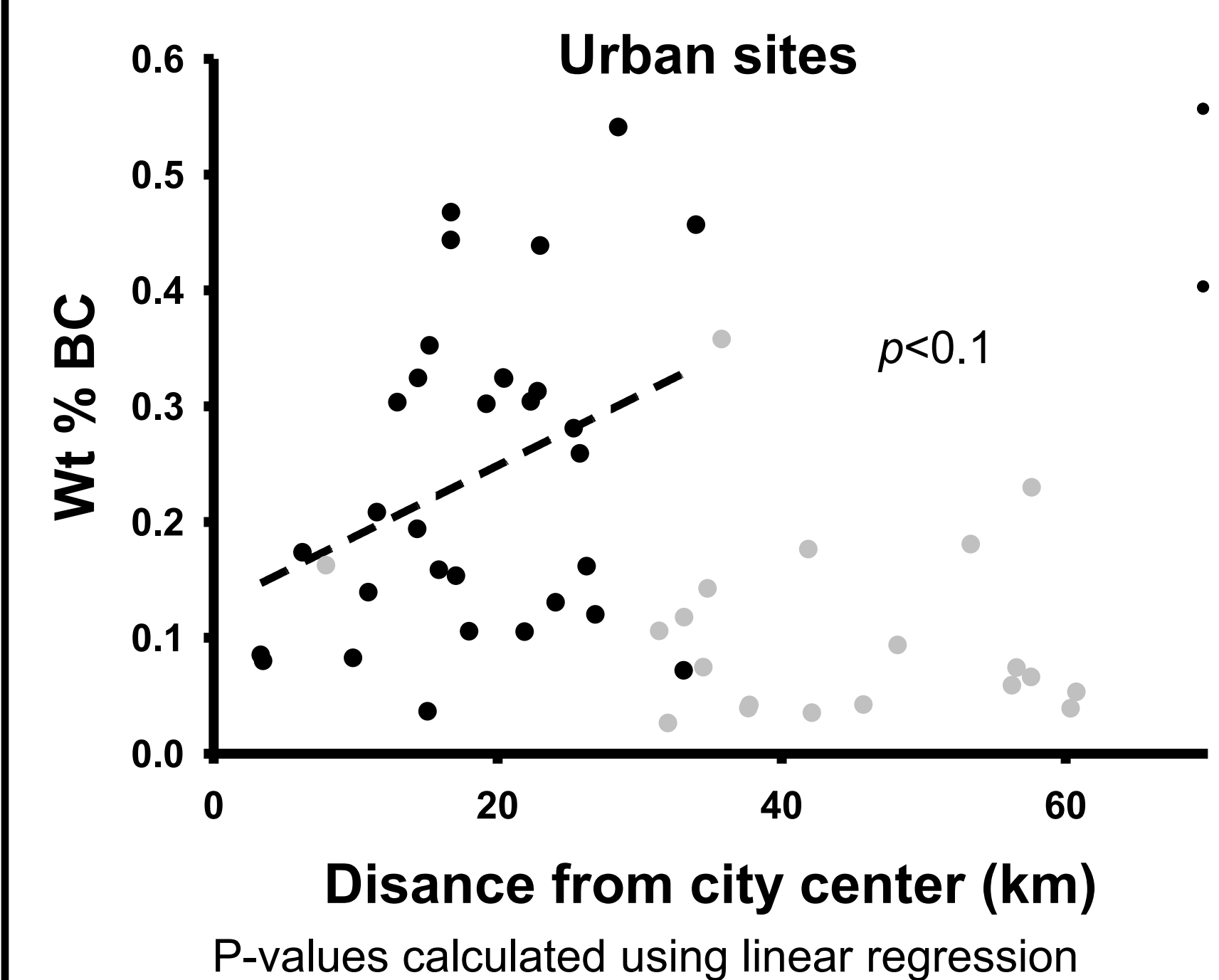
Soot BC concentration is high in the most recently urbanized areas



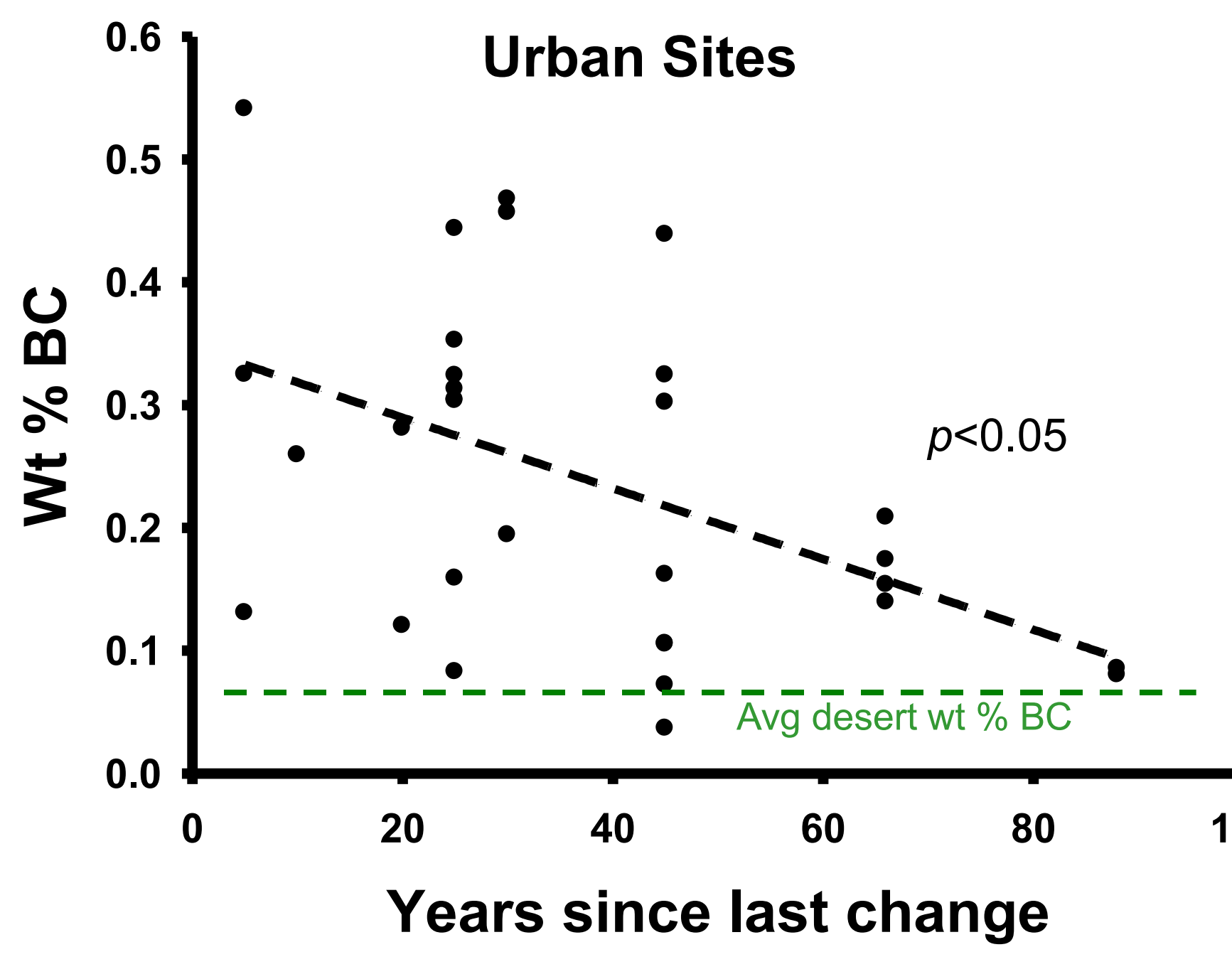
- Soot BC concentrations are higher at sites closer to city center.
- Urban sites have higher soot BC concentrations than desert sites because of human activities (see 'Background' section).



- Historical land use (LU) change data shows sites further away from city center have undergone more recent LU changes.
- Urban areas near city center have not experienced LU change in decades.

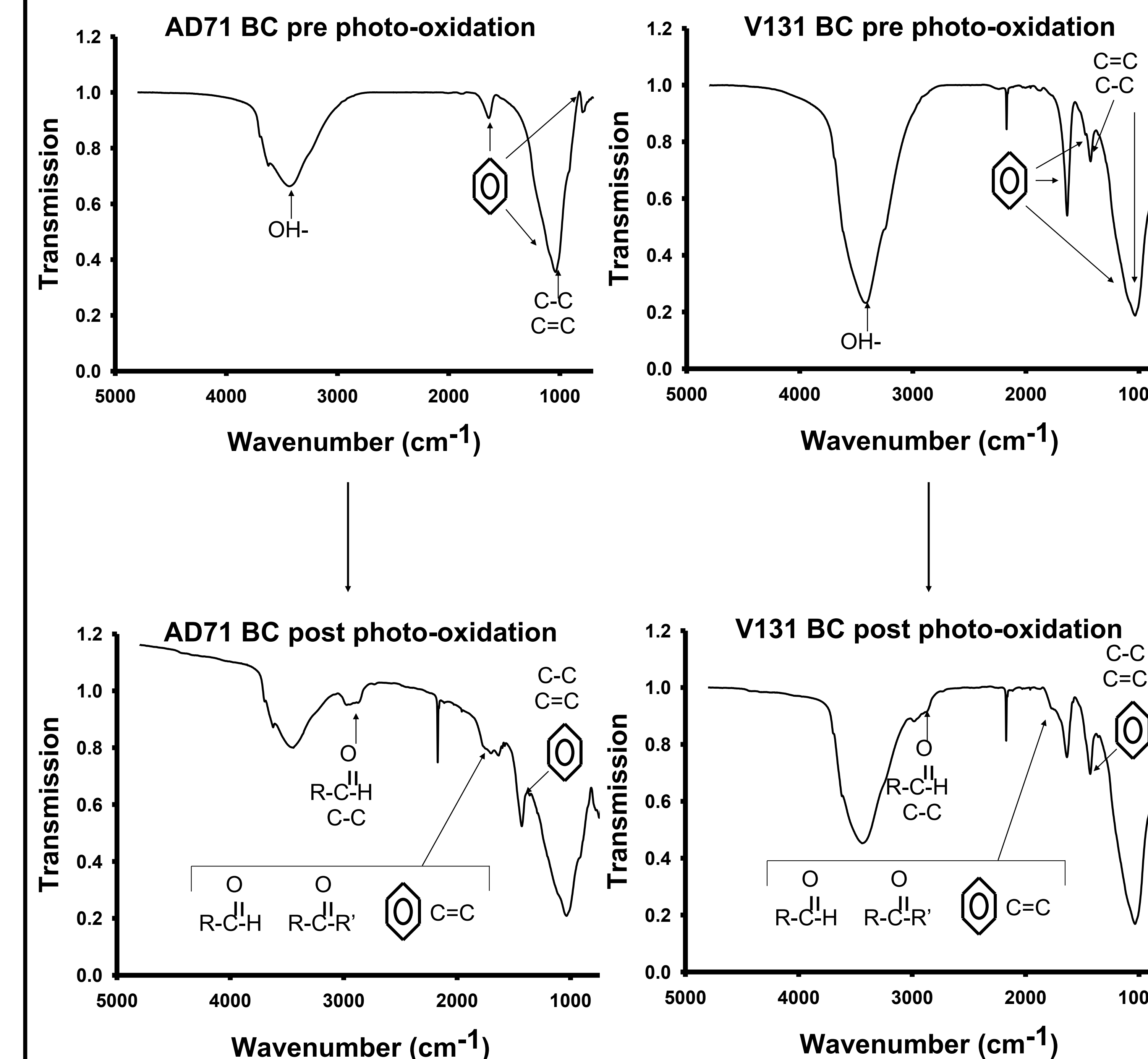


- Opposite trend is seen for urban sites.
- Soot BC input mechanisms for urban sites are different than those for desert and agricultural sites. (desert and agricultural sites are grayed out.)



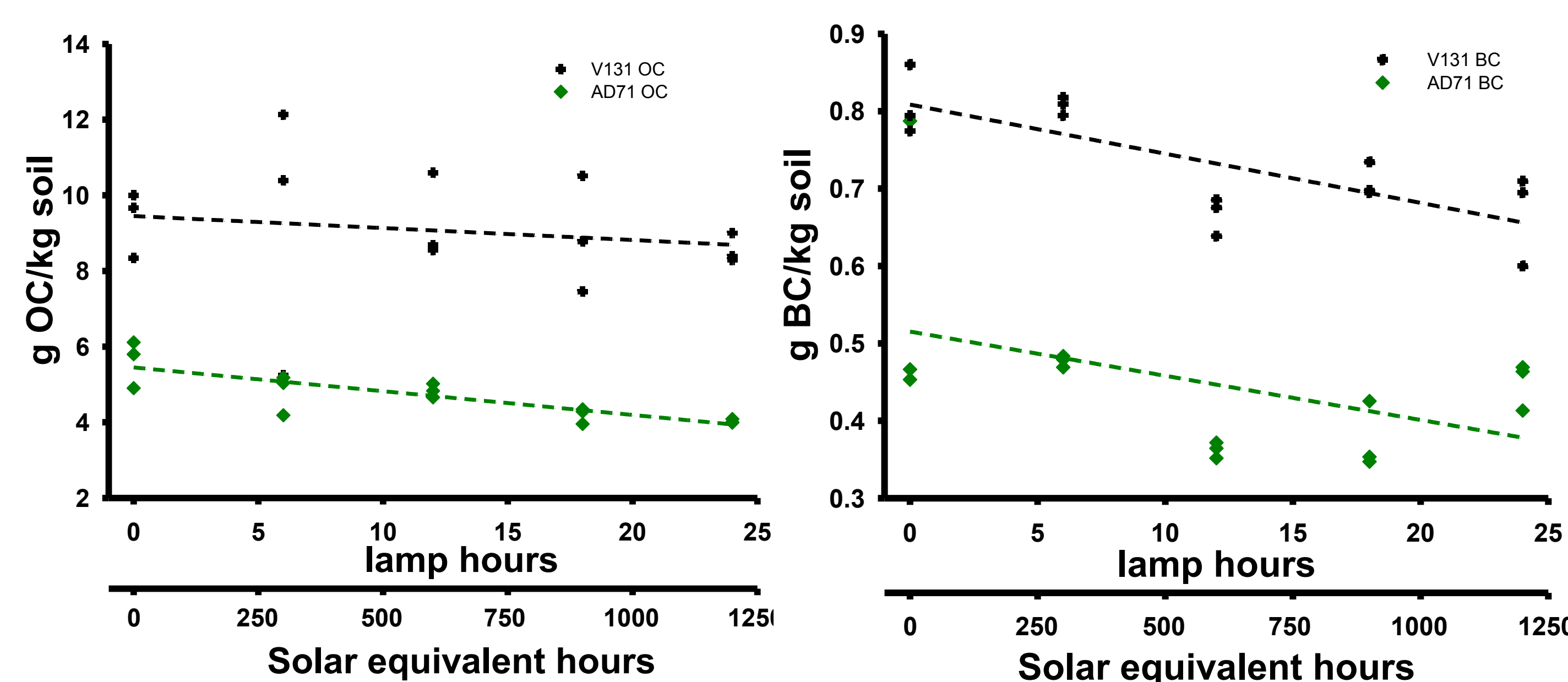
- Soot BC concentrations are higher at sites where LU change is recent.
- Changing LU deposits soot BC in soil.
- Soot BC is lowest at sites urbanized 60-100y ago, indicating soot BC oxidation rates > deposition rates in soils
- Older Urban sites approach desert-level soot BC!
- BC degradation rate determined from slope = 29 ± 10 mg soot BC/kg soil/yr

Photo-oxidation changes chemical composition



- Soot BC prior to photo-oxidation has a different chemical composition than soot BC after photo-oxidation.
- The differences appear in the form of oxygenated functional groups in the post photo-oxidation samples.
- Oxygenated functional groups increase the reactivity of molecules, allowing further reactions driven by biotic and abiotic processes.

Soot BC is degraded by UV radiation



- Organic and soot BC can be removed via photo-oxidation over monthly timescales (note the y-axis scale difference).

Degradation rate (mg C/kg soil/yr)

OC V131	2773 ± 4000
AD71	5498 ± 1000
BC V131	555 ± 100
AD71	490 ± 300

- Black carbon degradation rate is an order of magnitude lower than organic carbon degradation rate.
- Black carbon degradation rates from photo-oxidation are about an order of magnitude higher than those determined from historic land-use data

Despite the differences in methodology, uncertainty, variability, etc., the order of magnitude difference in the calculated degradation rates for these two data sets is fairly small. As a result we have gained a better understanding of the contribution of photochemical oxidation to soot BC degradation in central AZ.