

# Shrub-level planting is linked to lower summer exposures to ultrafine particle concentrations

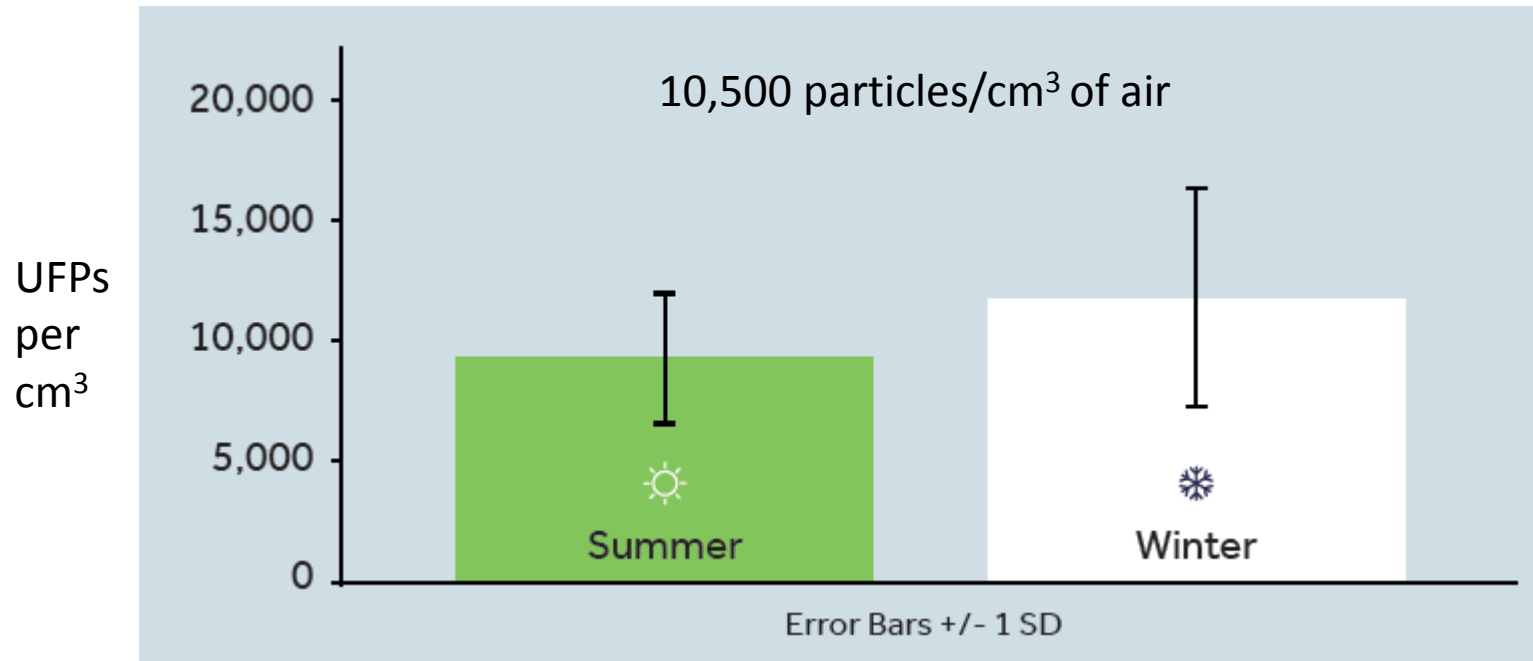
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# What are ultra-fine particles?

- The very smallest particles  $<0.1 \mu\text{m}$
- High toxicity and linked to cardio-vascular and respiratory disorders, diabetes and cancers
- Lack of comprehensive evidence of health impacts at different concentrations so no current air quality standards
- Older people likely to be *more sensitive*





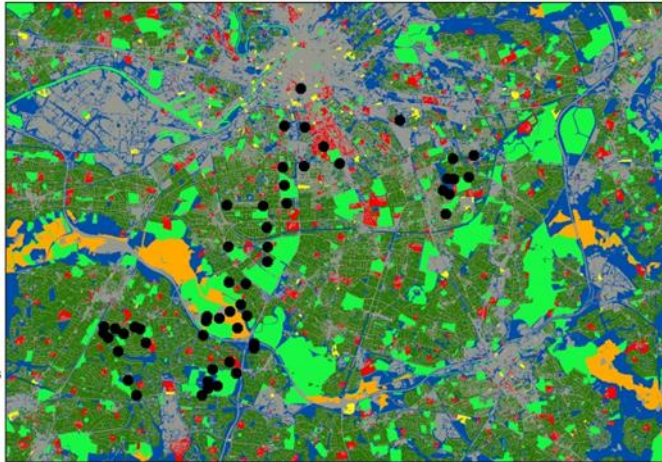
- Green space influences the geographical distribution of UFPs (Weichenthal et al., 2014; Cattani et al., 2017)
- Inconsistent evidence about the effects of different types of green infrastructure (Hagler et al., 2012)

Cattani, et al., (2017): Development of land-use regression models for exposure assessment to ultrafine particles in Rome, Italy, *Atmos. Environ.*, 156, 52–60

Hagler, et al., (2012) Field investigation of roadside vegetative and structural barrier impact on near-road ultrafine particle concentrations under a variety of wind conditions. *Sci Total Environ.* 419:7-15. doi: 10.1016/j.scitotenv.2011.12.002.

Weichenthal, et al., (2014). Characterizing the impact of traffic and the built environment on near-road ultrafine particle and black carbon concentrations. *Environmental Research*, 132, pp.305-310.



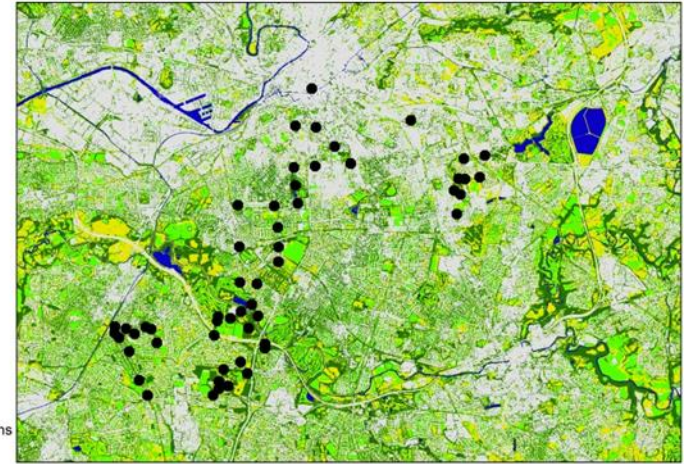
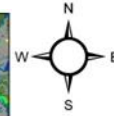


**Legend**

- UFP sampling locations

**Land-use**

- Amenity
- Domestic Gardens
- Institutional
- Peri-urban
- Previously Developed
- Public Recreation
- Urban Other



**Legend**

- UFP sampling locations

**Land-cover**

- Built
- Forbs and shrubs
- Grasses
- Tree canopy
- Water



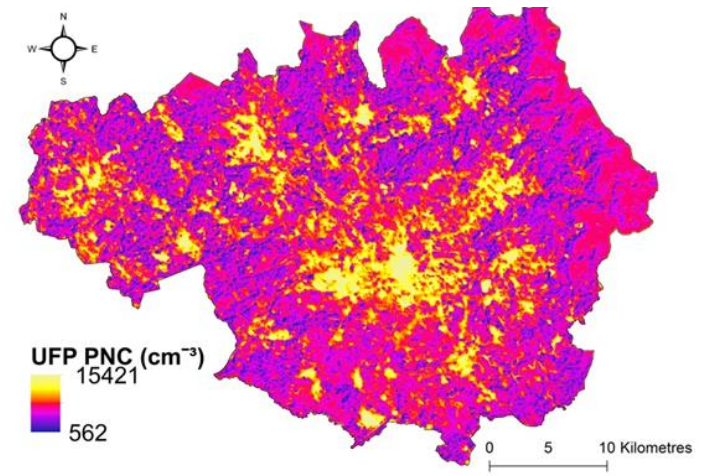
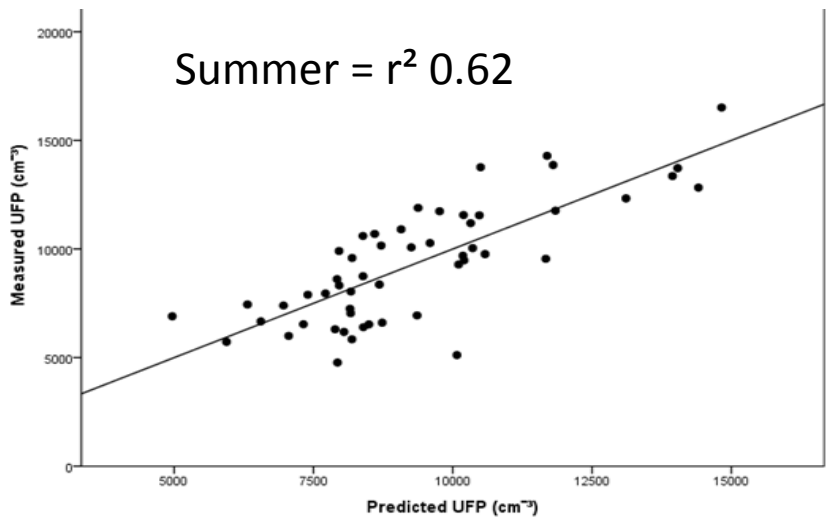
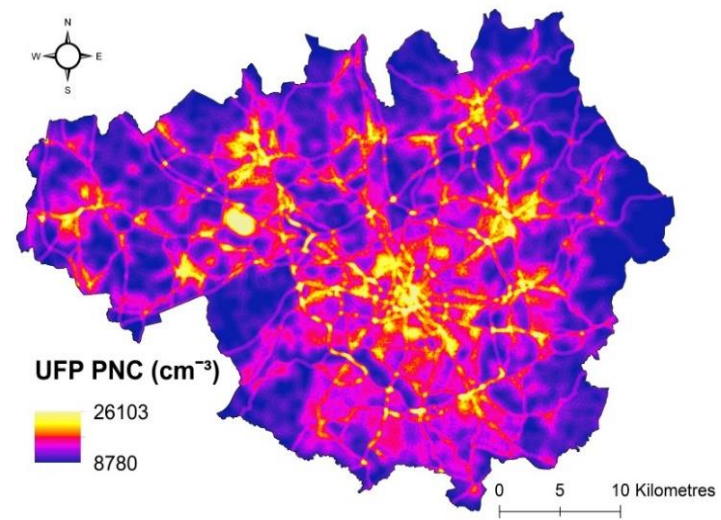
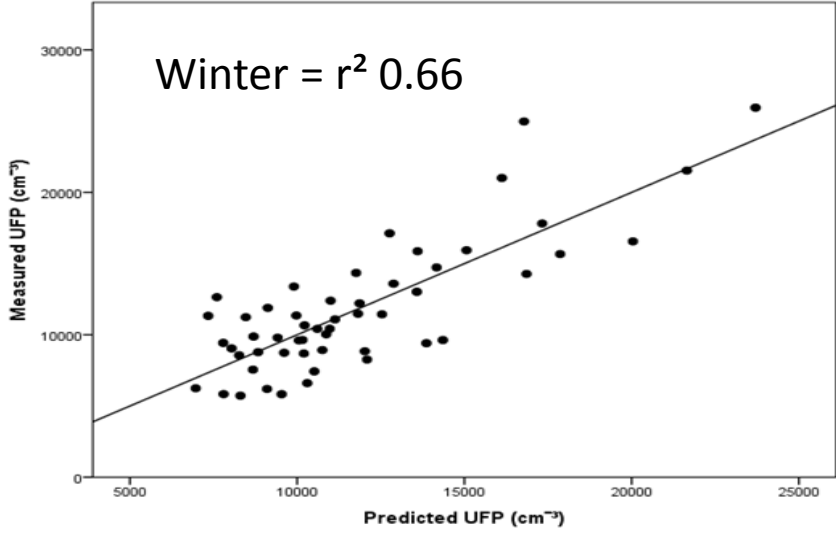
**Measurements**

- 2009 324 3-minute mean spot measurements (10am-3pm)
- 2019 **54 sites** resampled over a gradient of greenness (repeated summer & winter)

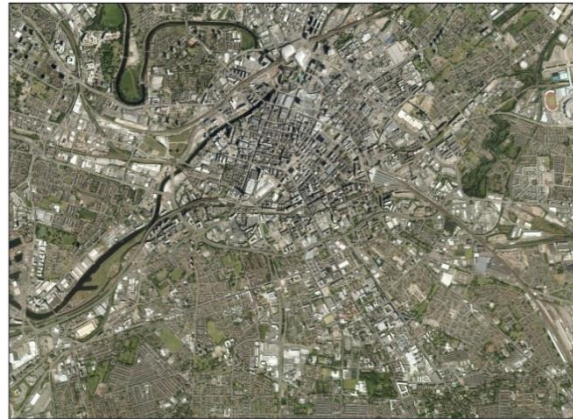
**Model created of UFP concentrations**

- > 500 predictor variables
    - 16 road and traffic-based factors
    - 23 GI characteristics (land-cover type, patch size, diversity & density)
- Controlled for local meteorology

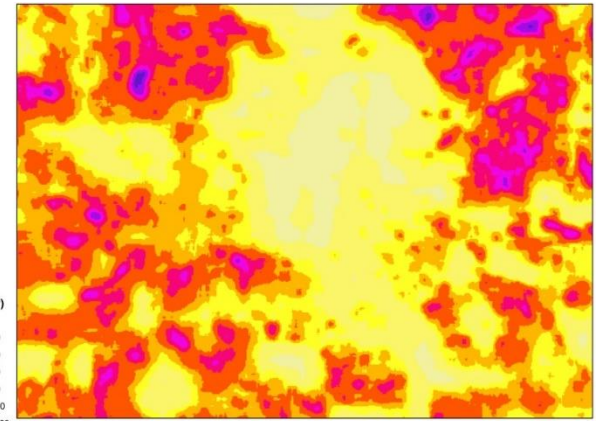




Significant GI predictors:  
1. Ground layer vegetation  
2. Field layer vegetation  
3. Land-cover diversity (SHDI)



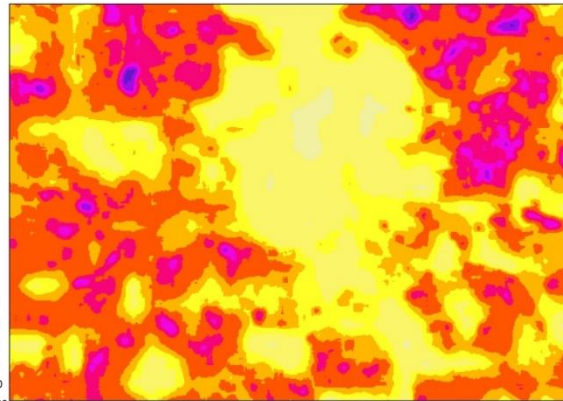
0 0.5 1 Kilometres



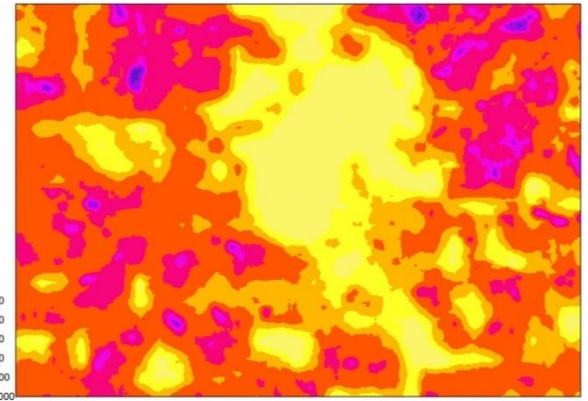
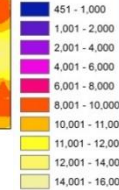
0 0.5 1 Kilometres

Current modelled UFP PNCs

Dense and diverse vegetation barriers have higher structural complexity (Hagler et al., 2012; Cattani et al., 2017)



With 10% vegetation cover



With 20% vegetation cover

Dennis, M. and Lindley, S. J. An integrated land-use-land-cover regression model for predicting ultra-fine particles in an urban city region (in preparation).

[www.ghia.org.uk](http://www.ghia.org.uk)

