Role of **strategic GI** in reducing exposure to road transport pollution

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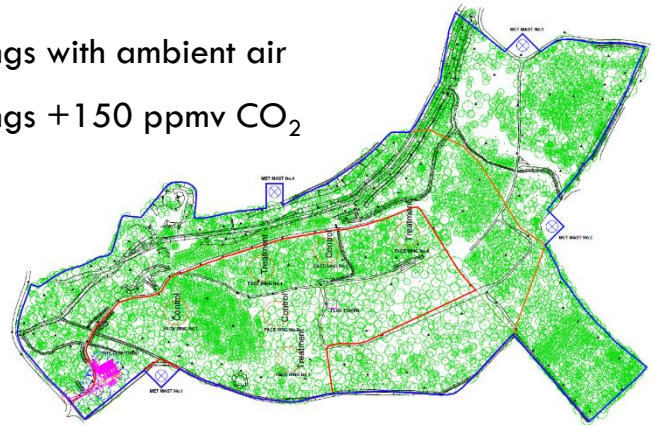
- Impact of climate and environmental change on woodlands

- Resilience of trees to pests and diseases

3 Rings with ambient air

3 Rings +150 ppmv CO_2



Free-Air CO_2 Enrichment experiment (1 of 3 globally): 10+ year study of a mature UK woodland ecosystem's response to future CO_2

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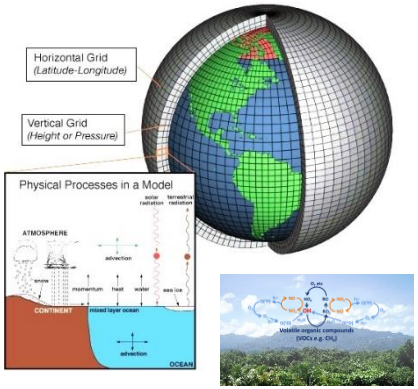
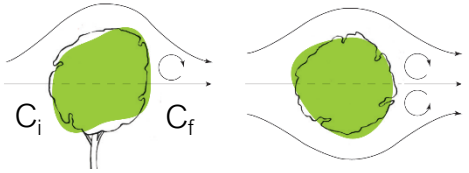
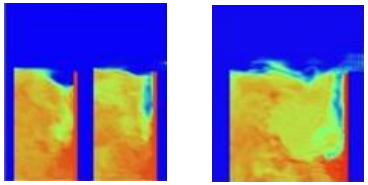


200 chemicals; 600 reactions



Flux ≠ $\{C_i - C_f\}$.deposition velocity



Measurements complemented by **numerical modelling** of the impacts of vegetation on **air quality and climate** (and vice versa)

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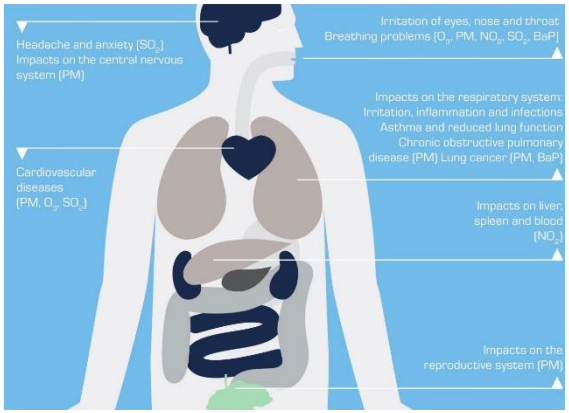
- Urban forestry and green infrastructure

- Natural Capital associated with ecosystem services



Courtesy of European Environment Agency

Colleagues are engaged in characterising all aspects of air quality from pollution **sources (road transport)** to **receptors (public health)**

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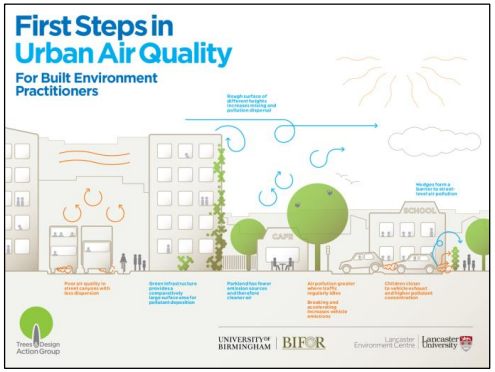

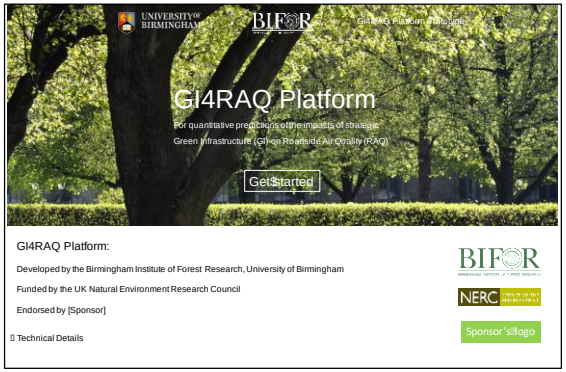

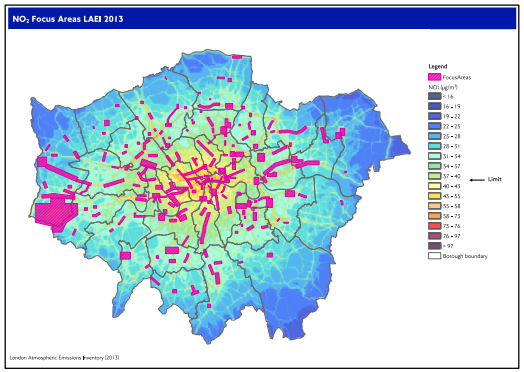

The role of strategic GI in managing air pollution for improved public health: **'First Steps'**, **GI4RAQ Platform** & **Transport for London**

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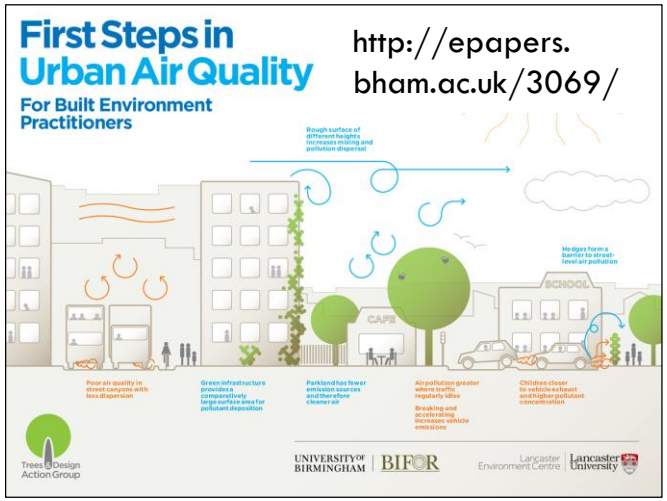
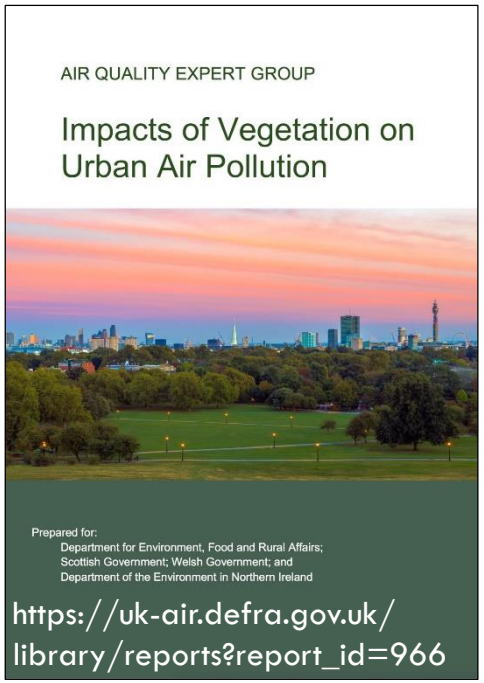
First Steps in Urban Air Quality





Trees & Design Action Group

Lancaster Environment Centre | Lancaster University

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The role of strategic GI: **dispersion to (re)distribute pollution and reduce public exposure** (c.f. deposition to remove pollution)

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First Steps in Urban Air Quality

The best way to improve urban air quality is to reduce emissions at source

Reducing exposure is a complementary means to improve public health outcomes

The role of strategic GI: **dispersion to (re)distribute pollution and reduce public exposure** (c.f. deposition to remove pollution)

First Steps in Urban Air Quality

For realistic planting schemes, deposition to leaves typically removes just a few % of $PM_{10\ /\ 2.5}$

Deposition likewise removes little NO_2 and what is removed is offset by soil emissions of NO

AQEG (2018)

The role of strategic GI: **dispersion to (re)distribute pollution and reduce public exposure** (c.f. deposition to remove pollution)

First Steps in Urban Air Quality

Vegetation emits VOCs, such as isoprene, but contributes little to total urban VOCs (and urban O_3)

Careful species selection can reduce their already minor impact on air quality (mainly downwind)

AQEG (2018)

The role of strategic GI: **dispersion to (re)distribute pollution and reduce public exposure** (c.f. deposition to remove pollution)

First Steps in Urban Air Quality

Dispersion 'only' redistributes pollution but can greatly reduce near-source concentrations

Vegetation barriers can reduce concentrations of pollutants in their immediate wake by 50%

AQEG (2018)

The role of strategic GI: **dispersion to (re)distribute pollution and reduce public exposure** (c.f. deposition to remove pollution)

Public Health Perspective

Sources (road transport) ▶ Dispersion ▶ Receptors (people)

Concentrations at point of exposure *

Number of people exposed

Vulnerability of those exposed

GI can reduce emissions at source by **incentivising active transport**

GI can reduce exposure by **drawing people to clean green corridors**

Public Health Perspective

Sources (road transport) ▶ **Dispersion** ▶ Receptors (people)

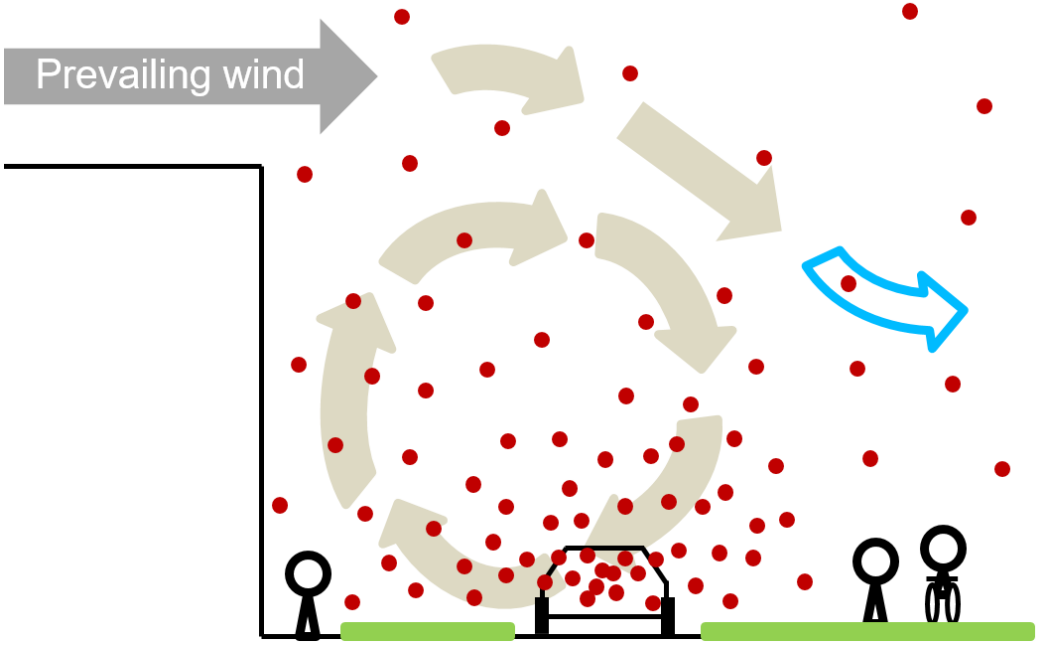
Concentrations at point of exposure *

Number of people exposed

Vulnerability of those exposed

Strategic GI to (re)distribute pollution and reduce public exposure

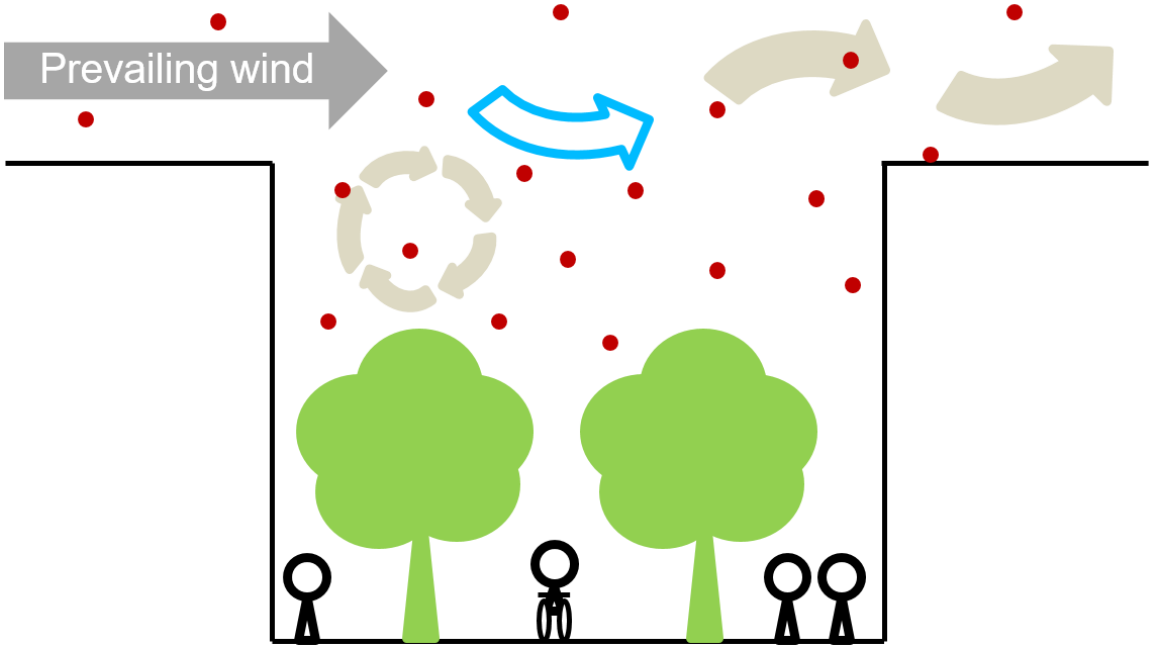
First Steps in Urban Air Quality



Green open spaces are vital to the dispersion of pollution

(and likely take the place of additional sources of pollution)

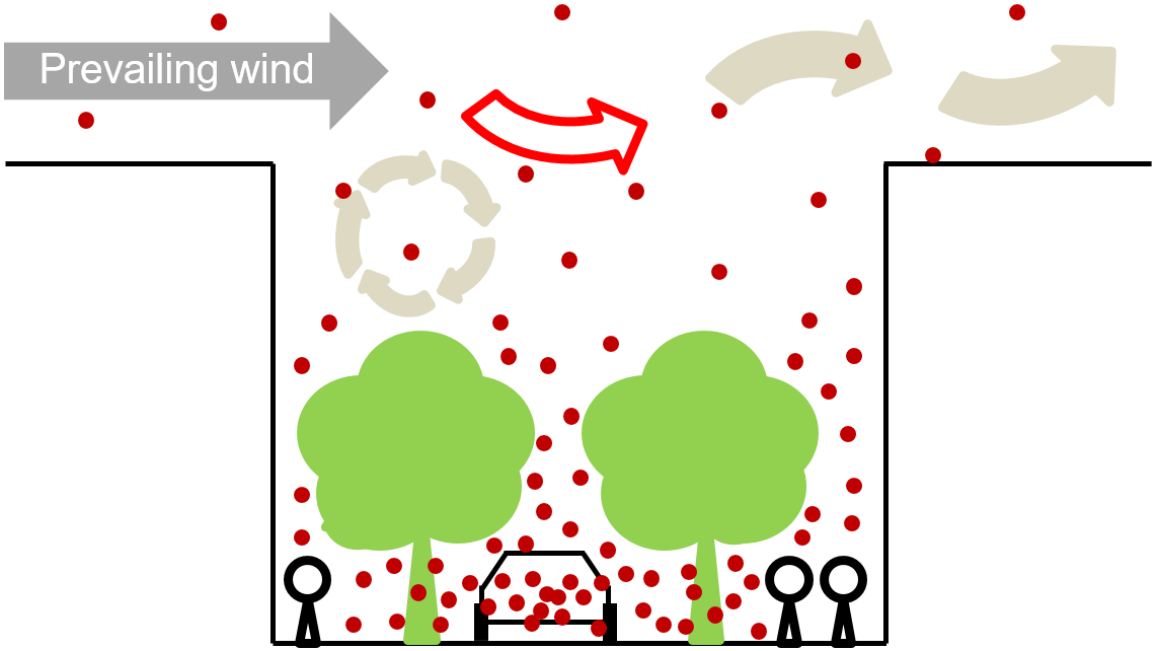
First Steps in Urban Air Quality



Dense avenues of trees <u>effectively protect quiet roads</u>

from the import of *more* polluted 'urban airshed' air aloft

First Steps in Urban Air Quality

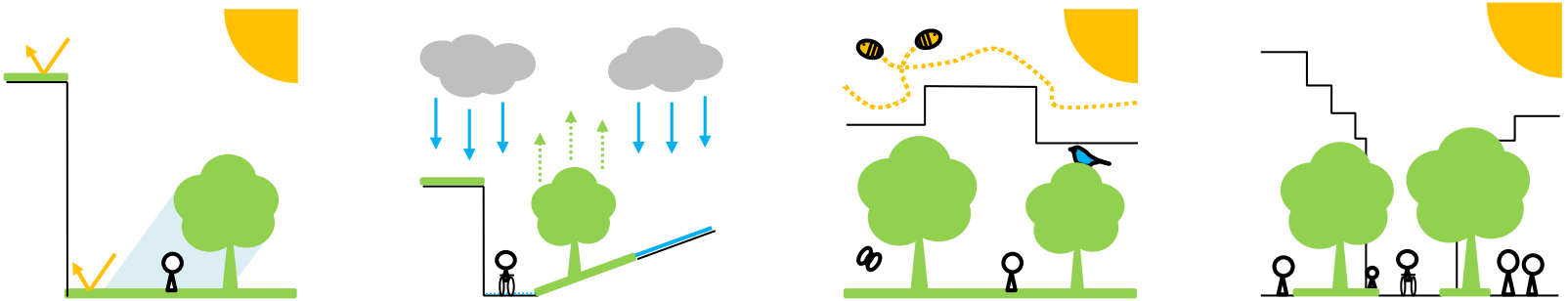


Dense avenues of trees can trap pollution on busy roads

and impede dilution by *less* polluted 'urban airshed' air aloft

First Steps in Urban Air Quality

All trees must be valued for their contributions to thermal comfort, sustainable urban drainage, biodiversity & placemaking



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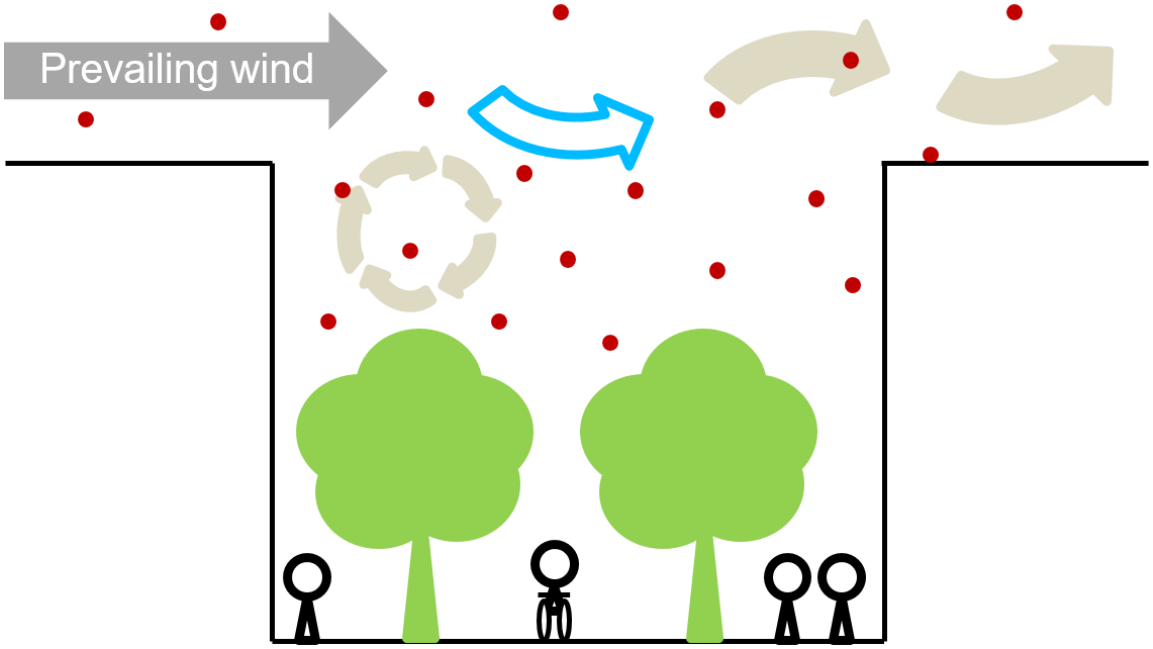
First Steps in Urban Air Quality



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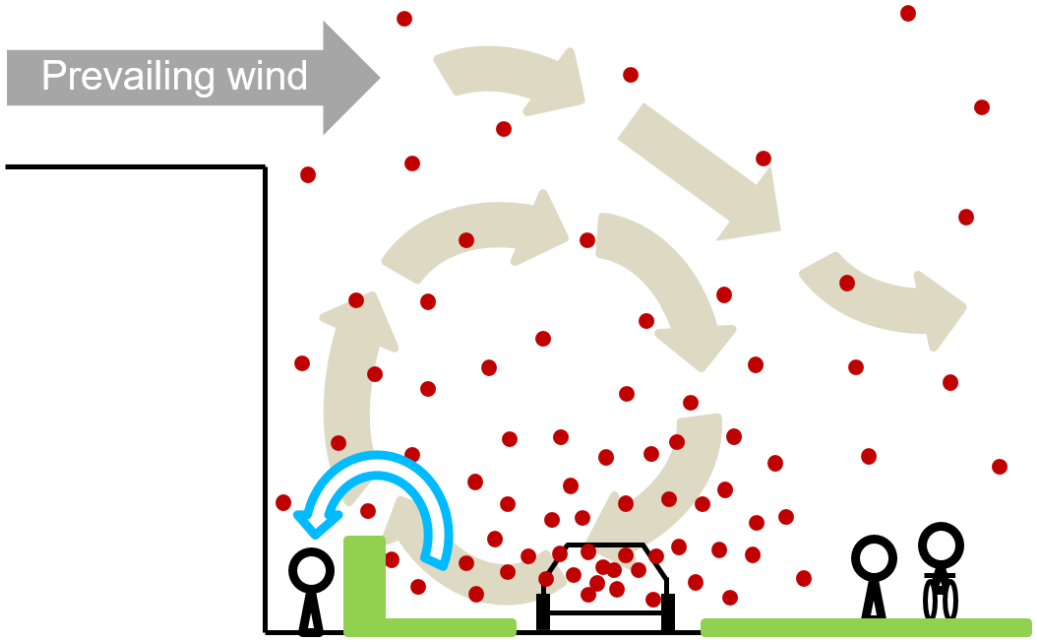
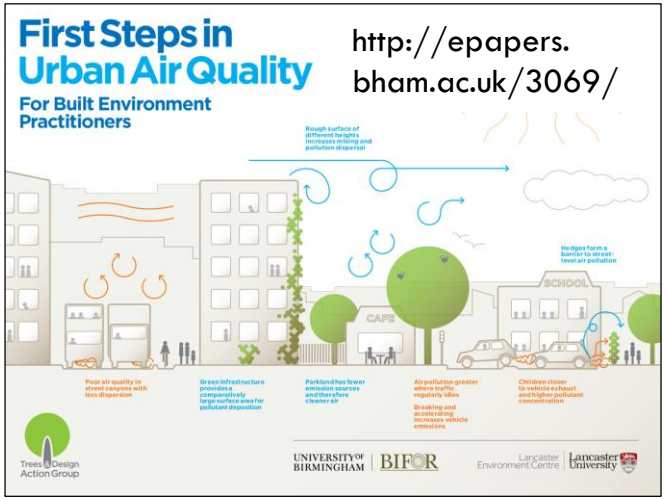
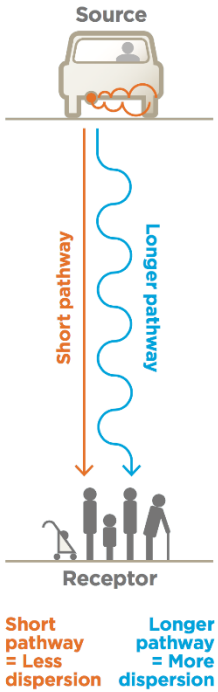


Hedges as barriers provide effective (highly localised) protection by reducing concentrations in their immediate wake

First Steps in Urban Air Quality





First reduce emissions at source, then lengthen

the 'source-receptor pathway' to **reduce public exposure**

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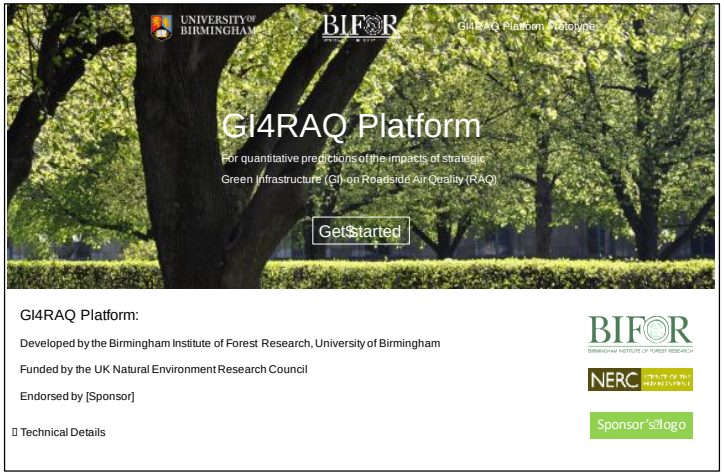
Quantitative GI4RAQ Platform



Developing a GI4RAQ Platform to **predict quantitatively** the **impacts of strategic GI** on roadside air quality (RAQ) **at planning**

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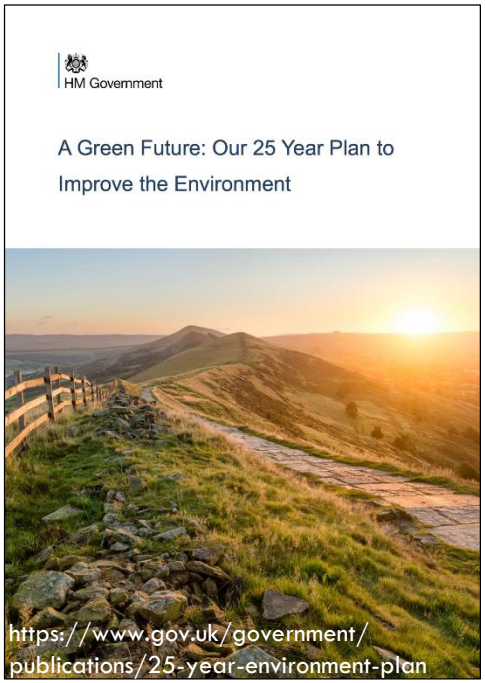
Quantitative GI4RAQ Platform



'We will explore strengthening this [biodiversity net gains] requirement for **planning authorities to ensure environmental net gains**'

Greater London Authority is proposing an **'Air Quality Positive' policy for large developments** In the next London Plan

Co-designed with its end-users (local authority officers & environmental consultants) **to inform pre-app discussions**

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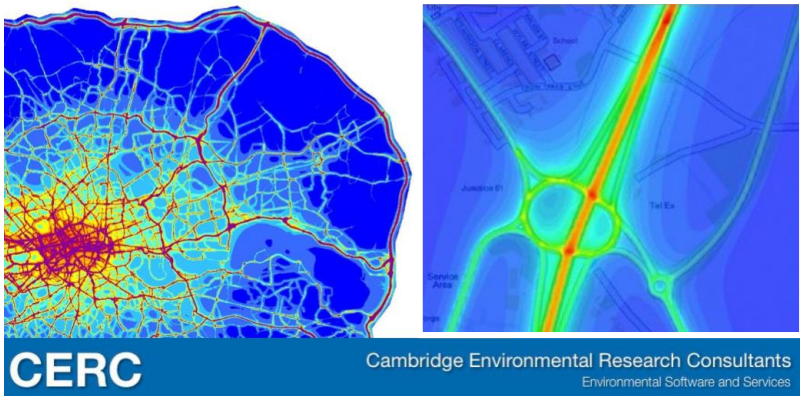
Quantitative GI4RAQ Platform



CERC and Ricardo engaged in two capacities: target end-users; and **developers of air-quality models familiar to local authorities**

Free to use to maximise use, and based on **open-source code to stimulate further innovation** in public, private and academic sectors

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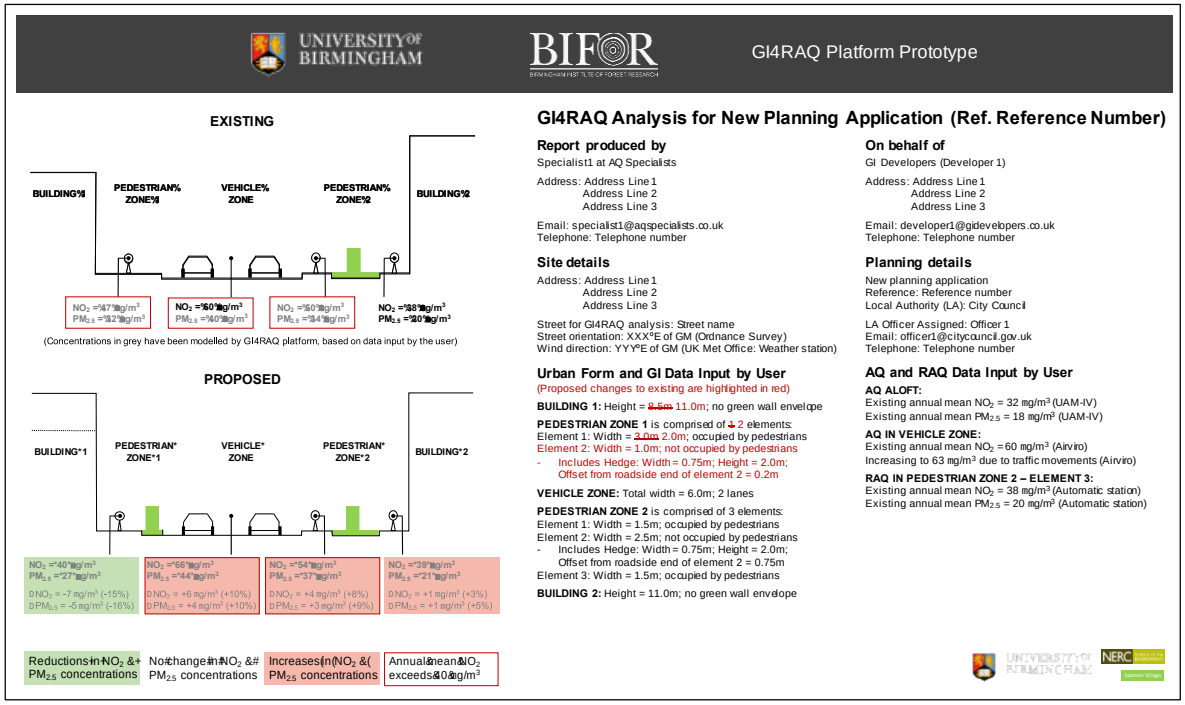
Quantitative GI4RAQ Platform



Quantitative predictions of the impacts on RAQ of proposed changes in GI (and urban form) subject to **site-specific conditions**

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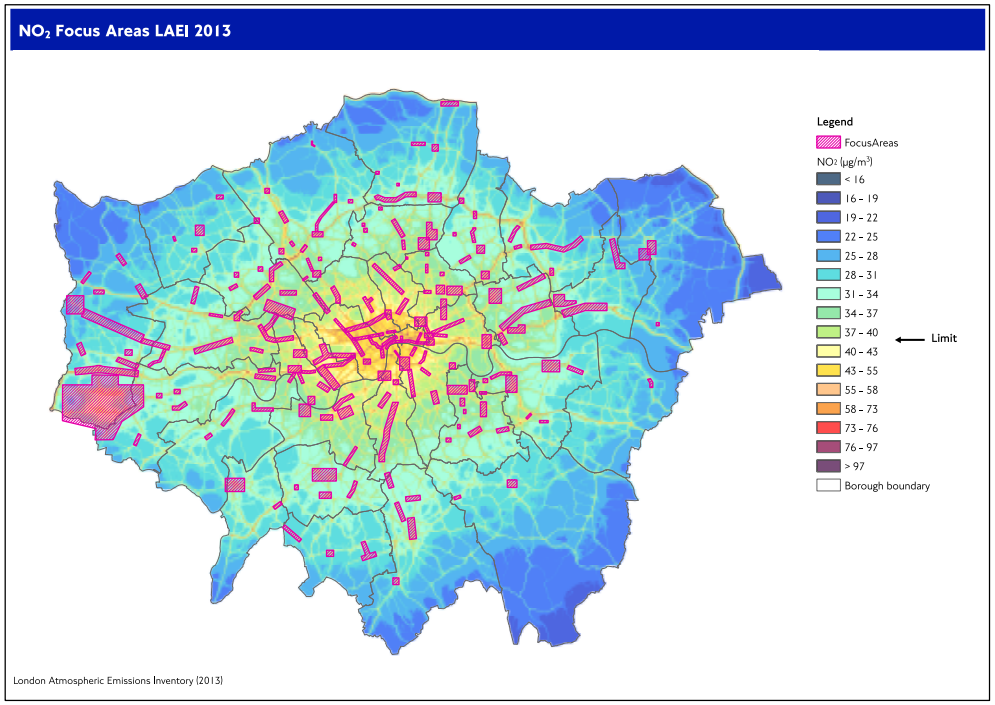
Transport for London Greater London Authority



KING'S College LONDON

TfL has identified **187 focus areas for air quality improvement for population-wide public health** (incl. exposure and vulnerability)

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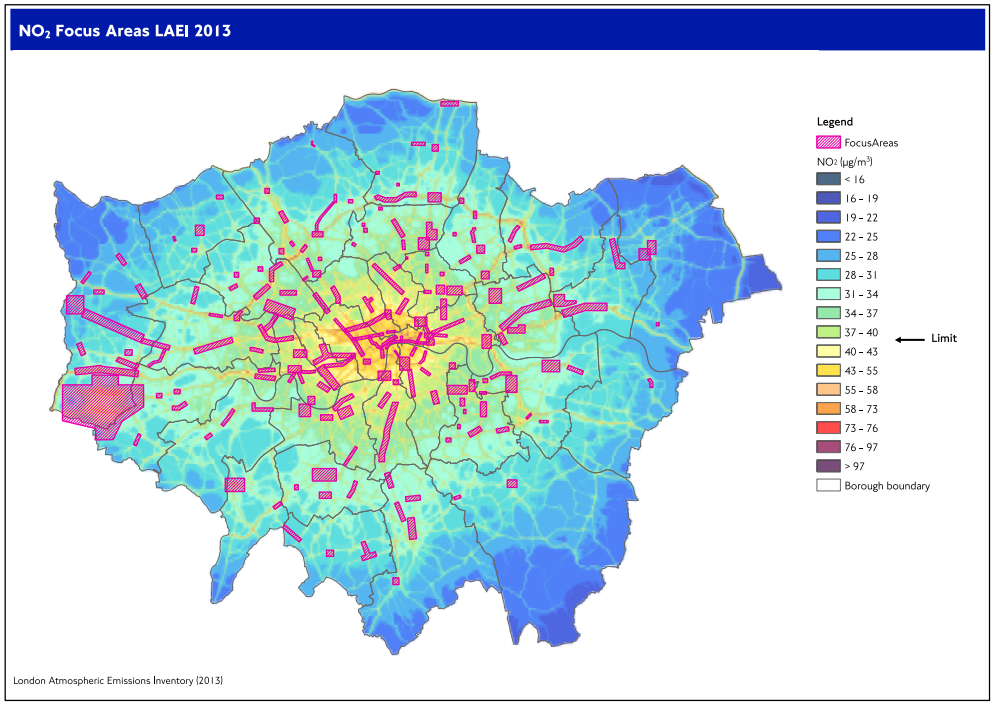
Transport for London Greater London Authority



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Developing an **evidence-based logic** (applicable to TfL's GIS data)

to identify the **most beneficial, practicable GI4RAQ interventions**

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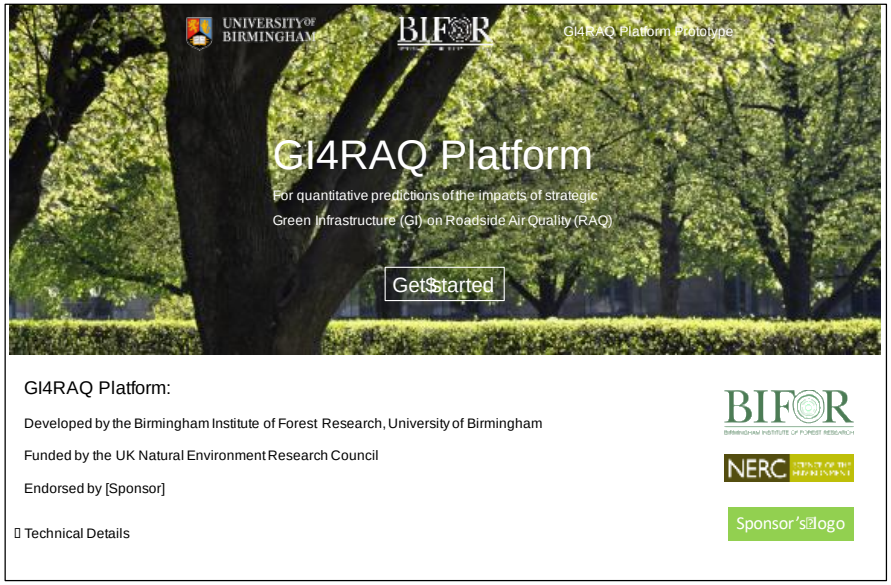
Transport for London Greater London Authority



Contextualising use of the GI4RAQ Platform: 'clean air' is just one indicator of a 'Healthy Street' & **GI offers many further benefits**

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Take Home Messages

The best way to improve urban air quality is to reduce emissions at source

Reducing exposure is a complementary means to improve public health outcomes

Take Home Messages

~~*'GI is always good for air quality'*~~

Green open spaces are vital to the dispersion of pollution

Dense avenues of trees effectively protect quiet roads
…but can trap pollution on busy ones

Hedges can much reduce exposure in their immediate wake

Take Home Messages

Strategic GI can effectively control dispersion to (re)distribute pollution and reduce public exposure

And we gain the co-benefits of GI for: thermal comfort, sustainable urban drainage, biodiversity and placemaking…

Focussing efforts based on exposure and vulnerability, as well as concentrations, maximises public health benefits

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