

THE CLIMATE EXPOSOME

A NEW TOOL FOR ADDRESSING THE HEALTH IMPACTS OF CLIMATE CHANGE

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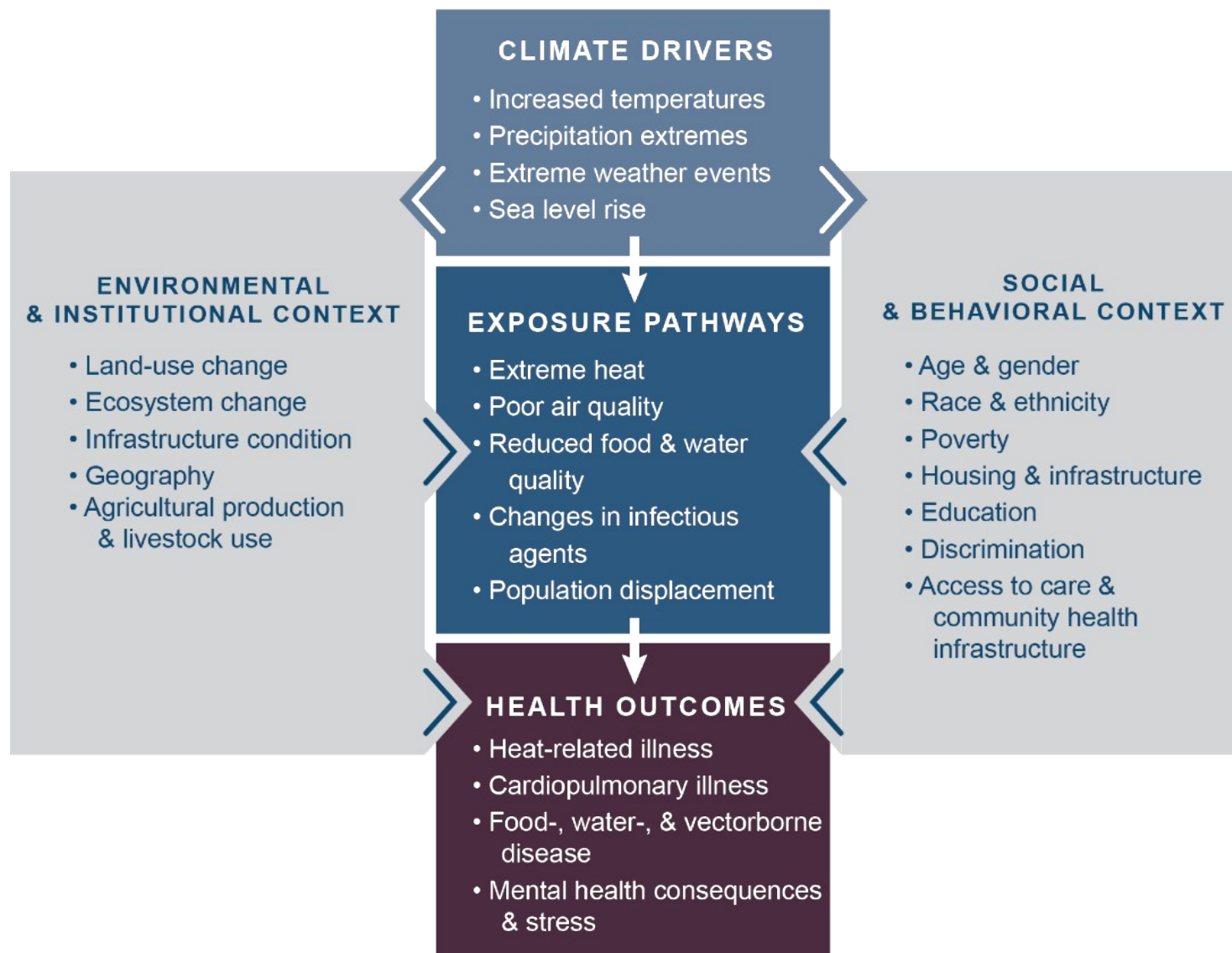
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CC health challenges





CC health challenges



Effects related to mitigation of /adaptation to climate change

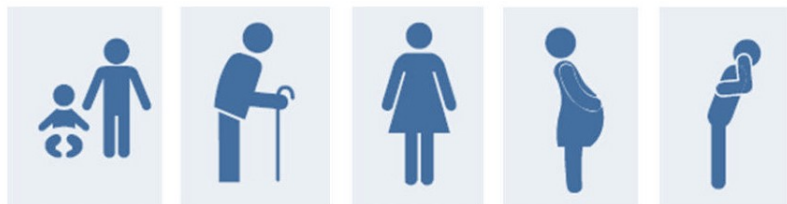
Selected examples

- Mitigating CO₂ emissions often results in increased air quality
 - *Irrational use of biomass → increased PM levels*
 - *Use of diesel → increased PM levels*
- Increased building insulation for energy efficiency results in increased indoor air pollution
- Increased use of pesticides for protecting crops



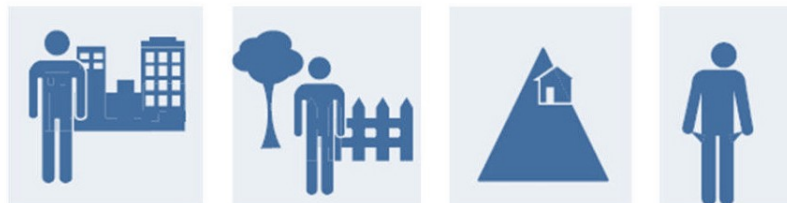
Vulnerabilities

Vulnerable population subgroups affected by climate change



Particularly sensitive groups of the population

Children, elderly, women, pregnant, people with chronic illnesses



Socially and economically distinct groups of the population

Workers outdoor, inhabitants of cities / remote regions, low-income people

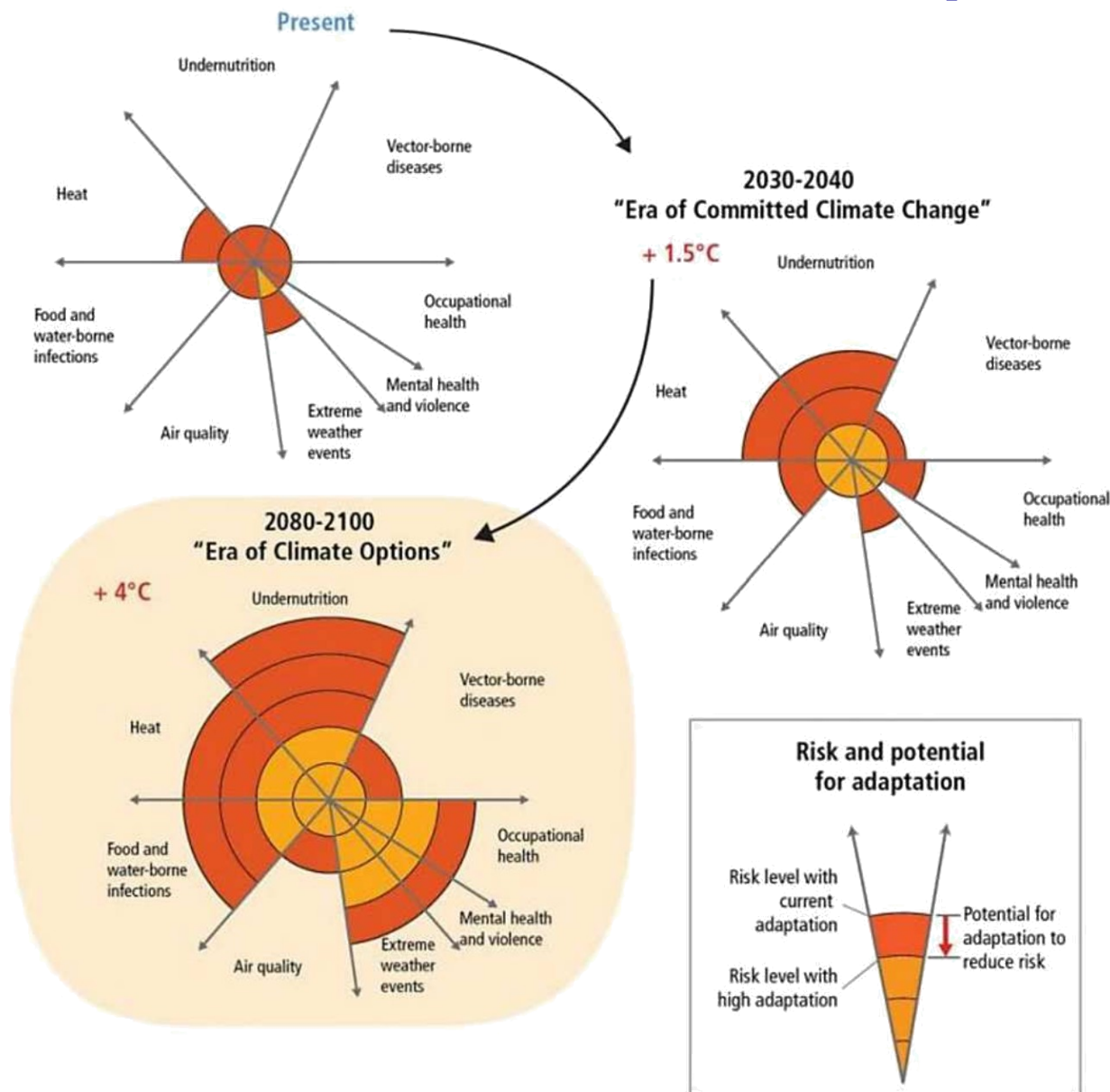


Regionally distinct groups of the population

Inhabitants of tropics / subtropics, small islands, mountain, Arctic regions



Risk and adaptation



How to identify the most efficient adaptation strategies for reducing health risks?

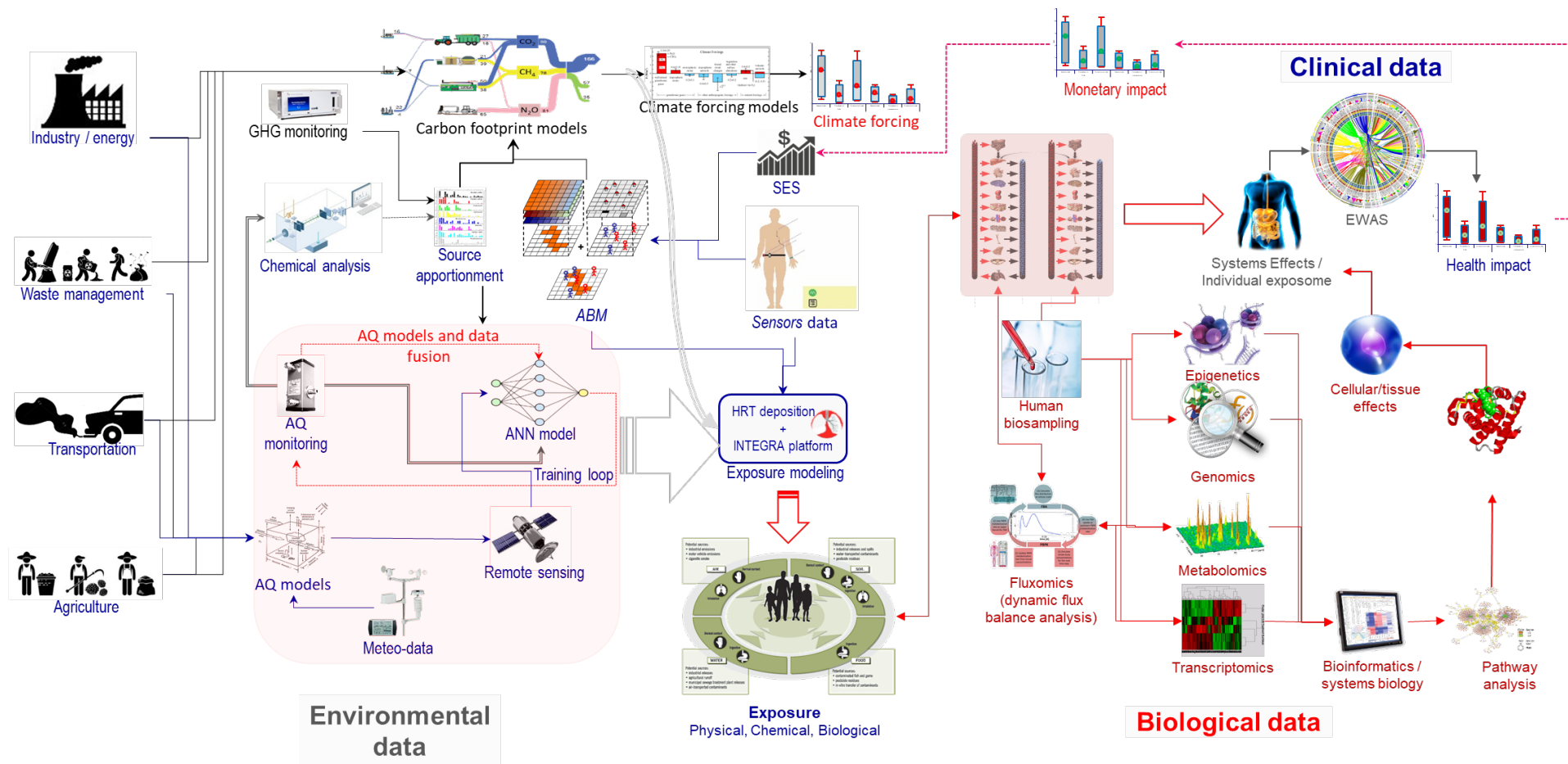
How to ensure better public health protection?

What can we do?

Using the **climate exposome** we can address:

- The interactions among activity sectors and changing environment
- Exposure and effects of
 - ✓ Chemical stressors (air pollution (ambient/indoor), pesticides), waste
 - ✓ Physical stressors (UV radiation, heat waves....)
 - ✓ Biological stressors (infectious diseases, microbiome.....)
- **Interactions** between chemical, physical and biological stressors
- Interplay of vulnerabilities and socioeconomic factors

Embracing complexity to seek simple solutions to EH problems

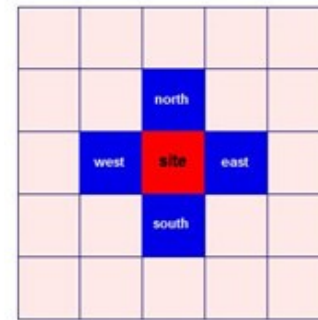
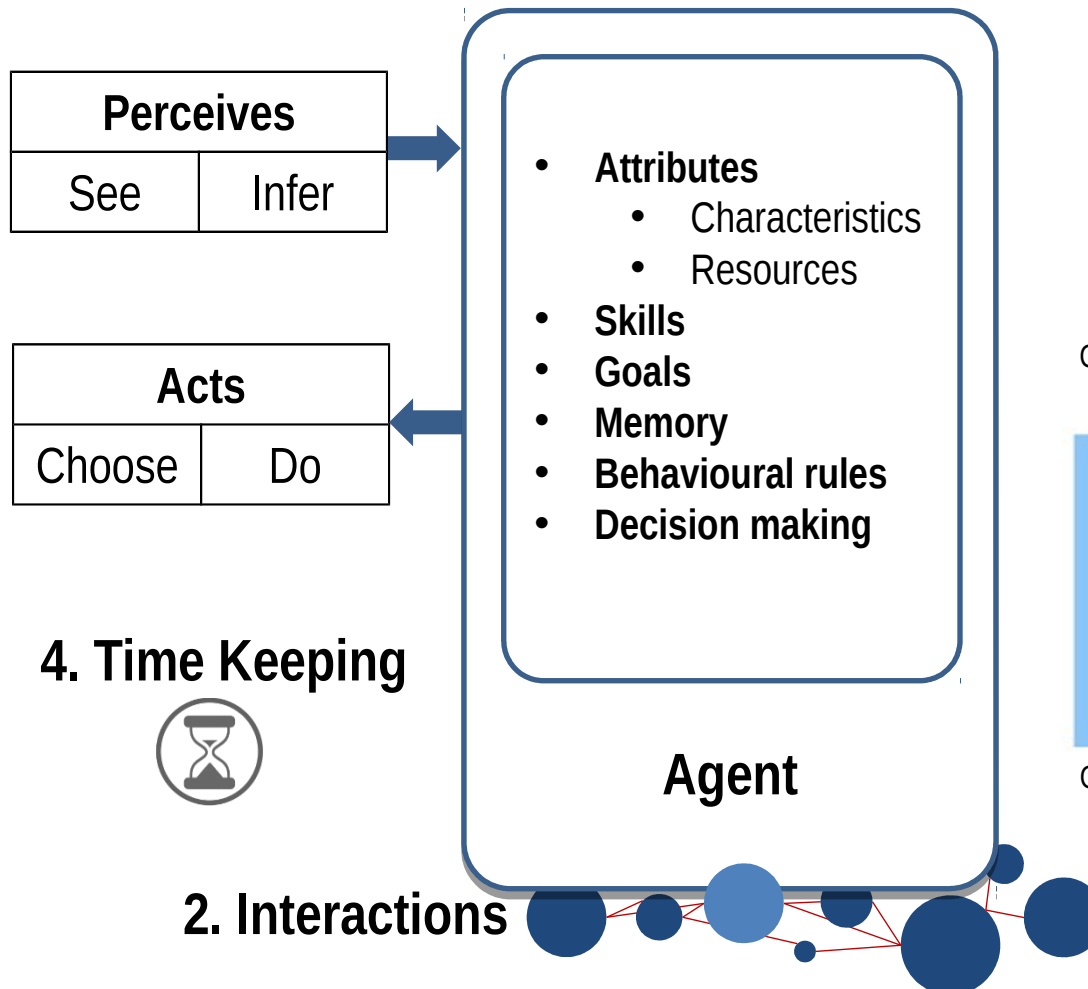


1. Agents

3. Environment

Agents are objects with attitude! Flexible, interacting, autonomous

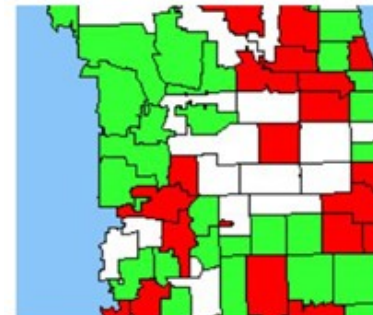
Major types of agent environments



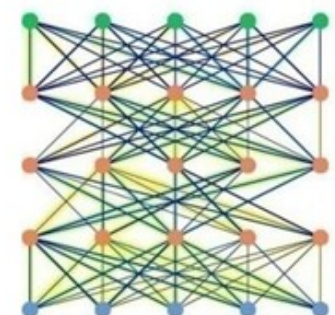
Cellular automata (von Neumann)



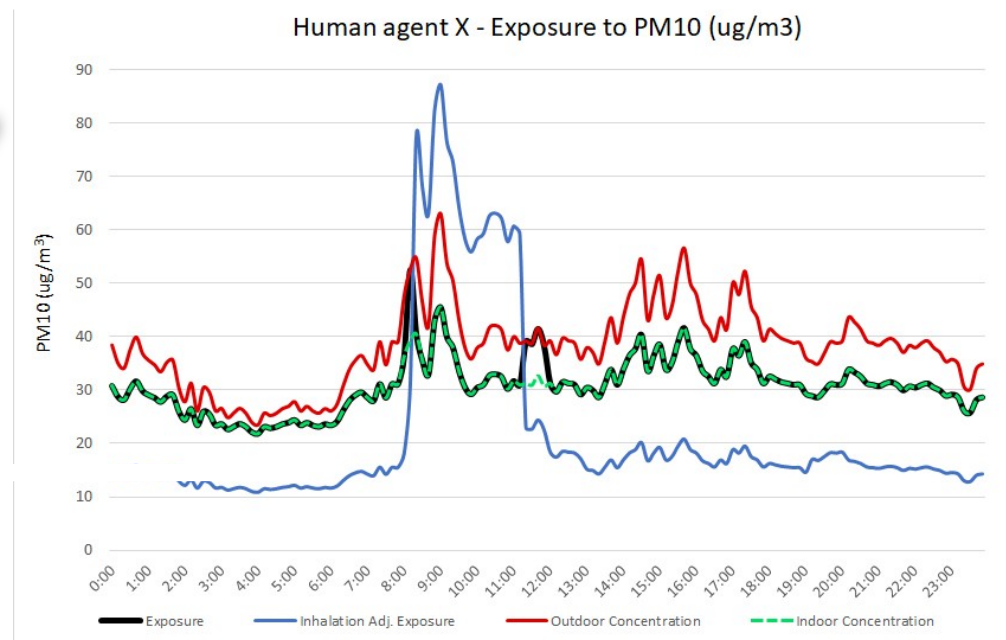
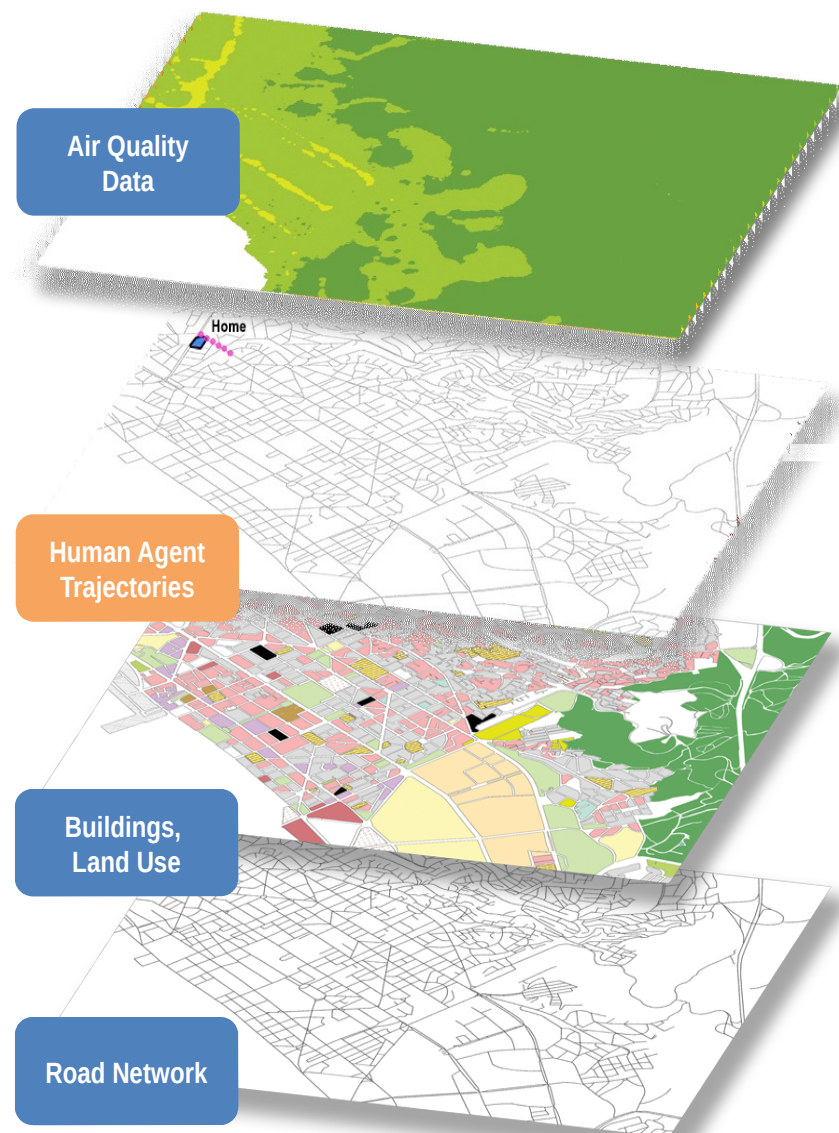
Euclidean Space (2D)



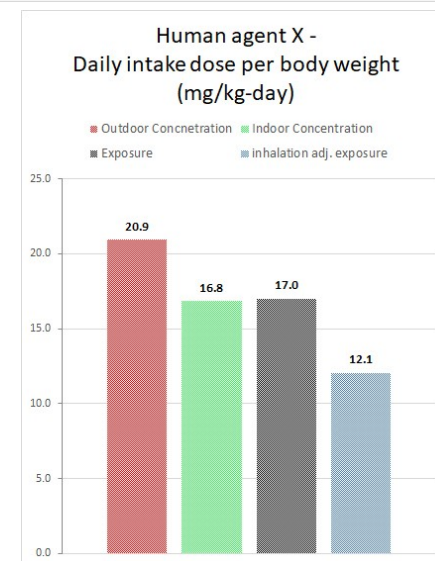
Geographic Information System (GIS)



Network topology

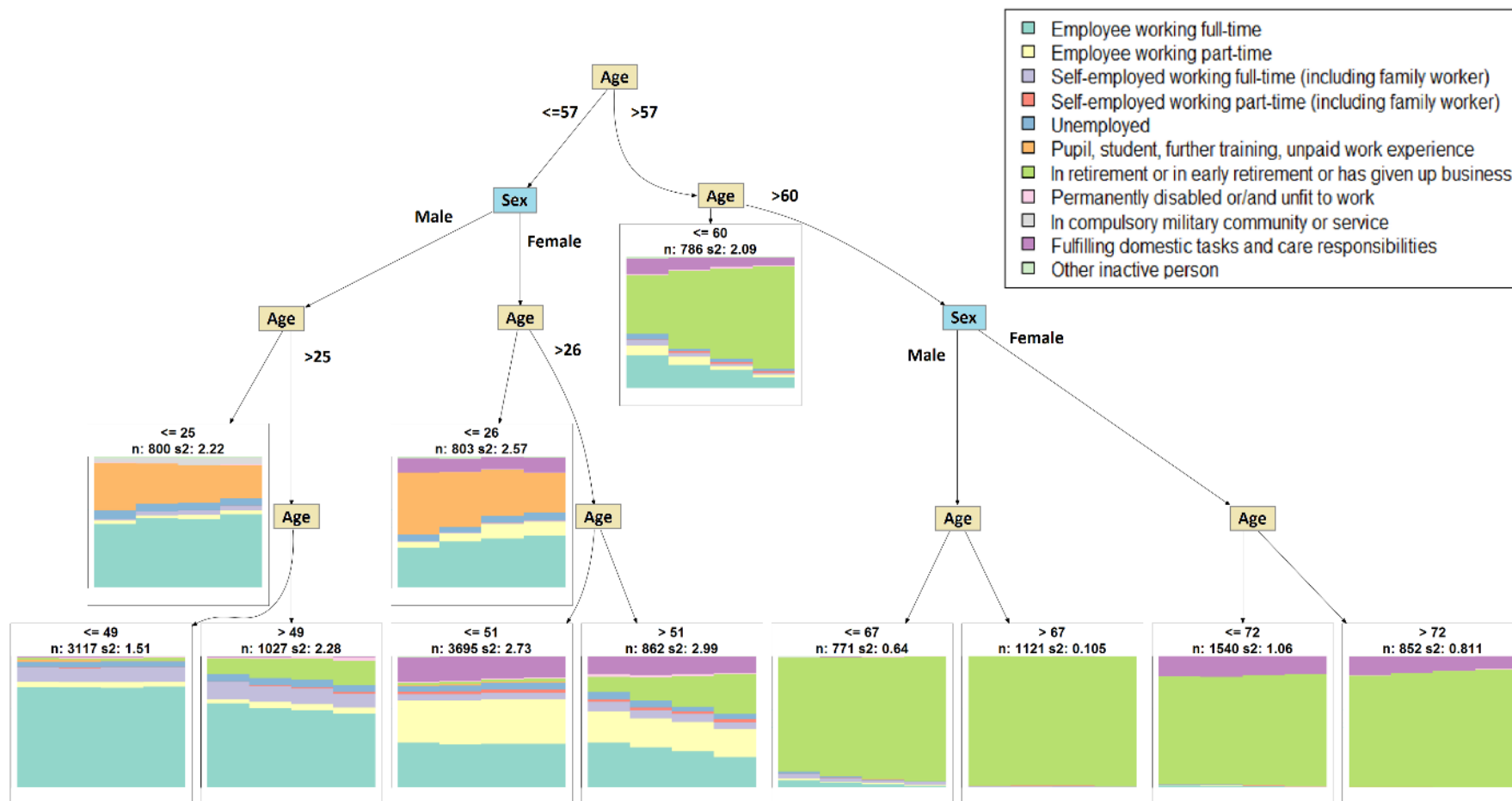


Time	Activity	Place	Vehicle
0:00	sleep	home	
8:10	commute	road	car
8:20	paidwork	work	
11:20	commute	road	car
12:00	eatdrink	home	
13:00	tvradio	home	
18:30	selfcare	home	
19:10	clean	home	
20:10	selfcare	home	
20:50	tvradio	home	



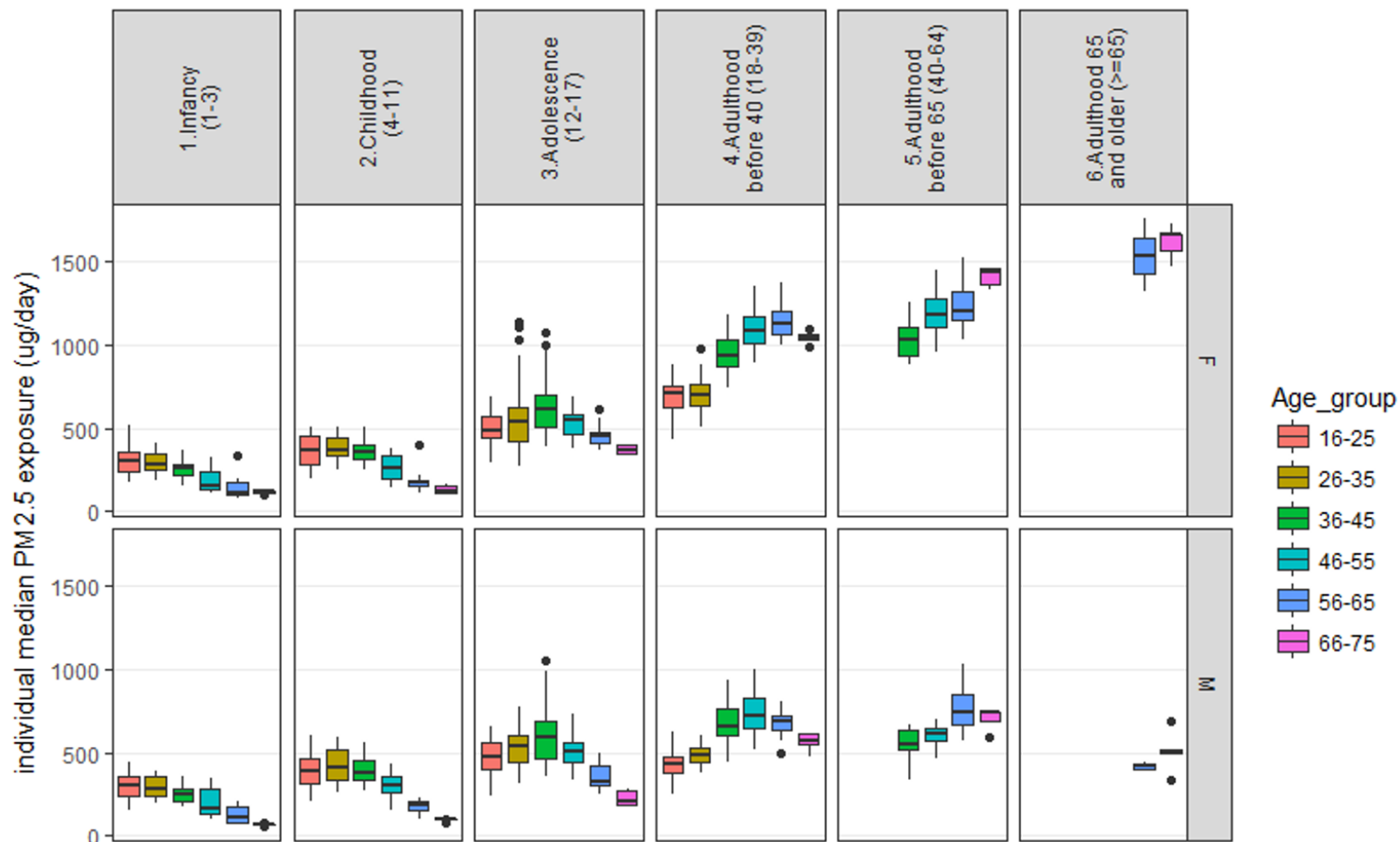
Exposure trajectories

Retrospective exposure

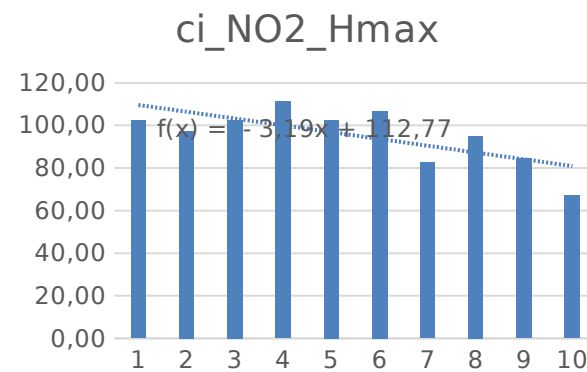
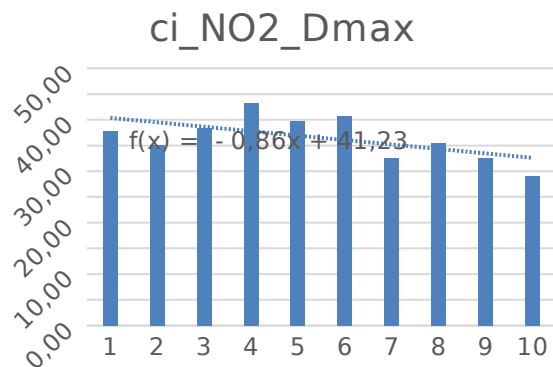
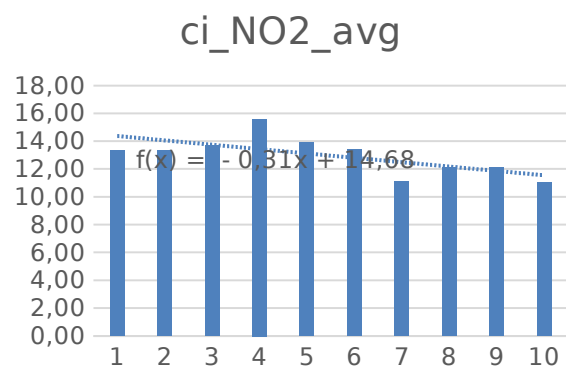


Exposure trajectories

Retrospective exposure



NO₂ exposure in Stuttgart 2020-2030

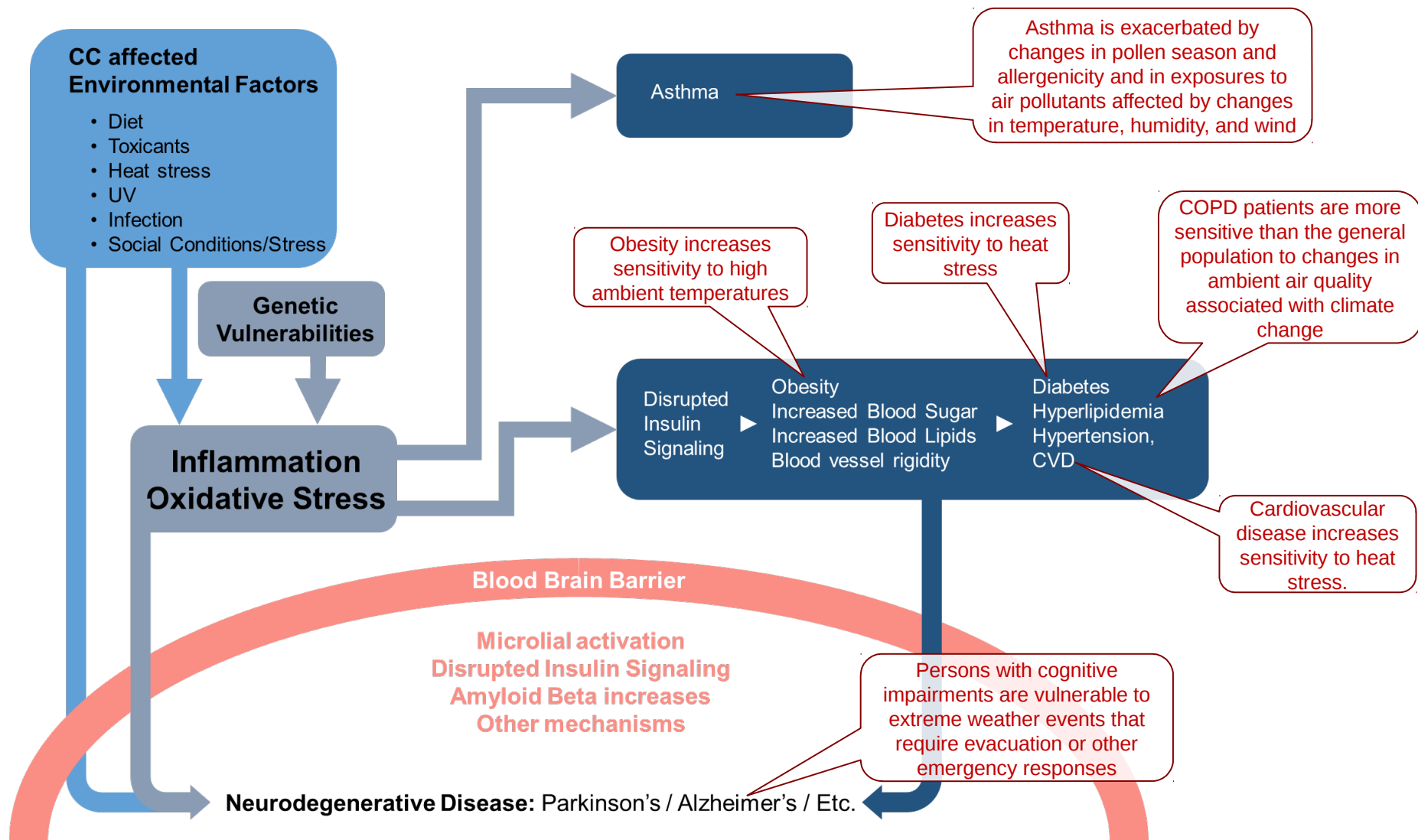




Understanding common pathways of disease



enhanced by CC or enhancing susceptibility to CC





Unequally distributed impacts



Period:
December –
mid-February



Unequally distributed impacts

Biomass emitted particles

- Lower aerodynamic diameter, hence penetrate deeper across HRT
- Higher PAHs content per mass of PM (more toxic)

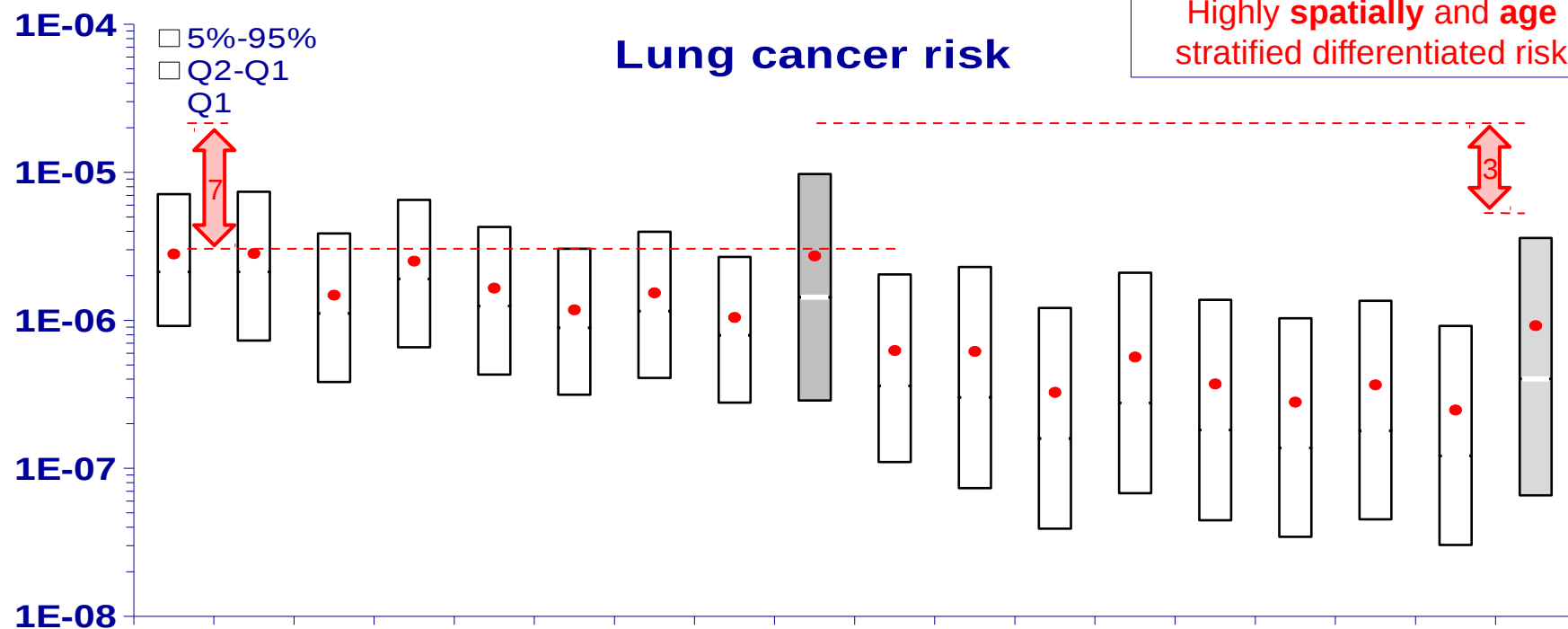


Significantly higher amount of PAHs reaches alveoli



Highly **spatially** and **age** stratified differentiated risk

Lung cancer risk

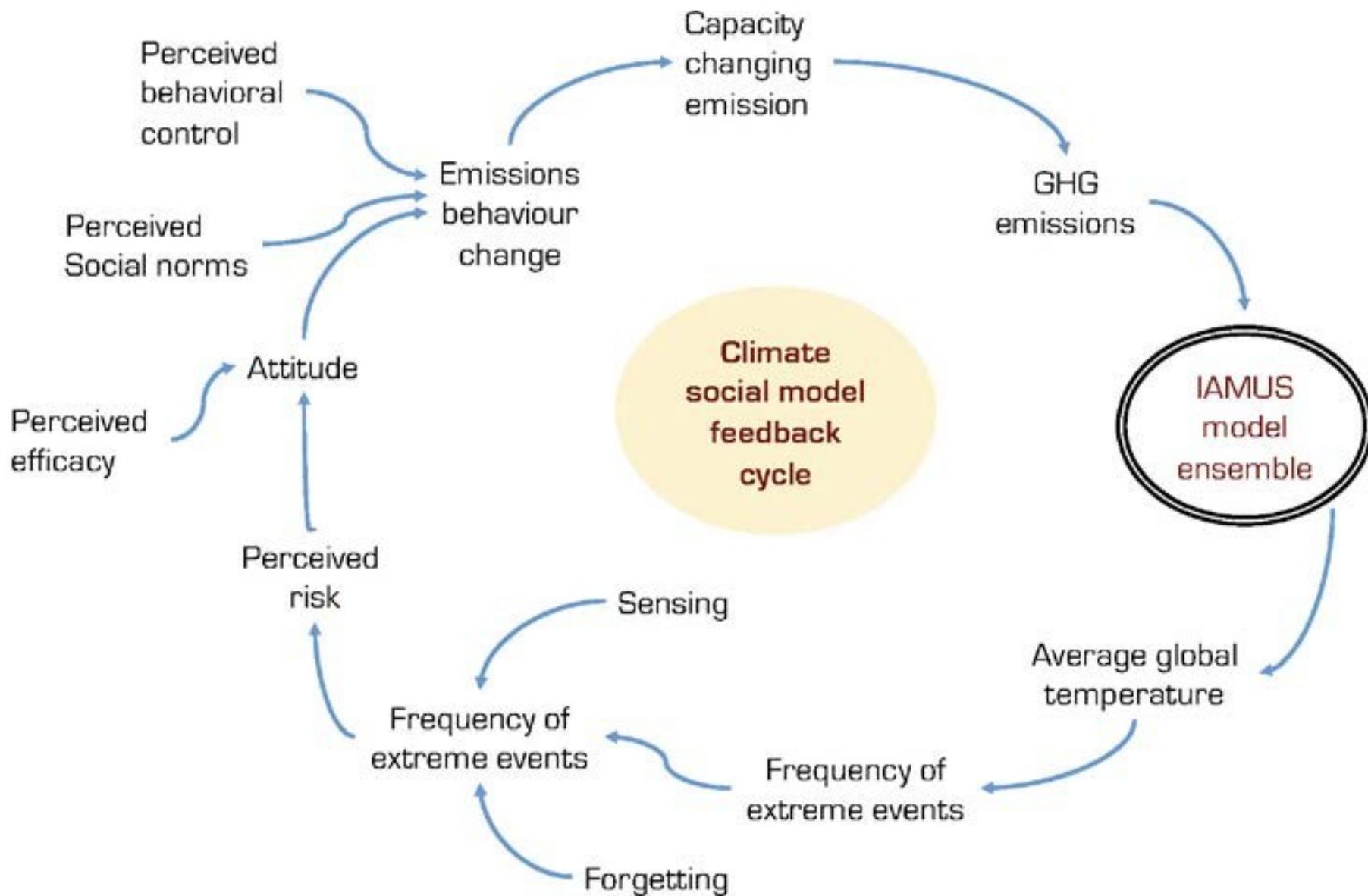


Lower SES area

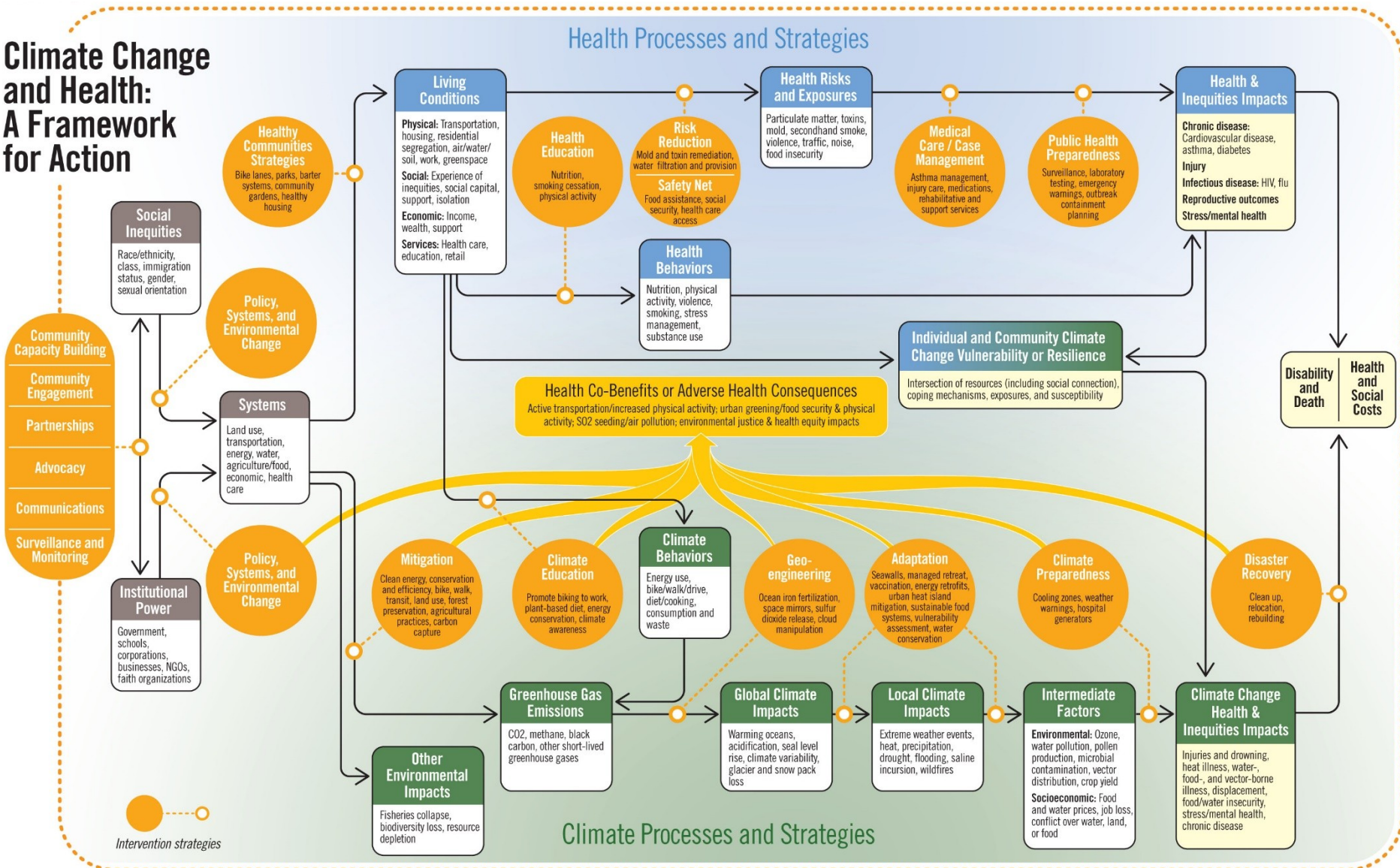
Higher SES area



Climate social model



Climate Change and Health: A Framework for Action



Final Conclusions

Climate exposome serves precise and cost-effective prevention by:

- Better understanding the multifactorial causes of disease
- Identifying early on the biological onset of adverse health outcomes
- Identifying the interplay among disease mechanisms – in relation to environment stressors and CC
- Integrated strategies for combating CC, environmental contamination and precise prevention

Bertold Brecht's *Life of Galileo*:

"The main objective of science is not to open the door to infinite wisdom but to roll back the boundaries of infinite error."

Thank you for your attention



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A connectivity perspective to environmental health