

Major challenges in environment, climate and health research

The HERA vision of research for the Green Deal

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HERA CONSORTIUM

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HERA

- Health and Environment Research Agenda is an H2020 coordination and support action project.
- Its aim is to develop a European research and innovation agenda on environment, climate and health covering key strategic research and policy aspects.



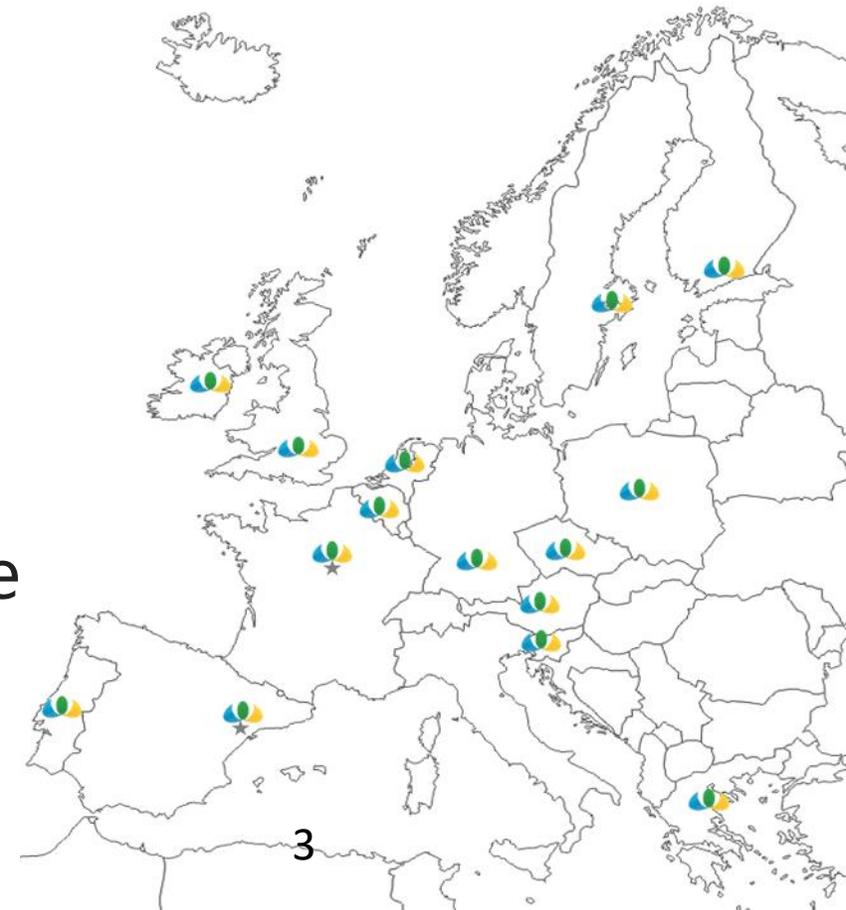
PROJECT INFORMATION

3-year project (2018-2021 + 3 months)

15 European countries

24 partners: researchers, civil society (HEAL) and international organization (WHO)

Expertise: environment, health, climate change and combinations thereof



HERA timeline



First stage HERA activities:

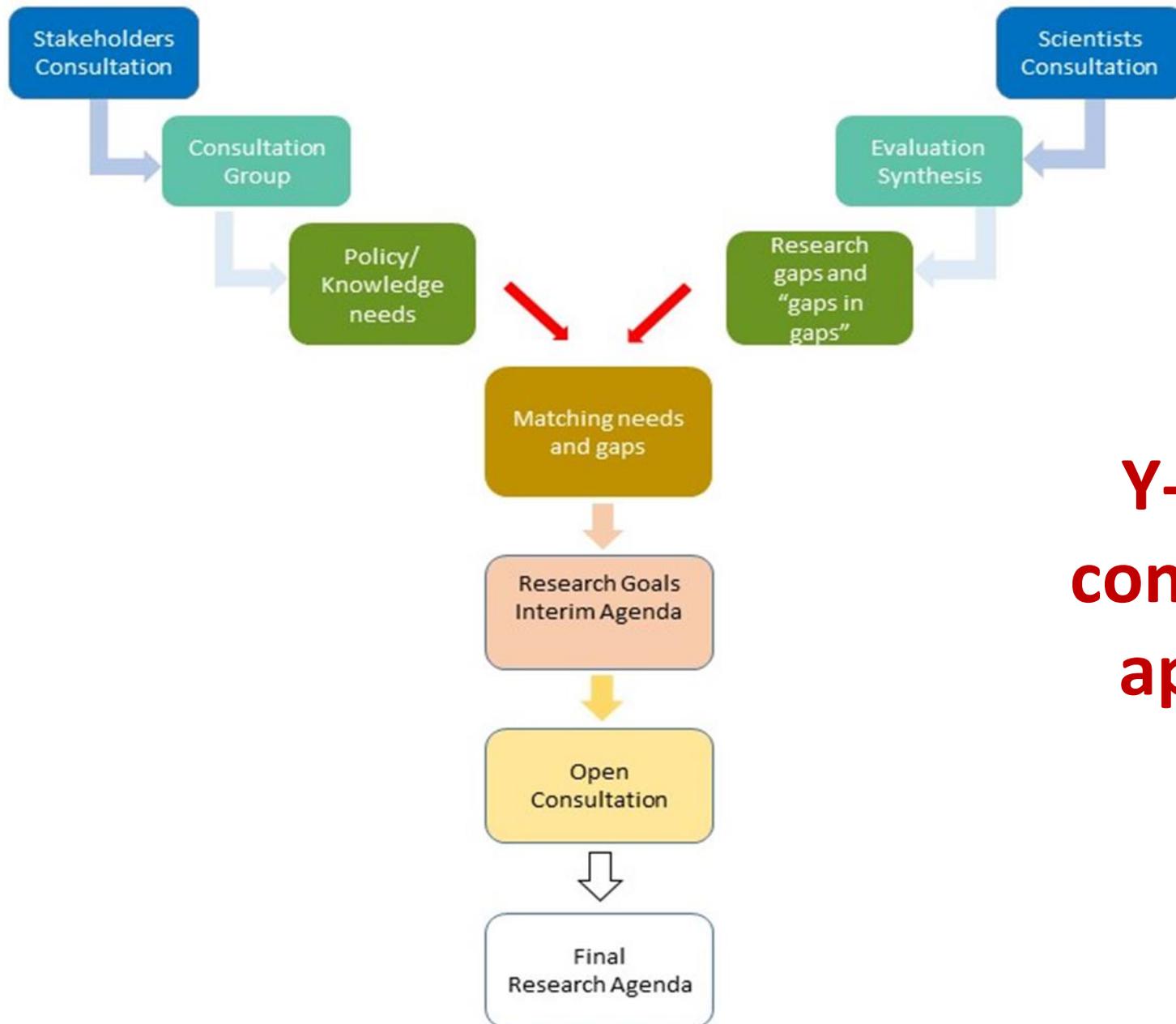
key issues in policy, practice and research

Second stage HERA activities:

further prioritization of research needs and of recommendations

What about unofficial HERA?





HERA
Y-shaped
consultation
approach

HERA Challenges

- **Matching research objectives and policy needs** as developed by stakeholder communities at different levels (national, regional, European, global).
- **Addressing complexity and long-term goals** in issues such as climate change, urban planning and ecosystem threats related to human health.
- **Increasing coordination and collaboration of diverse communities** in environment, climate and health; need for transdisciplinary practice and knowledge brokers.

 *A systems approach is needed at multiple levels*

Identifying Areas/Exposures covered in HERA at different levels of complexity

1) Environmental exposures and human health

air pollution, noise, Green/Blue spaces, Biological agents, Chemicals, Water, Radiation, Plastics, Endocrine disruptors,

2) Problem/sector based approaches to environment and human health

Urbanization, Transport, Sustainable food, Energy transition, Waste, Occupational changes

3) Holistic approaches to environment and human health

Ecosystems; Socioeconomic factors, justice; Environmental change; One Health; Planetary Health; Ethics and philosophy, Transformational change and health

The systems

1) The stressor system

2) The local or problem-based system

3) The planetary system



Climate change and biodiversity loss

Reduce effects on health and the environment



Cities and communities

Promote healthy lives in sustainable and inclusive societies



Chemicals and physical stressors

Prevent and eliminate harmful chemical exposures to health



Improve health impact assessment

of environmental factors and promote implementation research



Develop infrastructures, technologies and human resources

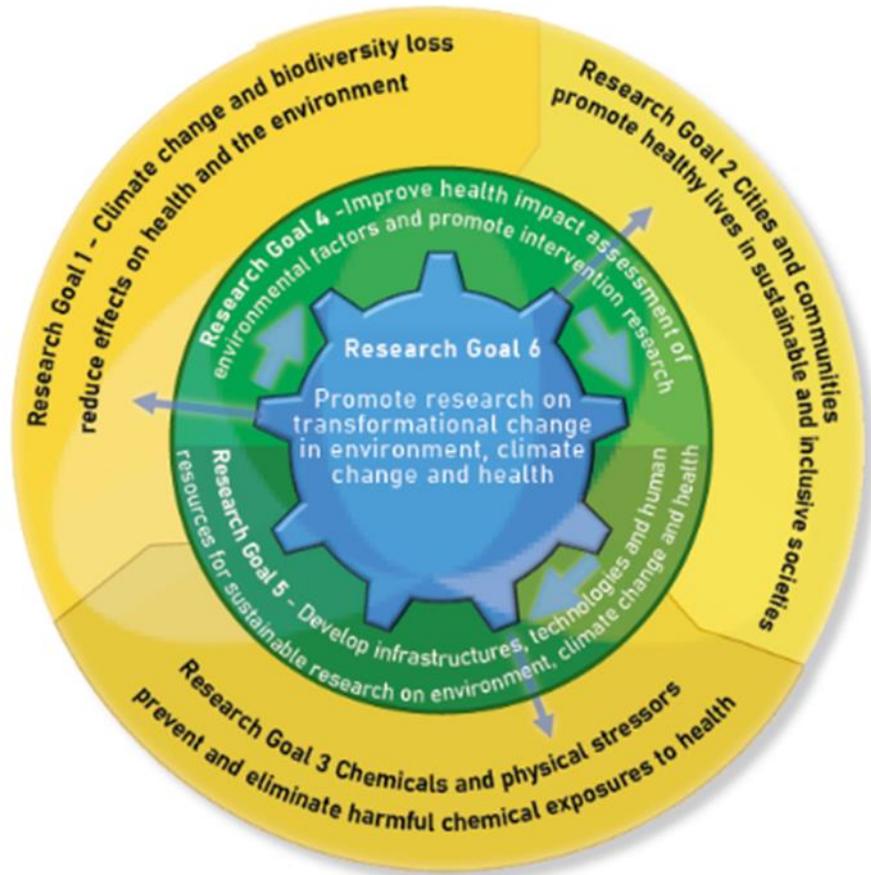
for sustainable research on environment, climate change and health



Promote research on transformational change

in environment, climate change and health

The HERA Research Goals are intimately linked



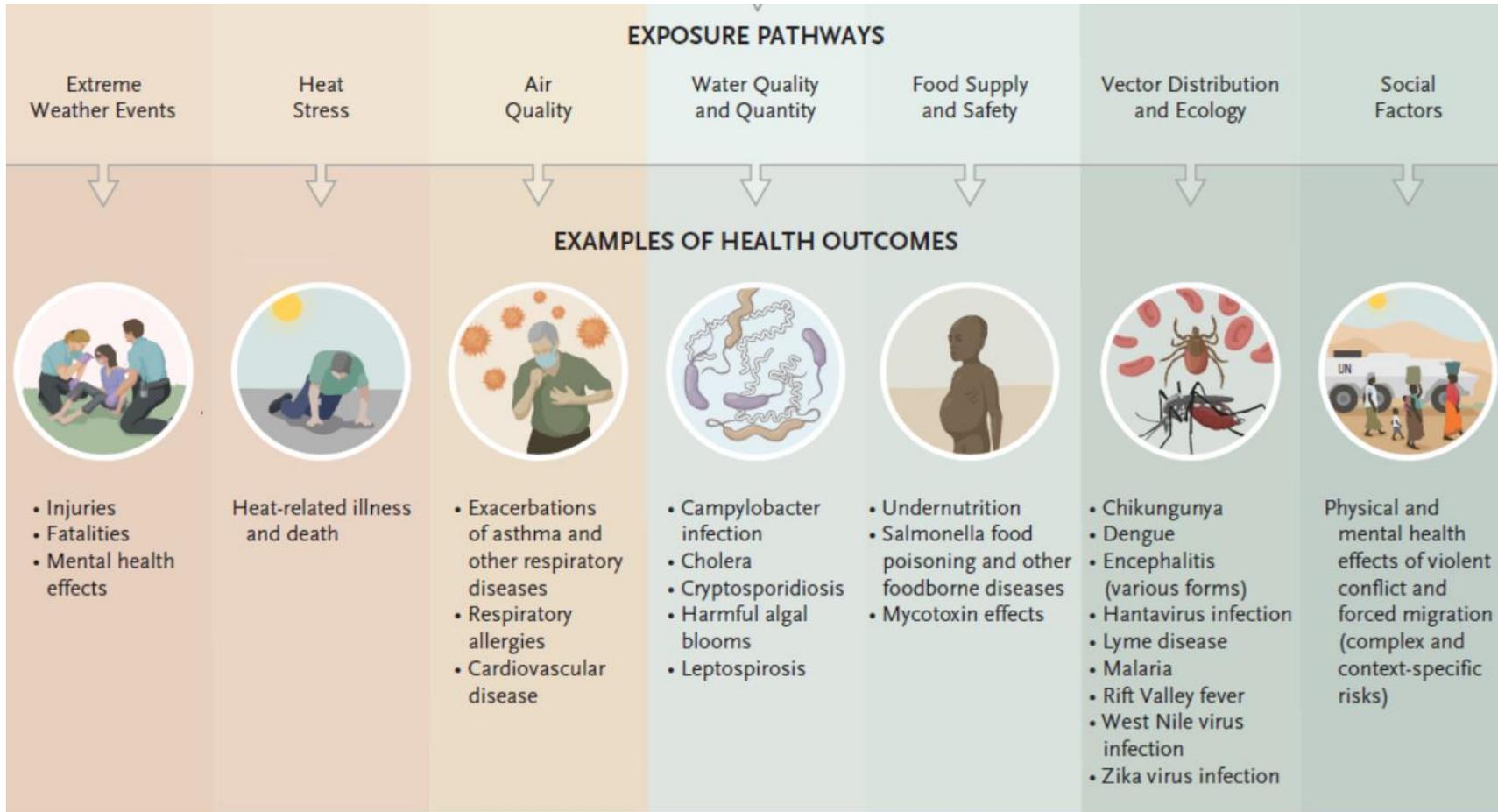
RG1, RG2, RG3: Exposures and health effects

RG4, RG5: . Methodologies and Infrastructures

RG6. Societal Transformation

RG1: Climate change and biodiversity loss - reduce effects on health and the environment

Major health risks associated with climate change

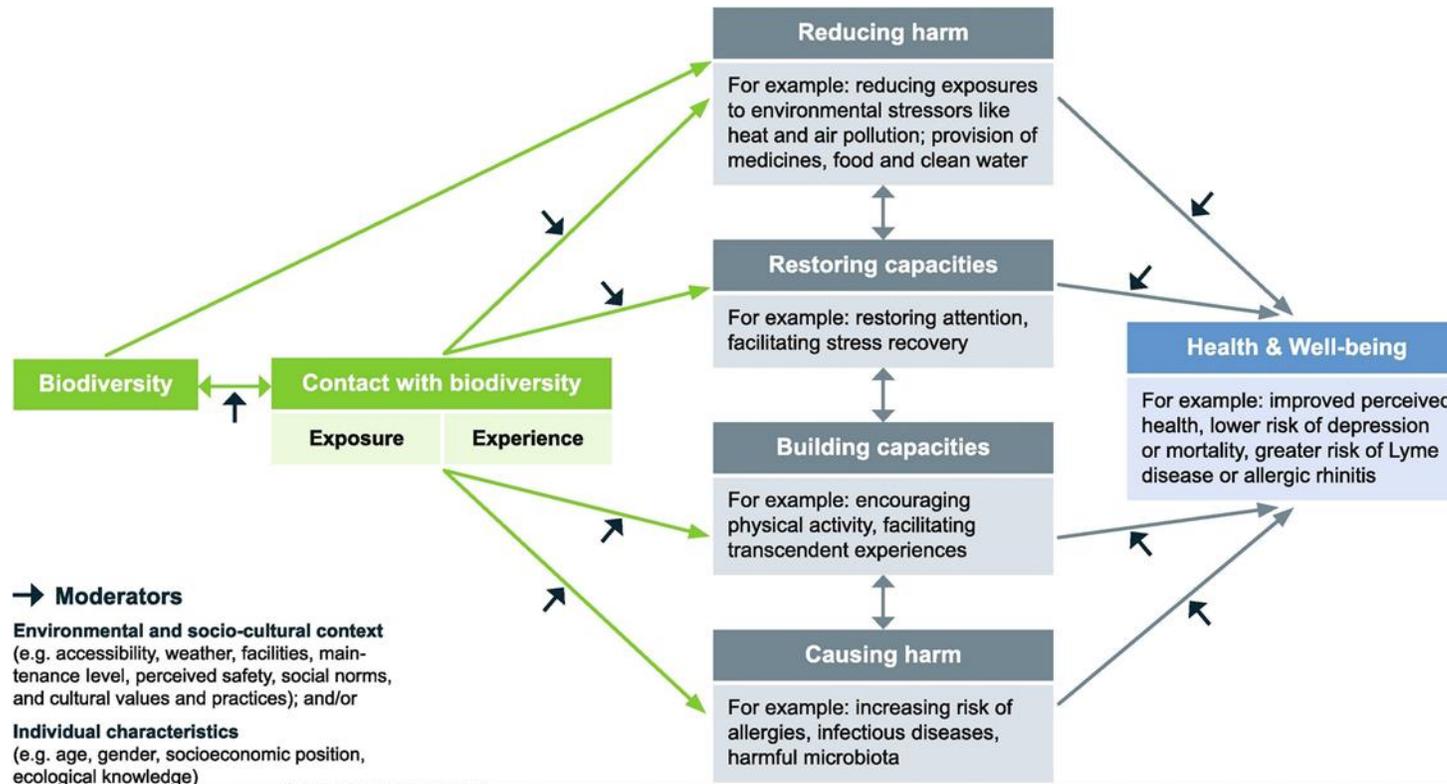


- ✓ Identify and quantify climate change impacts on health, effects of extreme weather event and attribution on a global scale
- ✓ Integrated health impact assessment of mitigation and adaptation measures
- ✓ How to achieve societal change and support for a transformation towards more sustainable, healthy and resilient societies?

Haines & Ebi, 2019

RG1: Climate change and biodiversity loss - reduce effects on health and the environment

Major health risks associated with biodiversity loss and biological agents

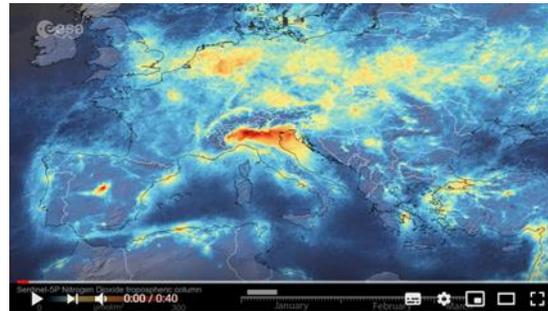
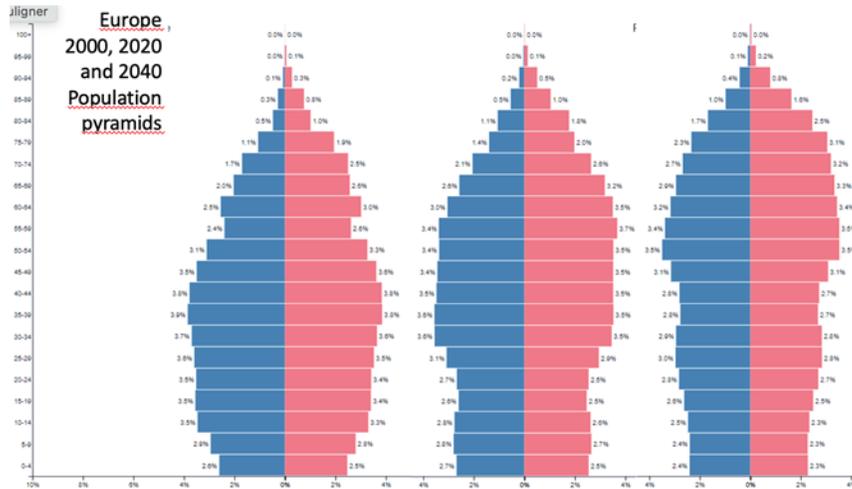


- ✓ Framework for exploring nature-related health risks and benefits
- ✓ Nature-based interventions for encouraging positive biodiversity-health linkages
- ✓ Multifactorial diseases and the role of non-communicable diseases in human susceptibility to infections

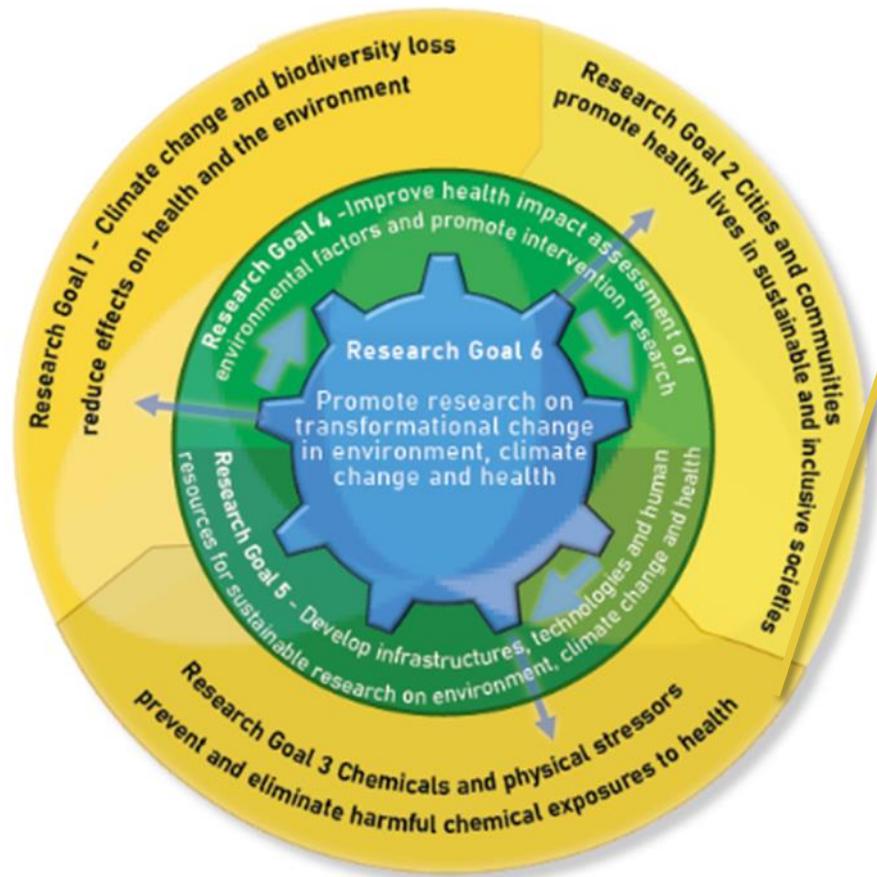
Marselle et al, *Env Int*, 2021

RG 2. Cities and communities - promote healthy lives in sustainable and inclusive societies

Healthy Urban Environments Air pollutants



- ✓ Evaluate promising urban interventions such as Nature-based solutions in terms of effects on health and harmful exposures
- ✓ Evaluate the effectiveness of knowledge translation of innovative methods and approaches to reduce harmful exposures in urban environments
- ✓ Promote healthy living in the urban-suburban-rural continuum
- ✓ Healthy air for abating ageing-related diseases and individualized prevention



RG 3. Chemicals and physical stressors – prevent and eliminate harmful chemical exposures to health

- › **RG3.1** Exposure to chemicals including legacy chemicals, emerging chemicals and mixtures
- › **RG3.2** Health effects of anthropogenic chemicals
- › **RG3.3** Radiation
- › **RG3.4** Water contamination
- › **RG3.5** Food and soil contamination

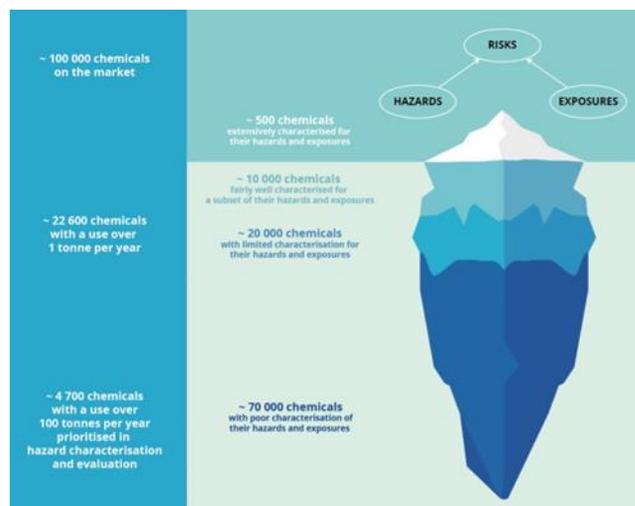
RG 3. Chemicals and physical stressors

– prevent and eliminate harmful chemical exposures to health

Exposure and health effects of chemicals

The hidden chemical World, incl. mixtures

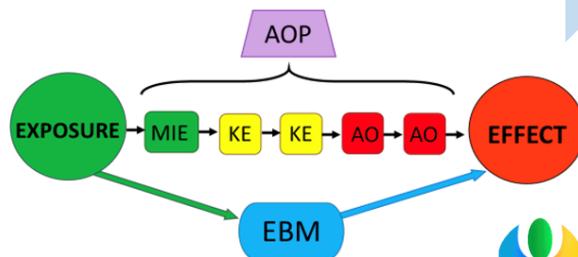
Chemical strategy for sustainability +EEA



The time dimension

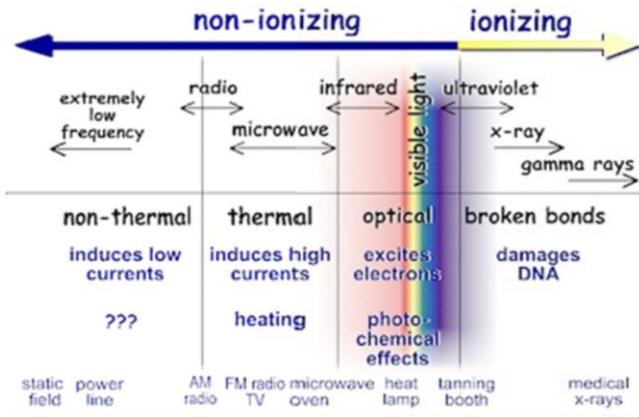


The mechanisms



- ✓ Advancing knowledge on real-life mixtures of chemicals in the EU and beyond
- ✓ Expanding environmental effect and health studies into novel areas of endocrine disruption, immunotoxicity and neurotoxicity.
- ✓ Development of a large cohort infrastructure to evaluate long term health effects of pesticides using exposome approaches
- ✓ Large scale development of Adverse Outcome Pathways (AOP) and AOP networks and tools to link chemicals to AOPs

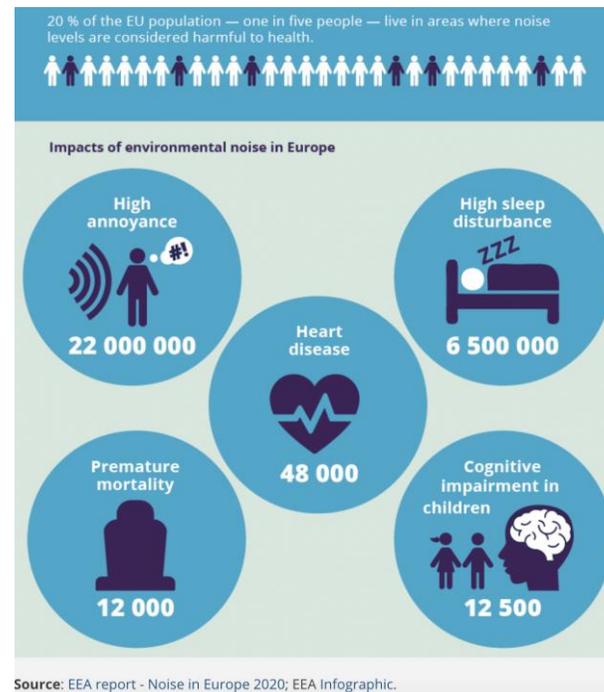
RG 3. Chemicals and physical stressors – prevent and eliminate harmful chemical exposures to health



US EPA



Figure 4: Earth's human-generated night-time lights for the calendar year 2003. Zoom on NASA's image by Robert Simmon based on data from the Defense Meteorological Satellite Program Operational Line Scanner



Exposure and health effects of physical stressors

- ✓ Advance knowledge on Effects of the entire spectrum of electromagnetic fields (EMF) exposure
- ✓ Effects of exposure to Artificial Light At Night (ALAN) on long term adverse outcomes in children and adults
- ✓ Effects of UV radiation
- ✓ Advance knowledge on effects of ionising radiation on non-cancer endpoints
- ✓ Health effects of environmental noise
- ✓ Biological mechanisms of noise

RG 4. Improve health impact assessment of environmental factors and promote implementation research

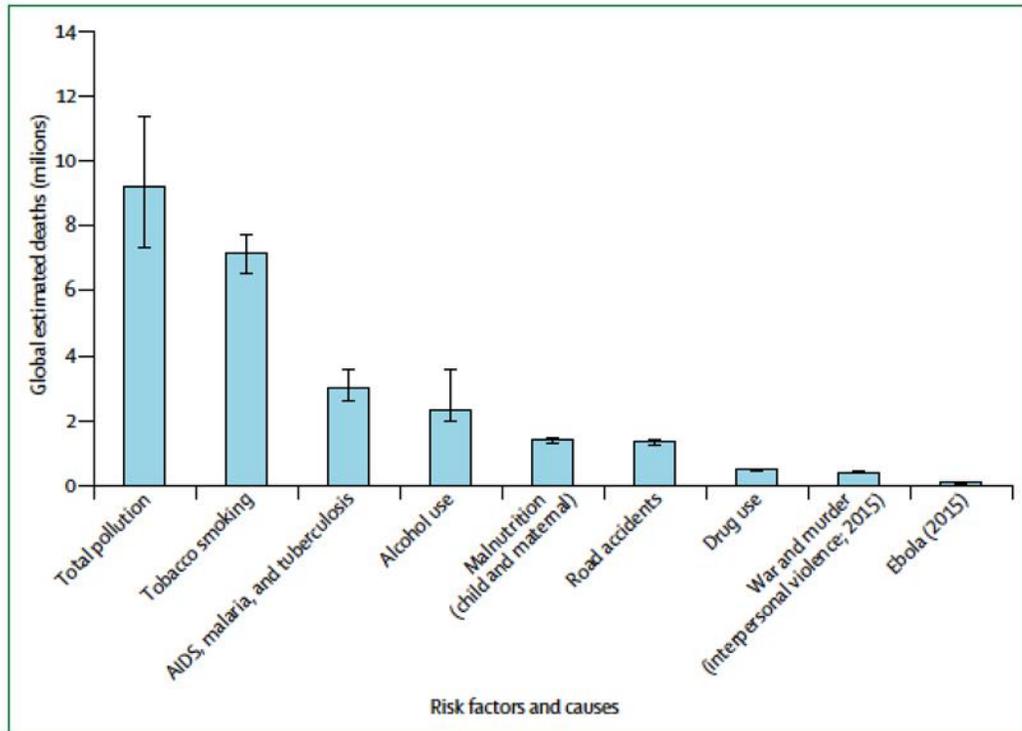


Figure 5: Global estimated deaths by major risk factor and cause, 2015
Using data from the GBD Study, 2016.⁴¹

WHO report

Methodological development for health impact assessment

- ✓ *Development of a unified framework for the assessment of burden of disease associated with multiple environmental factors*
- ✓ *Bridging toxicological and epidemiological lines of evidence towards improved human health risk assessment from chemicals*
- ✓ *Integrate implementation research into public health programmes tackling environmental health challenges with particular focus on the interaction between EU and low and middle-income countries*
- ✓ *Address methodological issues in participatory implementation research*

RG 5. Develop infrastructures, technologies and human resources for sustainable research on environment, climate change and health

Infrastructures for the exposome, big data and planetary health

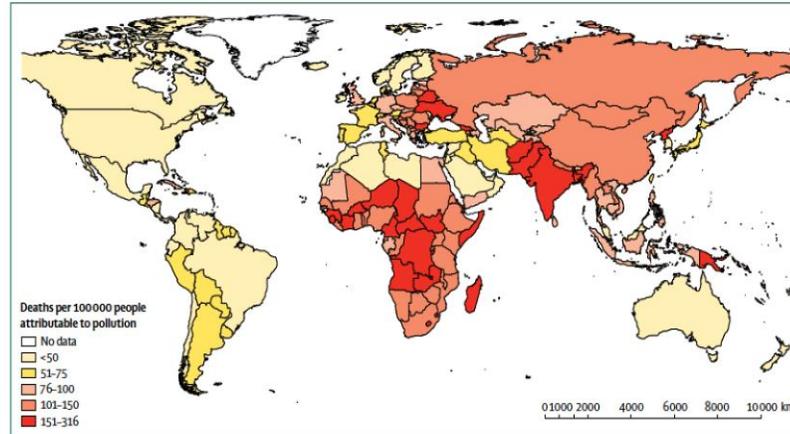
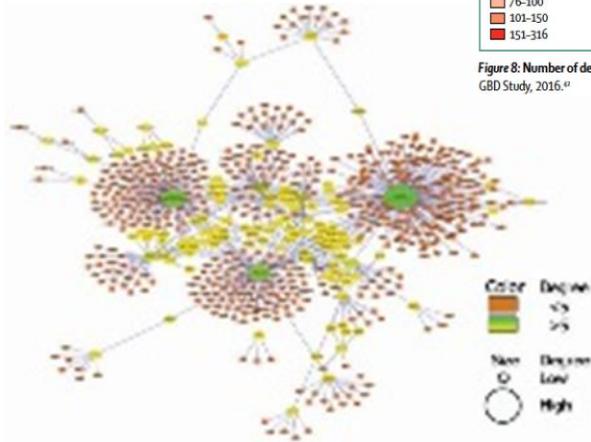
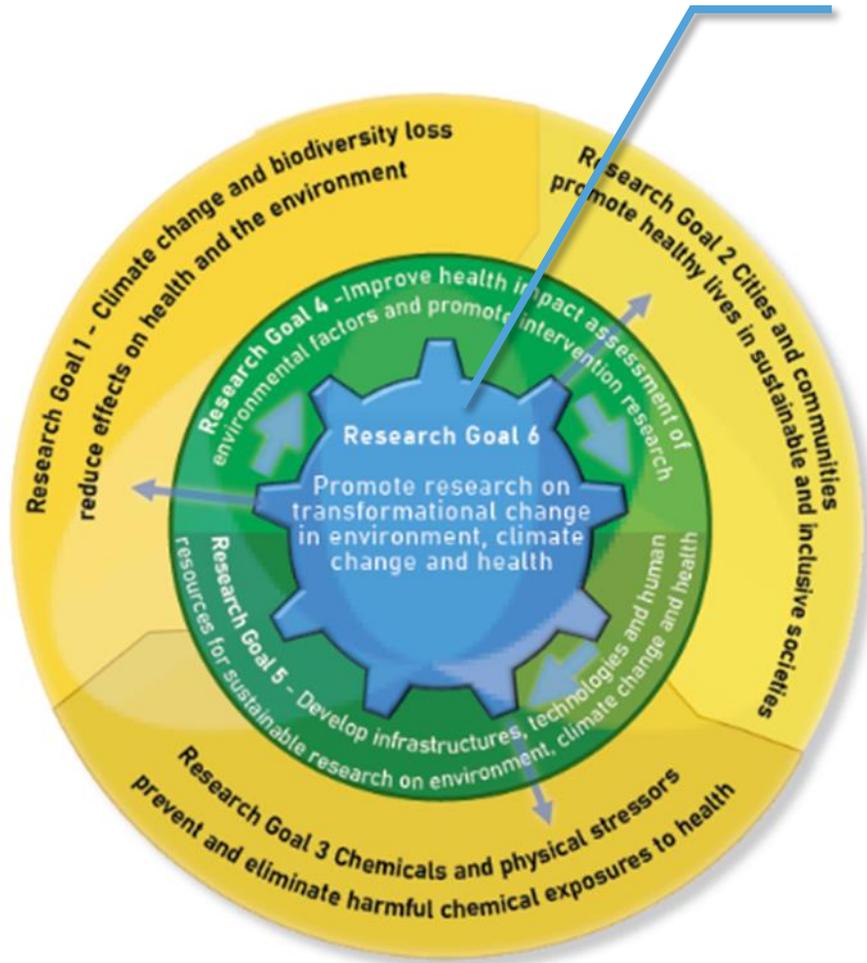


Figure 8: Number of deaths per 100 000 people that are attributable to all forms of pollution, 2015
GBD Study, 2016.⁴¹



- ✓ *Establishment of a system of mega-Cohorts in the EU with harmonized data and connections to biobanks*
- ✓ *Development of harmonised laboratory capacities for assessment of environmental and human exposures to legacy and emerging chemicals and their toxic mixtures*
- ✓ *Development of innovative methods and tools for integrating diverse data streams related to environment and health*
- ✓ *Building an integrated planetary health monitoring*

RG 6. Promote research on transformational change in environment, climate change and health



- ▶ **RG6.1** Preparedness to prevent and combat future environment and health threats/challenges
- ▶ **RG6.2** Transformational change
- ▶ **RG6.3** Socioeconomic factors and the environment, environmental injustice, equity, sustainable economic growth
- ▶ **RG6.4** Ethical, philosophical and political aspects
- ▶ **RG6.5** Science communication and science–policy–society dialogue
- ▶ **RG6.6** Transformational change in education, training and research

RG 6. Promote research on transformational change in environment, climate change and health

social cooperation



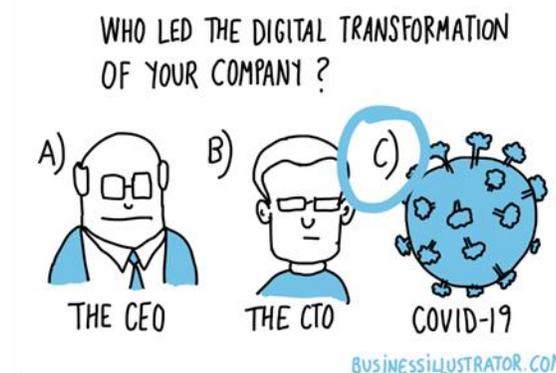
future generations



communication



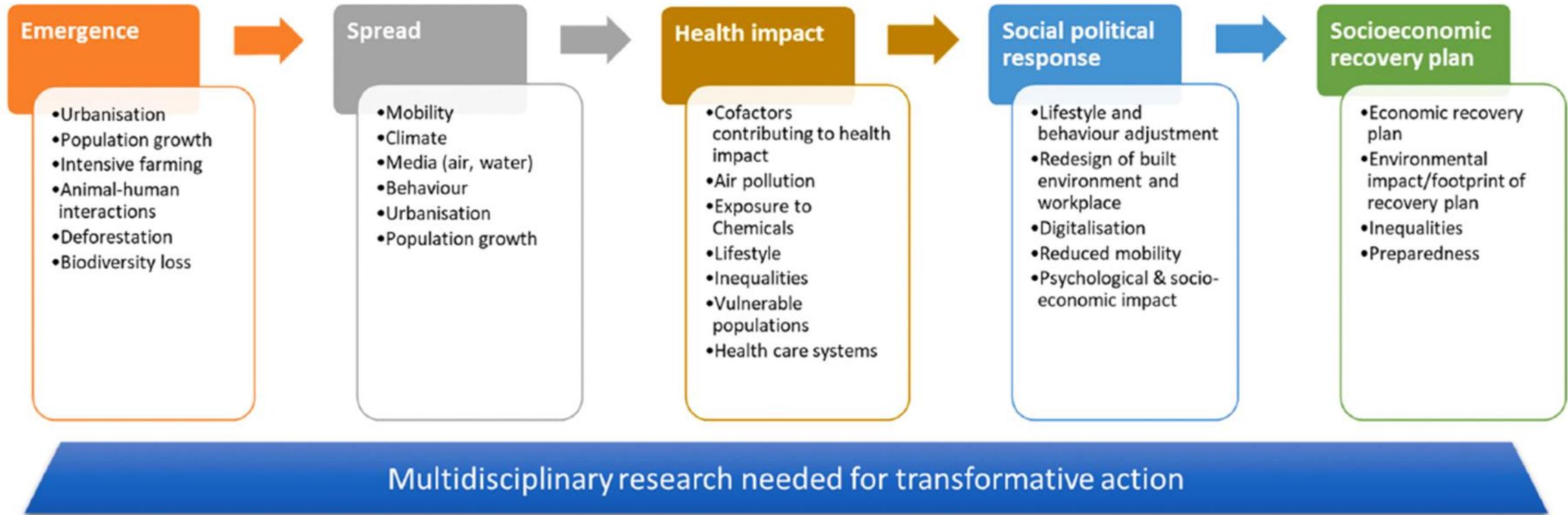
digital transformation



Concrete transformational change

- ✓ *Epidemiological intelligence for preparedness, response and resilience*
- ✓ *How to achieve healthier and sustainable societies: drivers and barriers of transformational change, including behavioural change and cultural shifts*
- ✓ *Develop research models on the responsibility towards future generations*
- ✓ *Improving Risk communication effectiveness by applying societal values*
- ✓ *Transformational change in the research and education sector: multidisciplinary, flexible and open research designs*

The HERA COVID-19 case study (1)



(Barouki et al, Env int. 2021)



Special thanks to

The HERA executive committee
The HERA advisory board
The HERA Partners

