IN-DEPTH ANALYSIS

Requested by the Public Health (SANT) Committee

European Parliament

Environmental determinants of health, including those caused by climate change

Policy Department for Economic, Scientific and Quality of Life Policies
Directorate-General for Internal Policies
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Environmental determinants of health, including those caused by climate change

Abstract

This in-depth analysis (IDA) examines the environmental determinants of health and their consequences, especially on the health of disadvantaged communities. It also assesses the impacts of European Union (EU) policies on the environment insofar as they affect human health, and provides recommendations on how the One Health and the Health in All Policies approaches can be better implemented in EU policy-making.

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LIST OF ABBREVIATIONS

AAQ	Ambient Air Quality (Directives)
AMR	Anti-microbial resistance
BPA	Bisphenol A
BWQ	Bathing Water Quality (Directive)
CAP	Common Agricultural Policy
CDC	US Centers for Disease Control and Prevention
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
DG	Directorate-General
DWQ	Drinking Water Quality (Directive)
ECA	European Court of Auditors
ECDC	European Centre for Disease Prevention and Control
ECHA	European Chemicals Agency
EDCs	Endocrine-disrupting chemicals
EEA	European Environment Agency
EFSA	European Food Safety Authority
EGD	European Green Deal
EIGE	European Institute for Gender Equality
EMA	European Medicines Agency
EP	European Parliament
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
GHG(s)	Greenhouse gas(es)
HiAP	Health in All Policies

ICE	Internal combustion engine
IDA	In-depth analysis
IED	Industrial Emissions Directive
IOM	International Organization for Migration
IPCC	Intergovernmental Panel on Climate Change
JRC	Joint Research Centre
NBS	Nature-based solutions
NO_2	Nitrogen dioxide
NUTS	Nomenclature of territorial units for statistics
O_3	Ozone
OECD	Organisation for Economic Co-operation and Development
PAH	Polycyclic aromatic hydrocarbons
PFAS	Per- and polyfluoroalkyl substances
PM	Particulate matter or particulate (air) pollution
$PM_{2.5}$	Fine inhalable particles with diameters that are generally 2.5 micrometres and smaller
PM_{10}	Inhalable particles with diameters that are 10 micrometres and smaller.
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals (Regulation)
RoHS	Restriction of the use of certain Hazardous Substances in electrical and electronic equipment
SDG(s)	Sustainable Development Goal(s)
SUPD	Single-Use Plastics Directive
TEN-T	Trans-European Transport Network
TFEU	Treaty on the Functioning of the European Union

UN	United Nations
UNEP	United Nations Environment Programme
UWWTD	Urban Wastewater Treatment Directive
WEEE	Waste electrical and electronic equipment
WFD	Water Framework Directive
WOAH	World Organization for Animal Health
WHO	World Health Organization

EXECUTIVE SUMMARY

Background

The climate, pollution and biodiversity crises continue to demonstrate the reliance of human health and well-being on a healthy and well-functioning natural environment. These crises, as well as the COVID-19 pandemic, can all be traced to society's overuse of resources and the resulting emissions and waste, which is beyond the capacity of the Earth. The processes that regulate the stability and resilience of the planet have been degraded over time, risking large-scale, abrupt and irreversible changes. These changes and their impacts will not be felt equally across countries, societies and generations.

The degrading environment and its impacts on individuals, society and the economy are high on the European agenda. The European Green Deal (EGD) and its associated strategies and actions are based on the shared understanding that climate change and environmental degradation are existential threats to Europe and the rest of the world. European Parliament resolutions have also emphasised that the European Union (EU) has little choice but to move away from business as usual.

In this context, the One Health and Health in All Policies (HiAP) approaches provide a holistic perspective on addressing human and environmental health.

Aim

This in-depth analysis (IDA) aims to provide members of the European Parliament (EP)'s Public Health Subcommittee (SANT) with:

- An overview of the environmental determinants of health, including those caused by climate change, and how those environmental determinants affect 'disadvantaged communities' in particular;
- An overview of how European policies consider and impact environmental and human health, notably the current proposals for the Ambient Air Quality (AAQ) and Sustainable Use of Pesticides Directives, and the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) Regulation;
- Recommendations on the further implementation of the One Health and the Health in All Policies (HiAP) approaches in the EU.

Key findings

Environmental determinants of health are the factors to which an individual is exposed in their daily life that negatively affect their health. These environmental determinants include air pollution, chemicals, water quality, extreme temperatures, infectious diseases, floods and droughts, microplastics, infectious diseases, and noise. In Europe, air pollution remains the largest environmental health determinant, and there are areas of growing concern including endocrine-disrupting chemicals (EDCs), floods, heatwaves, droughts, forest fires and sea-level rise, and the increase in infectious diseases.

The intersection and interaction of circumstances that disadvantaged communities experience mean that they face higher or worse risks from environmental determinants of health, including those caused by climate change. These circumstances include social structures, dynamics and processes; underlying (physical and mental) health; access to quality resources (e.g. education, income, food, water); ethnicity, age and gender; and geographical location.

Across Europe, a range of environmental determinants of health affect similar groups of disadvantaged communities. For example, the very young, those in low-income groups, those with pre-existing physical and mental health illnesses, and those with poor social connections are vulnerable to poor air quality, extreme temperatures, chemicals and infectious diseases. Children are especially vulnerable to the environmental determinants of health.

This IDA of the impact of European policies on environmental and human health focuses on policies associated with air quality, chemicals, and climate change and its consequences. However, other policies are also examined.

The current revision of legislation such as the AAQ Directive aims for higher protection of human and environmental health from air pollution. Other European legislative initiatives also contribute to reducing risks from air pollution, but concerns persist that the limits, timelines and potential derogations are insufficient to protect the most vulnerable.

The Commission is currently preparing revisions of the REACH Regulation and the Sustainable Use of Pesticides Directive that aim to better protect human and environmental health. Given the uncertainty about the impact of toxic chemicals on the most vulnerable and the speed at which new substances are produced and used, this task is particularly challenging.

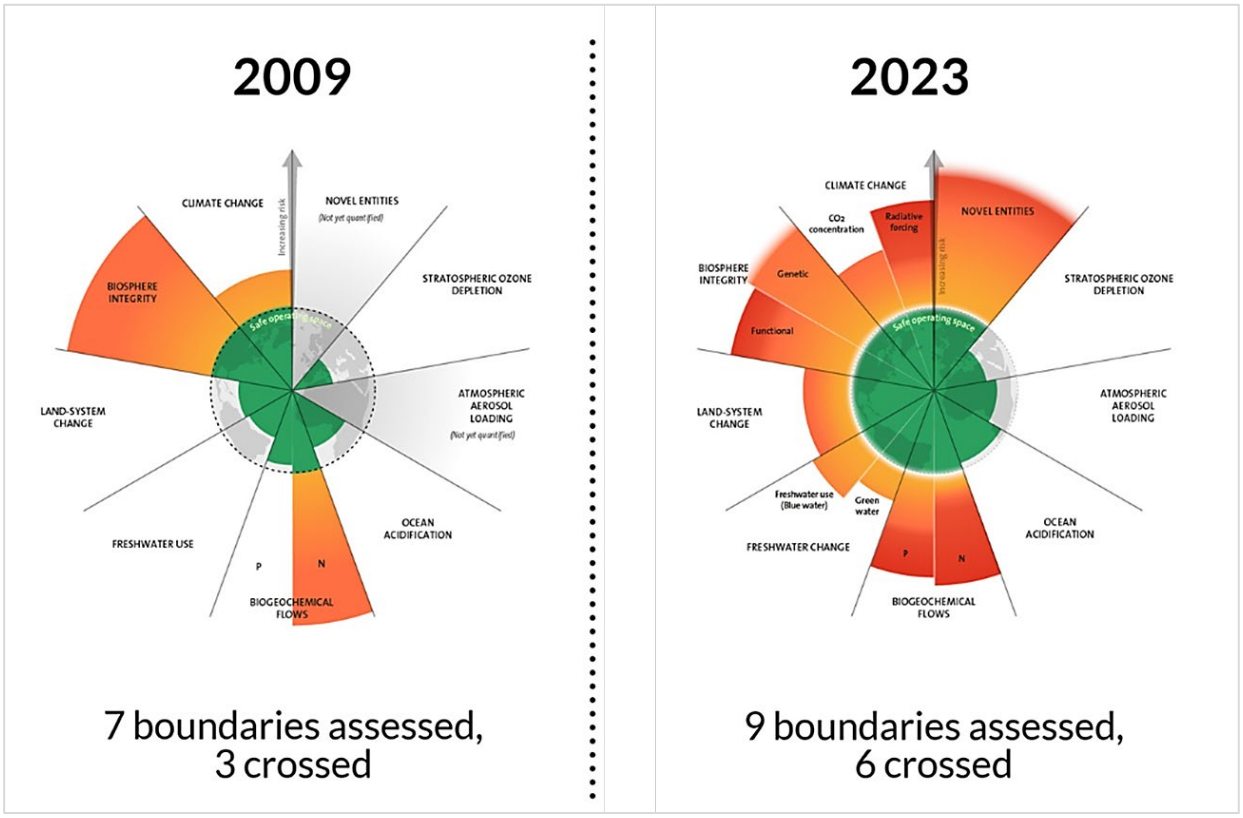
The current impacts from climate change largely stem from historical emissions, thus the effects of new initiatives to protect nature and reduce emissions will not materialise for some years. Several pieces of European legislation address current and future risks from flooding and infectious disease, for example. To ensure that the right solutions are put in place, these initiatives must consider the needs and participation of the most vulnerable.

The One Health and the HiAP approaches emphasise that quality human health requires actions before and beyond medical care and public health. These approaches identify ways to efficiently address environmental determinants of health, with special focus on the needs of disadvantaged communities. Historical application of the One Health and the HiAP approaches at the EU-level has been inconsistent, narrowly applied, and lacking in ambition. Such approaches require multi-disciplinary cooperation, resources, and long-term commitment. Additionally, the improved application of these approaches requires the assessment and evaluation of increasing and upcoming risks to human and environmental health, rather than solely focusing on existing risks. If the One Health and the HiAP approaches are not applied more broadly, efficiently and consistently in the EU, efforts to improve human health will be fragmented, costly and will not protect the health of the most vulnerable.

1. INTRODUCTION

The climate, pollution, biodiversity and COVID-19 crises continue to demonstrate the reliance of human health and well-being on a healthy and well-functioning natural environment. Literature is increasingly highlighting these links alongside the benefits from the natural world and the costs of degradation (e.g. Dasgupta, 2021; Organisation for Economic Co-operation and Development (OECD), 2019; Schuct et al., 2021; European Environment Agency (EEA), 2019; Intergovernmental Panel on Climate Change (IPCC), 2022). However, these crises can all be traced to society's overuse of resources and the resulting emissions and waste, which are beyond the capacity of the planet. The Stockholm Resilience Centre's planetary boundaries framework highlights how the processes that regulate the stability and resilience of the Earth system have been degraded over time. Crossing these boundaries increases the risk of generating large-scale, abrupt and irreversible changes, with impacts now and in the future.

Figure 1: Planetary boundaries framework: breaching the boundaries within which humanity can safely thrive



Source: Azote for Stockholm Resilience Centre, Stockholm University; based on Richardson et al. (2023), Steffen et al. (2015), and Rockström et al. (2009), https://www.stockholmresilience.org/research/planetary-boundaries.html.

Note: On the right, the analysis shows that six planetary boundaries were crossed in 2023. These are: climate change (CO_2 concentration and radiative forcing), novel entities, biogeochemical flows (phosphorous and nitrogen), freshwater change (freshwater use (blue water) and green water) , land-system change, and biosphere integrity (functional and genetic).

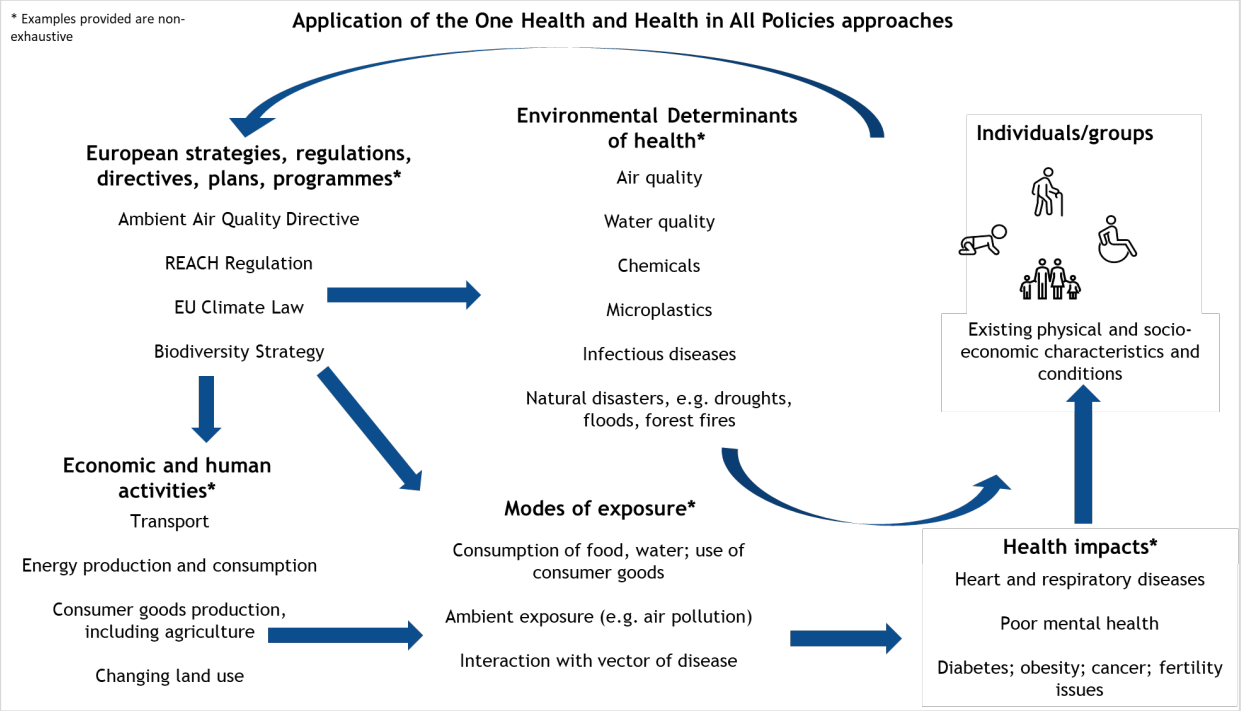
The problem of a degrading environment and its impacts on individuals, society and the economy are high on the European agenda. The European Green Deal (EGD) has been based on the acknowledgement that climate change and environmental degradation are existential threats to Europe and the rest of the world, and that Europe needs to move 'to a clean, circular economy and stop climate change, revert biodiversity loss and cut pollution' (European Commission, 2019a). The European Parliament (EP) adopted a resolution to support the EGD in January 2020 (European

Parliament, 2020). In June 2023, the EP drew attention to the health impacts of the global climate crisis through a resolution calling for a dedicated European Day[1].

1.1. Methodology

This in-depth analysis (IDA) is informed by peer-reviewed and grey literature, as well as publications from European and international bodies (e.g. EEA, World Health Organization (WHO)). Information on European initiatives to reduce environmental and human health risks is taken from online resources, such as those provided by the EP, the European Commission, and the EEA. Information from the desk-based research is supplemented by interviews with experts who work at the interface between science and policy on environmental health, human health and climate change. The aim is to clarify the links between environmental health, human health (including those who are more vulnerable or disadvantaged), and policies in the EU, as illustrated in Figure 2.

Figure 2: Research approach and links between topics



Source: Authors' elaboration.

Environmental factors in the workplace also have a significant impact on workers' health, but this and associated Occupational Safety and Health (OSH) policies are outside the scope of this report.

1.2. Structure of the report

Section 2 presents different environmental determinants of health and the concept of 'disadvantaged communities'. It then discusses four examples of how environmental determinants affect these disadvantaged or vulnerable communities, and concludes with key knowledge gaps on environmental determinants on human health, especially to disadvantaged communities.

[1] This annual day, 15 July, serves to commemorate victims of climate change in Europe and worldwide and 'to raise awareness of concrete steps that people can take at their level to help prevent disasters from happening and to be better prepared for and respond to climate disasters' (Directorate-General for Climate Action (DG CLIMA), 2023).

Section 3 presents the European initiatives related to the four environmental determinants of health covered in Section 2.

It focuses on three pieces of European legislation (Ambient Air Quality (AAQ) Directive, REACH Regulation, and the Sustainable Use of Pesticides Directive), as well as other relevant European legislation and initiatives addressing the environmental determinants of health. It also presents the One Health and the HiAP approaches in the EU. Section 3 concludes with the key gaps in European initiatives on environmental and human health protection including the implementation of the One Health and the HiAP approaches.

Section 4 presents recommendations to better implement the One Health and the HiAP approaches in the EU.

Annex 1 lists the different environmental determinants of health covered by this report, together with a high-level classification of the disadvantaged communities affected. Annex 2 presents the full list of European policies and initiatives reviewed, together with the classification for how these policies and initiatives address or reduce risks from environmental determinants. Annex 3 presents notes from the interviews with experts undertaken to supplement the research, and highlights their areas of agreement.

2. ENVIRONMENTAL DETERMINANTS OF HEALTH

KEY FINDINGS

Environmental determinants of health are factors to which an individual is exposed in their daily life that negatively affect their health. These determinants include air pollution, chemicals, water quality, extreme temperatures, infectious diseases, floods and droughts, microplastics, infectious diseases, and noise.

Air pollution remains the largest environmental health determinant in Europe. Other areas of growing concern include: endocrine-disrupting chemicals (EDCs) and their impacts, floods, heatwaves, droughts, sea-level rise, and forest fires (from more frequent, prolonged, and intense wet and dry weather), and increases in infectious diseases.

Disadvantaged communities are those individuals and groups facing higher or worse risks from environmental determinants of health due to the intersection and interaction of circumstances such as existing social structures, dynamics and processes; underlying (physical and mental) health; access to and quality of resources (e.g. education, income, housing, food and water, healthcare); ethnicity, age and gender; and geographical location.

Across Europe, a range of environmental determinants of health affect similar groups of disadvantaged communities. For example, the very young, individuals in low-income groups, with pre-existing physical and mental health illnesses, and with poor social connections are more vulnerable to poor air quality, extreme temperatures, chemicals and infectious diseases. Children are especially vulnerable to environmental determinants of health. Compounding factors intensify the length and strength of negative impacts on health and well-being, and the accumulation and persistence of these impacts can mean worse outcomes for vulnerable or disadvantaged individuals and groups.

There is limited knowledge on the specific pathways through which different environmental determinants individually and cumulatively affect the health of different disadvantaged communities. There is also limited understanding of how indoor behaviours of such communities could affect their health, especially during extreme weather events such as heatwaves.

2.1. Environmental determinants of health, including those caused by climate change

The WHO states that the prerequisites for good health include clean air, a stable climate, adequate water and hygiene, safe use of chemicals, protection from radiation, healthy and safe workplaces, sound agricultural practices, health-supportive cities and built environments, and a preserved nature (WHO, 2023). Environmental health impacts occur if these prerequisites are not met, and the EEA adds air and noise pollution, heavy metals, and climate-related events such as heatwaves and floods to the list of environmental health impacts (EEA, 2023a).

Box 1: Environmental determinants of health

Environmental determinants of health are the factors to which an individual is exposed as they go about their daily life and that are detrimental to their health. These come from the environment and its qualities, and are thus external to an individual (i.e. they are not a habit (e.g. smoking), nor an inherent characteristic (e.g. gender, age), nor a socioeconomic circumstance (e.g. income)).

Table 1: Environmental determinants of health and climate change

Environmental determinants	Impacts of human activities and climate change
Air quality (indoor and outdoor)	Sources such as the burning of fossil fuels for transport, heating and industrial production release greenhouse gases (GHGs) and particle pollution, exacerbating climate change impacts.
Chemicals (substances hazardous to health and the environment) Microplastics Noise	Human activities: resource use and by-products. For example, chemicals are key components in consumer products such as textiles, plastics, cleaning products, cosmetics, and many others. Noise pollution comes from activities, machinery and equipment.
Water quality	Worsens with climate change but is also directly affected by by-products of human activities. For example, sewage discharge into rivers and nutrient run-off from agricultural activities.
High temperatures Infectious, waterborne and foodborne diseases Floods and droughts Forest fires Food (in)security	Worsens as surrounding climatic conditions change (i.e. a warmer Europe with changed precipitation patterns), alongside the degradation of ecosystems.

Research for this IDA shows that several environmental determinants are related and are inputs/by-products of human and economic activities. Using fossil fuels for transport and heating releases air pollutants such as nitrogen dioxide (NO_2) and fine particulate matter (PM), which are also sources of GHGs that accelerate climate change. Land use change, discharge of nutrients and chemicals into watercourses, and the use of pesticides negatively affect the quality of soil and water bodies, which, in turn, affects biodiversity and habitats.

There is growing concern about some environmental health determinants that are increasingly visible and understood:

- EDCs[2] present in consumer goods that then accumulate in water, soil and human bodies (Demeneix and Slama, 2019);
- Push for material reuse and recycling in the transition to a more circular economy creates new risks for hazardous substances used in these processes (EEA and HBM4EU partners, n.d.);
- More frequent, prolonged and intense wet and dry weather in Europe causes floods, heatwaves, droughts, sea-level rise and forest fires (European Commission, n.d.; Joint Research Centre (JRC), 2023; IPCC, 2022);
- A warmer Europe may attract vectors of disease, such as mosquitoes known to carry dengue, the Zika virus disease, malaria and the West Nile Virus (European Commission and EEA, n.d.).

2.2. Disadvantaged communities

These determinants may have a particularly strong impact on disadvantaged communities. The literature associates vulnerable or disadvantaged individuals and/or groups with higher negative risks and impacts, primarily due to their characteristics and where they live. For example, the European Institute for Gender Equality (EIGE) (2023) indicates that disadvantaged or vulnerable groups are those that 'experience a higher risk of poverty, social exclusion, discrimination and violence than the general population, including… ethnic minorities, migrants, people with disabilities, isolated elderly people and children'. Kuran et al. (2020) highlight that vulnerable groups have specific characteristics that create a higher need for assistance in crisis situations. They emphasise that vulnerability is due to the interaction or intersection of these characteristics and the environment[3], i.e. vulnerability is context-specific and interdependent.

Box 2: Definition of disadvantaged communities

Disadvantaged communities are defined as those individuals and groups facing higher or worse risks from environmental determinants of health, including those caused by climate change, due to the intersection and interaction of factors such as:

- Existing social structures, dynamics and processes;
- Underlying (physical and mental) health issues;
- Access and quality of resources, e.g. education, income, housing/shelter, food and water, healthcare;
- Age, gender and ethnicity;
- Geographical location.

[2] The endocrine system controls the main physiological functions of the human body through hormones. Man-made and natural chemicals can disrupt endocrine system functions and result in adverse effects, such as altered neurodevelopment in foetuses, diabetes, obesity, reduced fertility and some cancers (e.g. breast, prostate). Endocrine disruptors are found in food contact materials, cosmetics and personal products, cleaning products. and pesticides. In 2019, Demeneix and Slama produced a report for the EP Committee on Petitions (PETI) on the scientific evidence on endocrine disruptors and the relevant EU legislation.

[3] In the IDA, the environment is not limited to the physical environment where an individual spends most of their time, but includes existing social structures and processes that can produce and sustain unequal outcomes for individuals.

The interaction of environmental determinants with other determinants (e.g. social determinants such as income and housing)[4] can leave some individuals and groups more vulnerable. This interaction was consistently highlighted during the experts' interviews. In addition, vulnerability is not static: new groups are becoming vulnerable, and future generations are also highlighted as vulnerable (Ganzleben and Kazmierczak, 2020). Examples include: the worsening of young people's mental health due to current and known future impacts of climate change (Gunasiri et al., 2022); the erosion of the way of life and physical and mental health of Arctic indigenous communities due to climate change (Jaakkola et al., 2018); and stigma against migrant groups as vectors of disease during the COVID-19 outbreak (International Organization for Migration (IOM), 2020). Compounding factors intensify the strength and length of negative impacts on health and well-being, while their accumulation and persistence are likely to result in worse outcomes for vulnerable or disadvantaged individuals and groups.

2.3. How environmental determinants of health affect disadvantaged communities

This section describes the impacts of environmental determinants of health on disadvantaged communities, focusing on air pollution and chemicals, as well as climate change-driven extreme weather events and infectious diseases. Although disadvantaged groups are often vulnerable to a wide range of environmental determinants, the discussion highlights current and growing issues in Europe. Annex 1 provides additional examples of disadvantaged communities that are vulnerable to different environmental determinants of health.

Box 3: Children and vulnerability to environmental determinants

The experts' interviews highlighted young children's unique vulnerability to environmental determinants. Children do not have the means, knowledge or agency to take action or make decisions to protect themselves on a day-to-day basis or in crisis situations (e.g. flooding). They rely on adults, who may not always have the right information or resources to take appropriate action. The growth, developing physiology, and behaviours of children also make them especially vulnerable. For example, children breathe more air, exposing them to larger volumes of pollutants; exposure to hazardous substances could affect their developing immune, reproductive, digestive and other systems; and activities such as playing and crawling could expose them to chemicals in soil or toys.

Source: Interview with Dr Gerardo Sanchez Martinez (EEA), supplemented with information from WHO (n.d.).

Note: The European Parliament resolution of 11 March 2021 on children's rights in view of the EU Strategy on the rights of the child recognises that children are among the most vulnerable to the impacts of climate change, as it affects their life expectancy, health, right to education and right to be protected.

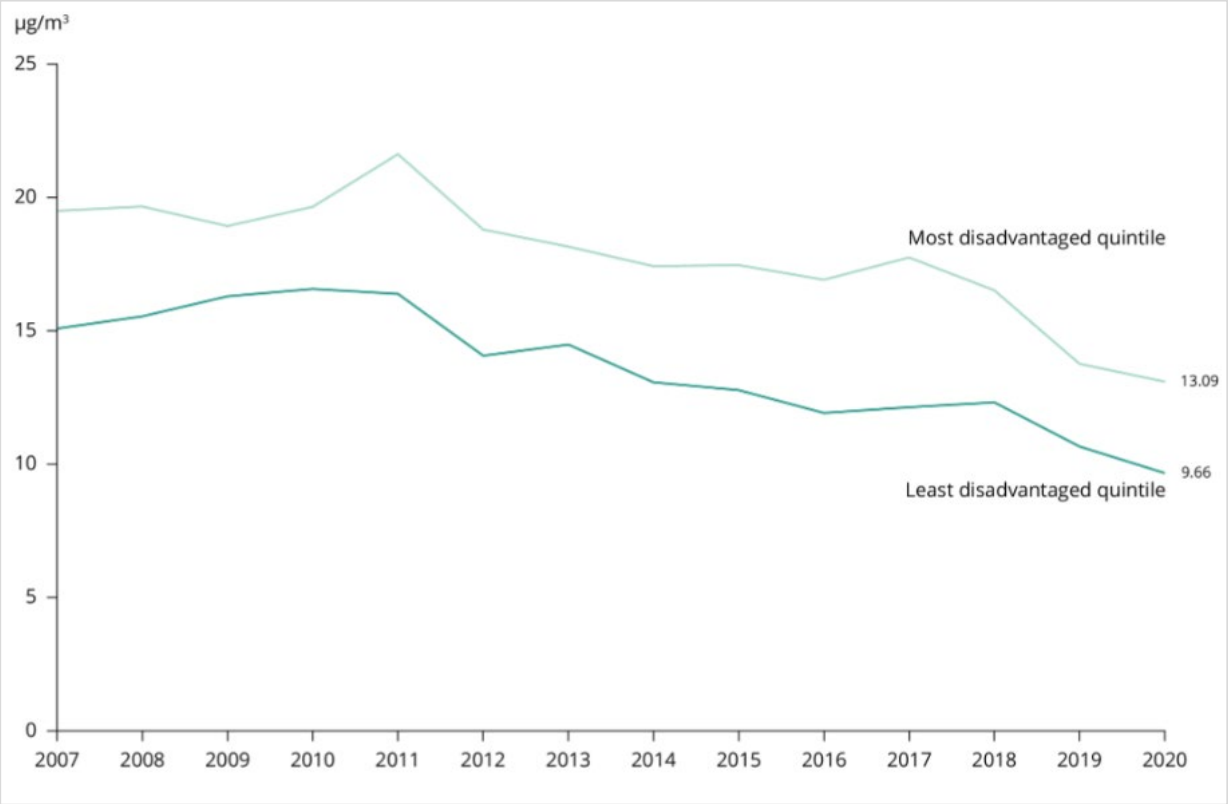
2.3.1. Air pollution

Air pollution levels have declined in Europe, but it remains the largest environmental health risk, and fine particulate matter (fine inhalable particles with diameters that are generally 2.5 micrometres and smaller - $PM_{2.5}$) causes more premature deaths than any other ambient air pollutant (EEA, 2023b). Exposure to pollutants in the EU remains at levels above WHO recommendations (EEA, 2023b). Even low levels of air pollution have detrimental impacts on health (Armand, 2022).

[4] An IDA on addressing health inequalities in the EU (Scholz, 2020) provides a more thorough description of the different determinants of health and how these can result in health disparities between groups.

Air pollutant concentrations in Europe tend to be higher in regions with higher population density. European regions[5] characterised by low socioeconomic status, low incomes, high unemployment rates and a low proportion of the population with tertiary education are more susceptible to exposure to inhalable particles with diameters that are 10 micrometres and smaller (PM_{10}), $PM_{2.5}$ and Ozone (O_3)[6] (EEA, 2018). By contrast, richer regions tend to be more exposed to NO_2 pollution. Unlike particulate matter ($PM_{2.5}$ and PM_{10}), economic elements such as Gross Domestic Product (GDP) per capita and household income weakly correlate with O_3 exposure (EEA, 2018).

Figure 3: Population-weighted concentrations of $PM_{2.5}$ in the richest and poorest regions in the EU



Source: EEA (2023c).

Gender-related differences in pollution exposure and health impacts include greater exposure among men to certain toxic substances (e.g. asbestos) due to historically gendered job allocations (e.g. construction) (Dr Gerardo Sanchez Martinez, *pers. comm.*), and a higher risk for women of breast cancer (Gabet et al, 2021) and osteoporosis (Prada, 2023).

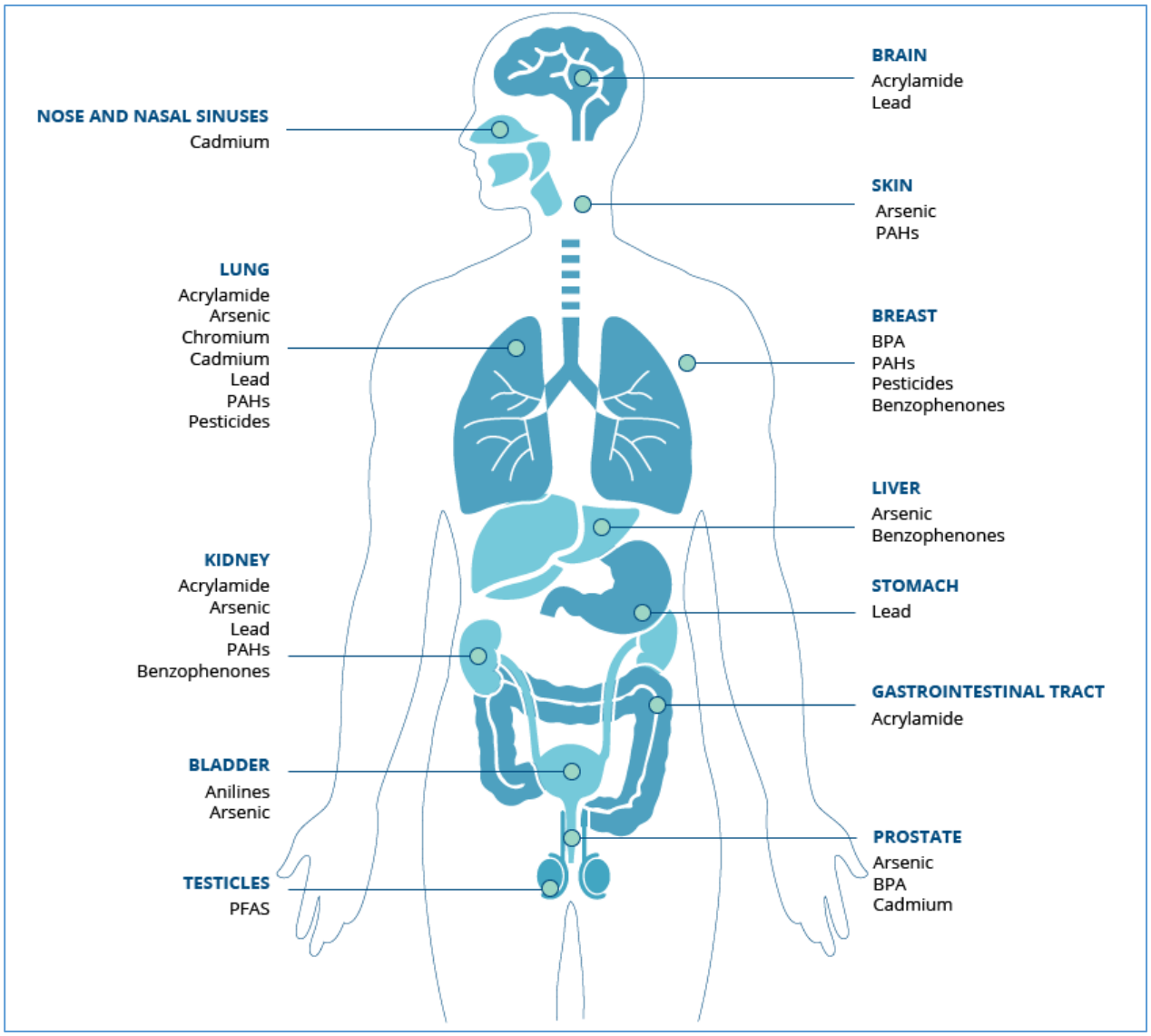
2.3.2. Chemicals hazardous to health, including pesticides

In Europe, the production and use of new substances that are hazardous to health has evolved faster than their regulation and monitoring. Europeans continue to be exposed to hazardous substances above the levels deemed safe (EEA, 2023d).

[5] These regions are concentrated in Bulgaria, Greece, parts of Italy, Spain and Slovakia.

[6] Regions simultaneously ranking in the top 20 % for O_3 exposure and the bottom 20 % for higher education are found in southern Europe, mainly in Greece, Italy and Portugal (WHO Europe, 2021).

Figure 4: Known or suspected chemical carcinogens and organs affected



Source: EEA (2022a).

Note: BPA (Bisphenol A) is a chemical compound used in the production of some plastics and resins. PAHs (Polycyclic Aromatic Hydrocarbons) are groups of organic compounds formed during incomplete combustion of organic matter such as fossil fuels. PFAS (Per- and Polyfluoroalkyl Substances) are a group of human-made synthetic chemicals that are water and oil repellent and are resistant to heat and chemical reactions.

Due to the different ways in which hazardous chemicals enter the human body (see Figure 4), most of the population in Europe is at risk, with certain groups more vulnerable than others. Exposure to chemicals during pregnancy has negative repercussions for foetal neurological, endocrine and immune system development (Demeneix and Slama, 2019). Children are particularly vulnerable to short and long-term effects of chemicals (WHO, 2016), not only from exposure but also from accidental ingestion. The European Human Biomonitoring Initiative found that pesticide levels are consistently higher in children than in adults (Govarts et al., 2023). It seems clear that future generations are already at risk. Individuals with existing health problems are also more likely to have occupations with poor working conditions or with little health protections (Burgard and Lin, 2013).

Hazardous substances also impact environmental health. The use of pesticides has negatively affected biodiversity and the quality of aquatic, terrestrial and marine habitats in Europe.

A large percentage of European agriculture continues to rely on pesticides to maintain crop yields[7], yet these pesticides negatively affect the agricultural sector by reducing pollinator populations and soil and water quality. These negative impacts also affect food security, nutritional quality, and affordability in Europe.

2.3.3. Extremes of weather due to climate change

Recent years have seen Europe experience weather extremes resulting in significant property damage and loss of life. The extreme floods in 2021 in Belgium, Germany and surrounding countries resulted in more than 200 fatalities (Copernicus, 2021), while the 2023 wildfire season covered 468 289 hectares in the EU (JRC, 2023), damaging property and protected habitats, and posing respiratory health risks across large areas. The summer of 2022 led to over 60 000 excess heat-related deaths in Europe (Ballester et al., 2023), with the highest mortality in Italy (over 18 000 deaths) and Spain (over 11 000 deaths). Changes to/lack of precipitation cause droughts in several areas, with the JRC concluding that a large proportion of Europe is under 'warning' or 'alert' drought levels[8] (JRC, 2022), creating risks for public and agricultural water use.

In several European countries, areas at higher risk of floods also have a higher proportion of disadvantaged groups, including young people, with approximately 10 % of schools in potential flood prone areas (EEA, 2022b). Increased urbanisation, loss of green space, an ageing European population and an increase in cardiovascular diseases exacerbate the effect of extreme heat on already vulnerable groups (EEA, 2022b). Ballester et al. (2023) found that the burden of heat-related mortality is higher in women: 56 % more women died during the heatwave in summer 2022[9]. Those in difficult financial situations find it more difficult to respond and recover from the additional health, financial and economic impacts of extreme weather. Kerblat et al. (2021) calculated that an extreme flood event could increase poverty in Tblisi, Georgia, by more than 59 000 individuals (around 5.2 % of the city's population)[10]. Global and European crop failures increased the prices of staple agricultural products (e.g. wheat, rice, potatoes) (De Winne and Peersman, 2021), disproportionately affecting those on low incomes.

2.3.4. Infectious and other diseases

The changing climate in Europe promotes ideal conditions for waterborne, foodborne, and vector-borne diseases. Semenza and Paz (2021) state that changing conditions facilitate disease outbreaks such as chikungunya, dengue and West Nile fever from mosquitoes, and Lyme disease and encephalitis from ticks. Longer and hotter summers have also increased food-borne diseases (Semenza and Paz, 2021). Semenza and Ko (2023) highlighted that climate hazards such as increased ambient temperature, extreme precipitation (including floods), increased drought, and sea-level rise drive climate-sensitive pathways for waterborne diseases[11].

[7] Data on pesticide sales show relative stability, at around 350 000 tonnes sold per year between 2011 to 2020 (EEA, 2023e).

[8] 'Warning': soil moisture deficit; 'alert': vegetation stress from rainfall and soil moisture deficit (JRC, 2022).

[9] This study also found that the burden of heat-related deaths increases with age. Women dying from heat are more likely to be 80+ years.

[10] Defines an extreme flood event as a 1 in 200 years flood event.

[11] For example, vibrio bacteria such as *V. parahaemolyticus* and *V. vulnificus* thrive in warm brackish water and can cause food poisoning and wound infections. The protozoan cryptosporidium (which causes diarrhoea) can survive in moist soil and water and survive both heat and cold (Semenza and Ko, 2023).

Table 2: Climate change-driven diseases and disadvantaged communities

Disease	Hazard, exposure and vulnerability pathway	Disadvantaged communities
Vector-borne disease, e.g. from mosquitoes and ticks	More areas in Europe suitable for vectors; longer breeding season Exposure at home and work from lack of safeguards (e.g. window screens, repellent) or insecticide resistance No vaccines available	Low-income groups may not have resources to obtain necessary safeguards Personal susceptibility (e.g. age, pre-existing medical conditions) Those working outdoors or without adequate protection (e.g. agricultural workers)
Waterborne diseases, e.g. from extreme weather events such as floods	Increased survival and growth of pathogens in warm, untreated water Exposure to contaminated flood or drinking water	Low-income groups or those living in overcrowded areas that lack adequate water and sanitation infrastructure/facilities Very young children; immunocompromised people
Foodborne diseases, e.g. from food contamination	Increased temperatures and precipitation Consumption of contaminated food and drink	Under 5s; young adults

Notes: See Semenza and Paz (2021) and Semenza and Ko (2023) for details of hazard, exposure and vulnerability to infectious diseases driven by climate change.

Exposure to vector-borne diseases is no longer exclusive to those living in the warmer parts of Europe (e.g. the Mediterranean, such as Spain and Greece) – diseases from mosquitoes have been detected in Germany, Northern France, and the United Kingdom (UK).

Infectious diseases are driven by other factors such as human activity (e.g. global travel), as evidenced by the spread of dengue and COVID-19 (Prof. Jan Semenza, *pers. comm*). These diseases are unpredictable and challenging, and several of these diseases, their spread and impacts on human health are still being studied in Europe (Prof. Jan Semenza, *pers. comm*). Whether infectious diseases are driven by changing climatic conditions or other factors, the outcomes are worse for vulnerable groups. For example, deaths from COVID-19 in the UK disproportionately affected ethnic groups who also tended to have pre-existing medical conditions (e.g. diabetes, hypertension) due to low income or employment conditions (e.g. delivery drivers) (European Centre for Disease Prevention and Control (ECDC), 2020).

2.4. Key knowledge gaps

The previous sections have summarised the impacts of key environmental determinants of health, in particular for disadvantaged communities. Nonetheless, there are important knowledge gaps.

Despite some understanding of the relationship between environmental quality and health, knowledge remains limited on the specific pathways by which environmental determinants individually and cumulatively affect health. For example, there is limited understanding on how worsening climate change impacts will affect the health of disadvantaged communities (e.g. interaction of high temperatures and asthma) (Prof. Emma Bland, *pers. comm.*). Additionally, there are knowledge gaps on the spread and impacts of some infectious diseases in Europe.

Air pollution tends to be discussed in terms of outdoor air pollution, but concentrations can be many times higher indoors, given the smaller space and lack of ventilation (Simoni et al., 2003). Europeans, particularly older people, spend a lot of time indoors at home, at work or in education (Simoni et al., 2003). The ageing population in Europe will increase the numbers of older people at risk from indoor pollution, but as yet, there is insufficient evidence on the health effects of indoor pollution on this group (Prof. Emma Bland and Dr Gerardo Sanchez Martinez, *pers. comm.*).

Individual behaviours and choices when indoors, drivers of these behaviours, and their impacts on health are not fully understood, e.g. older people's actions at home during heatwaves, or home-heating decisions by those with low incomes when the temperatures drop. Efforts to increase understanding remain in their infancy[12].

The burden of disease[13] in Europe from toxic chemicals is poorly understood and is likely to be underestimated (Dr. Gerardo Sanchez Martinez, *pers. comm.*). This is exacerbated by the fact that the production and use of new substances that are hazardous to health has evolved faster than their regulation and monitoring.

[12] For example, a project to evaluate the social value of sensor systems in social housing in England, carried out by the University of Exeter's European Centre for Environment and Human Health. In the UK, social housing is available for those on low incomes and vulnerable people. Additional information is available at: https://www.ecehh.org/research/evaluating-the-social-value-of-sensor-systems-in-social-housing/.

[13] Burden of disease is the sum of mortality (deaths from disease) and morbidity (state of having an illness or a disease) (Roser et al., 2021).

3. ENVIRONMENTAL DETERMINANTS OF HEALTH, EUROPEAN INITIATIVES, AND THE ONE HEALTH AND THE HIAP APPROACHES

KEY FINDINGS

The ongoing revision of legislation such as the AAQ Directive and the Industrial Emissions Directive (IED), together with new vehicle standards (Euro 7) and other European initiatives, target higher protections on human and environmental health. However, there are concerns that the proposed revisions, including limits, timelines and potential derogations, are insufficient to protect the most vulnerable.

Further activities aim to revise legislation on chemicals and hazardous substances in the EU – the REACH Regulation and the Sustainable Use of Pesticides Directive. Other European initiatives, such as those in the Common Agricultural Policy (CAP) 2023-2027, aim to reduce reliance on substances known to be harmful to biodiversity, soil health and human health. Given the uncertainties on the impact of toxic chemicals on the most vulnerable, the proposed revisions may be insufficient.

Current climate change impacts stem from historical emissions, and the effects of new initiatives to protect nature and reduce emissions will take some years to materialise. However, several pieces of European legislation address current and future risks from determinants such as flooding and infectious disease. Influence is also drawn from international, transdisciplinary and systematic action. The right solutions must take account of the needs of the most vulnerable.

The One Health and the HiAP approaches emphasise that (human) health has no borders, that the quality of human health is affected by factors external to human physiology, and that improvements and promotion of human health require actions before and beyond medical care. Such approaches can be used to effectively and efficiently identify ways to address several environmental determinants of health while prioritising the needs of disadvantaged groups.

One Health is an integrated unifying approach that aims to sustainably balance and optimise the health of people, animals, and ecosystems. Although somewhat weakened by a lack of ambitious implementation and operationalisation, there are positive signs that its application in the EU may be expanded. For example, the five European agencies – ECDC, European Chemicals Agency (ECHA), EEA, European Food Safety Authority (EFSA) and European Medicines Agency (EMA) – recently published a statement on the application of the One Health approach in the EU, together with a list of urgent priorities and the roles of their respective organisations.

HiAP is a horizontal policy-related strategy that addresses all determinants of health influenced by policies across different sectors. Since the early 2000s, the European Commission has actively integrated health considerations into policies to enhance public health. Health assessment methods are now reflected in the Better Regulation toolbox under social impacts. There are challenges to HiAP integration in the EU, with limited consideration of health in impact assessments across different European Commission Directorates-General.

3.1. Selected environmental determinants of health and European legislation and initiatives

This section focuses on European legislation and initiatives on air quality, chemicals, and climate change and its impacts. European legislation covering other environmental determinants of health are also briefly discussed. The research shows that different European initiatives, their objectives and implementation will influence the environmental determinants of health, so this is explored further in Annex 2.

3.1.1. Air quality

The AAQ Directives (2004/107/EC, and 2008/50/EC) and the IED (2010/75/EU) have driven historical improvements in air quality in the EU. Recent reviews of these Directives highlighted that some areas are insufficient and there are long-term implementation issues, given the increasing risks (European Commission, 2022a; 2022b).

The European Commission's proposed revision of the AAQ Directives[14] aims to strengthen environmental and human health protections through:

- Closer alignment of European air quality standards with WHO recommendations, and periodic reviews to ensure that standards keep pace with the latest scientific evidence; and
- Inclusion/coverage of non-regulated pollutants with known and demonstrated adverse health and environmental impacts (e.g. ultrafine particles, black carbon, mercury, ammonia).

The impact assessment of the proposed revision highlights that further air quality improvements will benefit 'sensitive population groups' (European Commission, 2022c). In this impact assessment, 'sensitive population groups' include children, pregnant women, older people and those with underlying conditions. The preferred policy options could result in an estimated 12-53 % decrease in annual premature mortality from air pollution (European Commission, 2022c).

The tabled revision for the IED focuses on the prevention of pollutant and GHG emissions at source by agro-industrial installations, including mining, large-scale battery production and cattle farming[15]. Changes in the permitting of emissions from these large installations will promote more efficient resource use and reuse, as well as a transition towards the use of safer and less toxic chemicals. The impact assessment presents monetised indirect health benefits of between EUR 860 million and EUR 2 800 million per year (European Commission, 2022d).

The revision of these three directives covers improved rules on air quality monitoring and modelling and better public information. It also includes provisions for access to justice and compensation for damages to health when air quality rules and industrial emission permits are violated. Although the objectives show more ambition on health protection, their success will depend on effective implementation by Member States[16].

Road vehicles are the main source of air pollution in urban environments (European Commission, 2022e).

[14] The revision involves the merging of the two Directives (2004/107/EC, and 2008/50/EC) into a single AAQ Directive.

[15] These were previously unregulated.

[16] The European Court of Auditors (ECA) (2018) stated that most Member States did not effectively implement actions to achieve objectives of the AAQ Directive (2008/50/EC). For example, Member States did not measure air quality near industries or main urban traffic routes due to the degree of flexibility and multiple criteria set out in the provisions of the Directive. There were also instances where high levels of pollution were not included in the data submitted by some Member States. Monitoring of transboundary pollution was also found to be lacking.

Accordingly, the European Commission proposed new 'Euro 7' standards for internal combustion engine (ICE) vehicles (European Commission, 2022f)[17]. These new standards cover better control of air pollutant emissions from all new vehicles, update and tightening of emission limits, regulation of emissions from brakes and tyres, and ensuring that new cars stay 'clean' for longer, and are expected to result in lower emissions[18] by 2035.

Other EU initiatives that will also have an influence are described below.

Table 3: Other EU initiatives that will influence air quality improvements

European initiatives	Impact/influence on air quality
Zero Pollution Action Plan[19]	Targets a 55 % reduction in the number of premature deaths caused by air pollution
Trans-European Transport Network (TEN-T) Regulation[20,21]	Move towards a comprehensive, integrated and more sustainable mode of transportation to reduce emissions and pollution of air (and water). However, expansion of road networks without incentivising a move away from fossil-fuel powered vehicles could add to air pollution and GHG emissions
EU Climate Law[22]	A 55 % net GHG emission reduction target for 2030 and an EU-wide climate neutrality target for 2050 Sources of air pollution are also sources of GHG emissions

3.1.2. Chemicals hazardous to health, including pesticides

The Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) Regulation (1907/2006/EC) covers all chemical substances used within the EU and aims to protect human and environmental health from risks from chemicals[23]. The Chemicals Strategy for Sustainability (European Commission, 2020a) announced a proposal for the revision of the REACH Regulation due to knowledge gaps for many substances, safety assessments overlooking combined effects of chemicals, and an overly slow restriction process[24].

[17] The EP recently adopted its negotiating position on updating the Euro 7 standards, in response to the citizens' expectations on the evolution of transport and vehicle standards in the EU (European Parliament, 2023a).

[18] For example, 35 % less nitrous oxide (NOx) from cars and vans and 56 % less from buses and lorries.

[19] European Commission, 2021a, *Zero Pollution Action Plan*, Luxembourg. https://environment.ec.europa.eu/strategy/zero-pollution-action-plan_en.

[20] Regulation (EU) No 1315/2013 of the European Parliament and of the Council of 11 December 2013 on Union guidelines for the development of the trans-European transport network and repealing Decision No 661/2010/EU Text with EEA relevance. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32013R1315.

[21] The proposed revision aims 'to make the EU's transport network safer, more sustainable, faster and more convenient for its users; where more people take the train, and more goods are transported by rail, inland waterways, and short sea shipping' (European Commission, 2021b). Expected benefits cover public health and safety, climate change, air pollution, energy use, noise emissions, and land use and biodiversity.

[22] Regulation (EU) 2021/1119 of the European Parliament and of the Council of 30 June 2021 establishing the framework for achieving climate neutrality and amending Regulations (EC) No 401/2009 and (EU) 2018/1999 ('European Climate Law'). https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32021R1119.

[23] It also aims to enhance the competitiveness of Europe's chemicals' industry. However, the burden of proof on the risks of chemicals rests with companies. Companies must register, in a central database, all the chemicals they manufacture or import in quantities of 1 tonne or more per year, which are then checked by the ECHA. Companies must identify and manage any risks linked to the substances they manufacture and market in the EU. National authorities may restrict the manufacture or use of certain substances if they consider the risks inadequately managed.

[24] The inception impact assessment identifies seven problems in the existing version of the REACH Regulation. In addition to the three noted are: inefficient communication in the supply chains; overly complex and insufficient evaluation of registration dossiers and substances; overly heavy and inflexible authorisation procedure; and unequally effective control and enforcement of Member States (European Commission, 2021c).

This revision 'will include a thorough assessment of the possible impacts of potential changes…on…the protection of human health and the environment' (European Commission, n.d.). The full impact assessment is not yet available, therefore expected and quantified benefits for health and the environment are not confirmed. However, the inception impact assessment expects 'increased human health protection through reduced exposure to chemicals for citizens, workers and the self-employed, including via the environment; and better control and safer use of chemicals at workplaces to reduce risk of occupational disease, premature retirement and related health costs to society' (European Commission, 2021c).

Box 4: Per- and polyfluoroalkyl substances (PFAS) and recent developments in the EU

In January 2023, Germany, Denmark, the Netherlands, Norway and Sweden submitted a proposal to the ECHA to restrict the manufacture, placing on the market and use of per- and polyfluoroalkyl substances (PFAS), arguing that:

> PFAS are, or ultimately transform into, persistent substances, leading to irreversible environmental exposure and accumulation. Their water solubility and mobility has led to contamination of surface, ground- and drinking water, and soil in the EU and globally. It is difficult and costly to remove PFAS when released to the environment. In addition, some have been documented as toxic and/or bio accumulative substances for human health and the environment. Without taking action, their concentrations will continue to increase and their toxic and polluting effects will be difficult to reverse.

In March 2024, the ECHA clarified the next steps for the proposals to restrict PFAS under REACH.

Source: ECHA (2021; 2024).

The Sustainable Use of Plant Protection Products Directive[25] was proposed for revision[26] to include an EU-wide target of a 50 % reduction in the use of and risks from chemical pesticides by 2030 (European Commission, 2022g). The proposed revision aimed to reduce the overall footprint of the EU's food system due to its current impacts on biodiversity, climate change and human health. Within the proposed revision are measures such as:

- Use of Integrated Pest Management, with chemical pesticides used as a last resort; and
- Prohibition of pesticide use in places such as urban green areas (e.g. public parks, gardens, recreation or sports grounds), as well as protected areas and ecologically sensitive areas set aside for threatened pollinators. Buffer zones will be established around water bodies to protect aquatic ecosystems from pesticide contamination.

The impact assessment for the proposed revision of the Sustainable Use of Pesticides Directive does not provide quantified health or environmental benefits of the scenarios considered. However, it states that the policy related to the 50 % reduction (or the 'medium ambitious' option) will result in additional actions to reduce pesticide use, positively impacting health and the environment (European Commission, 2022h). It will also benefit the general public and vulnerable groups (e.g. children) due to the prohibition of pesticide use in common areas (e.g. playgrounds, schoolyards) (European Commission, 2022h).

[25] Also referred to as the Sustainable Use of Pesticides Directive (2009/128/EC).
[26] The proposed revision was rejected by the EP on 22 November 2023 (EP, 2023b).

Table 4: Other EU initiatives that will influence human and environmental health risks from chemicals

European initiatives	Impact/influence on risks from chemicals
Chemicals Strategy for Sustainability[27]	Includes actions to: • Phase out PFAS and ban the most harmful chemicals in consumer products in the EU, except for essential use • Extend risk management to ensure that consumer products do not contain chemicals that cause cancers or gene mutations, affect the reproductive or endocrine systems, or are persistent, bio accumulative and toxic
Farm to Fork Strategy[28]	Aims to transform the current EU food system towards a lower environmental and climate impact, taking into account ecosystem health, biodiversity, food security, fairness and safety
Restriction of the use of certain Hazardous Substances in electrical and electronic equipment (RoHS) Directive[29]	Evaluation found that the Directive has had a positive impact on environmental and human health by reducing the amount of hazardous substances in electrical and electronic products and through the reduction of damaging emissions during the recycling processes (European Commission, 2021d)
CAP	Within the CAP Strategic Plans 2023-2027, Member States submitted plans to promote organic fertilisers (European Commission, 2023a). This will reduce the use of chemical pesticides, positively impacting biodiversity, soil health and human health

3.1.3. Climate change-driven determinants such as extreme weather and infectious disease

The EGD targets climate neutrality by 2050, with several EU policies and initiatives[30] to put Europe on the path to a green transition, and protect biodiversity, ecosystems and human health. The current impacts from climate change largely reflect historical emissions (Jones et al., 2023), thus the environmental and human health effects of these new initiatives will not materialise for some years. Several pieces of European legislation aim to reduce current and future risks from determinants such as flooding and infectious disease.

[27] This Strategy is a product of the zero-pollution ambition, which stems from the EGD and is linked to the Zero-Pollution Action Plan (European Commission, 2020).

[28] The Farm to Fork Strategy stems from the EGD (European Commission, 2020b). It influenced the proposal for the revision of the Sustainable Use of Pesticides Directive.

[29] Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (recast). https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32011L0065.

[30] Initiatives (including action plans, strategies and legislation) linked to the EGD. https://www.consilium.europa.eu/en/policies/green-deal/.

Table 5: Existing EU legislation that reduces risks from climate change-driven environmental determinants

European legislation	Impact/influence on environmental determinants driven by climate change
Floods Directive	Aims to reduce and manage the risks and hazards posed by floods to human health, the environment, infrastructure and property by providing a framework for Member States. This includes the mapping of flood risks and hazards, the development of flood management plans and transboundary cooperation with other (EU and non-EU) countries. The second flood management plans, prepared in 2021, address climate change impacts
Bathing Water Quality (BWQ) Directive	Aims to protect the environment and human health by attaining good BWQ throughout the EU. Member States must take monthly water samples from bathing water sites and assess the concentration of at least two specific bacteria. As changing climatic conditions creates higher risks for waterborne diseases, monitoring helps to protect the health of users of Europe's bathing waters
Urban Wastewater Treatment Directive (UWWTD)	Reduction of organic matter and pollution in treated wastewater has improved water quality throughout the EU. The current proposal to revise this Directive (European Commission, 2022i) aims to improve access to sanitation for disadvantaged communities, and requires Member States to monitor pathogens in wastewater[31].
EU Wildlife Trade Regulations[32] and the EU (revised) Wildlife Action Plan[33]	Wildlife Trade Regulations enforce the provisions of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) in the EU. CITES has a key role to play in the prevention and/or reduction of risk of zoonotic disease spread from wildlife trade

Addressing determinants such as extreme weather and infectious disease is also influenced by international, transdisciplinary and systematic action (British Medical Journal (BMJ), 2020). The EU has several initiatives to restore the natural environment, with expected benefits for human health (see Table 6).

[31] Adopted by the EP in April 2024 (https://www.europarl.europa.eu/news/en/press-room/20240408IPR20307/new-eu-rules-to-improve-urban-wastewater-treatment-and-reuse)

[32] Three EU regulations cover wildlife trade: 1) Regulation (EC) No 338/97 on the protection of species of wild fauna and flora by regulating trade therein; 2) Regulation (EC) No 865/2006 laying down detailed rules concerning the implementation of Council Regulation (EC) No 338/97 on the protection of species of wild fauna and flora by regulating trade therein; and 3) Regulation (EC) No 792/2012 laying down rules for the design of permits, certificates and other documents. In July 2012, the EU Commission published a proposal to amend Council Regulation (EC) No 338/97 to bring this together with its amendments and to introduce new changes. The proposal provides the Commission with the power to adopt delegated acts and to implement resolutions. The EP provided a resolution with 13 amendments, but the Council's first reading position is still pending.

[33] The revised EU Wildlife Action Plan includes actions to examine risks of zoonotic disease spread, as well as implementation of targeted measures to reduce these risks in supply chains. This is connected to the One Health approach (see section 3.2.1).

Table 6: Examples of European initiatives to restore nature

European initiatives	Role in restoring nature
Forest Strategy 2030[34]	Recognises the role of healthy and diverse forests in addressing climate change, biodiversity loss, air quality, and the livelihoods of many Europeans. It includes an objective to increase the quantity and quality of forests in the EU and strengthen their protection, restoration and resilience
Biodiversity Strategy[35]	Aims to protect and conserve Europe's ecosystems by addressing issues and causes of its decline. It specifically addresses ecosystem degradation, pollinators, the use of pesticides, and other topics relevant to food security, human and natural health

The European Climate Adaptation Strategy interacts with the Farm to Fork Strategy and the Biodiversity Strategy. It was adopted to equip the EU to adapt to the unavoidable impacts of climate change and to manage uncertainties (European Commission, 2021e). It includes increased resources for international climate resilience and preparedness, as well as stronger international engagement on adaptation, demonstrating the EU's commitment to tackling climate change and its impacts.

3.1.4. Other environmental determinants of health

Table 1 in section 2.1 lists other environmental determinants of health including noise[36], water quality and microplastics. The review of European initiatives found policies to address these determinants (see Table 7).

[34] Forest Strategy 2030 was born out of the EGD and is an update to the 2020 strategy (European Commission, n.d.).

[35] The Biodiversity Strategy is born of the EGD (European Commission, n.d.).

[36] Environmental noise is the second worst environmental determinant of health in Europe after air pollution, primarily from road traffic (EEA, 2021). 'Chronic exposure to environmental noise has significant impacts on physical and mental health and well-being…and 20% of individuals in Europe are exposed to levels harmful to health' (EEA, 2020).

Table 7: European legislation on other environmental determinants of health

Environmental determinant of health	European initiative	Impact/influence on environmental determinants
Noise	Environmental Noise Directive	Establishes a common EU approach to avoid, prevent or reduce the harmful effects of exposure to environmental noise. The 2023 implementation report concluded that this Directive is still relevant, but delays in implementation mean it has not delivered all of its potential EU added value (European Commission, 2023b). The review also concluded that the existing number and intensity of actions must be increased to reduce the number of people affected by transport noise by 30 % by 2030[37]
	Outdoor Noise Directive	Covers the regulation of noise emissions by outdoor equipment such as machinery used in construction sites, parks and gardens. The implementation review found room for improvement on the technical aspects of the Directive, such as the scope of outdoor equipment covered and inclusion of noise limits (European Commission, 2020c)
Water Quality	Water Framework Directive (WFD)	Aims to prevent and reduce pollution, promote sustainable water use, protect and improve the aquatic environment, and mitigate the effects of floods and droughts. The 2019 fitness check concluded that the WFD is broadly fit for purpose, but needs quicker implementation and better Member State enforcement (European Commission, 2019b)
	Drinking Water Directive	The 2021 revision updates existing safety standards and improves access to safe drinking water in line with WHO recommendations (European Commission, n.d.). It aims to protect human health through updated water quality standards and tackling pollutants such as EDCs and microplastics
Microplastics	Microplastics Regulation	Microplastics are persistent, very mobile and difficult to remove from the environment. This new Regulation was adopted in September 2023 (European Commission, n.d.). It follows the 2020 Circular Economy Action Plan and supports the targets set in the Zero Pollution Action Plan[38]

3.2. The One Health and the Health in All Policies Approaches

The previous section reviewed existing and proposed EU legislation and policy addressing key environmental determinants of health. Recent perspectives – the One Health and the HiAP approaches – emphasise the need to address human health and environmental health in a broader perspective.

[37] As set out in the Zero-Pollution Action Plan.

[38] Examples of products covered by the restriction include the granular infill material used on artificial sport surfaces, cosmetics, detergents, fabric softeners, glitter, fertilisers and plant protection products, toys, medicines and medical devices. Some derogations and transition periods apply in specific cases.

These approaches highlight that (human) health has no borders: the quality of human health is affected by factors external to human physiology, and improvements and promotion of human health require actions before and beyond medical care. In this perspective, addressing the environmental determinants of health also needs to prioritise those groups and individuals at higher risk. The One Health and the HiAP approaches also highlight the need for cooperation across different disciplines and governance levels.

3.2.1. One Health

One Health is defined by the One Health High Level Expert Panel as an integrated unifying approach that aims to sustainably balance and optimise the health of people, animals, and ecosystems (WHO, 2021). There are close links between One Health and sustainability: Sustainable Development Goal (SDG) 3 focuses on good health and well-being at all ages. The European Observatory on Health Systems and Policies and McKee (2022) emphasise that health is affected by other factors, such as poverty, access to water and sanitation, and the health of the environment. In Europe, One Health has previously been advocated in relation to anti-microbial resistance (AMR) and animal disease, with newfound awareness of the need for improved and wide-spread application following the COVID-19 pandemic[39].

Reviews of the application of One Health in the EU highlight significant gaps. For example, Coli and Schebesta (2023) found that One Health is referenced in a number of different strategies developed by the European Commission, including on climate change, resilient nature, AMR, environmental pollution and policy-making. This was confirmed by this IDA. Several policies and legislative proposals, especially those stemming from the EGD and post-2020, tend to refer to One Health, but provide no evidence of how it is applied in these policies. This view is echoed by the messages from the recent European One Health Conference in Luxembourg[40], where the opening session noted that the success of One Health involves its application in other sectors and disciplines (e.g. natural resource and waste management, policy-making, law and economics)[41].

[39] Through a One Health lens, the COVID-19 pandemic showed that prevention is better than cure. Initial estimates by the Global Preparedness Monitoring Board (GBMP) of the costs of the worldwide response to COVID-19 is USD 11 trillion, excluding the immediate costs of loss of economic activity due to lockdowns, ill health and loss of life (GMBP, 2020). An additional USD 10 trillion loss of future earnings is also expected. This is compared to a preparedness cost of USD 5 per person per year, or USD 40 billion (EUR 36 billion) per year (exchange rate of EUR 1 = USD 1.09 (European Central Bank, 14 December 2023. https://www.ecb.europa.eu/stats/policy_and_exchange_rates/euro_reference_exchange_rates/html/index.en.html). Excluding a price base adjustment, this is 0.25 % of EU GDP in 2021 (valued at EUR 14.5 trillion) (European Union, n.d.).

[40] One Health Conference: One Health for All, All for One Health, 13 November 2023, Luxembourg. https://health.ec.europa.eu/events/one-health-conference-one-health-all-all-one-health-2023-11-13_en.

[41] The One Health Joint Plan of Action states that other disciplines and sectors have a poor understanding of the environmental determinants of health, but there is potential to integrate environmental considerations more consistently, boosting and broadening the application of One Health (FAO, United Nations Environment Programme (UNEP), WHO and WOAH, 2022).

Table 8: EU strategies, legislation and plans that refer to One Health

EU strategies, legislation and plans	Details
Biodiversity Strategy	'The EU will enhance its support to global efforts to apply the One Health approach, which recognises the intrinsic connection between human health, animal health and healthy, resilient nature'
Wildlife Trade Regulations	One Health is not mentioned in the Wildlife Trade Regulations, but in the EU Action Plan against wildlife trafficking: 'Take a 'One Health' approach into account in the context of regulating wildlife trade in source, transit and destination countries'
Animal Welfare Regulations	The proposed change to the Regulations acknowledges that the COVID-19 pandemic has highlighted the importance of the One Health approach
Climate Adaptation Plan	'The Commission will pool and connect data, tools and expertise to communicate, monitor, analyse and prevent the effects of climate change on human health, based on a 'One Health' approach'
EU Soil Strategy	'The "One Health" principle clearly recognises that the health of the planet is closely linked with human and animal health. If one group is affected, this influences the health of the rest…'

The One Health Conference, together with the review of EU strategies, legislation and plans (see Table 8) show weak implementation and operationalisation of One Health, compared to its ambition. Nevertheless, recent positive developments are evident: five European agencies (ECDC, ECHA, EEA, EFSA, EMA) recently published a statement on the application of the One Health approach in the EU (ECDC, ECHA, EEA, EFSA, EMA, 2023a). They also published a document listing urgent priorities and their organisations' roles in the One Health approach (ECDC, ECHA, EEA, EFSA, and EMA, 2023b)[42]. The Quadripartite of the FAO, the UNEP, WHO and WOAH have developed a One Health Joint Plan of Action containing principles, high-level actions, action tracks, expected medium to long-term outcomes, and impacts (FAO, UNEP, WHO and WOAH, 2022). Although not specific to the EU, the Plan can usefully inform the development of the One Health approach in the EU. Two of the principles in the One Health Joint Plan of Action relate to gender equality and to inclusiveness and equity. These principles are an important part of ensuring that disadvantaged communities are not left behind.

3.2.2. Health in All Policies

HiAP is a way of working rather than a predefined action plan. It considers societal health and wellbeing holistically and as a priority in all areas of policy-making (Godziewski, 2020). It is described as a horizontal policy-related strategy that addresses determinants of health controlled by policies in sectors beyond public health (Pan American Health Organization (PAHO), n.d.). HiAP is also linked to sustainability by reducing health inequalities and considering health impacts for future generations.

HiAP was put on the EU agenda by the Finnish EU Presidency in 2006. It was chosen as the central theme for public health due to concerns about the insufficient integration of health into EU policies and the need for more effective use of available structures and mechanisms (Puska and Ståhl, 2010).

[42] The four main priority areas of work for the cross-agency taskforce are: strategic coordination and EU policy support; research coordination; engagement with stakeholders; joint activities and procurement.

It was also prompted by instances, particularly in the agriculture sector, where health impacts were secondary to economic or regional policy interests (Puska and Ståhl, 2010). Article 168 of the Treaty on the Functioning of the European Union (TFEU) underlines the commitment that '[a] high level of human health protection shall be ensured in the definition and implementation of all Union policies and activities' (OJ C 115, 9.5.2008). The HiAP principles are therefore firmly enshrined in the legal basis of the EU. The European Commission (via the Directorate-General for Health and Food Safety (DG SANTE)) began to actively integrate health considerations into pivotal community public health policies since the early 2000s, using health impact assessment methods to evaluate the potential health implications of its decisions (Green et al., 2021). More recently, the Better Regulation Toolbox[43] now includes social, environmental and economic impacts, with social impacts encompassing effects on the health system, public health, and safety[44].

The largest challenge for HiAP integration in the EU is its political nature – it is not only about extending health promotion activities to other sectors, but ensuring that policies for other sectors are based on health policy priorities. This implies a need to balance health improvements against economic growth or other policy aims. Notwithstanding the Better Regulation Toolbox, in the past there was limited consideration of health in European Commission policy impact assessments, which tended to focus on single market competitiveness (Koivusalu, 2006). Ståhl (2009) found that of 48 impact assessments prepared in 2006[45] by 17 European Commission DGs, 10 (from five different DGs) made no references to public health or public health systems, despite five of those 10 relating to policies that could impact health. This indicated that impacts considered were likely framed solely according to the perspective of the DG carrying out the impact assessment.

Other challenges for HiAP integration include:

- HiAP needs to be resourced in order to be effective, but demonstrating its impact is challenging (Green et al., 2021). Key resources include financial, human and intellectual capital (e.g. public health professionals with dedicated time, capacity, and skills to engage with other policy areas, and information resources). Policies are not always monitored, however, and impacts on health, well-being and equity may be difficult to attribute to a single policy in the long-term. This lack of evidence may lead to insufficient resourcing;
- Historically, HiAP focused on social determinants of health[46] (Cairney et al., 2021). For example, the book on the prospects and potentials for HiAP in the EU, published by the Finnish Ministry of Social Affairs during the Finnish EU Presidency (Ståhl et al., 2006) focused on the social determinants of health. A scan of the WHO HiAP training manual (WHO, 2015) also reveals a stronger emphasis on the social determinants of health, with 'environmental determinants of health' mentioned only twice. Improved integration of the HiAP approach must consider all determinants of health, including environmental determinants. This will help to identify solutions with broader benefits for health; and

[43] The most recent Better Regulation Toolbox was released in July 2023. https://commission.europa.eu/document/download/9c8d2189-8abd-4f29-84e9-abc843cc68e0_en?filename=BR%20toolbox%20-%20Jul%202023%20-%20FINAL.pdf.

[44] For example, Tool #32 covers health impacts and opens with: 'human health is a fundamental value and an investment in economic growth and social cohesion'. It also advises that both positive and negative health impacts are considered, and that the health relevance and significance of a policy initiative should be established.

[45] The author reviewed impact assessments from 2006, following the revised impact assessment guidelines (2005). The review was undertaken because of the Finnish Presidency's concern that health impacts are not always considered appropriately in the European law-making institutions.

[46] Examples of social determinants of health are income and social protection, education, employment, job security and work conditions, food security, housing, early childhood development, social inclusion, structural conflict and access to affordable and decent health services (WHO, n.d.).

- Successful HiAP implementation is rarely achieved through a top-down approach (Cairney et al., 2021), while Green et al. (2021) warn against HiAP efforts focusing solely on the health or medical sector. Instead, it requires participation and commitment from policymakers across levels of governance, national and local health practitioners, different sectors, and communities. Both papers emphasise that HiAP must be treated as a long-term commitment to multi-stakeholder collaboration to improve health and well-being rather than a model to be implemented.

Some examples of global good practices in implementing the HiAP approach are presented in Box 5.

Box 5: Good practice in the HiAP application around the world

Wales (UK) – the Well-being of Future Generations (Wales) Act 2015 has a specific well-being goal of a healthier Wales where 'a society in which people's physical and mental well-being is maximised and in which choices and behaviours that benefit future health are understood'. Health impact assessments are statutory for public bodies in certain circumstances.

New South Wales (Australia) – health impact assessments are in place since 2003 and are largely decentralised, enabling easier collaboration with wider partners. They are not influenced by government priorities or election cycles.

Source: Green et al. (2021).

3.3. Key gaps in European initiatives and the implementation of the One Health and the HiAP approaches

The review of existing and proposed EU legislation and policy, and of EU implementation of the One Health and HiAP approaches, has identified important gaps in EU action and in knowledge.

One key gap in EU action is that the proposed revisions to existing legislation are insufficient to protect human health. For example, the AAQ Directive targets closer alignment with WHO standards rather than seeking to achieve or outperform these standards. This could result in derogations by Member States, resulting in health problems for vulnerable groups living in areas with very high levels of air pollution. The proposed revisions to chemicals legislation may be insufficient given the uncertainties about individual and combined exposure and impacts of existing/new toxic chemicals, particularly on the most vulnerable. Although the REACH Regulation is the EU's main mechanism to regulate chemicals, the rate at which new chemicals are developed and put on the market implies further examination of the issue of 'essential use'. The future of the Sustainable Use of Pesticides Directive is currently on hold, delaying efforts to address the impacts of pesticides on human and environmental health.

In this context, knowledge gaps on the health impacts of climate change are a key concern. The impacts of climate change on society are multi-faceted. They include extreme weather, such as very high temperatures, heavy flooding, droughts and forest fires, leading to significant social and economic costs and loss of life. Recent extreme weather events in Europe show a largely reactive approach that rarely takes into account the needs of the most vulnerable. Changing weather patterns in Europe create new risks from infectious disease. Human travel (by air or sea) and migration patterns also increase the risks of infectious disease, as highlighted by the rapid spread of COVID-19. The uncertainty of the origin and magnitude of infectious disease risks creates a continuing need to monitor these diseases and understand the relationships between climatic conditions, diseases in animals, and their eventual impact on humans (including human-to-human transfer).

A further gap concerns implementation and integration of the One Health and HiAP approaches. One Health is concerned with the links between environmental, human and animal health. HiAP focuses on incorporating health considerations into policies across all sectors to gain the best overall health outcomes. Both approaches emphasise that good human health requires actions beyond public health (e.g. medical treatments and technologies) and both can be used to identify ways to address environmental determinants of health. Both approaches aim to reduce health inequalities and consider current and future risks and impacts in order to ensure that disadvantaged communities are not left behind.

Historical application of the One Health and the HiAP approaches in the EU (including EU institutions for environment and health) has been inconsistent, narrowly applied, and lacking in ambition. The economic impacts of post-2020 events (e.g. COVID-19, the energy crisis due to Russia's war of aggression against Ukraine) are amplifying calls for economic recovery, sometimes resulting in the promotion of technologies known to be harmful to human health and the environment[47] (Prof. Andy Haines, *pers. comm.*). Economic recovery that takes away from human and environmental health is likely to be short-lived and will only worsen existing disparities. The concept of operating within planetary boundaries, given that human health is affected by environmental health, is implied in the One Health and the HiAP approaches because of their links to sustainability. Without broad, efficient and consistent implementation of the One Health and the HiAP approaches, efforts to improve human health will be fragmented and costly and will not protect the health of the most vulnerable.

[47] For example, in 2022, the UK government approved a coal mine in the north-west of the country (BBC, 2022). The promoters and supporters emphasised the creation of jobs and lower reliance on imported coal.

4. CONCLUSIONS AND RECOMMENDATIONS

SUMMARY OF RECOMMENDATIONS

The following recommendations focus on SANT subcommittee actions to improve the application of the One Health and the HiAP approaches in the EU:

- Investigate the actions, resources, commitment and leadership required to improve implementation of the One Health and HiAP approaches across the EU;
- Request the European Commission to assess if the Better Regulation Toolbox #32 (Health Impacts) is sufficiently and effectively used and applied in EU evaluations, fitness checks and impact assessments across policy areas and Directorates-General;
- Call on the European Court of Auditors to assess if the implementation of key European legislation such as Cohesion Policy and climate and energy policy reduces risks from environmental determinants of health;
- Request the European Commission and the EEA to investigate how the health of disadvantaged communities can be better protected, in particular from poor air quality;
- Continue to scrutinise the work of the European Commission and ECHA in implementing and revising the REACH Regulation, including concerning PFAS and additives in plastics; and
- Call on European agencies, including ECDC and EEA, to increase and coordinate EU risk assessment, surveillance and early-warning systems for potential sources and spread of diseases linked to environmental and climate impacts.

4.1. Conclusions

The environment has a direct impact on human health and the impacts of a deteriorating environment are worse for disadvantaged communities. These communities often have little or no resources and resilience to avoid, cope with and recover from these individual and cumulative impacts. More groups and communities are becoming disadvantaged due to the consequences of climate change (e.g. young children's mental health, indigenous communities' way of life). Evidence from the COVID-19 pandemic has shown that the specific vulnerabilities and needs of disadvantaged communities are not well-considered in decision-making, leaving them disproportionately negatively affected.

Notwithstanding some progress in recent years, air pollution remains the worst environmental determinant in the EU; even low levels of air pollution have detrimental impacts on health. The revised proposals on the AAQ Directive aim to closely align EU air standards with WHO recommended standards, rather than reaching or surpassing these standards. This gap will impact those who are most vulnerable, including future generations.

The envisaged revision of the REACH Regulation aims to further protect human and environmental health from the negative impacts of chemicals and hazardous substances. Other efforts in the EU seek to limit and ban the use of PFAS with known negative environmental and health impacts. Given the knowledge gaps about the impact of toxic chemicals on the most vulnerable, there are concerns that these proposals may be insufficient. Uncertainties are not limited to environmental determinants of health and impacts on human health, but extend to individual behaviours and choices when indoors, their drivers (e.g. exposure to environmental determinants) and impacts.

The EGD shows high EU-level ambition in response to the existential threat of climate change and environmental degradation. Initiatives such as strategies, action plans, new legislation and proposed revisions to existing legislation clearly state the aim of improving safeguards for environmental and human health. As a healthy environment and good physical health are part of the SDGs – to which the EU is committed – improved application of the One Health and HiAP approaches provide an opportunity to promote sustainability. They emphasise that (human) health has no borders, necessitating long-term commitment and cooperation between different disciplines and organisations, investment in financial, intellectual and human capital, and the development and implementation of solutions that address more than one problem.

4.2. Recommendations

The following recommendations for the **European Parliament's SANT subcommittee** focus on actions to improve the application of the One Health and the HiAP approaches in the EU.

- **Investigate the actions, resources, commitment and leadership required across the EU to improve implementation of the One Health and HiAP approaches.** To overcome the challenges in their implementation within the EU, both approaches need long-term commitment from different actors to prioritise human health, together with recognition that good health of all citizens is a resource in the EU. The European Commission and EU agencies including EEA and ECDC in particular need to be included in the discussion how a long-term commitment will be supported by financial, human and intellectual resources;
- **Request the European Commission to assess if the Better Regulation Toolbox #32 (Health Impacts) is sufficiently and effectively used and applied in EU evaluations, fitness checks and impact assessments across policy areas and Directorates-General:** past studies have identified gaps in the assessment of health impacts, with little exploration of the types of disadvantaged communities. To better ensure HiAP, this assessment should investigate if implementation of the revised Toolbox has addressed these gaps, including health costs and benefits (whether quantified, monetised or qualitative) for disadvantaged communities. It will be valuable to understand if all health impacts are included: for example, the mental health impacts of climate change should be included;
- **Call on the European Court of Auditors to assess if the implementation of key European legislation such as Cohesion Policy and climate and energy policy reduces risks from environmental determinants of health.** This IDA examined several European initiatives with a direct, indirect and enabling impact on different environmental determinants of health; however, most of the initiatives described here are linked to environmental policies and the EGD. As a key step for strengthening the HiAP and One Health approaches in the EU, it is important to understand how the implementation of EU economic legislation and policy is addressing risks from environmental determinants of health, to ensure that these policies, funding and incentives do not promote activities with adverse environmental and health impacts;
- **Request the European Commission and the EEA to investigate how the health of disadvantaged communities can be better protected, in particular from poor air quality.** The proposal to revise the AAQ Directive aims to 'align EU air quality standards more closely with WHO recommendations'; however, it does not set or exceed these standards, and the alignment appears to be a long-term goal. Given that low levels of pollution can have significant negative health impacts, EU air quality standards that are less stringent than WHO

standards will continue to result in disproportionate burden on disadvantaged communities across Europe. More generally, EU legislation does not specifically aim at protecting disadvantaged communities. This means it is important to identify key actions at EU, national and also local levels to protect the health of these communities in the short to medium term;

- **Continue to scrutinise the work of the European Commission and ECHA to implement and revise the REACH Regulation, including concerning PFAS and additives in plastics**. Chemicals with negative human and environmental health impacts need to be sufficiently controlled and substituted in a timely manner with chemicals that do not cause equivalent levels of concern to human health and the environment. This includes restrictions on the manufacture, placing on the market and use of PFAS, which are of growing concern across the EU. Another key area for attention is that of plastics with potentially toxic additives, which should be phased out to ensure that the growing recycling of plastics and the transition to a circular economy do not increase toxic chemical exposure; and
- **Call on European agencies, including ECDC and EEA, to increase and coordinate EU risk assessment, surveillance and early-warning systems for potential sources and spread of diseases linked to environmental and climate impacts.** Part of the improved application of the One Health and HiAP is better knowledge of the links between environmental and human health, such as surveillance of potential sources and spread of diseases driven by changing climatic conditions and studies on the resulting disease burden in communities. Work in this area can build on previous actions to understand the links between a changing environment and human health: for example, enhanced ECDC knowledge on the regions and individuals at higher risk of diseases spread by ticks led to targeted, region-specific public awareness materials and medical advice. This initiative will be particularly valuable in light of potential health impacts arising from climate change.

In addition to the recommendations above to the subcommittee, the information and analysis has identified key actions that EU institutions and Member States should consider to enhance the implementation of One Health and HiAP. These are presented below.

- **Prioritise the health of disadvantaged communities in climate mitigation and adaptation strategies, and prioritise solutions with co-benefits.** Experts interviewed for this project have highlighted the need and opportunities for European actions stemming from climate ambitions and targets to bring co-benefits for environmental and human health and prioritise the needs of disadvantaged communities. For example, disadvantaged communities are disproportionately impacted during very cold and very hot weather, and solutions to reduce GHG emissions from dwellings that focus on reducing heat loss in winters could create health problems during summer periods of very high temperatures. Nature-based solutions are important in minimising the impacts of heatwaves or heavy precipitation on existing infrastructure and communities in cities; however, the location of these solutions should ensure that the most vulnerable participate in the benefits. Improvements to public transport infrastructure (including 'active' transport such as cycling) reduce reliance on private transport, lower GHG emissions and air pollution, and support those who are (financially) unable to purchase electric vehicles: here it is important to understand how these types of solutions can benefit disadvantaged communities, including older people and people with disabilities; and
- **Enhance public and local participation in the decision-making processes and ensure timely access to relevant information.** HiAP seeks to engage the public to solve problems collectively and avoid a top-down approach, enabling more inclusive and resilient solutions.

EU-level support for Member States, regions and cities thus needs to involve different stakeholders at all levels. Community-level knowledge will identify and understand the specific health needs and behaviours of the most vulnerable groups in the context of a particular problem, together with the resources they require to adapt and mitigate health impacts from environmental determinants. Increased public access to information on environmental health determinants is part of the proposed revisions of the AAQ Directive and the IED. This will enable communities to take action at ground-level (e.g. use of warnings) and hold authorities to account (including Member State compliance).

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ANNEX 1: ENVIRONMENTAL DETERMINANTS OF HEALTH AND DISADVANTAGED COMMUNITIES

Environmental determinants of health	Disadvantaged communities that are most affected, as informed by the literature reviewed for the IDA.
Air quality	Live/work in areas with higher population densities or are highly urbanised. Have low income or lower socio-economic status. Children, the elderly, those who are pregnant. Have chronic physical and mental health issues, including disabilities. Live/work in rural areas with high levels of agricultural activities.
Heat/extreme temperature	Live/work in areas with higher population densities or are highly urbanised. Have low income or lower socio-economic status. Children, the elderly, and women. Have chronic physical and mental health issues, including disabilities. Live in central and southern Europe.
Infectious diseases	Have low income or lower socio-economic status. Young children, the elderly, those who are pregnant. Have chronic physical and mental health issues, including disabilities. Agriculture and forestry workers (most of whom are from migrant communities).
Chemicals	Children, the elderly, those who are pregnant. Have chronic physical and mental health issues, including disabilities. Have direct occupational contact. Live/work in rural areas with high levels of agricultural activities.
Natural disasters, including forest fires and floods	Live in central and southern Europe, and the Arctic regions of Europe. Young children and the elderly. Have chronic physical and mental health issues. Those who have little or no social support network.

ANNEX 2: OTHER EUROPEAN INITIATIVES THAT ADDRESS ENVIRONMENTAL HEALTH DETERMINANTS

For this IDA, a review of 37 European initiatives that address environmental determinants of health was completed. These initiatives cover legislation (regulation and directives), strategies, ambitions and action plans, several of which are linked to the European Green Deal. These were assessed on their links to addressing or reducing risks from environmental determinants of health, and three classifications were developed. These classifications are further described in the table below.

Classification	Description
Direct	The policy's purpose is to directly address the environmental determinant and their sources and set standards/limits/targets on the determinant. Example: Ambient Air Quality Directive and air quality
Enabler	Although not setting standards or limits on the environmental determinant, the policy is expected to have significant positive contribution because it addresses a source of the environmental determinant. Conversely, there is the potential that this policy could drive an increase in the environmental determinant. Example: EU wildlife trade regulations and infectious diseases
Indirect	Policies that are expected to have positive impacts on intermediary components which help reduce risks from environmental determinants. Example: Water Framework Directive and droughts

A list of these initiatives and their impacts (given the classifications above) on the different environmental determinants of health identified in this study are presented in the table below.

EU policy	Status	air quality	water quality	noise	temperature	chemicals	microplastics	infectious disease	floods, droughts, forest fires
AAQ Directive	tabled for revision	D							
IED	tabled for revision	D	E	I		E			
Euro 7 Standards	tabled for revision	D	I						
UWWTD	tabled for revision		D			I	I	I	
DWQ Directive	in force		D			I	I	I	
Bathing Water Directive	in force, but potential proposal		D			I	I	I	I
WFD	in force		D			E	I	I	
Environmental Noise Directive	in force			D					
Outdoor Noise Directive	proposal for revision			D					
REACH Directive	proposal for revision		I			D			
RoHS Directive	in force		I			D			
Sustainable Use of Pesticides Directive	proposal for revision recently rejected by EP	I	I			D			

EU policy	Status	air quality	water quality	noise	temperature	chemicals	microplastics	infectious disease	floods, droughts, forest fires
Microplastics Regulation	in force		I			E	D		
SUPD	implementation						D		
Packaging and Packaging Waste Directive	proposal for revision					I	D		
Floods Directive	in force								D
Forest Strategy 2030	announced (2021)	I	I	I	E				E
EU Soil Monitoring Law	tabled		E						
Farm to Fork Strategy	announced (2020)	E	E			E		E	
Animal Welfare regulations	tabled for revision							E	
Toy Safety Directive	proposal for revision					E			
GMO directives	in force	I	I			I		I	
Nature Restoration Law	about to be in force	I	I		E			I	
Biodiversity Strategy	announced (2020)		I					I	E
Climate Adaptation Plan	adopted/completed	E	I		E			I	E
Climate Law	adopted/completed	E	I		E			I	E

EU policy	Status	air quality	water quality	noise	temperature	chemicals	microplastics	infectious disease	floods, droughts, forest fires
European Urban Areas Initiative	n/a	E	I	E	E	I	I	I	I
Zero Pollution Action Plan	adopted (2021)	E	E	E		E	E		
T-ENT Regulation	tabled for revision	E	I	I					
Net Zero Industry Act	tabled								
Re-fuel	adopted/completed	E							
EU Soil Strategy	announced (2021)	I	E				I		
Nitrates Directive	in force		E			I		I	
Textiles Labelling Regulation	proposal for revision								
CITES	in force							E	
CAP	in force	E	E			E		I	

ANNEX 3: NOTES FROM INTERVIEWS WITH EXPERTS

The research team undertook interviews with experts whose work is at the scientific and policy overlap and cover different topics for the IDA. The purpose of these interviews is to supplement and complement the information found through research, and to provide emphasis on areas where there is agreement in views from these experts.

Not all interview notes have been reproduced for this Annex, and this Annex does not present word-for-word reproduction of the interviews.

During the interviews, several interviewees provided additional information (e.g. scientific papers they have authored or co-authored), and these are referenced in this annex as footnotes where relevant. It is also noted that two interviewees, based in the UK, emphasised that they might have limited knowledge on EU policies especially after the UK's exit from the EU.

Interview with Professor Emma Bland

Professor Emma Bland[48] is a founding member of the European Centre for Environment and Human Health at the University of Exeter. Her professional interest lies in how people are impacted by and impact their environment and how this leads to issues of equity and well-being.

- Which environmental determinants of health have the highest disproportionate impact today (hitting vulnerable communities the most/hardest)? Will it be the same ones in 2030, 2050? And why?

Vulnerable communities have fewer choices than others but are at the same time more exposed. "Vulnerability" can refer to different circumstances like location, or existing characteristics. The risks due to the determinants of health are having a more severe impact on vulnerable groups, but these risks are the same as for the rest of the population.

From the UK perspective, heat and flooding have the highest impact on vulnerable communities today and will increase further in the future. The UK, in terms of society, governance and infrastructure, is not prepared for events such as high heat waves and heavy rainfall. Besides heat waves and heavy rainfalls, wildfires are expected to increase, which is not only an urgent risk, but which is also responsible for low air quality. In general, all climate change-related events will be a risk to the population, as those are new, and the infrastructure is not adapted.

- What are key ways to mitigate[49] the negative effects of climate change on environmental determinants of health?

We have changed the climate so much, that we now need to adapt to it. One very important tool is nature-based solutions (NBS) to build a diverse and natural environment to mitigate the risks. Examples of NBS that could have a great impact are rewilding rivers (allowing rivers to go back to their natural shape), repopulating areas with beavers (against flooding), and green and blue spaces in urban areas (cooling effects). The idea is to reconfigure the built environment to alleviate heat stress. Adaptation will also require improvements in transport (e.g. railway infrastructure and homes), which should go hand in hand with NBS.

It is also important to highlight that in the race to achieve Net Zero, it is important to carefully consider

[48] Her professional profile is available at: https://www.ecehh.org/person/emma-bland/.

[49] Professor Bland's work is on adaptation rather than mitigation so her response is related to adaptation.

and evaluate the solutions being proposed and implemented. For example, the UK housing stock is generally poorly insulated[50]. This means that the Net Zero solutions for this have often been related to keeping in the heat during winter months. However, this will have negative side effects during heatwaves. Aside from insulation, appropriate ventilation will also be necessary.

- What are key ways to mitigate the negative effects of climate change on the health of disadvantaged communities?

We cannot separate health and the environment. Housing is an important topic, as people spend a lot of time in their houses, and this is the place where differences are the most important. Disadvantaged people, such as elderly people, are known to spend almost 80 % of their time indoors, but less is known about indoor air quality, or what climate change could bring.

Homes must be made fit for the future, especially regarding heat. Disadvantaged communities have fewer assets to adapt their houses to specific conditions and are therefore more exposed to risks. There is not enough focus on the day-to-day living patterns of people, and adaptation is needed. There is an overall need to rethink housing and building patterns given climate change.

- What are the main knowledge gaps with regard to the relationships between climate change, environmental determinants, and human health?

We don't have enough knowledge about the specific issues related to climate change and even less regarding specific cases of vulnerable populations (like how heat aggravates asthma). Understanding how climate change is going to affect us and which pathways exist (direct and indirect) will help us adapt and mitigate the impacts. The data is limited, so we don't have a lot of knowledge on risks for vulnerable populations and how those will evolve. Health needs to be addressed through different ways so we need information from different scientific disciplines.

- In what ways could EU policies further reduce risks and impacts from the environmental determinants of health?

We need policies that set priorities; the policies have to be long-term and involve as many sectors as possible (especially between health and the environment). Also, those policies need to cover adaptation. We need to decarbonise and think of health as an endpoint. We need to shift the purpose and basis of policies away from the largest [monetised] economic benefits and towards community-based decisions.

- Are there any conflicts, issues or negative side-effects between EU policies that hinder the achievement of reducing negative impacts on health? Is there anything on this that we can learn from the COVID-19 pandemic?

The Hierarchy of policymaking has to shift towards different priorities as they are often very disconnected from health [outcomes].

Data has shown that COVID-19 outcomes for older, vulnerable, poorer people were worse than for younger, healthier, and wealthier people. Vulnerable groups have not been prioritised or more protected. The pandemic showed how decision making often does not account for the needs of the most vulnerable, and this highlights that the vulnerable need to be better represented and considered in decision making.

- How could the One Health and HiAP approaches be better implemented in Europe?

[50] Information, through the authors' elaboration rather than quoted by Professor Bland, is available at: https://www.theguardian.com/commentisfree/2021/sep/28/britain-homes-energy-crisis-governments-insulation-low-carbon-heating.

Policies should start with the most vulnerable groups, and consider that impacts of policies differ across the population. This means that more nuance in policymaking is needed, as well as the participation of [representatives from] different and especially vulnerable groups.

- Can you give an example of a country, e.g. in Europe, that can be considered an exemplar in implementing the One Health approach? If yes, which one and why?

The term One Health is not always used, but there is now evidence in the UK to enhance health in local communities and to work across and beyond boundaries. These efforts tend to be driven more at a local rather than national level.

- What is your last message to conclude this interview?

Health cannot be addressed when we work in isolation, therefore it is important that policies also promote cross-disciplinary work and research.

Interview with Dr Gerardo Sanchez Martinez

Dr Sanchez[51] is an expert in climate change and human health at the European Environment Agency (EEA). His primary areas of work are climate adaptation and mitigation policies, environmental risk assessment, environmental policy design and evaluation, and environmental economics.

- How do environmental determinants (air pollution, etc.) affect disadvantaged communities differently from the population as a whole?

Air pollution, particularly outdoor and indoor pollutants, stands out by far on average as the most harmful environmental risk for Europeans. The significance of indoor air pollution relative to the lack of information on indoor exposure levels (inside homes, in the workplace, in schools, etc.) is a major challenge.

There is also water and soil pollution, including various toxic substances. Major knowledge gaps persist for many toxic chemicals, making it challenging to determine the significance of these pollutants in terms of health effects and disease burden. Noise pollution, specifically focusing on environmental noise from road traffic, aircraft, railway, and industrial sources, also impacts different groups in varying ways.

Another significant factor is the exposure to risks that are either caused or aggravated by climate change. These comprise heatwaves, extreme weather events, wildfires, and water scarcity, but also vector-borne diseases and water- and foodborne diseases, which are exacerbated by higher temperatures and a range of other aggravated exposures, impacting diverse groups as well.

There is the biological vulnerability of certain populations to pollution. Children, due to their distinct biology, are more vulnerable to pollution, and the effects on them differ from those on adults. They lack agency and tools to protect themselves from pollution. They experience different effects from various environmental determinants, including noise, heat, pollution, and exposure to toxic chemicals. It is important to recognise and address the vulnerability of children, who lack the means to advocate for pollution restrictions. The elderly and individuals with disabilities or chronic diseases exhibit increased sensitivity and are more likely to experience severe health effects from pollution.

Socioeconomic variables also play a crucial role in vulnerability. There are social and economic differences in exposure to pollution across Europe. Regions with higher pollution levels often coincide

[51] His profile is available at: https://www.researchgate.net/profile/Gerardo-Sanchez-Martinez.

with areas of lower socioeconomic status. This correlation is evident in maps, such as the European Environment and Health Atlas[52], illustrating overlaps between the most polluted and the poorest regions, particularly in Eastern Europe. Hazardous job exposures also align with lower education and income levels, contributing to systematic differences in pollution exposure. There are also gender-related differences in occupational exposures: men are more often systematically exposed to certain toxic chemicals and fibres (e.g. asbestos) due to historical gender-related job allocations. Then, while vulnerability to pollution is generally consistent across genders, there is a slight gender imbalance in heat sensitivity. Women tend to be more sensitive to extreme heat, leading to worse health outcomes. This sex-related vulnerability is another factor influencing environmental health outcomes.

- What are key ways to mitigate the negative effects of climate change on environmental determinants of health and on the health of disadvantaged communities? Do the occurrences of these diseases show variations based on geography, specifically between rural and urban areas?

The exposures discussed in the previous question are not new but are existing issues worsened by climate change. The main types of exposures related to health impacts are associated with extreme weather events: heat-related effects, wildfires, and water scarcity.

Heat is a major contributor to extreme weather-related mortality. Vulnerable populations, such as the elderly, individuals with disabilities, and those with chronic illnesses, are disproportionately affected. Socioeconomic factors play a role, with poorer individuals facing higher risks due to challenges in protecting themselves from heat. Wildfires, in addition to direct effects like trauma and suffocation, contribute to high pollution levels. This elevated pollution has adverse health effects on vulnerable populations.

Increased frequency and intensity of flooding result in direct mortality and trauma, but also have long-term effects on mental health, causing depression and post-traumatic stress disorder, especially in affected communities.

Climate change leads to the expansion of disease vectors, such as mosquitoes and ticks, transmitting diseases like West Nile virus and Lyme disease. Vulnerable groups, including children and those working outdoors, face higher exposure risks.

Addressing these health impacts requires a focus on prevention, including vaccination against vector-borne diseases. It is stressed that there is a need for proactive measures to protect vulnerable populations and mitigate the health effects of climate change. For example, protection against heat should be a right, similar to protection against the cold.

- Do the occurrences of these diseases show variations based on geography, specifically between rural and urban areas?

The prevalence of vector-borne diseases can sometimes be higher in rural areas due to the biology of ticks. However, diseases transmitted by mosquitoes, like the Aedes mosquito, are well-suited for urban areas. For instance, in places with a history of dealing with such diseases, such as Singapore, it is considered an urban health issue, and measures are taken accordingly.

- What are the main knowledge gaps in Europe on environmental determinants and human health?

[52] Available at: https://discomap.eea.europa.eu/atlas/.

There is lack of information about the actual burden of diseases caused by toxic chemicals in Europe; there is no clear understanding of the magnitude of illnesses resulting from environmental exposures to these chemicals, highlighting the need for dedicated research and data collection.

While outdoor air quality is well-documented with detailed maps, there is inadequate understanding of the actual exposure of individuals to pollutants indoors. This is particularly concerning as Europeans spend most of their time indoors, making it crucial to address this gap in knowledge, especially for vulnerable populations. Indoor air quality mimics outdoor air to some extent, and without proper filtering, indoor air quality may not necessarily be better than outdoor air quality. Poor indoor air quality can result from various sources such as electronics, furniture, cleaning supplies, and more, contributing to a mixture of chemicals that can be more hazardous due to indoor concentration. However, there is limited information available on the specific impacts of indoor air quality.

There is also the lack of comprehensive data on the exposure of people to temperatures within their homes, workplaces, and schools. The absence of such data presents a challenge in comprehensively addressing the health impacts of temperature variations.

- Are there gaps in European policy making when it comes to reducing health inequalities? Are there specific challenges in taking action?

European Regulations often do not explicitly consider the effects on vulnerable populations, such as children.

There are no binding targets related to climate change mitigation and adaptation in EU policies, for example a % reduction in heat mortality. While there are binding targets for greenhouse gas emissions, there is a lack of specific and measurable goals for adapting to climate change impacts such as heat. There are well-known, evidence-based interventions proven to work in countries that have implemented heat action plans. These action plans require time, effort, and investment, but there is clear understanding of what needs to be done to address the issue effectively. Binding targets in adaptation efforts will also ensure effective implementation and incentivise action. Regulation concerning indoor air quality in workplaces is also significant, although there is also the absence of similar regulations for other environments. These are crucial in addressing health inequalities.

- How are European cities addressing health risks associated with climate change? Are there any relevant European policies/initiatives/laws implemented in recent years to protect vulnerable groups in cities from the health risks associated with climate change?

Much is being done through networks such as Local Governments for Sustainability (ICLEI)[53], the WHO Healthy Cities Network[54], C40 Cities[55], and the Regions for Health Network (RHN)[56].

A key current effort involves prioritising green spaces in urban planning, not solely for climate reasons but as integral elements in urban portfolios. This approach yields various benefits, including protection from sun-related exposures such as air pollution and heat. However, there is the importance of conscious planning to ensure accessibility and active utilisation of these green spaces by those who need it the most. While outdoor greening addresses heat outdoors, attention to indoor temperatures through housing standards is crucial, especially for those spending significant time indoors. It is also important for cities to combat energy poverty, including during summers, ensuring equitable access

[53] Available at: https://iclei.org/.

[54] Available at: https://www.who.int/europe/groups/who-european-healthy-cities-network.

[55] Available at: https://www.c40.org/.

[56] Available at : https://www.who.int/europe/groups/regions-for-health-network-(rhn).

to cooling, possibly through expanding district cooling systems. Cooling should be treated as essential as medicine for vulnerable populations.

- What evidence is there of the integration of the "One Health" and "Health in All Policies" approaches into EU policymaking/governance? Can you give some examples? In your view, how can the One Health and Health in All Policies approaches be better implemented in European policy making?

There is limited evidence of effective integration of the Health in All Policies into EU policies, and it is more a theoretical concept than a practically applied principle. In contrast, the "One Health" approach is a more useful label, facilitating collaboration across different areas and individuals.

There have been positive developments on One Health, including the establishment of a One Health Directorate and joint mandates to EU agencies for assessments, such as those for fungicides and cross-border health threats. These administrative measures are designed to promote a cross-disciplinary approach and have been successful by encouraging collaboration between the various directorates and disciplines. There are also other collaborative initiatives, such as the EEA's and EFSA's work on the burden of disease associated with lead.

In terms of future outlook: despite challenges, there is optimism about the future impact of One Health especially in research funding initiatives. For example, One Health is actively promoted in the Directorate General for Research and Innovation's (DG RTD) research initiatives and prominently featured in (Horizon Europe) funding calls, signaling increasing commitment. These collaborative efforts would eventually yield tangible outcomes, although there will still be potential challenges when scientific conclusions clash with policy debates.

Interview with Professor Jan Carlos Semenza

Professor Semenza[57] is an environmental epidemiologist and was Head of the Health Determinants Programme at the European Centre for Disease Control (ECDC). He has analysed infectious disease threat events in Europe that were detected through epidemic intelligence activities at ECDC, and these enhanced understanding and public health interventions.

- What are the most pressing risks in Europe that are related to infectious diseases? Are there regions that are more vulnerable to these diseases and who are the people that are most vulnerable?

Some diseases have epidemic potential, and some have a higher burden in terms of mortality and morbidity. For example, campylobacter infections in Scandinavia are associated with water contamination and increase during summer months but it is not directly associated with temperature increases. Ticks cause Lyme disease which is a high-burden disease (60 000 individuals per year) and tick-borne encephalitis which is a severe disease that can result in severe neurological damages in 10 % of patients. These ticks are spreading further North and Lyme disease affects vulnerable and marginalised communities that harvest berries and mushrooms in Scandinavian forests. Tick-borne encephalitis is common in central and northern Europe. The West Nile virus is transmitted by migratory birds who overwinter in Europe from North Africa or the Middle East. Transmission to humans occurs when these mosquitoes feed on infected birds and then on humans. The years 2010 and 2018 saw outbreaks, and these outbreaks happened due to high temperatures during spring. There are increasing cases in Italy, Greece and Southern Europe.

[57] His profile is available at: https://orcid.org/0000-0002-4625-874X.

Some individuals can get severely sick, mainly the elderly (65 years old and above), those who are already sick, and those who are marginalised. The main concern for overall public health is contaminated blood, because 80 % of infected people do not have symptoms but can donate blood. Chikungunya which has a growing epidemic potential is transmitted by the Asian tiger mosquito and there have been outbreaks in Italy and France. Dengue virus risks increases with warm temperatures and cases have been identified in Spain, France and Croatia. This disease is imported from Asia by travellers that have been bitten by mosquitoes.

- What are the main challenges in EU policy making when it comes to addressing disease related threats from climate change? Are there any gaps in knowledge that contribute to these challenges?

These diseases are unpredictable and challenging, therefore there is a need for more sophisticated disease surveillance systems, including the surveillance of disease in animals given changing climatic conditions, and the understanding of human, animal and environmental health relationships.

A lot of infectious diseases are still being studied in Europe, so there is limited knowledge on them. For example, the Congo haemorrhagic fever from ticks is of concern in Albania and Bulgaria but can potentially be spread across Europe. There are a lot of knowledge gaps, but it is also important to engage citizens to help scientists get data, for example, the mosquitoes alert[58] has been successfully used in Barcelona, Spain.

- How can Europe do better in reducing infectious disease risks that are driven by climate change?

Work on public health needs to be interdisciplinary to reflect that health itself is part of and affected by a system. Climate and temperature driven diseases need to be high on the European health agenda.

About 10 years ago, he and other colleagues worked on the projections of disease burden due to climate change[59], where diseases were ranked given the burden on society and recommendations were made on where surveillance needs to be strengthened. This has led to increased and targeted surveillance in Europe on tick-borne encephalitis. This study would benefit from an update, but it demonstrates that surveillance works and produces benefits. Since infectious disease risks are not equal across Europe, regional surveillance is required. For example, dengue is present mostly in southern Europe.

There is also benefit of surveillance of disease in animals. For example, the West Nile virus in Europe was discovered in dead birds which made scientists ask if this also signalled the presence of the virus in human populations. Further investigation showed that the disease was already circulating in humans but most of those who are infected are asymptomatic.

- How could the One Health and Health in All Policies approaches be better implemented in Europe? Are these approaches sufficient in tackling emerging health risks from climate change?

Big and existing data, including those from social media, can be taken advantage of for the benefit of epidemiology. For example, the spread of diseases and hotspots of disease can be identified through data gained from social media. Data from air transportation can also be used as early warning systems, especially for diseases such as dengue which has been imported into Europe through travel. There are also benefits from better collaboration and cooperation between European agencies.

[58] https://www.mosquitoalert.com/

[59] Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3295348/.

Lessons can also be learned from other communities. For example, two communities in Nepal[60] demonstrated how different levels of community-level preparedness and simple warning systems can prevent damages and loss of life from floods. The building of 'social capital' through community engagement, collective decision-making and the implementation of actions related to preparedness are important, and the engagement of disadvantaged communities is necessary.

For Europe [where very high temperatures are becoming more common], heat action plans based on the most vulnerable are needed. The 2003 heatwave resulted in 70 000 deaths, and this led to many European countries putting in place heat action plans which were used in the 2006 heatwave[61]. However, the 2022 heatwave that caused more than 60 000 heat related deaths in Europe shows that existing plans and preparedness actions related to heat are insufficient. This is the same with infectious disease, where preparedness actions (such as vaccinations were already available) need to be applied to those who are vulnerable.

Interview with Professor Andrew Haines

Professor Andrew Haines[62] is a professor and an epidemiologist at the London School for Hygiene and Tropical Medicine. He is a recognised leader in planetary health who has advanced understanding of the impacts of environmental change on health and the actions needed to protect health.

- Which environmental determinants of health have the highest disproportionate impact today (hitting vulnerable communities the most/hardest)? Will it be the same ones in 2030, 2050? How can the EU address these future challenges now?

Air pollution is the environmental determinant with the most impact in terms of deaths and health issues: worldwide, there are an estimated 8 million deaths from air pollution, and about 5 million (in the hundreds of thousands in Europe) of this can be attributed to fossil-fuel emissions[63]. Climate change and its impacts are emerging issues and estimates on health impacts are not yet clear, although there are studies that are already looking at these[64]. There are already estimates on deaths from heat-related events, but these are not always attributable to climate change as other factors (e.g. existing medical conditions of victims) can aggravate the impact. Climate related health risks and issues will further emerge. This includes impacts from forest fires, infectious disease, changes in water quality, noise and other pollution. Not all will cause deaths but they will have an impact on health.

To address the challenges now, phasing out of the use of polluting energy sources (including biomass, wood and fossil fuels) is needed. There are solutions already available (such as wind and solar energy) that can be implemented on a much wider scale, but more ambition is required through net zero policies and pollution and emission controls. Agriculture and the food[65] system is also a large source of carbon emissions (about 25 % of the total) therefore this sector also requires Net Zero policies. Aside from this, there are also health impacts of unhealthy diets.

- Air pollution in Europe has decreased since the early 2000s, but this is still the worst environmental health determinant. In your view, what factors have affected Europe's ability to

60 Available at : https://pubmed.ncbi.nlm.nih.gov/33869383/.

61 An assessment of the extent of these heatwaves are available at: https://link.springer.com/article/10.1007/s00704-007-0370-9.

62 His profile is available at: https://profiles.lshtm.ac.uk/2337-andrew-haines/about.

63 Available at: https://www.bmj.com/content/383/bmj-2023-077784.

64 For example, the *Lancet* Countdown on health and climate change, available at: https://www.thelancet.com/countdown-health-climate.

65 Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7610659/.

further drive down air pollution levels (e.g. pollution limits, increase in pollution from other sources)?

COVID-19, the energy crisis and the war in Ukraine has resulted in several European countries increasing their use of combustion fuels. For example, Germany has resorted to burning coal after reducing its reliance on nuclear energy[66], and this highlights the disconnect between actions at EU Member State level with the European ambition on net zero.

The transport sector, with the use of fossil fuels and the wear and tear of tyres and brakes also contribute to air pollution. There is a need to understand what technology is required for tyres and brakes. Better public transport (including 'active transport' (e.g. cycling, walking)[67]) policies, strategies and actions to decrease the dependence on private transport also need to be implemented at scale and promote accessibility and safety. Active transport will have co-benefits for the planet and human health.

- The European directives related to Ambient Air Quality are tabled for revision to be more in line with (evolving) WHO standards, to include other pollutants previously not covered, and it also includes proposals related to compensation for health damages. In your view, are these proposals sufficient to tackle current and future challenges relating to air quality and health, especially the health of those who are vulnerable? Where are the gaps that still need to be addressed?

There is very good evidence that even low levels of pollution are harmful[68]. The EU has to adopt the new WHO levels, and have the ambition to go below these levels given findings of the harm from low levels of pollution and to protect the health of vulnerable communities.

Air quality improvement policies and actions that have been implemented have often focused on making it more costly to use older thus more polluting vehicles. However, policies and actions have not considered that individuals with lower incomes are the ones who cannot afford the capital expenditure to upgrade their vehicles to less polluting ones. This, unreliable public transport, and mis- and disinformation on the rationale for air quality improvements (i.e. to protect health especially of the most vulnerable) can cause dissatisfaction and push-back against policies to improve air quality. It is important that policies and actions are supported by the right communication strategies, otherwise, public trust and support may be eroded.

- What should European policy and decision makers be mindful of when considering actions related to air pollution and climate change?

Properly designed policies that have multiple benefits covering human health and the environment need to be prioritised. For example, using end-of-pipe solutions such as filters to remove sulphate emissions from powerplants will only address air pollution and not greenhouse gas emissions.

Biomass and wood burning for heating at an industrial and dwelling scale is still an issue in Europe as these still result in poor air quality and GHG emissions even though they are referred to as alternative to fossil fuels.

- What are the main knowledge gaps with regard to the relationship between climate change, environmental determinants and human health? How can the EU do better?

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66 Professor Haines has not pointed to a specific source on this statement, but as the authors' elaboration for this IDA, a news article on this is available at: https://www.reuters.com/business/energy/germanys-gas-crisis-generates-nuclear-dilemma-ruling-greens-2022-07-15/.

67 Available at: https://pubmed.ncbi.nlm.nih.gov/25900805/.

68 Available at : https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7161422/

Generally, there are still a lot of unknowns on the impacts of climate change on health and how we can adapt to the consequences that are already here.

For example, how infectious disease will evolve and new sources of disease (e.g. those currently trapped in the permafrost[69]) with future climate change scenarios; quality of food and nutrition in Europe and the vulnerability of the supply chain from climate change impacts; potential increases in allergies (including asthma)[70]; and the direct effects of heat.

We also need to know more on how to adapt to climate change. For example, through early warning strategies and systems to inform us about heat, floods and diseases, and by making cities more adaptable to heat using trees and vegetation and considering their distribution and access by the most vulnerable. Health infrastructures (e.g. hospitals) and their vulnerability to climate change impacts such as floods also need to be understood.

Mitigation will involve the cutting of GHG emissions and the creation of more sustainable food systems that have lower environmental impacts.

Aside from these, policies and actions that are implemented also need to be accepted by the public in order to succeed, therefore there is some aspect of a social science research agenda to this.

- From your observation, are there conflicts, issues or negative side-effects between EU policies that hinder the achievement of reducing negative impacts on health? Can you give examples?

European agriculture and food policies and systems have not been aligned with sustainability, demonstrated through the historical financial subsidisation of agricultural practices that involve the excessive use of water, fertilisers, pesticides and antibiotics[71]. However, farmers are allies and need to be involved in finding solutions for more sustainable but nutritious food systems.

The response of some European countries to the energy crisis, by burning coal (including lignite), will have long-term consequences.

- How could the One Health and Health in All Policies approaches be better implemented in Europe to address environmental and health quality? Do you think these approaches give enough emphasis on disadvantaged communities?

One Health has focused on diseases (in animals) and this focus is too narrow and not comprehensive. One Health should be a broader approach, for example, framed in terms of planetary health because this is what supports animal and human health[72]. Conceptualising sustainability by including planetary boundaries is better for assessing the human impact on environmental health and vice-versa. The name or term used, One Health or planetary health, is not as important as the application.

[69] Available at: https://www.nature.com/articles/s41558-021-01162-y.

[70] Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9606573/.

[71] Note that the 2023-2027 CAP aims to promote and reward better environmental performance; available at: https://www.europarl.europa.eu/news/en/press-room/20210617IPR06468/eu-farm-policy-reform-parliament-and-council-strike-a-deal.

[72] This is promoted by the Rockefeller Foundation-Lancet Commission on Planetary Health. Available at: https://unfccc.int/climate-action/un-global-climate-action-awards/planetary-health, and https://www.thelancet.com/commissions/planetary-health.

This Study examines the environmental determinants of health and their consequences, on the health of disadvantaged communities. It also assesses the impacts of European Union (EU) policies on the environment insofar as they affect human health, and provides recommendations on how the One Health and the Health in All Policies approaches can be better implemented in EU policymaking.

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