



Climate change and health: embedding ethics into policy and decision making



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Foreword

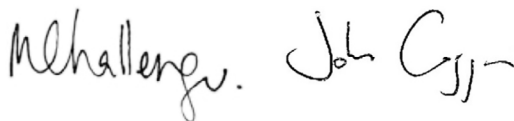
Climate change threatens the health of all species and the future of our planet. It requires urgent action if we are to limit the adverse effects being experienced around the world. This is, or at least should be, widely accepted, particularly amongst governments and policy makers with legal obligations to meet net zero targets and transition to more ‘climate-friendly’ ways of living. This report demonstrates that in developing policies and interventions to meet these goals, it is imperative to consider the intersections between climate and health, and to embed ethics from the outset.

Why is there a need for such a report? The answer lies in the distinct challenges and ethical complexities at play. These range, for example, from the contested moral status of non-human animals through to disagreements over the relative moral importance of more immediate and longer-term challenges to the Earth’s environments and inhabitants. Such moral questions are compounded, furthermore, by the impacts and implications of structural and regulatory realities. For instance, legal personhood is enjoyed by some non-human actors, such as government agencies and commercial organisations, while entities such as future people, animals, and environments, lack comparable legal status. The socio-structural context provided by law is, of course, overlaid by many others. These include economic interests, group identities, and interests that can stand in tension with one another, and all the more so when measured across different points in time. The scale and complexity of the ethical and practical challenges call on us to question basic assumptions, including the very boundaries of the “bio” in bioethics.

We invite readers to approach this report with such questions in mind, particularly on the reach and bearing of obligations and entitlements, and where trade-offs emerge. Disagreement is inevitable, but action is essential. Without shared recognition of what it means to embed ethics in policy and practice concerning climate and health, efforts to build consensus are bound to fail.

The report is perhaps unusual for providing two broad recommendations, rather than a series of more specific ones. That more specific work is to come. What has been generated here, through engagement with experts and published resources, is the preliminary analysis that builds on established work in this area. That analysis, we hope, will ensure that the intersections between climate change and health are recognised and addressed by policy and decision makers, and that the importance and urgency of embedding ethics is brought to the forefront. Additionally, the report provides a foundation for the Council's future work on this topic and, we hope, secures a basis for others who share our views on the necessity of ensuring that ethics is recognised for being key in addressing climate and health challenges.

In our roles co-chairing the Nuffield Council on Bioethics' advisory group on the Environment and Health, it has been our pleasure to oversee the considerable work involved in the production of this report. That work has been led by Maili Raven-Adams and involved the generous advice and input from a great number of parties interested in the importance of identifying and addressing questions concerning the intersections of health, climate change, and ethics.

Handwritten signatures of Melanie Challenger and John Coggon in black ink.

Melanie Challenger and John Coggon
Co-chairs of the advisory group

Executive summary

This report explores the importance of integrating ethics into measures that address anthropogenic climate change. It aims to inform policy development and decision-making in the UK, highlighting the need to address the intersections between climate change and health. It is particularly relevant for those working in government departments and agencies focused on climate change mitigation and adaptation, as well as those in organisations whose remit intersects with climate change, health and the environment. It will also be a useful resource for a wider, interested audience.

The report makes two key recommendations to ensure that climate change measures are fair and effective:

1. Policy and decision makers should recognise, consider and address the intersections between climate change and health when developing and implementing all climate measures.
2. Ethics should be embedded in this process from the outset.

Climate change and health: an urgent challenge

Climate change presents one of the most significant threats to human and non-human health, as well as to ecosystems globally. Despite existing legal and regulatory frameworks aimed at mitigating, adapting and responding to the impacts of climate change, human activities continue to drive adverse consequences.

The health impacts of climate change are severe and wide-ranging in the UK and globally. For example, extreme weather events such as heatwaves and flooding are increasing deaths, injuries and health conditions, which have all been attributed to climate change. In the UK, the 2022 heatwaves (where 40°C was recorded for the first time) led to around 3,000 excess human deaths and heat-related deaths are projected to rise to 10,000 annually without effective climate interventions.¹ Elsewhere for example, flooding led to over 300 deaths in the Horn of Africa in 2023.²

Loss of biodiversity is also associated with climate change and has led to poor health outcomes. Currently, around one million species face extinction globally due to climate change, and the changing climate is increasing the risk of the emergence and spread of infectious diseases.

The causes of climate change, such as the burning of fossil fuels, also contribute to significant health problems. In 2022, almost the entire global population was exposed to air pollution that exceeded the limits set by World Health Organization guidelines,³ and air pollution remains the largest environmental risk to public health in the UK, leading to an estimated 28,000 to 36,000 human deaths annually.⁴

Without immediate, concerted action to tackle climate change, including through measures that mitigate and adapt to climate change, these health risks will continue to grow in both scope and severity. This has significant socioeconomic costs, and populations that have contributed least to climate change often face the worst outcomes.

To safeguard health today and into the future, this report calls upon policy and decision makers to recognise and respond to the intersections between climate change and health. The health of humans, non-human animals and the environments we inhabit are interdependent and cannot be considered in isolation from one another. Considering health as an objective of all climate measures has the potential to help us to better address, limit and avoid the adverse health impacts of climate change, while unlocking wider ecological and socioeconomic benefits.

1 Environmental Audit Committee. (2024) *Heat resilience and sustainable cooling UK*, available at: <https://publications.parliament.uk/pa/cm5804/cmselect/cmenvaud/279/summary.html>.

2 Kimutai J, Barnes C, Zachariah M, et al. (2023) Compounding natural hazards and high vulnerability led to severe impacts from Horn of Africa flooding exacerbated by climate change and Indian Ocean Dipole *World Weather Attribution*, available at: <https://spiral.imperial.ac.uk/handle/10044/1108015>.

3 World Health Organization (2022) *Billions of people still breathe unhealthy air: new WHO data*, available at: <https://www.who.int/news/item/04-04-2022-billions-of-people-still-breathe-unhealthy-air-new-who-data>.

4 Public Health England (2018) *Health matters: air pollution*, available at: www.gov.uk/government/publications/health-matters-air-pollution/health-matters-air-pollution.

Ethical challenges to overcome

While the case for addressing climate change and health is clear, there are complex, challenging issues that policy and decision makers must overcome. Difficult choices and trade-offs need to be made by multiple stakeholders, with often competing interests and priorities. These challenges exist for the UK in both its domestic and international policy.

Fundamental ethical questions are raised, such as:

- How should limited resources for adaptation and mitigation measures be allocated to protect those most at risk from the impacts of climate change and to ensure that health inequities are not exacerbated, in the UK and globally?
- How can we ensure that climate measures that have positive outcomes for the UK do not result in negative outcomes elsewhere?
- What duty do high-income countries, which have historically contributed the most to climate change, have to support adaptation and mitigation efforts in low-income countries disproportionately impacted by climate change?

Practical ethical questions also exist within individual sectors, such as:

- In light of financial limitations and resource constraints, how should the NHS balance the need to prioritise available resources for clinical care for patients today with the necessity of transitioning to net zero to reduce harms to public health in the long term?
- How can policy and decision makers balance the interests of humans, livestock and wildlife as agricultural systems transition to net zero, and how should they proceed where there may be conflicts?
- If solutions already exist, in what circumstances is it appropriate to pursue technologies such as geoengineering where there is a lack of certainty about the effectiveness and long-term consequences?

There is growing recognition of the importance of embedding ethics to address these complex challenges. For example, the Intergovernmental Panel on Climate Change (IPCC) states that: "Adaptation and mitigation actions that prioritise equity, social justice, climate justice, rights-based approaches and inclusivity, lead to more sustainable outcomes, reduce trade-offs, support transformative change and advance climate resilient development."⁵

Despite this recognition, ethics is often not systematically integrated into policy and decision-making processes. Therefore, this report calls for ethics to be embedded from the outset. This will provide an analytical foundation to identify, navigate, evaluate and seek to address practically the complex, challenging issues inherent in

⁵ Intergovernmental Panel on Climate Change (2023) Climate change 2023 synthesis report: summary for policymakers, available at: www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_SPM.pdf.

climate and health measures, to ensure that they are fair and effective.

What does the report cover?

This report is divided into four main sections:

- 1 Why is bioethics relevant to climate change and health?
- 2 How does climate change pose a threat to health (for human and non-human animals)?
- 3 What challenges need to be overcome when developing and implementing climate change measures?
- 4 How can ethical analysis support policy development and decision making in the UK?

In the final section we highlight ethical considerations that arise in three distinct case studies relevant to current climate change and health priorities: human health and care; agriculture; and geoengineering. These case studies offer an overview of key ethical issues within each of these areas and illustrate why ethical analysis should be an integral part of policy design and implementation.

We will build on the findings of this report in future work, and we hope that it provides a starting point for others to embed ethical analysis into climate change measures, unlocking greater benefits for humans, non-human species and the environment.

Introduction

Climate change is a significant threat to the health of humans, non-human animals and supporting ecosystems around the world. A wide range of poor health outcomes are caused or exacerbated by the adverse effects of climate change, including increasing temperatures, extreme weather events, rising sea levels and ocean acidification. These adverse effects, widely evidenced and experienced in the UK and globally, will grow in number and severity without effective and urgent action.

The pressing need to mitigate and adapt to climate change has led to the development of numerous important legal and regulatory obligations. The United Nations Framework Convention on Climate Change (UNFCCC) 1992 was the first multilateral agreement on climate change and has underpinned subsequent global commitments, including the Paris Agreement 2015.⁶ Countries that have ratified this binding international legal agreement commit to efforts to ensure that global average temperatures remain well below 2°C above pre-industrial levels, and to pursue efforts to limit the increase to below 1.5°C.⁷ Meeting this commitment requires changes across the human activities that have predominantly caused climate change, particularly those that have resulted in harmful greenhouse gas (GHG) emissions, such as of carbon dioxide, methane and nitrous oxide.⁸

6 United Nations Framework Convention on Climate Change 1992, available at: <https://unfccc.int/resource/docs/convkp/conveng.pdf>; and Paris Agreement 2015, available at: https://unfccc.int/files/essential_background/convention/application/pdf/english_paris_agreement.pdf.

7 Paris Agreement 2015, Article 2, available at: https://unfccc.int/files/essential_background/convention/application/pdf/english_paris_agreement.pdf.

8 Intergovernmental Panel on *Climate Change (2023) Climate change 2023 synthesis report: summary for policymakers*, available at: www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_SPM.pdf.

Despite these commitments, the world is warming at a faster rate than at any point in recorded history.⁹ The year 2023 saw the highest global temperatures in over 100,000 years, and in the period between February 2023 and January 2024, the average global temperature exceeded pre-industrial levels by 1.5°C.¹⁰ As a result, the world is currently on track to reach almost 3°C above pre-industrial levels by the end of the century.¹¹

The UK has made notable progress in reducing its emissions. It became one of the first countries in the world to enshrine a target in law for 'net zero' – where GHG emissions are balanced by their removal – through the Climate Change Act 2008.¹² The Act commits the UK to reaching this target by 2050 through a series of carbon budgets, set on a five-year basis. So far, all three carbon budgets have been maintained, resulting in emissions dropping to less than half of those in 1990.¹³ However, the UK Climate Change Committee (CCC) – a statutory body appointed to provide independent advice to the UK and devolved governments on their climate goals – has highlighted that the UK is not on track to reach its 2030 target of reducing emissions by 68% compared with 1990 levels.¹⁴ UK trade is also responsible for additional GHG emissions abroad through the consumption of imported goods, and these emissions are declining at an even slower rate.¹⁵ This reinforces the need to maintain, and where necessary regain, momentum in reducing emissions. The CCC has further indicated that strong consistent domestic policy and communications on climate change that avoid mixed messaging are crucial to robustly advocating for high climate ambitions internationally.¹⁶

Interventions that both mitigate and adapt to the adverse effects of climate change are required. While mitigation measures reduce and limit GHG emissions, adaptation measures adjust natural and human systems to the current or expected effects of climate change to moderate harm or promote beneficial outcomes.¹⁷ Both should be aimed at ensuring that the adverse health effects of climate change are addressed, limited or, where possible, avoided altogether. There are also ongoing international negotiations focused on 'loss and damage' measures, aimed at addressing the

9 World Meteorological Organisation (2023) *2023 State of climate services: health*, available at: <https://library.wmo.int/records/item/68500-2023-state-of-climate-services-health>.

10 European Environment Agency (2024) *European climate risk assessment*, available at: www.eea.europa.eu/publications/european-climate-risk-assessment.

11 Romanello M, Napoli C, Green C *et al.* (2023) The 2023 report of the *Lancet* Countdown on health and climate change: the imperative for a health centred response in a world facing irreversible harms *The Lancet* **402(10419)**: P2346–94, available at: [https://doi.org/10.1016/S0140-6736\(23\)01859-7](https://doi.org/10.1016/S0140-6736(23)01859-7).

12 Climate Change Act 2008, available at: <https://www.legislation.gov.uk/ukpga/2008/27/contents>.

13 Climate Change Committee (2024) *2024 progress report to parliament*, available at: www.theccc.org.uk/publication/progress-in-reducing-emissions-2024-report-to-parliament.

14 Climate Change Committee (2024) *2024 progress report to parliament*, available at: www.theccc.org.uk/publication/progress-in-reducing-emissions-2024-report-to-parliament.

15 Office for National Statistics (2024) *Greenhouse gas emissions and trade, UK: 2024*, available at: www.ons.gov.uk/economy/environmentalaccounts/articles/greenhousegasemissionsandtradeuk/2024.

16 Climate Change Committee (2024) *COP28: key outcomes and next steps for the UK*, available at: www.theccc.org.uk/publication/cop28-key-outcomes-and-next-steps-for-the-uk.

17 Intergovernmental Panel on Climate Change (2023) *Climate change 2023 synthesis report: annexes*, available at: www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_AnnexesIndex.pdf.

economic and non-economic loss and damage associated with the current or expected impacts of climate change.¹⁸

While there are indisputable health benefits to tackling climate change, the best ways to achieve them can be contested. Without careful consideration, interventions may have unintended consequences. Decision making can require difficult choices and trade-offs between competing interests or priorities.¹⁹ This leads to numerous ethical issues that must be considered by policy and decision makers.

This report sets out why policy and decision makers in the UK need to recognise, consider and address issues at the intersection of climate change and health. In responding to climate change, we argue, it is imperative to embed ethical analysis in policy and decision making from the outset. This will help to ensure that interventions are fair and effective, while unlocking wider ecological and socioeconomic benefits. We end the report with three case studies focusing on human health and care, agriculture, and geoengineering. These illustrate why ethical analysis should be an integral part of the design, development and implementation of mitigation and adaptation measures in different contexts.

The report was informed by desk-based research, expert interviews and two workshops held with a range of experts in animal welfare, communication, climate and environmental sciences, economics, ethics, health and care, global health, law, politics, public health, policy, public engagement, research funding, and veterinary health. It builds on our 2023 report **Health, climate change and ethics: an overview** and is accompanied by two literature reviews, published in August 2024, that respectively provide an overview of relevant **ethical approaches for policy and practice addressing climate change and health** and the **legal and regulatory instruments relevant to climate change and health in the UK**.

18 Intergovernmental Panel on Climate Change (2023) *Climate change 2023 synthesis report: annexes*, available at: www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_AnnexesIndex.pdf.

19 We recognise that there are different understandings of the term 'trade-offs' and ongoing debate about whether and how it should be used in relation to climate change. Throughout this report we use the term simply to illustrate that there may be conflicting interests. In these cases, decisions may have to be made that favour some interests over others. Further actions may be needed to avoid any adverse consequences of this, or justification may be required for the decision.

I. Why is bioethics relevant to climate change and health?

Key messages

- Ethics can provide conceptual language and analytical frameworks to identify, navigate, evaluate and seek to practically address complex, challenging issues.
- Many well-established ethical issues are raised by climate change and health, including the need to balance the benefits and harms of different interests and addressing health inequities and inequalities. Numerous ethical principles are also engaged, including justice, solidarity, responsibility and rights.
- Embedding ethics into policy development and decision-making can help to navigate potential tensions and ensure that unintended consequences of potential climate change interventions are identified, considered and addressed, leading to fairer and more effective measures.
- Prominent international organisations emphasise the importance of incorporating ethics in policy development, but there is a lack of comprehensive and coordinated ethics underpinning policy development and decision making.

Bioethics – an area within the broader field of applied ethics – has traditionally focused on questions concerning human health. However, there is growing recognition that drawing on bioethics can help to address other challenging issues, including climate change.²⁰ This recognition often focuses on the interconnectedness of human health with that of non-human animal health, alongside a mutual dependence on a shared ecosystem. Relevant issues have been explored in environmental ethics (which concerns the moral status of the

20 Dwyer J (2009) How to connect bioethics and environmental ethics: health, sustainability and justice *Bioethics* **23**(9): 497–502; Resnik D (2009) Human health and the environment: in harmony or in conflict? *Health Care Analysis* **17**(3): 261–76; Lee L (2017) A bridge back to the future: public health ethics, bioethics and environmental ethics *American Journal of Bioethics* **17**(9): 5–12; Richie C (2020) Guest editorial. Sustainability and bioethics: where have we been, where we are, where are we going? *The New Bioethics* **26**(2): 82–90; Macpherson CC (2022) Can bioethics do for our planet what it's done for autonomy? *Perspectives in Biology and Medicine* **65**(4): 548–58; and Macedo J (2023) Climate change: a bioethical emergency and health priority *Ethics, Medicine and Public Health* **27**: 100872.

environment)²¹ and animal ethics (which concerns the moral status of non-human animals),²² among other areas. However, there is growing consensus that considering these areas in isolation is not beneficial when responding to climate change.

Ethics can provide conceptual language and analytical frameworks that policy and decision makers can use to identify, navigate, evaluate and seek to practically address complex, challenging issues, including climate change and health. Embedding ethics in policy development and decision-making can ensure that potential tensions and unintended consequences are identified, considered and addressed, especially when the relative benefits of potential solutions are contested. The importance of embedding ethics has been emphasised by international organisations addressing climate change and health. The World Health Organization (WHO) 'Ethics in health and climate change' programme acknowledges that ethical awareness will be required to identify value conflicts, unintended consequences and competing interests.²³ Similarly, the IPCC states that:

"Adaptation and mitigation actions that prioritise equity, social justice, climate justice, rights-based approaches and inclusivity, lead to more sustainable outcomes, reduce trade-offs, support transformative change and advance climate resilient development."²⁴

However, research has shown that there is currently a lack of comprehensive and coordinated ethics underpinning decision-making and policy responses to climate change and health.²⁵ Throughout our stakeholder engagement, we heard that this could be because the focus is often placed on responding to scientific information, meeting legal obligations and making cost-benefit trade-offs. Although such focus is vital, ethical analysis should sit alongside these considerations as a way to evaluate the rationales for, and outcomes and consequences of, existing and potential climate measures.

Recognising and responding to the health impacts of climate change (which we will explore in the next section) engages many well-established ethical issues, including:

- **Balancing benefits and harms:** Anyone responsible for developing and implementing climate change measures needs to consider the health impacts on a range of different interests, including human and non-human; national and international; individual and collective; and current as well as future generations. Sometimes these interests may conflict with each other

21 Stanford Encyclopedia of Philosophy (2021) *Environmental ethics*, available at: <https://plato.stanford.edu/entries/ethics-environmental>.

22 Stanford Encyclopedia of Philosophy (2024) *The moral status of animals*, available at: <https://plato.stanford.edu/entries/moral-animal>.

23 World Health Organization, *Ethics in Health and Climate Change*, available at: www.who.int/teams/health-ethics-governance/health-and-climate-change.

24 Intergovernmental Panel on *Climate Change* (2023) *Climate change 2023 synthesis report: summary for policymakers*, available at: www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_SPM.pdf.

25 Sheather J, Littler K, Singh JA and Wright K (2023) Ethics, climate change and health: a landscape review *Wellcome Open Research* 8: 343.

or with non-health outcomes, including economic and commercial interests. In these cases there may be uncertainty about how to proceed, and it may not be possible to avoid some harms. For example, a measure that aims to advance human health may not be experienced equitably by all people within the UK or internationally, or human health benefits may result in adverse health outcomes for non-human animals. Here, certain moral trade-offs may emerge and the benefits and harms of potential decisions must be balanced.

- **Considering the interests of non-human animals:** Balancing benefits and harms requires consideration of many different perspectives, some of which cannot be self-represented. For example, the interests of non-human animals need to be considered in policy and decision making on climate change, based on both their intrinsic and their instrumental moral value.²⁶ Views differ on the extent to which these interests should be prioritised and how they should be weighed against the interests of humans.
- **Considering the interests of future generations:** Similarly, climate change can raise ethical questions regarding intergenerational responsibility. What do present generations owe to future generations, what moral value can we ascribe to entities that do not yet exist, and how should their interests be weighed against those of the current generation?²⁷
- **Exacerbating or creating inequity:** Both climate change and the measures that seek to address it can exacerbate existing inequalities or create new ones, in the UK and globally. There is considerable disparity between the individuals and countries that have historically contributed the most to climate change and those that are most at risk of its adverse health outcomes. This in turn is often linked to, and compounded by, historical injustices such as colonialism (discussed further in Section 3).

These issues can engage established ethical principles, including:

- **Justice:** This most commonly includes questions related to:
 - addressing the just division and distribution of the benefits and burdens of climate change and climate measures, and identifying responsibilities to address that distribution – i.e. distributive justice;²⁸
 - the fairness of the decision-making process, including complex and politically fraught questions of governance of the global commons, how responsibilities can be enforced, and inclusion – i.e. procedural justice;²⁹ and

²⁶ 'Intrinsic value' refers to non-human animals being granted some form of moral standing independent of their relation to humans. 'Instrumental value' refers to their being granted some form of moral standing based on the extent to which they might prove useful to human beings.

²⁷ Nuffield Council on Bioethics (2023) *Health, climate change and ethics: an overview*, available at: www.nuffieldbioethics.org/publication/health-climate-change-and-ethics-an-overview.

²⁸ Nuffield Council on Bioethics (2023) *Health, climate change and ethics: an overview*, available at: www.nuffieldbioethics.org/publication/health-climate-change-and-ethics-an-overview.

²⁹ Nuffield Council on Bioethics (2023) *Health, climate change and ethics: an overview*, available at: www.nuffieldbioethics.org/publication/health-climate-change-and-ethics-an-overview.

- distinct interpretations of justice, including 'global justice'³⁰ and 'intergenerational justice'³¹ which are often invoked in relation to climate change issues.
- **Solidarity:** This involves shared practices and a collective commitment to carry 'costs' (financial, social, emotional or otherwise) to assist others.³² This may extend to solidarity with (aspects of) the non-human world.
- **Responsibility:** How is responsibility for actions identified and addressed? This includes responsibility and possible reparation for historical contributions to climate change. It encompasses individuals, corporations, governments and other institutions, and questions of where responsibilities lie in relation to non-human animals, the environment and future generations.
- **Rights:** This concerns respecting and upholding the dignity and wellbeing of individuals and communities (human rights).³³ Rights are often conceptions of what is owed to and by individuals, organisations, states, public bodies and agencies. The 'right to health' and the 'right to a healthy environment' are often raised in discourse at the intersection of climate change and health. Some rights-based approaches extend to non-human animals (animal rights) and the environment. The human rights of future generations are also garnering increased attention.

30 Stanford Encyclopedia of Philosophy (2023) *Global justice*, available at: <https://plato.stanford.edu/entries/justice-global>.

31 Stanford Encyclopedia of Philosophy (2021) *Intergenerational justice*, available at: <https://plato.stanford.edu/entries/justice-intergenerational>.

32 Nuffield Council on Bioethics (2023) *Health, climate change and ethics: an overview*, available at: www.nuffieldbioethics.org/publication/health-climate-change-and-ethics-an-overview.

33 Timmerman C, Wabnitz Katharina and Wild V (2024) *Ethical approaches at the intersection of climate change, the environment and health* (London: Nuffield Council on Bioethics), available at: <https://cdn.nuffieldbioethics.org/wp-content/uploads/ETHICA1.pdf>.

2. How does climate change pose a threat to health?

Key messages

- Climate change and its causes already result in significant adverse consequences for human health, non-human animal health and ecosystems. These will continue to be experienced, and without urgent and effective action they will increase in severity.
- The health impacts for humans and non-human animals are inescapably intertwined and cannot be considered in isolation from each other or the environments they inhabit.
- The extent to which adverse health outcomes are experienced depends on exposure to climate change effects and vulnerabilities, which in turn are influenced by social, economic, geographical and individual differences.
- Policy and decision makers must consider issues at the intersection of climate change and health to ensure that the adverse health effects of climate change are addressed, limited or, where possible, avoided altogether.
- Climate measures themselves need to be designed to deliver health benefits and ensure that poor health outcomes are not created or exacerbated, alongside achieving the overall aims of mitigation and adaptation.

Clear and compelling evidence shows that climate change and its causes (e.g. burning fossil fuels) already have significant adverse consequences for human health, non-human animal health, and the ecosystems that underpin the health of all species. Without adaptation and mitigation, these impacts will continue to be experienced and will increase in severity in future years. Even in optimistic, low-warming scenarios that have been explored, we are likely to experience peak temperatures mid-century, meaning that those living in the 2050s–2080s will be affected by some of the most adverse consequences.³⁴

A growing number of individuals and organisations use health as a driver to advocate for climate change action internationally. This has led to notable international policy

³⁴ UK Health Security Agency (2023) *Health effects of climate change in the UK: state of the evidence 2023*, accessible at: www.gov.uk/government/publications/climate-change-health-effects-in-the-uk.

commitments. Since winter 2023, 151 countries – including the UK – have endorsed the Conference of Parties (COP)³⁵ 28 Declaration on Climate and Health.³⁶ The Declaration covers a range of areas, including the need to build more resilient health systems, strengthen collaboration to reduce emissions, and maximise the health benefits of climate action.³⁷ The value of prioritising health in policymaking is also recognised by the WHO, which promotes a ‘health in all policies’ approach highlighting that policies in every sector can affect health and inequities in health.³⁸

Recognising and responding to the health impacts associated with climate change can help to ensure the long-term key drivers of ill health are also addressed, rather than only treating the immediate ill health effects of climate change. To achieve this, climate measures need to be designed to deliver health benefits and ensure that poor health outcomes are not created or exacerbated, alongside achieving the overall aims of mitigation and adaptation. There are numerous examples of such co-benefits for health and climate change. For example, mitigation measures which reduce air pollution can both limit GHG emissions and benefit human health.³⁹ Agricultural systems which adapt to climate change can promote the health of livestock animals and sustain environments even when the adverse impacts of climate change are being experienced. Our research also suggests that focusing on health within loss and damage measures (measures aimed at addressing economic and non-economic loss and damage associated with climate change) may ensure that countries experiencing the worst health outcomes receive adequate support. This can enable them to adapt to and repair damage from the adverse health outcomes of climate change.

Below, we consider both human and non-human health in demonstrating the importance of responding to the health outcomes associated with climate change. Human health is intrinsically linked with the health of non-human animals, and non-human animals are reliant on human action to mitigate and adapt to climate change to protect their health.⁴⁰ One therefore cannot be considered in isolation from the other. Moreover, we recognise that the health of humans and non-human animals cannot be considered in isolation from the environment itself: functioning ecosystems are required for health to be promoted, and these are directly affected by the changing climate.

35 The COP is the primary decision-making body of the UN Framework Convention on Climate Change where signatories review progress and seek to agree on future emissions standards, individual climate policies and the further interpretation of the convention.

36 World Health Organization (2023) *COP28 UAE Declaration on Climate and Health*, available at: <https://www.who.int/publications/m/item/cop28-uae-declaration-on-climate-and-health>.

37 World Health Organization (2023) *COP28 UAE Declaration on Climate and Health*, available at: <https://www.who.int/publications/m/item/cop28-uae-declaration-on-climate-and-health>.

38 World Health Organization, *Promoting health in all policies and intersectoral action capacities*, available at: www.who.int/activities/promoting-health-in-all-policies-and-intersectoral-action-capacities.

39 Whitmee S, Green R, Belesova K, *et al.* (2024) Pathways to a healthy net-zero future: report of the Lancet Pathfinder Commission *The Lancet Commissions* **403(10421)**: 67–110.

40 We acknowledge that by grouping ‘human health’ and ‘non-human health’ for the purpose of summarising information coherently in this report, we risk simplifying and generalising the experiences and interests of peoples and non-human animal species. Different humans and non-human animals are affected by climate change and its causes in diverse ways, and different mitigation and adaptation measures may be required depending on context. Additionally, the relationship between humans, non-human animals and the ecosystems they operate within are complex and are not unpicked in detail in this report.

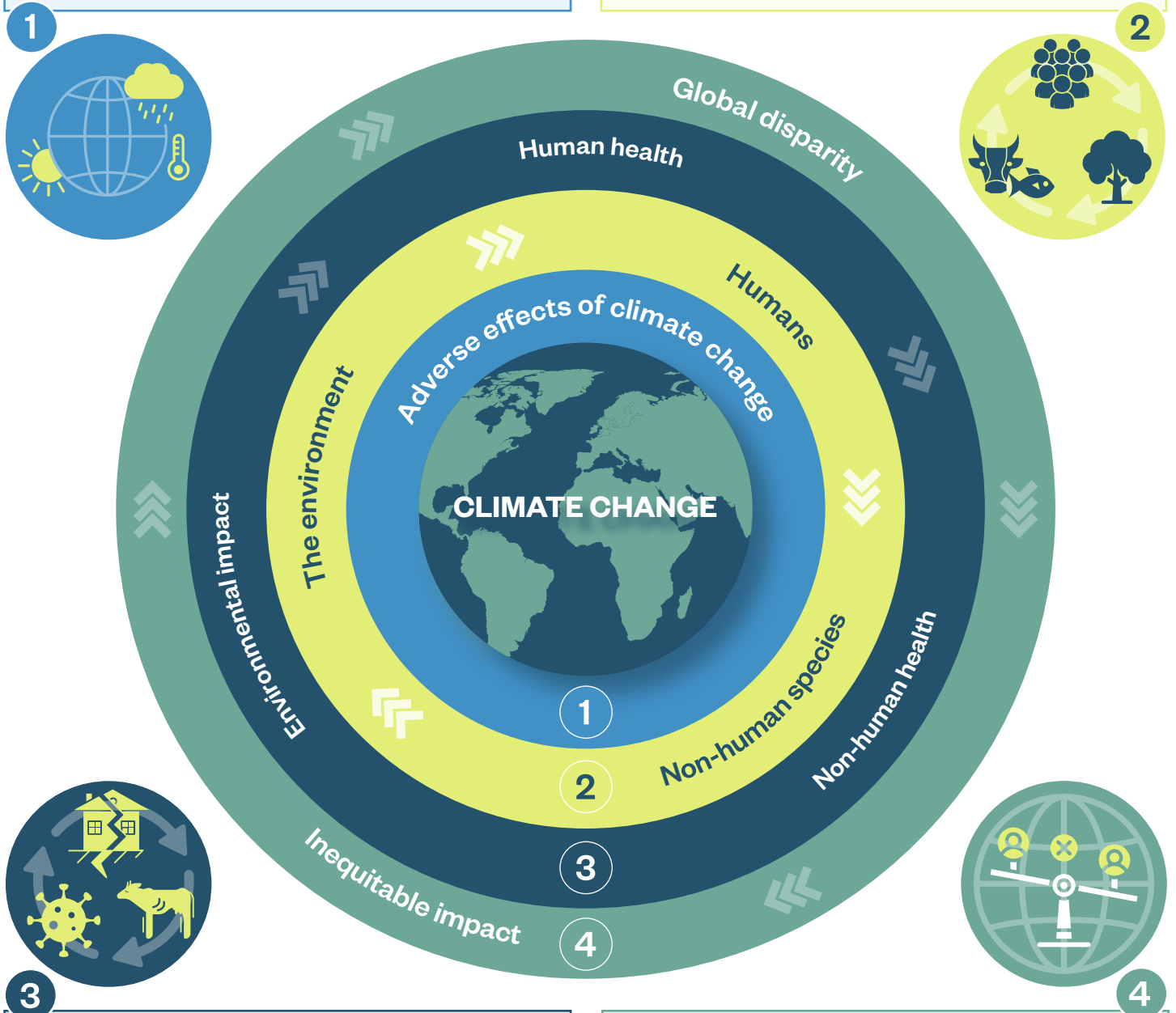
The health impacts of climate change

Adverse effects:

- Human activities (e.g. burning fossil fuels, deforestation and livestock farming) are a predominant driver of climate change.
- Adverse effects associated with climate change include increasing temperatures, extreme weather events, rising sea levels and ocean acidification
- Without urgent action these will continue and increase in severity.

Humans, non-human animals and the environment:

- Climate change and its causes can lead to adverse health outcomes for humans, non-human animals, and the ecosystems that underpin the health of all species.
- These impacts cannot be considered in isolation from each other as they are inescapably intertwined.
- Additionally, non-human animals are reliant on human action to mitigate and adapt to climate change.



Health impacts:

- Human physical and mental health is affected directly and indirectly by climate change, leading to death, injury, health conditions and disease.
- Some individual non-human animals are at risk of injury or death and some species are at risk of extinction.
- Climate change also threatens essential infrastructures and the ecosystems that all species rely on through the destruction and loss of habitats and biodiversity.

Inequity and global disparity:

- An imbalance often exists between those that have contributed the most to climate change and those which experience the worst health outcomes.
- Adverse health outcomes are influenced by exposure and vulnerabilities affected by social, economic, geographical and individual differences.
- These factors must be addressed and not exacerbated in climate policy and decision making.

Human health

The Lancet Countdown has described climate change as the greatest threat to human health.⁴¹ In this sub-section we highlight the numerous and significant ways that both physical and mental health are negatively affected, directly and indirectly, by climate change and its causes. The extent to which these impacts are experienced, however, will depend on exposure and vulnerabilities, which are influenced by social, economic, geographical and individual differences.⁴²

Below we list some of the main direct impacts of climate change on human health.

- **Extreme heat can worsen physical and mental health conditions.** Although rising temperatures may reduce the risk of cold-related illness and death in some countries,⁴³ aspects of physical health such as cardiovascular and respiratory conditions, allergies, neo-natal health, and non-communicable diseases such as diabetes have all been linked to hotter weather.⁴⁴ Mental health conditions such as anxiety, post-traumatic stress disorder and suicidality have also been linked extreme heat.⁴⁵ Neurological diseases and their treatments can affect the body's ability to thermoregulate, which may also be exacerbated by rising temperatures.⁴⁶
- **Adverse climate events can result in direct injury, increased physical and mental health conditions, and death.** For example, flooding can lead to drowning, physical trauma from displaced objects, electrocution and gut infections.⁴⁷ Wildfires can result in burns, injuries and smoke inhalation.⁴⁸ There is also evidence that survivors of natural disasters are at increased risk of suicidal thoughts and acts.⁴⁹

41 Romanello M, Napoli C, Green C *et al.* (2023) The 2023 report of the *Lancet* Countdown on health and climate change: the imperative for a health centred response in a world facing irreversible harms *The Lancet* **402(10419)**: P2346–94, available at: [https://doi.org/10.1016/S0140-6736\(23\)01859-7](https://doi.org/10.1016/S0140-6736(23)01859-7).

42 Intergovernmental Panel on *Climate Change* (2022) *Climate change 2022: impacts, adaptation and vulnerability*, Chapter 7, available at: www.ipcc.ch/report/ar6/wg2/downloads/report/IPCC_AR6_WGII_FullReport.pdf.

43 Our World in Data (2024) *How many people die from extreme temperatures, and how this could change in the future*, available at: <https://ourworldindata.org/part-two-how-many-people-die-from-extreme-temperatures-and-how-could-this-change-in-the-future>.

44 Ebi KL, Capon A, Berry P, *et al.* (2021) Hot weather and heat extremes: health risks *Lancet* **398**: 698–708, available at: [www.thelancet.com/pdfs/journals/lancet/PIIS0140-6736\(21\)01208-3.pdf](http://www.thelancet.com/pdfs/journals/lancet/PIIS0140-6736(21)01208-3.pdf); and Wellcome (2023) The health effects of climate change, explained, available at: <https://wellcome.org/news/how-climate-change-affects-health-explained>.

45 Wilson N and Rae K (2022) *Climate change and mental health: report from a COP-26 public participation event* (Glasgow: Mental Health Foundation Scotland), available at: www.mentalhealth.org.uk/sites/default/files/2022-07/MHF-Scotland-Climate-Change-COP26-report_0.pdf.

46 Sisodiya SM, Gulcebi MI, Fortunato F, *et al.* (2024) Climate change disorders of the nervous system *The Lancet Neurology* **23(6)**: P636–48.

47 UK Health and Security Agency (2023) *Come rain or shine, adverse weather matters for our health*, available at: <https://ukhsa.blog.gov.uk/2023/06/01/come-rain-or-shine-adverse-weather-matters-for-our-health>.

48 World Health Organization, *Wildfires: impact*, available at: www.who.int/health-topics/wildfires#tab=tab_2.

49 Fitzpatrick KM and Spialek ML (2020) Suicide ideation and a post-disaster assessment of risk and protective factors among Hurricane Harvey survivors *Journal of Affective Disorders* **277**: 681–7, available at: <https://doi.org/10.1016/j.jad.2020.08.072>; and Safarpour H., Sohrabzadeh S, Malekyan L, *et al.* (2020) Suicide death rate after disasters: a meta-analysis study *Archives of Suicide Research* **26(1)**: 14–27, available at: <https://doi.org/10.1080/1381118.2020.1793045>.

- **Changing climates can create the conditions for the emergence and spread of infectious disease.**⁵⁰ This includes waterborne, food-borne and vector-borne diseases, such as malaria, dengue, West Nile virus, cholera and Zika. Changes in climatic conditions can also lead to the development and emergence of new infectious diseases, sometimes in previously unaffected locations.⁵¹ According to some estimations, the chance of another global pandemic (referred to as 'Disease X' by the WHO) in the next decade is more than one in four,⁵² and environmental change contributes to increasing this risk.⁵³

Some of the indirect impacts of climate change on health are outlined below.

- **A lack of nutritious food can result in food insecurity and malnutrition.**⁵⁴ For example, heatwaves and droughts can impact crop productivity and healthy livestock; increased sea temperatures and ocean acidification may reduce the availability of marine life that can safely be used as human food;⁵⁵ and extreme heat may reduce agricultural food production in circumstances where labouring conditions are unsafe and unworkable.⁵⁶
- **Water insecurity from a lack of available and clean water can lead to reduced food production, poor sanitation and dehydration.**⁵⁷ This could be caused by a variety of climate events, such as droughts. Activities that contribute to climate change, such as agriculture, mining and oil extraction, can also contaminate water sources.⁵⁸
- **Poverty, homelessness and loss of livelihoods can exacerbate wider social determinants of ill health.** Climate change can result in the loss of employment and livelihood, increased food and energy prices, destroyed homes, reduced mobility, and increased anxiety and poverty among those

50 Intergovernmental Panel on *Climate Change (2022) Climate change 2022: impacts, adaptation and vulnerability*, Chapter 7, available at: www.ipcc.ch/report/ar6/wg2/downloads/report/IPCC_AR6_WGII_FullReport.pdf.

51 Intergovernmental Panel on *Climate Change (2023) Climate change 2023 synthesis report: summary for policymakers*, available at: www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_SPM.pdf; and Romanello M, Walawender M, Hsu SC, et al. (2024) The 2024 report of the *Lancet* Countdown on health and climate change: facing record breaking threats from delayed action **The Lancet** **404(10465)**: P1847–96, available at: [www.thelancet.com/journals/lancet/article/PIIS0140-6736\(24\)01822-1/abstract](http://www.thelancet.com/journals/lancet/article/PIIS0140-6736(24)01822-1/abstract).

52 World Health Organization, *WHO R&D blueprint for epidemics*, available at: www.who.int/teams/blueprint/who-r-and-d-blueprint-for-epidemics.

53 Kelland K (2023) *How climate change increases pandemic risk*, Coalition for Epidemic Preparedness Innovations, 29 November, available at: <https://cepi.net/how-climate-change-increases-pandemic-risk-0>; and World Health Organization, *WHO R&D blueprint for epidemics*, available at: www.who.int/teams/blueprint/who-r-and-d-blueprint-for-epidemics.

54 Intergovernmental Panel on Climate Change (2022) *Climate Change 2022: impacts, adaptation and vulnerability*, Chapter 7, available at: www.ipcc.ch/report/ar6/wg2/downloads/report/IPCC_AR6_WGII_FullReport.pdf.

55 Falkenberg LJ, Bellerby R, Connell SD, et al. (2020) Ocean acidification and human health *International Journal of Environmental Research and Public Health* **17(12)**: 4563, available at: <https://doi.org/10.3390/ijerph17124563>.

56 Romanello M, Di Napoli C, Drummond P, et al. (2022) The 2022 report of the *Lancet* Countdown on health and climate change: health at the mercy of fossil fuels **The Lancet** **400(10363)**: 1619–54, available at: [www.thelancet.com/article/S0140-6736\(22\)01540-9/fulltext](http://www.thelancet.com/article/S0140-6736(22)01540-9/fulltext).

57 World Meteorological Organization (2021) *2021 state of climate services: water*, available at: <https://wmo.int/publication-series/2021-state-of-climate-services-water>.

58 Wentworth J and Ward J (2021) *Water supply resilience and climate change* (London: UK Parliament), available at: <https://post.parliament.uk/research-briefings/post-pb-0040>.

already socially disadvantaged and marginalised.⁵⁹ In 2023, a record 512 billion potential labour hours were lost globally due to climate change, worth 835 billion US dollars in potential income.⁶⁰

- **Displacement and migration can result in an increase in physical and mental health conditions.**⁶¹ Climate change may mean that many people are displaced from their homes due to unsafe or unliveable conditions. This may lead to as many as 1.2 billion climate refugees by 2050.⁶² Displacement may result in loss of livelihoods, impede access to essential health services, reduce access to nutritious food and negatively affect psychosocial wellbeing.⁶³ There are also physical and mental health effects associated with the violent conflict and forced migration that may be caused or influenced by climate change.⁶⁴
- **There may be a decline in physical activity due to unsafe conditions.** For example, high temperatures and humidity reduce the number of available hours for safe physical activity, reducing the frequency, duration and intensity of physical exercise, with implications for physical and mental health.⁶⁵
- **Limited access to urban green spaces and nature can negatively impact mental health and decrease physical activity.**⁶⁶ For example, green spaces could become inaccessible due to unsafe outdoor temperatures or could be destroyed due to adverse weather events.
- **Limited access to healthcare infrastructures and healthcare professionals may place health at risk.** Climate change may directly affect the health of available healthcare professionals in a specific locality and leave healthcare infrastructures inaccessible or unable to operate. For example, in

59 Munro A, Boyce T and Marmot M (2020) *Sustainable health equity: achieving a net-zero UK* (London: Institute of Health Equity), available at: www.instituteoftheequity.org/resources-reports/sustainable-health-equity-achieving-a-net-zero-uk/main-report.pdf.

60 Romanello M, Walawender M, Hsu SC, *et al.* (2024) The 2024 report of the *Lancet* Countdown on health and climate change: facing record breaking threats from delayed action *The Lancet* **404(10465)**: P1847–96, available at: [www.thelancet.com/journals/lancet/article/PIIS0140-6736\(24\)01822-1/abstract](http://www.thelancet.com/journals/lancet/article/PIIS0140-6736(24)01822-1/abstract).

61 Intergovernmental Panel on *Climate Change (2022) Climate change 2022: impacts, adaptation and vulnerability*, Chapter 7, available at: www.ipcc.ch/report/ar6/wg2/downloads/report/IPCC_AR6_WGII_FullReport.pdf.

62 World Economic Forum (2024) *Quantifying the impact of climate change on human health*, available at: https://www3.weforum.org/docs/WEF_Quantifying_the_Impact_of_Climate_Change_on_Human_Health_2024.pdf.

63 Schütte S, Gemenne F, Zarman M, *et al.* (2018) Connecting planetary health, climate change and migration *Lancet Planet Health* **2(2)**: e58–9.

64 Haines A and Ebi K (2019) The imperative for climate action to protect health *New England Journal of Medicine* **380(3)**: 263–73.

65 Romanello M, Di Napoli C, Drummond P, *et al.* (2022) The 2022 report of the *Lancet* Countdown on health and climate change: health at the mercy of fossil fuels *The Lancet* **400(10363)**: 1619–54, available at: [www.thelancet.com/article/S0140-6736\(22\)01540-9/fulltext](http://www.thelancet.com/article/S0140-6736(22)01540-9/fulltext); and Sisodiya SM, Gulcebi MI, Fortunato F, *et al.* (2024) Climate change disorders of the nervous system *The Lancet Neurology* **23(6)**: P636–48.

66 Mental Health Foundation (2021) *Mental health awareness week 2021: how connecting with nature benefits our mental health*, available at: www.mentalhealth.org.uk/sites/default/files/2022-06/MHAW21-Nature-research-report.pdf; Mind (2021) *How can nature benefit my mental health?* Available at: www.mind.org.uk/information-support/tips-for-everyday-living/nature-and-mental-health/how-nature-benefits-mental-health; and Yassaie R and Brooks L (2024) Reassessing ‘good’ medical practice and the climate crisis *Journal of Medical Ethics* online first, available at: <https://doi.org/10.1136/jme-2023-109713>.

the UK, 10% of hospitals are currently at risk of flooding.⁶⁷ Additionally, extreme heat can lead to surgery cancellations, IT and laboratory disruptions, and equipment malfunction.⁶⁸

- **The risk of climate change can have broader mental health impacts.**⁶⁹ There is increasing evidence of individuals suffering from feelings of distress, fear, hopelessness and grief due to climate change and its consequences – symptoms often referred to as ‘climate anxiety’ or ‘eco anxiety’⁷⁰ and thought to be contributing to increased mental distress, particularly among young people.⁷¹ There is also increased worry about climate change: in 2022 the UK’s Office for National Statistics reported that around three in four adults felt (very or somewhat) worried about climate change,⁷² and in a recent study from the US it was found that the vast majority of young people aged 16–25 across all states are worried about the climate crisis.⁷³

The causes of climate change are also linked to a range of adverse health outcomes. Burning fossil fuels, for example, is closely associated with air pollution and can cause poor health outcomes such as asthma, strokes, poor birth outcomes, dementia and lung disease.⁷⁴ In 2020, nine-year-old Ella Adoo-Kissi-Debrah was the first person in the UK to have air pollution formally recorded as a cause of death, illustrating the severity of the issue. Poor air quality has also been linked to mental health conditions such as depression and anxiety.⁷⁵

67 Landeg O, Whitman G, Walker-Springett K, *et al.* (2019) Coastal flooding and frontline health care services: challenges for flood risk resilience in the English health care system *Journal of Health Services Research Policy* **24(4)**: 219–28; and Round Our Way (2023) *NHS underwater: analysis of increasing flooding events in the NHS and its impact on patients*, available at: <https://roundourway.org/uploads/files/ROW-NHS-UNDERWATER-REPORT-MARCH23-FINAL.pdf>.

68 UK Health Alliance on Climate Change (2024) *Lancet Countdown UK policy brief: 2024 climate and health priorities for United Kingdom*, available at: https://s41874.pcdn.co/wp-content/uploads/Lancet-Countdown-2024_United-Kingdom-Policy-Priorities.pdf.

69 Intergovernmental Panel on *Climate Change* (2022) *Climate change 2022: impacts, adaptation and vulnerability*, Chapter 7, available at: www.ipcc.ch/report/ar6/wg2/downloads/report/IPCC_AR6_WGII_FullReport.pdf.

70 Wilson N and Rae K (2022) *Climate change and mental health: report from a COP-26 public participation event* (Glasgow: Mental Health Foundation Scotland), available at: www.mentalhealth.org.uk/sites/default/files/2022-07/MHF-Scotland-Climate-Change-COP26-report_0.pdf.

71 Rocque RJ, Beaudoin C, Ndjaboue R, *et al.* (2021) Health effects of climate change: an overview of systematic reviews *British Medical Journal Open* **11(6)**.

72 Office for National Statistics (2022) *Worries about climate change, Great Britain: September to October 2022*, available at: www.ons.gov.uk/peoplepopulationandcommunity/wellbeing/articles/worriesaboutclimatechangegreatbritain/septembertooctober2022.

73 Lewandowski RE, Clayton S, Olbrich L, *et al.* (2024) Climate emotions, thoughts, and plans among US adolescents and young adults: a cross sectional descriptive survey and analysis by political party identification and self-reported exposure to severe weather events *The Lancet Planetary Health* **8(11)**: E879–93.

74 Public Health England (2018) *Health matters: air pollution*, available at: www.gov.uk/government/publications/health-matters-air-pollution/health-matters-air-pollution; and UK Health Alliance on Climate Change (2024) *Lancet Countdown UK policy brief: 2024 climate and health priorities for United Kingdom*, available at: https://s41874.pcdn.co/wp-content/uploads/Lancet-Countdown-2024_United-Kingdom-Policy-Priorities.pdf.

75 Braithwaite I, Zhang S, Kirkbride J, *et al.* (2019) Air pollution (particular matter) exposure and associations with depression, anxiety, bipolar, psychosis and suicide risk: a systematic review and meta-analysis *Environmental Health Perspective* **127(12)**: 126002, available at: <https://doi.org/10.1289/EHP4595>; and Yang T, Wang J and Huang J *et al.* (2023) Long term exposure to multiple ambient air pollutants and association with incident depression and anxiety *Journal of the Medical Association of Psychology* **80(40)**: 305–13.

The effect of climate change on health in the UK

Despite the UK being a significant contributor to climate change, the effects experienced by the UK population are less severe than for people in many other countries around the world. Nevertheless, UK residents still experience adverse climate-related health impacts, in particular from rising temperatures and adverse weather events such as flooding. Higher summer temperatures in the UK are now 10–25% more common due to climate change.⁷⁶ During the 2022 heatwaves (where 40°C was recorded for the first time in the UK), high temperatures – attributable to climate change – led to around 3,000 excess deaths.⁷⁷ The risk of infectious diseases is also increasing.⁷⁸ For example, in 2019, tick-borne encephalitis was identified in the UK for the first time.⁷⁹

Locality, including whether someone lives in an urban or rural environment and where in the UK they are, may also have consequences for how health is affected by climate change. For example, in Scotland, people who live in rural areas are at a greater risk of being adversely affected by climate change than those in urban areas, particularly due to flooding.⁸⁰ On a UK-wide level, evidence suggests that emerging climate-related health risks such as droughts, wildfires and vector-borne diseases will likely emerge first in southern regions.⁸¹

The effect of climate change on health inequalities across and within countries

Worldwide, the health-related impacts of climate change do not fall equally. Some populations are at greater risk of morbidity and mortality given their exposure to its causes and effects, such as extreme heat and unpredictable or extreme weather events.

Vulnerability to climate-related risks can also be compounded by wider social determinants of health (e.g. socioeconomic status, age and location) and existing

76 UK Health Alliance on Climate Change (2024) *Lancet Countdown UK policy brief: 2024 climate and health priorities for United Kingdom*, available at: https://s41874.pcdn.co/wp-content/uploads/Lancet-Countdown-2024_United-Kingdom-Policy-Priorities.pdf.

77 UK Health Security Agency (2024) *Heat mortality monitoring report: 2022*, available at: www.gov.uk/government/publications/heat-mortality-monitoring-reports/heat-mortality-monitoring-report-2022.

78 Medlock JM and Leach SA (2015) Effect of climate change on vector-borne disease risk in the UK *The Lancet Infectious Diseases* **15**(6): P721–30.

79 UK Health Security Agency (2023) *HAIRS risk assessment: tick-borne encephalitis*, available at: www.gov.uk/government/publications/hairs-risk-assessment-tick-borne-encephalitis/hairs-risk-assessment-tick-borne-encephalitis; UK Health Security Agency (2023) *Tick-borne encephalitis: epidemiology, diagnosis and prevention*, available at: www.gov.uk/guidance/tick-borne-encephalitis-epidemiology-diagnosis-and-prevention; and Yassaie R and Brooks L (2024) Reassessing 'good' medical practice and the climate crisis *Journal of Medical Ethics* online first, available at: <https://doi.org/10.1136/jme-2023-109713>.

80 Sayers P, Lindley S, Carr S and Figueroa-Alfaro R (2022) *The impacts of climate change on population groups in Scotland* (Edinburgh: ClimateXChange), available at: www.climateexchange.org.uk/publications/the-impacts-of-climate-change-on-population-groups-in-scotland.

81 UK Health Security Agency (2023) *Health effects of climate change in the UK: state of the evidence 2023*, available at: <https://assets.publishing.service.gov.uk/media/659ff6a93308d200131f78/HECC-report-2023-overview.pdf>.

health conditions.⁸² Climate change typically affects people who have contributed least to advancing climate change and who are the least able to protect themselves from adverse health outcomes.⁸³

Globally, the WHO identifies “women, children, ethnic minorities, poor communities, migrants or displaced persons, older populations and those with underlying health conditions” as populations who are (and will be) impacted disproportionately.⁸⁴ The United Nations Human Rights Office has highlighted that disabled people are also one of the most adversely affected groups.⁸⁵ In the UK, climate change and its drivers disproportionately affect these same groups, who are already marginalised and disadvantaged.⁸⁶ For example, people who live in more deprived areas and people from the global majority are more likely to experience higher levels of air pollution, and are thus more susceptible to the associated poor health outcomes, than those who live in affluent areas or are white.⁸⁷

Non-human animal health

Climate change also significantly affects the health of non-human animals, including wildlife, livestock and companion animals (e.g. pets). The adverse effects of climate change place some individual non-human animals at risk of injury or death, and some species at risk of extinction.⁸⁸

One reason for this is loss of biodiversity and habitats. This is driven, in part, by effects of climate change such as extreme weather (e.g. droughts, wildfires and heat), changing weather patterns, ocean acidification, and melting ice caps and glaciers. Biodiversity loss is also associated with pollution, deforestation, and the conversion of land for human interests such as urbanisation, food systems and livestock feed (e.g. soy plantations), which can also contribute to climate change.⁸⁹ Over the last 50 years, climate change and its causes have led to wildlife populations declining by 73%

82 Romanello M, Walawender M, Hsu SC, *et al.* (2024) The 2024 report of the *Lancet* Countdown on health and climate change: facing record breaking threats from delayed action *The Lancet* **404(10465)**: P1847–96, available at: [www.thelancet.com/journals/lancet/article/PIIS0140-6736\(24\)01822-1/abstract](http://www.thelancet.com/journals/lancet/article/PIIS0140-6736(24)01822-1/abstract).

83 World Health Organization (2023) *Climate change: key facts*, available at: www.who.int/news-room/fact-sheets/detail/climate-change-and-health.

84 World Health Organization (2023) *Climate change: key facts*, available at: www.who.int/news-room/fact-sheets/detail/climate-change-and-health.

85 United Nations (2021) *The impact of climate change on the rights of persons with disabilities*, available at: www.ohchr.org/EN/Issues/HRAndClimateChange/Pages/PersonsWithDisabilities.aspx.

86 Greenpeace and the Runnymede Trust (2022) *Confronting injustice: racism and the environmental emergency*, available at: www.greenpeace.org.uk/wp-content/uploads/2024/07/Confronting-Injustice-2022-web.pdf.

87 Brainard J, Jones A, Bateman I, *et al.* (2002) Modelling environmental equity: access to air quality in Birmingham, England *Environment and Planning A: Economy and Space* **34(4)**: 695–716, available at: <https://doi.org/10.1068/a34184>; Logika Noise Air Quality Consultants (2021) *Air pollution and inequalities in London: 2019 update*, available at: https://www.london.gov.uk/sites/default/files/air_pollution_and_inequalities_in_london_2019_update_0.pdf; and The Health Foundation (2024) *Inequalities in likelihood of living in polluted neighbourhoods*, available at: www.health.org.uk/evidence-hub/our-surroundings/air-pollution/inequalities-in-likelihood-of-living-in-polluted.

88 Intergovernmental Panel on Climate Change (2022) *Biodiversity: climate change impacts and risks*, available at: www.ipcc.ch/report/ar6/wg2/downloads/outreach/IPCC_AR6_WGII_FactSheet_Biodiversity.pdf.

89 United Nations (2020) *Report of the UN economist network for the UN 75th anniversary: shaping the trends of our time*, available at: www.un.org/development/desa/publications/wp-content/uploads/sites/10/2020/10/20-124-UNEN-75Report-ExecSumm-EN-REVISED.pdf.

on average.⁹⁰ Today, changes to the world's ecosystems mean that around one million species face extinction if further measures are not taken to address biodiversity loss.⁹¹ In the UK, the degradation of habitats is a particular area of risk for wildlife.⁹² These same climate-related events can negatively affect the health of other non-human animals, such as livestock and companion animals.

Collectively, the adverse health outcomes of non-human animals will also impact human health. Interactions between human and non-human animal health are complex, but some examples can clearly illustrate how they are inescapably intertwined:

- pets and positive encounters with other species in nature can improve human physical and mental health;
- non-human animals, especially wildlife and livestock, can be reservoirs and vectors for infectious disease (such as avian flu), and human action can exacerbate the risks this poses to both human and non-human animal health;
- the health of livestock in food systems (e.g. for meat and dairy produce) can influence human health outcomes; and
- some animal products can contribute directly to poor human health outcomes (e.g. red meat consumption is linked to a higher risk of cardiovascular disease)⁹³ and non-human animal welfare standards, as well as indirectly through agricultural GHG emissions.

Both humans and non-human animals require healthy environments to promote health and to survive. For example, plants are required across food systems, to provide sustenance for humans and other animals. The notion of interconnectedness between humans, non-human animals and ecosystems has been acknowledged for centuries, particularly through different Indigenous peoples' and non-Western perspectives. Indigenous peoples typically maintain deep connections with the natural environment that are important for the social, livelihood, cultural and spiritual practices that underpin their health and wellbeing.⁹⁴ Knowledge frameworks such as *autā matua*, a Māori concept, and the *buen vivir* of the Quecha people⁹⁵ are based on

90 WWF (2024) *Living planet report 2024*, available at: <https://livingplanet.panda.org/en-GB>.

91 United Nations (2020) *Report of the UN economist network for the UN 75th anniversary: shaping the trends of our time*, available at: <https://desapublications.un.org/publications/report-un-economist-network-un-75th-anniversary-shaping-trends-our-time>.

92 The State of Nature Partnership (2023) *State of nature 2023*, available at: https://stateofnature.org.uk/wp-content/uploads/2023/09/TP25999-State-of-Nature-main-report_2023_FULL-DOC-v12.pdf.

93 Papier K, Fensom GF, Knuppel A, *et al.* (2021) Meat consumption and risk of 25 common conditions: outcome-wide analyses in 475,000 men and women in the UK Biobank study *BMC Medicine* **19**: 53, available at: <https://doi.org/10.1186/s12916-021-01922-9>.

94 Food and Agriculture Organization of the United Nations (2021) *The white/wiphala paper on Indigenous peoples' food systems*, available at: <https://openknowledge.fao.org/server/api/core/bitstreams/3462ba89-0a23-4d49-a3bf-e64bdcc83613/content>.

95 Merino R (2016) An alternative to 'alternative development'? Buen vivir and human development in Andean countries *Oxford Development Studies* **44(3)**: 271–86; and Heke I, Rees D, Swinburn B, *et al.* (2019) Systems thinking and indigenous systems: native contributions to obesity prevention *AlterNative International Journal of Indigenous Peoples* **15(1)**: 22–30.

deep and ancestral connections with the environment.⁹⁶ Contemporary policy approaches seek to recognise interconnections too, such as ‘One Health’ and ‘Planetary Health’. One Health emphasises the importance of interventions that take a holistic approach to human, animal and plant health, and the responsible stewardship of ecosystems and natural processes, including the global climate.⁹⁷ Similarly Planetary Health recognises that safeguarding human health requires the health of the planet and its natural systems to be maintained.⁹⁸ The notion of interconnectedness is also recognised by the United Nations Convention on Biodiversity’s 2022 Kunming-Montreal Global Biodiversity Framework, which sets out targets to achieve the goal of a society that lives in harmony with nature by 2030.⁹⁹

Scientific evidence is consistent with the assumption that many non-human animals possess morally significant abilities including agency, complex thinking and social behaviours (such as the formation of cultures) and may experience feelings which matter to them.¹⁰⁰ The ability of non-human animals to communicate their interests is also increasingly recognised, and many experts highlight the need to acknowledge and address these interests in policy and decision-making processes.¹⁰¹ These findings raise questions about how and the extent to which non-human animal interests should influence climate-related action. This may require ethical analysis of interspecies justice (including what we owe to different non-human animals) and on what moral basis it is determined, such as animal dignity.¹⁰²

96 Zavaleta C, Berrang-Ford L, Llanos-Cuentas A, *et al.* (2017) Indigenous Shawi communities and national food security support: right direction, but not enough *Food Policy* **73**: 75–87; and Curtis E, Jones R, Tipene-Leach D, *et al.* (2019) Why cultural safety rather than cultural competency is required to achieve health equity: a literature review and recommended definition *International Journal for Equity in Health* **18**: 174.

97 ClimatHealth, *One health*, available at: <https://climahealth.info/theme/one-health>.

98 The Lancet (2015) *Planetary health*, available at: www.thelancet.com/infographics-do/planetary-health.

99 UN Environment Programme (2022) *Kunming-Montreal Global Biodiversity Framework 2022*, available at: www.cbd.int/doc/decisions/cop-15/cop-15-dec-04-en.pdf.

100 Nuffield Council on Bioethics (2021) *Genome editing and farmed animal breeding: social and ethical issues*, available at: www.nuffieldbioethics.org/publication/genome-editing-and-farmed-animal-breeding-social-and-ethical-issues; Whiten A (2021) The burgeoning reach of animal culture *Science* **372**: 6537; and New York University (2024) *The New York declaration on animal consciousness*, available at: <https://sites.google.com/nyu.edu/nydeclaration/declaration>.

101 Animals in the Room, *What is Animals in the Room?*, available at: <https://animalsintheroom.org>.

102 Kempers EB (2020) Animal dignity and the law: potential, problems and possible implications *Liverpool Law Review* **41(2)**: 173; and Challenger M (Editor) (2023) *Animal dignity: philosophical reflections on non-human existence* (London: Bloomsbury).

3. What challenges need to be overcome when developing and implementing climate change measures?

Key messages

- Key challenges include navigating ever-evolving legal and regulatory obligations; collaboration across a large number of agencies, groups and individuals; achieving meaningful communication and engagement with diverse audiences; addressing global injustices; and making decisions on how best to allocate resources and expenditure.
- Climate change is not the responsibility of one individual, organisation, government department or country. Multiple individuals and organisations have a responsibility to consider it and its implications for health. Measures can be strengthened when different stakeholders work together on a national and international level.
- Some stakeholders may bear greater responsibility than others for leading and facilitating change, based on their role in advancing and profiting from climate change and their available resources.
- Effective communication about climate change, its health impacts and the measures which seek to address it is required.
- Meaningful engagement with those affected by climate change is vital and should be guided by the affected communities.
- Policy and decision makers need to make sure that global injustices associated with climate change are not exacerbated or created by climate measures
- Up-front investment will often be required to avoid the most dangerous impacts of climate change. This will likely to lead to substantial savings and health benefits over time, but may require competing interests and priorities to be balanced in the short term.

This section explores some of the key challenges that policy and decision makers must overcome in responding to climate change and health. These include navigating the large number of agencies, groups and individuals required to collaborate; achieving meaningful and appropriate communication and engagement with diverse audiences; addressing global injustices; and deciding how best to allocate resources and expenditure. As well as considering the ethical implications raised by these challenges, those developing and implementing climate measures must operate within a quickly evolving legal and regulatory landscape, summarised in Box 1.

Box 1: The legal and regulatory landscape

Those developing and implementing climate measures are subject to legal and regulatory obligations at international and national levels. These obligations arise from an extensive mix of legislation, regulation and a growing number of legal cases, which are all developing rapidly. A full review of the legal and regulatory landscape in the UK can be found in our [legal and regulatory overview](#). Key findings include:

- Legislation and regulation have been used to set important targets for climate commitments.¹⁰³
- Net zero commitments have been made across the UK and under devolved powers. However, the devolved governments have taken different approaches: Scotland and Northern Ireland incorporate the objective of a 'just transition',¹⁰⁴ while Wales places an obligation on public bodies to act in the interests of future generations.¹⁰⁵
- Across the UK, a number of other legal obligations relevant to climate change can be found in sector-specific legislation and regulation, e.g. health and social care, planning law, and company law.¹⁰⁶
- Climate activists and organisations increasingly use case law as a mechanism to drive climate action and hold governments to account on their climate-related promises and obligations.¹⁰⁷
- Some case law has used international human rights law to address climate

103 UN Framework Convention on Climate Change 1992; Kyoto Protocol 1997; Climate Change Act 2008; Climate Change (Scotland) Act 2009; Paris Agreement 2015; Wellbeing of Future Generations (Wales) Act 2015; Environment (Wales) Act 2016; and Climate Change (Northern Ireland) Act 2022.

104 Climate Change (Scotland) Act 2009; and Climate Change (Northern Ireland) Act 2022.

105 Wellbeing of Future Generations (Wales) Act 2015.

106 Planning and Compulsory Purchase Act 2004, Sections 19(1A) and 38(ZA); Companies Act 2006, Sections 172 and 414CB; Planning Act 2008, Sections 5 and 10; and Health and Social Care Act 2022, Section 9.

107 Caddell R (2024) *Legal and regulatory review: climate change, the environment and health in the UK* (London: Nuffield Council on Bioethics), available at: <https://cdn.nuffieldbioethics.org/wp-content/uploads/Legal-and-Regulatory-review-Climate-change-environment-and-health-FINAL.pdf>. This includes the 2024 Supreme Court ruling that decision makers considering planning applications for fossil fuel production must consider both the greenhouse gas emissions from burning the fuel and the emissions during the life of the development in R (Finch) v Surrey County Council and others [2024] UKSC 20..

change and health.¹⁰⁸

- Legal and regulatory instruments aimed directly at protecting the environment have also been implemented or proposed, including:¹⁰⁹
 - designating legal personhood to parts of the environment (giving them the same legal rights as human beings), as in Aotearoa (New Zealand);¹¹⁰
 - introducing a human right “to a healthy environment”,¹¹¹ and
 - establishing the criminal offence of ecocide, i.e. “unlawful or wanton acts committed with knowledge that there is a substantial likelihood of severe and either widespread or long-term damage to the environment being caused by those acts”.¹¹²
- Across the UK, the Animal Welfare (Sentience Act) 2022 also recognises the sentience and welfare needs of all vertebrate (and some other) animals and requires policymakers to consider animal sentience when creating or changing laws.¹¹³ However, this does not require decisions to be made in animals’ favour.

The continuously evolving landscape and the variation in approach can be difficult to navigate, affecting how countries and organisations reach consensus. However, further change is expected. For example, the Parliamentary Office of Science and Technology has highlighted that new governance mechanisms may be required if climate risks are to be managed, as conventional approaches may not be able to deal with the complexity that climate change presents.¹¹⁴ The International Court of Justice is also expected to provide an advisory opinion in 2025 on the legal obligations that countries have to protect the climate and whether they could face legal consequences if they do not comply. Ongoing developments will require policy and decision makers to be prepared to respond to legal and regulatory changes and navigate differences across countries and contexts.

108 Verein KlimaSeniorinnen Schweiz v. Switzerland, available at: [https://hudoc.echr.coe.int/eng-press#%22item%22%22003-7919428-11026177%22](https://hudoc.echr.coe.int/eng-press#%22item%22%22%22003-7919428-11026177%22)]; in April 2024, the European Court of Human Rights ruled that deficiencies in climate policy on the part of the Swiss government had breached the right to private and family life protected under Article 8 of the [European Convention for the Protection of Human Rights and Fundamental Freedoms 1950](#).

109 UN Environment Programme (2022) *Kunming-Montreal Global Biodiversity Framework 2022*, available at: www.cbd.int/doc/decisions/cop-15/cop-15-dec-04-en.pdf.

110 Aotearoa’s (New Zealand’s) Te Urewera Act 2014 and Te Awa Tupua Act 2017.

111 Scottish Government (2023) *A human rights bill for Scotland: consultation*, available at: www.gov.scot/publications/human-rights-bill-scotland-consultation/pages/6; and Scottish Human Rights Commission, *Environment and climate*, available at: www.scottishhumanrights.com/our-law-and-policy-work/environment-and-climate.

112 Stop Ecocide International (2021) *June 2021: historic moment as Independent Expert Panel launches definition of ecocide*, available at: <https://www.stopecocide.earth/legal-definition>.

113 Animal Welfare (Sentience Act) 2022.

114 Wentworth J (2024) *Climate and environmental risks: governance challenges* (London: UK Parliament), available at: <https://post.parliament.uk/climate-and-environmental-risks-governance-challenges>.

Who should be involved?

Addressing climate change is not the responsibility of one individual, organisation, government department or country. Multiple individuals and organisations have a responsibility to consider it and its implications for health. Measures can be strengthened when national and international stakeholders work together: the Lancet Countdown has identified that aligned, structural and sustained changes across multiple stakeholders are needed to avoid the most severe health impacts of climate change.¹¹⁵ Health emergencies such as the COVID-19 pandemic have illustrated how interconnected and interdependent nations are, the downfalls of national self-prioritisation, and the importance of international collaboration to overcome global challenges.¹¹⁶

Working together across countries, sectors or areas of expertise may help to identify possible co-benefits. ‘Co-benefits’ are approaches that may have mutual and multiple benefits and may avoid ethical challenges which might otherwise arise.¹¹⁷ For example, collaborating effectively may create opportunities for climate action to simultaneously improve public health, reduce healthcare costs, create jobs and address existing health inequalities as well as reducing and responding to GHG emissions. Identifying co-benefits may also avoid what the IPCC calls “maladaptive measures”.¹¹⁸ These are actions that may appear to address climate change but are instead likely to lead to even more adverse climate outcomes (e.g. due to increased GHG emissions) or inequitable outcomes.¹¹⁹ The IPCC suggests that maladaptive measures occur when initiatives focus on individual sectors or risks in isolation or consider only short-term gains without long-term commitments.

A diverse range of agencies, groups and individuals are relevant to the intersection of climate change and health and should be included in including coordinated planning across multiple sectors. Key stakeholders were identified throughout our research activities, across:

- agriculture, food systems and environmental protection;
- communication (e.g. news outlets, journalists, marketers, campaigners);
- education (e.g. teachers, professional training bodies, academic bodies, journals);
- energy systems (e.g. fossil fuel and renewable energy industries);

115 Romanello M, Walawender M, Hsu SC, *et al.* (2024) The 2024 report of the Lancet Countdown on health and climate change: facing record breaking threats from delayed action *The Lancet* **404(10465)**: P1847–96, available at: [www.thelancet.com/journals/lancet/article/PIIS0140-6736\(24\)01822-1/abstract](https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(24)01822-1/abstract).

116 Nuffield Council on Bioethics (2023) *Health, climate change and ethics: an overview*, available at: www.nuffieldbioethics.org/publication/health-climate-change-and-ethics-an-overview.

117 Nuffield Council on Bioethics (2023) *Health, climate change and ethics: an overview*, available at: www.nuffieldbioethics.org/publication/health-climate-change-and-ethics-an-overview.

118 Intergovernmental Panel on *Climate Change* (2023) *Climate change 2023 synthesis report: summary for policymakers*, available at: www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_SPM.pdf.

119 Intergovernmental Panel on *Climate Change* (2023) *Climate change 2023 synthesis report summary for policymakers*, available at: www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_SPM.pdf.

- health and care organisations;
- international and UK governments;
- non-governmental organisations (e.g. think tanks, charities, policy and research organisations);
- the built environment (e.g. transport, planners, local councils, architects, engineers);
- the economy (e.g. banks, insurers, investors, pension providers and funders);
- individuals and communities whose health is affected by climate change; and
- the legal system (e.g. judges, courts, lawyers).

We must also consider how to meaningfully represent the interests and experiences of non-human animals in developing and implementing mitigation and adaptation measures. In our research we heard of novel attempts to ensure that these interests are factored into policy making, such as *Animals in the Room*, which is working to devise and test models for representing non-human animals in decision making.¹²⁰ Our research and engagement also highlighted stakeholders that can promote the inclusion of future generational interests, such as the Future Generations Commissioner for Wales, who helps public bodies to consider the long-term effects of their decisions.

A concern raised throughout our research activities was that clear decision-making and responsibility structures are needed to ensure that climate measures are not delayed, diluted or made incoherent by the involvement of too many actors. This requires the promotion of procedural justice, to ensure that the decision-making process is fair and inclusive as well as remaining practical. Participants noted that there may be scenarios where stakeholders have conflicting interests. Ways to navigate such disagreements will therefore be required, including evidence-based approaches, ethical analysis, time, resources, and ongoing monitoring and evaluation.

While everyone has a role in responding to climate change and collaboration is essential, we heard clear feedback from our engagement activities that some groups may bear greater responsibility than others for enacting, leading and facilitating change. For example, the role that stakeholders have had in advancing and profiting from climate change, and the amount of resources available to them, are key factors in deciding where the burden of responsibility should fall, today and into the future.

Communication and engagement

Our research indicated that meaningful and appropriate engagement and communication with a broad range of people is imperative to prevent unintended consequences and ensure public support for climate-related interventions. However, this must be done well, and our research highlighted numerous complexities that

¹²⁰ *Animals in the Room*, *What is Animals in the Room?*, available at: <https://animalsintheroom.org>.

need to be overcome.

Communication about climate change, the impacts on health and the measures to address these issues was seen as key. However, questions were raised about how best to convey messages to a diverse range of audiences, and who should be responsible for this communication, especially on the threat that climate change poses and the benefits (and necessity) of taking action to mitigate or adapt to its effects. How information is best communicated, and by whom may depend on numerous factors, including who the audiences are and what actions are available to them. Difficulties were highlighted, in particular, where there are limited courses of action for certain audiences to take in response to the information provided. One example raised during our research activities related to informing the public about the adverse health impacts of air pollution in their area. Although this information may raise awareness and empower people to try and limit their exposure (e.g. by travelling outside of the area, moving house or campaigning), this information may cause distress, especially where there are limited or no options to limit exposure or where these options are not available equitably or may place someone else at risk. Additionally, respondents highlighted the need to prevent organisations from 'greenwashing' in their communication strategies, i.e. communicating false or misleading statements about the environmental benefits of a product or practice.

Meaningful engagement – where people are equitably engaged and their input is clearly reflected in decision-making outcomes – was highlighted as essential in developing and implementing climate measures. In particular, we heard that engaging those who disproportionately experience the negative health impacts of climate change (e.g. people from poorer socioeconomic backgrounds, disabled people, the global majority) is vital to ensuring that these experiences are addressed and not perpetuated or created by climate measures at a national or international level. These issues may also engage ethical considerations relating to procedural justice, including fair access to participative decision-making mechanisms.¹²¹

Engaging with international stakeholders may require additional consideration and can present challenges that must be overcome. Historically, voices from the Global South have been excluded from the development of climate measures in the Global North, or engagement has been extractive.¹²² This can make it more likely that the measures implemented are inappropriate or harmful, because their potential effect on different communities has not been sufficiently considered. This has been evidenced in some carbon offsetting schemes, where individuals and organisations can invest in environmental projects, such as tree planting and renewable energy

121 Schlosberg D (2007) *Defining environmental justice: theories, movements, and nature* (Oxford: Oxford University Press; and Coolsaet B (Editor) (2021) *Environmental justice: key issues* (New York: Routledge).

122 We recognise the limitations of 'Global South' and 'Global North', which are generalised terms that can homogenise the experiences of people, communities and countries. The term 'Global South' emerged to overcome negative terminology such as 'third world' to refer to regions of Oceania, South America, Asia and Africa. 'Global North' generally refers to countries in Northern Europe, North America, Russia, Australia and Aotearoa (New Zealand). These terms are used in this report not to represent geographical borders but to refer to global power dynamics and inequalities between regions. See Klob ST (2017) The Global South as subversive practice: challenges and potentials of a heuristic concept *The Global South* 11(2): 1-17.

projects, to balance their own carbon emissions. These schemes are used by many stakeholders in the UK, but the majority of land available to facilitate carbon offsetting is in Global South countries and such schemes have often resulted in adverse impacts such as land grabbing, human rights abuses and forced evictions,¹²³ especially for Indigenous peoples and local communities.¹²⁴

Throughout our research we heard that involving populations from the Global South in the development and implementation of climate measures, especially when their health is likely to be impacted or disproportionately affected, is important and would be beneficial.¹²⁵ For example, drawing on knowledge from Indigenous peoples has been shown to protect Indigenous health in times of health emergencies as well as benefiting policy development and wider society.¹²⁶

Meaningful engagement may ensure that unintended harms caused to different communities as a result of climate action in the UK are limited.¹²⁷ This engagement needs to be undertaken sensitively and to be guided by the affected communities, requiring consent, equitable collaborations, meaningful co-creation and co-production of knowledge, and knowledge exchange that does not perpetuate harms.

International injustice

Climate change is linked to different forms of international injustice, and measures need to ensure that existing issues are not perpetuated and new issues are not created.

There is a clear imbalance between countries that contribute (and have contributed) the most to climate change and those which disproportionately experience the worst effects.¹²⁸ In 2020, 92% of global carbon dioxide emissions were attributable to the Global North (including the USA, Canada, Europe, Israel, Australia, New Zealand and Japan).¹²⁹ At the same time, populations in the Global South are experiencing losses and damages associated with climate change, both economic (e.g. damage to crops, homes or infrastructure) and non-economic (e.g. health harms, loss of Indigenous

123 Greenpeace and the Runnymede Trust (2022) *Confronting injustice: racism and the environmental emergency*, available at: www.greenpeace.org.uk/wp-content/uploads/2024/07/Confronting-Injustice-2022-web.pdf.

124 Hooker H and Wentworth J (2024) *Carbon offsetting*, UK Parliament POSTnote 713, 24 January, available at: <https://researchbriefings.files.parliament.uk/documents/POST-PN-0713/POST-PN-0713.pdf>.

125 For examples of Indigenous and non-Western perspectives, see the ethics review we commissioned: Timmermann C, Wabnitz K and Wild V (2024) *Ethical approaches at the intersection of climate change, the environment and health* (London: Nuffield Council on Bioethics), available at: <https://s47055.pcdn.co/wp-content/uploads/ETHICA1.pdf>.

126 Arotoma Rojas I, Chichmana V, Anza-Ramirez C, et al. (2023) Policy recommendations from the COVID-19 Observatories on Indigenous Peoples for Peruvian stake holders, available at: <https://doi.org/10.6084/m9.figshare.22357822.v1>; and Zavaleta-Cortijo C, Ford JD, Galappaththi EK, et al. (2023) Indigenous knowledge, community resilience, and health emergency preparedness *Lancet Planet Health* **7(8)**: e641–43.

127 Byskov MF and Hyams K (2022) Epistemic injustice in climate adaptation *Ethical Theory and Moral Practice* **25**: 613–34, available at: <https://doi.org/10.1007/s10677-022-10301-z>.

128 Althor G, Watson JEM and Fuller RA (2015) Global mismatch between greenhouse gas emission and the burden of climate change *Scientific Reports* **6**: 20281; and Frame D, Harrington LJ, Fuglestedt JS, et al. (2019) Emissions and emergence: a new index comparing relative contributions to climate change with relative climatic consequences *Environmental Research Letters* **14**: 084009.

129 Hicel J (2020) Quantifying national responsibility for climate breakdown: an equality-based attribution approach for carbon dioxide emissions in the excess of the planetary boundary *Lancet Planetary Health* **4(9)**: E399–404, available at: [https://doi.org/10.1016/S2542-5196\(20\)30196-0](https://doi.org/10.1016/S2542-5196(20)30196-0).

and local knowledge, and damage to biodiversity and habitats), at a greater rate than those in the Global North.¹³⁰

This imbalance is compounded by historical injustices such as colonialism,¹³¹ and its complex and exploitative aftermath.¹³² For example, significant extraction of natural resources, such as fossil fuels, has occurred in Global South countries for the use and profit of Global North countries.¹³³ Evidence from the oil, gas and mining industries illustrates that richer countries have taken a total of 62 trillion US dollars from the Global South since 1960, leading to lost growth of 152 trillion dollars.¹³⁴

The effects of colonialism are still experienced today.¹³⁵ This includes inequalities in wealth and power between (and within) countries, poor health outcomes, displacement, and disruptions to Indigenous peoples' close relationship with the natural environment.¹³⁶ At the same time, countries facing the most severe impacts of climate change often have fewer resources and less infrastructure to enable them to respond, due to these long-standing inequalities. The poorest countries spend five times more on debt payments to foreign banks, governments and other financial institutions than on the infrastructure required to respond to the impacts of climate change.¹³⁷ For example, while Pakistan was experiencing flooding in 2022, its external debts increased from 128.980 billion US dollars in the first quarter of the year to 130.2 billion dollars in the second quarter.¹³⁸ In the same year, the cost of flood damage and economic losses reached over 30 billion dollars, with reconstruction needs of over 16 billion dollars.¹³⁹ Compounding this, the vast majority of people in countries with a lower human development index are not insured for economic losses, meaning that local communities are often left to deal with any adverse

130 London School of Economics and Political Science (2022) *What is climate change 'loss and damage'?* Available at: www.lse.ac.uk/granthaminstitute/explainers/what-is-climate-change-loss-and-damage.

131 Colonialism can be understood as some countries, including the UK, undertaking control over countries in the Global South, resulting in extraction and exploitation (e.g. of goods and cheap labour) for profits predominantly gained in the Global North.

132 Chakrabarty D (2009) The climate of history: four theses *Critical Inquiry* **35(2)**: 197–222, available at: <https://doi.org/10.1086/596640>; and Intergovernmental Panel on Climate Change (2023) *Climate change 2023 synthesis report: summary for policymakers*, available at: www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_SPM.pdf.

133 Greenpeace and the Runnymede Trust (2022) *Confronting injustice: racism and the environmental emergency*, available at: www.greenpeace.org.uk/wp-content/uploads/2024/07/Confronting-Injustice-2022-web.pdf.

134 Cameron PD and Stanley MC (2017) *Oil, gas and mining: a sourcebook for understanding the extractive industries* (Washington, DC: World Bank), available at: <https://documents1.worldbank.org/curated/en/222451496911224999/pdf/Oil-Gas-and-Mining-A-Sourcebook-for-Understanding-the-Extractive-Industries.pdf>.

135 Greenpeace and the Runnymede Trust (2022) *Confronting injustice: racism and the environmental emergency*, available at: www.greenpeace.org.uk/wp-content/uploads/2024/07/Confronting-Injustice-2022-web.pdf.

136 McGregor D, Whitaker S and Sritharan M (2020) Indigenous environmental justice and sustainability *Current Opinion in Environmental Sustainability* **43**: 35–40, available at: <https://doi.org/10.1016/j.cosust.2020.01.007>.

137 Jubilee Debt Campaign (2021) *Lower income countries spend five times more on debt payments than dealing with climate change*, available at: https://debtjustice.org.uk/wp-content/uploads/2021/10/Lower-income-countries-spending-on-adaptation_10.21.pdf.

138 Loach M (2023) *It's not that radical: climate action to transform our world* (London: Penguin Random House), at page 46.

139 World Bank Group (2022) *Pakistan: flood damages and economic losses over USD 30 billion and reconstruction needs over USD 16 billion – new assessment*, available at: www.worldbank.org/en/news/press-release/2022/10/28/pakistan-flood-damages-and-economic-losses-over-usd-30-billion-and-reconstruction-needs-over-usd-16-billion-new-assessme.

consequences.¹⁴⁰

Measures that respond to climate change and health that do not consider these international injustices can risk continued harms. For example, although there are moves to transition to renewable energy sources, some forms, such as electric cars and solar panels, require batteries to store this energy. These batteries require lithium and cobalt which are mined in countries including the Democratic Republic of the Congo (DRC), Bolivia and Chile. Without careful oversight, this can result in displacement, destruction of livelihoods, food and water insecurity, biodiversity loss, and poor health outcomes for local communities – sometimes leading to human rights violations – while profits are gained in the Global North.¹⁴¹ In the DRC, cobalt miners have experienced high levels of toxic metals in their body and are at risk of developing respiratory illness, heart disease or cancer due to a lack of preventative strategies associated with mining.¹⁴² This is exacerbated by companies based in the Global North taking control over an industry without ensuring safe working practices or considering the consequences of their actions for local communities – a long-standing practice throughout the history of oil, gas and coal extraction.¹⁴³ This risks leaving the Global South vulnerable and dependent on the Global North, as communities may rely on such exploitative practices for income and livelihoods.¹⁴⁴

International negotiations (for example at annual COP meetings) often consider the development of ‘climate change loss and damage’ measures that are designed to “avert, minimize and address loss and damage associated with climate change impacts, especially in developing countries that are particularly vulnerable to the adverse effects of climate change.”¹⁴⁵ Many countries have asked for the loss and damage they have experienced to be recognised by the countries that have contributed the most to driving climate change, and for financial needs to be covered by those responsible for current and historical emissions, including through reparations.¹⁴⁶ These claims raise pressing ethical questions related to solidarity and responsibility, outlined earlier in this report, particularly for countries that have contributed to and profited from historical climate emissions and that have

140 Romanello M, Walawender M, Hsu SC, *et al.* (2024) The 2024 report of the *Lancet* Countdown on health and climate change: facing record breaking threats from delayed action *The Lancet* **404(10465)**: P1847–96, available at: [www.thelancet.com/journals/lancet/article/PIIS0140-6736\(24\)01822-1/abstract](http://www.thelancet.com/journals/lancet/article/PIIS0140-6736(24)01822-1/abstract).

141 Sovacool B, Ali S, Bazilian M, *et al.* (2020) Sustainable minerals and metals for a low carbon-future *Science* **367(6473)**: 30–3; Sovacool BK, Hook A, Martiskainen M, *et al.* (2020) The decarbonisation divide: contextualising landscapes of low-carbon exploitation and toxicity in Africa *Global Environmental Change* **60**: 102028; and Sovacool B (2021) Who are the victims of low-carbon transitions? Towards a political ecology of climate change mitigation *Energy Research and Social Science* **73**: 101916.

142 Sovacool B, Ali S, Bazilian M, *et al.* (2020) Sustainable minerals and metals for a low carbon-future *Science* **367(6473)**: 30–3.

143 Greenpeace and the Runnymede Trust (2022) *Confronting injustice: racism and the environmental emergency*, available at: www.greenpeace.org.uk/wp-content/uploads/2024/07/Confronting-Injustice-2022-web.pdf.

144 Zylinski S (2024) *Neocolonial climate finance: keeping the Global South vulnerable and dependent*, Transforming Society, available at: www.transformingsociety.co.uk/2024/08/22/neocolonial-climate-finance-keeping-the-global-south-vulnerable-and-dependent.

145 United Nations Framework Convention on Climate Change FCCC/CP/2012/8/Add.1.

146 Rowling M (2021) Climate ‘loss and damage’ earns recognition but little action in COP26 deal, Reuters, available at: www.reuters.com/business/cop/climate-loss-damage-earns-recognition-little-action-cop26-deal-2021-11-13.

implemented colonial practices in the past.¹⁴⁷

The question of how to respond to these claims ethically can apply to policy and decision makers more generally. They have an ongoing responsibility to ensure that current and future policies for mitigation and adaptation do not further exacerbate existing global inequity and inequality. As highlighted in the previous sub-section, the clear feedback from our research activities was that while everyone has a role to play in responding to climate change, some bear greater responsibility for enacting change than others. The role that stakeholders have, or have had, in advancing and profiting from climate change is arguably a key factor in indicating where the burden of responsibility should fall, today and into the future. Policy and decision makers need to consider the inequities outlined in this section and ensure that barriers to mitigation and adaptation (e.g. due to a lack of resources) for some countries are acknowledged and that support is given to overcome them.

Allocating resources and expenditure

Our research highlighted the challenges associated with allocating resources and direct expenditure to develop and implement climate change measures, both nationally and internationally. Climate change action will often require up-front investment. This is recognised by the IPCC, which notes that:

"To accelerate climate action, the adverse consequences of these changes can be moderated by fiscal, financial, institutional and regulatory reforms and by integrating climate action with macroeconomic policies through (i) economic wide packages, consistent with national circumstances, supporting sustainable low-emission growth paths; (ii) climate resilient safety nets and social protection; and (iii) improved access to finance for low-emissions infrastructure and technologies, especially in developing countries."¹⁴⁸

This was echoed in the Lancet Countdown's 2024 report, which argued that "a rapid growth in predictable and equitable investment is urgently needed to avoid the most dangerous impacts of climate change."¹⁴⁹ While these financial responses may result in a short-term economic loss, evidence suggests that they are likely to lead to substantial savings and health benefits over time.¹⁵⁰ In the UK, it is estimated that the

147 Nuffield Council on Bioethics (2023) *Health, climate change and ethics: an overview*, available at: www.nuffieldbioethics.org/publication/health-climate-change-and-ethics-an-overview.

148 Intergovernmental Panel on Climate Change (2023) *Climate change 2023 synthesis report: summary for policymakers*, available at: www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_SPM.pdf.

149 Romanello M, Walawender M, Hsu SC, et al. (2024) The 2024 report of the *Lancet* Countdown on health and climate change: facing record breaking threats from delayed action *The Lancet* **404(10465)**: P1847–96, available at: [www.thelancet.com/journals/lancet/article/PIIS0140-6736\(24\)01822-1/abstract](http://www.thelancet.com/journals/lancet/article/PIIS0140-6736(24)01822-1/abstract).

150 Hill P (2024) *Strategy and justice: managing the geopolitics of climate change* (London: LSE), available at: www.lse.ac.uk/granthaminstitute/publication/strategy-and-justice-managing-the-geopolitics-of-climate-change; and Romanello M, Walawender M, Hsu SC, et al. (2024) The 2024 report of the *Lancet* Countdown on health and climate change: facing record breaking threats from delayed action *The Lancet* **404(10465)**: P1847–96, available at: [www.thelancet.com/journals/lancet/article/PIIS0140-6736\(24\)01822-1/abstract](http://www.thelancet.com/journals/lancet/article/PIIS0140-6736(24)01822-1/abstract).

net zero transition will cost around 2% of GDP but will have a net benefit of around 4%.¹⁵¹ Similarly, global mitigation action could reduce the economic costs of climate change damages to the UK from 7.4% to 2.4% of UK GDP by 2100.¹⁵² Without investment into climate change measures, financial costs are only likely to increase. For example, air pollution alone costs the NHS and social care sector approximately £1.6 billion annually, with costs expected to increase if climate impacts intensify.¹⁵³

Despite the benefits of investment, deciding how best to spend money – on a national or international level; on mitigation, adaptation, or loss and damage – can be challenging. Policy and decision makers need to balance a range of considerations and trade-offs between competing priorities that engage ethical considerations related to responsibility, justice and solidarity. These interests and claims have been acknowledged in various ways, including the UNFCCC’s principle of “common but differentiated responsibilities and respective capabilities”¹⁵⁴ and ethical principles such as ‘polluter pays’ (which urges financial decisions to be influenced by who is accountable for causing the problem) and ‘ability to pay’ (which aims to ensure that the cost of climate measures do not exacerbate inequalities).¹⁵⁵

151 Rising J, Dietz S, Dumas M, et al. (2022) *Policy brief: what will climate change cost the UK?* Grantham Research Institute on Climate Change and the Environment, LSE, accessed at: www.lse.ac.uk/granthaminstitute/wp-content/uploads/2022/05/Climate-costs-UK-policy-brief.pdf.

152 Rising J, Dietz S, Dumas M, et al. (2022) *Policy brief: what will climate change cost the UK?* Grantham Research Institute on Climate Change and the Environment, LSE, accessed at: www.lse.ac.uk/granthaminstitute/wp-content/uploads/2022/05/Climate-costs-UK-policy-brief.pdf.

153 NHS England (2023) *Greening the business case*, available at: <https://www.england.nhs.uk/long-read/greening-the-business-case/>.

154 United Nations Framework Convention on Climate Change 1992, available at: <https://unfccc.int/resource/docs/convkp/conveng.pdf>.

155 The Stanford Encyclopedia of Philosophy (2021) *Climate justice*, available at: <https://plato.stanford.edu/archives/win2021/entries/justice-climate>; and Nuffield Council on Bioethics (2023) *Health, climate change and ethics: an overview*, available at: www.nuffieldbioethics.org/publication/health-climate-change-and-ethics-an-overview.

4. How can ethical analysis support policy development and decision making in the UK?

Key messages

- Case studies can help us explore key ethical considerations that may arise when developing and implementing climate change and health measures.
- In **human health and care**, ethical issues may arise in decarbonising infrastructure and services and due to changing professional and patient expectations, responsibilities, roles and relationships.
- Ethical considerations that are engaged with the sustainability and decarbonisation of the **agricultural sector** include employment and livelihoods, meat consumption, meat alternatives and human/non-human interactions.
- Large-scale technological interventions that manipulate the Earth's natural environment through **geoengineering** raise questions about balancing the benefits and harms of this technology, considering non-human animals, ecosystems and future generations, and about the possible legal and ethical implications of interventions that may cross jurisdictional boundaries.
- These case studies illustrate why ethical analysis is integral to the development of mitigation and adaptation measures that seek to address the interconnected challenges of climate change and health.

In this section, we provide three case studies that illustrate the ethical considerations raised by different climate measures, highlighting why and how ethical analysis can support policy and decision making in the UK. The case studies focus on:

- human health and care;
- agriculture; and
- geoengineering.

These case studies have been chosen to convey a variety of ethical considerations that may arise across other, distinctly complex areas in which there is a common goal

of addressing climate change and health. The section is not intended to be an exhaustive or representative account of all of the ethical considerations relevant to each issue, or to provide recommendations for how specific challenges should be addressed. Instead, it aims to provide an overview of the relevant ethical issues and of where an ethical analysis may be beneficial. We will build on this in future work, and we hope that it provides a starting point for others to embed ethical analysis into climate change measures (alongside other considerations such as scientific evidence and the law).

Human health and care

While human health and care systems are responsible for treating adverse health outcomes associated with climate change, they also contribute significantly to emissions. For example, NHS England and NHS Scotland are responsible for around 4–5% of GHG emissions in their respective countries.¹⁵⁶ Commitments have been made to reach net zero across healthcare in all four nations of the UK.¹⁵⁷ England and Scotland aim to meet this target by 2040, Wales and Northern Ireland by 2050. The UK government has also enshrined the NHS England commitment into legislation through Section 9 of the Health and Social Care Act 2022.¹⁵⁸ In NHS England, progress is monitored using data on the economic spend and carbon intensity of different activities.¹⁵⁹ Meeting these targets requires change both in how health and care is provided and across the NHS estate (including supply chains, procurement, waste management and energy use).¹⁶⁰

Positive changes to reduce the NHS's carbon footprint could include moving some care out of hospitals; pursuing low-carbon alternatives to non-reusable equipment (e.g. swabs and gloves) and particular treatment options (e.g. inhalers to treat asthma or anaesthetics to provide pain relief which currently contain GHGs);¹⁶¹ ensuring that health and care research promote climate-friendly outputs; and prioritising preventative healthcare to reduce the number of people who require hospital

156 NHS England (2021) *One year on from a world-first ambition – let's stay impatient on the NHS reaching net zero*, available at: www.england.nhs.uk/greenernhs/2021/10/blog-one-year-on-from-a-world-first-ambition-lets-stay-impatient-on-the-nhs-reaching-net-zero; and NHS Scotland (2022) *Climate emergency and sustainability strategy 2022–2026*, available at: www.gov.scot/publications/nhs-scotland-climate-emergency-sustainability-strategy-2022-2026.

157 NHS England (2020) *Delivering a 'net zero' National Health Service*, available at: www.england.nhs.uk/greenernhs/publication/delivering-a-net-zero-national-health-service; Northern Ireland Executive (2021) *The path to net zero energy*, available at: www.economy-ni.gov.uk/publications/energy-strategy-path-net-zero-energy; Welsh Government (2021) *NHS Wales decarbonisation strategic delivery plan 2021–2030*, available at: www.gov.wales/nhs-wales-decarbonisation-strategic-delivery-plan; and Scottish Government (2022) *NHS Scotland: climate emergency and sustainability strategy 2022–2026*, available at: www.gov.scot/publications/nhs-scotland-climate-emergency-sustainability-strategy-2022-2026.

158 Health and Social Care Act 2022, Section 9.

159 Tennison I, Roschnik S, Ashby B, et al. (2021) Health care's response to climate change: a carbon footprint assessment of the NHS in England *The Lancet Planetary Health* **5(2)**: E84–92.

160 Tennison I, Roschnik S, Ashby B, et al. (2021) Health care's response to climate change: a carbon footprint assessment of the NHS in England *The Lancet Planetary Health* **5(2)**: E84–92.

161 NHS England (2020) *Delivering a 'net zero' National Health Service*, available at: www.england.nhs.uk/greenernhs/publication/delivering-a-net-zero-national-health-service.

admissions.¹⁶²

Additionally, the health and care sector will need to adapt to the effects of climate change so that it can operate effectively despite adverse impacts on infrastructure, health and care professionals, and patients. The NHS will need to maintain essential services and provide care even at the most challenging times.¹⁶³ This needs to be done equitably, to ensure that no one is prone to experiencing worse health outcomes based on who they are, or where they live, as a result of climate impacts.

Box 2 provides some examples of changes that are already being implemented.

Box 2: Examples of progress towards net zero

- The first carbon net zero surgery has been undertaken by University Hospitals Birmingham. This was achieved through a number of changes, including using reusable gowns, recycling and minimising electricity.¹⁶⁴
- Manchester University NHS Foundation Trust halved its CO2 emissions from patient travel for specialist macular eye treatment – and simultaneously improved accessibility – by delivering consultation and treatment services from community hubs rather than hospitals.¹⁶⁵
- Great Ormond Street Hospital NHS Foundation Trust has significantly reduced the use of disposable gloves, saving the hospital £90,000.¹⁶⁶ Key to this success was the role of the lead nurse for infection prevention and control and lead practice educators, who engaged colleagues and raised awareness.¹⁶⁷
- NHS Scotland launched a new Environmental Management System in 2021 which health boards can use to identify environmental risks, assess the likelihood and scale of impacts, identify mitigation measures, and prioritise actions.¹⁶⁸

The role of healthcare professionals in responding to climate change has been

162 Callan C, Cameron G and Hardie T (2024) *Policy levers for a net zero NHS: four priorities for the future*, The Health Foundation, available at: www.health.org.uk/reports-and-analysis/briefings/policy-levers-for-a-net-zero-nhs-four-priorities-for-the-future.

163 NHS England, *Adaptation*, available at: www.england.nhs.uk/greenernhs/a-net-zero-nhs/adaptation.

164 NHS England, *University Hospitals Birmingham: a world first in carbon net zero surgery*, available at: www.england.nhs.uk/greenernhs/whats-already-happening/university-hospitals-birmingham-a-world-first-in-carbon-net-zero-surgery.

165 McGeoch (2023) *Net zero care: what will it take?* The Health Foundation, available at: www.health.org.uk/publications/long-reads/net-zero-care-what-will-it-take.

166 NHS England, *Great Ormond Street Hospital: reducing single use plastics case study*, available at: www.england.nhs.uk/greenernhs/whats-already-happening/great-ormond-street-hospital-reducing-single-use-plastics-case-study.

167 McGeoch (2023) *Net zero care: what will it take?* The Health Foundation, available at: www.health.org.uk/publications/long-reads/net-zero-care-what-will-it-take.

168 Scottish Government (2022) *NHS Scotland: climate emergency and sustainability strategy 2022–2026*, available at: www.gov.scot/publications/nhs-scotland-climate-emergency-sustainability-strategy-2022-2026.

championed worldwide.¹⁶⁹ The Lancet Countdown reports that:

"The powerful and trusted leadership of the health community could hold the key to reversing ... concerning trends and making people's wellbeing, health and survival a central priority of political and financial agendas."¹⁷⁰

The General Medical Council (GMC)¹⁷¹ has updated its core professional ethics guidance to include sustainability considerations.¹⁷² The guidance outlines that doctors (an example of one healthcare profession) should choose sustainable solutions when they are able to, provided that these do not compromise care standards or patient outcomes.¹⁷³

Ethical considerations

Ethical consideration is needed for sustainability to be incorporated into the health and care sector, to reduce emissions and adapt to adverse impacts, while ensuring that health and care standards are maintained. For example, as our 2023 report outlines:

"... action on climate change which seeks to reduce greenhouse gas emissions from healthcare may affect what services and treatment can be provided. The potential future benefits must be weighed against the immediate need to provide high-quality healthcare services to those who need it."¹⁷⁴

Ways of reducing emissions could include changes to what medication is prescribed by healthcare professionals; the choice of equipment they use; the frequency of patient monitoring; and the way research and drug development is undertaken, evaluated and implemented.¹⁷⁵ Adaptation measures could include raising patient awareness and preparing healthcare professionals to respond to climate health impacts; ensuring infrastructure resilience; and changing how care is delivered to

169 Romanello M, Napoli C, Green C *et al.* (2023) The 2023 report of the *Lancet* Countdown on health and climate change: the imperative for a health centred response in a world facing irreversible harms *The Lancet* **402(10419)**: P2346–94, available at: [https://doi.org/10.1016/S0140-6736\(23\)01859-7](https://doi.org/10.1016/S0140-6736(23)01859-7).

170 Romanello M, Walawender M, Hsu SC, *et al.* (2024) The 2024 report of the *Lancet* Countdown on health and climate change: facing record breaking threats from delayed action *The Lancet* **404(10465)**: P1847–96, available at: [www.thelancet.com/journals/lancet/article/PIIS0140-6736\(24\)01822-1/abstract](http://www.thelancet.com/journals/lancet/article/PIIS0140-6736(24)01822-1/abstract).

171 As the statutory regulator of doctors in the UK, the GMC sets out the standards that medical professionals are expected to meet.

172 GMC (2024) *Good medical practice 2024*, available at: www.gmc-uk.org/professional-standards/good-medical-practice-2024.

173 GMC (2024) *Good medical practice 2024*, Section 15, available at: www.gmc-uk.org/professional-standards/good-medical-practice-2024.

174 Nuffield Council on Bioethics (2023) *Health, climate change and ethics: an overview*, available at: www.nuffieldbioethics.org/publication/health-climate-change-and-ethics-an-overview.

175 Yassaie R and Brooks L (2024) Reassessing 'good' medical practice and the climate crisis *Journal of Medical Ethics* online first, available at: <https://doi.org/10.1136/jme-2023-109713>.

ensure it is accessible, regardless of infrastructure damage.¹⁷⁶ Such changes may provide an opportunity for co-benefits to be identified. For example, we heard that over-prescribing could be reduced while also lowering medication-related emissions.

These changes could also affect relationships between patients and healthcare professionals, which are central to high-quality care and are built on trust, shared decision making and good communication. Our research highlighted the importance of policy and decision makers considering the impact on patients of any proposed changes, especially those who already experience health-related inequality. For example, although more sustainable alternative treatment options may be as effective as less sustainable treatments, patients (and healthcare professionals) may be reluctant to see alterations to their care and treatment, especially if they have become used to a particular pathway over time. Resistance to change can negatively impact quality of care and be a barrier to the acceptance of further measures required to reach net zero. Ethical questions also arise in relation to the responsibility of individual patients to make healthcare decisions with sustainability in mind, such as in using medication, making healthy lifestyle changes and proactively considering alternative treatment options.

For healthcare professionals, we found that questions arise about how to exercise professional judgement; how their ability to practise may be affected by sustainability standards; and whether they have the support and resources required to make changes to the way care is provided. Stakeholders expressed uncertainty about how the GMC's sustainability standard should interact with the other standards of care and behaviour, especially where these may be in tension.

Additionally, although healthcare professionals are being called upon to exercise leadership in responding to climate change and health, some perceive there to be considerable individual risk to their professional registration arising from sanctions imposed in recent regulatory cases related to climate activism. The GMC has suspended doctors who have received sentences for peaceful, but illegal, climate action which it is argued may undermine public confidence in the medical profession.¹⁷⁷ Some healthcare professionals feel that these sanctions conflict with messaging around leadership, believing that such action is both part of their professional responsibility and a justified response to the urgency of climate change and its health impacts. This highlights a tension between the different interpretations of 'professional responsibility' by the GMC and by healthcare professionals who wish to advocate for change.

176 Stanford V, *Climate change adaptation: a guide for health and care professionals*, Centre for Sustainable Healthcare, available at: <https://sustainablehealthcare.org.uk/blog-climate-change-adaptation>.

177 Medical Practitioners Tribunal Service (2024) Dr Sarah Benn, available at: <https://www.mpts.org/hearings-and-decisions/tribunal-hearings-and-decisions/dr-sarah-benn--apr-24>; and Medical Practitioners Tribunal Service (2024) Dr Diana Warner, available at: <https://www.mpts-uk.org/hearings-and-decisions/tribunal-hearings-and-decisions/dr-diana-warner--aug-24>.

In summary, the following key questions arose from our research:

- How should healthcare practitioners involve patients in treatment and care decisions where there are different options with varying sustainability impacts?
- How can healthcare practitioners ensure public trust and protect their relationship with patients in a transition to net zero, where there is a risk that treatment options may change?
- How can we ensure that changes to health and care do not exacerbate existing health inequalities and affect some people disproportionately?
- How can we make sure that sustainability is aligned with the best possible healthcare for the patient?
- At what level should sustainability decisions be made (e.g. patient, clinician, senior leadership, drug regulators, healthcare regulators, government)?
- Should healthcare professionals inform patients about the health risks of the effects of climate change, even where individuals may be unable to act on the information or guidance they are given?
- Is it justifiable to pursue a treatment option that may minimally compromise the quality of care for some patients, but that would significantly reduce emissions and thereby benefit the health of many individuals?
- In the light of resource constraints, how should the NHS navigate the need to prioritise clinical care and the need to direct resources to addressing climate change?
- How can the NHS ensure that it is prepared for service disruption, including increased demand and threats to infrastructure, caused by climate change, in the light of these additional constraints?
- How should climate change considerations interact with cost–benefit factors?

Agriculture

In the UK, agriculture accounts for around 12% of GHGs.¹⁷⁸ These emissions come from sources such as livestock, agricultural soils and off-road machinery.¹⁷⁹ As a result, the CCC has identified agriculture as a sector that needs to accelerate its reduction of emissions.¹⁸⁰

Currently, there are numerous UK-based initiatives aimed at ensuring that climate action is taken across the agricultural sector. In 2019 the National Farming Union

178 Department for Environment, Food and Rural Affairs (2024) *Agriculture in the United Kingdom 2023*, available at: www.gov.uk/government/statistics/agriculture-in-the-united-kingdom-2023.

179 Department for Environment, Food and Rural Affairs (2024) *Agri-Climate Report 2023*, available at: www.gov.uk/government/statistics/agri-climate-report-2023/agri-climate-report-2023.

180 Climate Change Committee (2024) *2024 progress report to parliament*, available at: www.theccc.org.uk/publication/progress-in-reducing-emissions-2024-report-to-parliament.

(NFU) set a 2040 net zero target for agriculture in England and Wales.¹⁸¹ NFU Scotland has also acknowledged that action will be required to reach the wider national target of net zero by 2045 in Scotland.¹⁸² The UK government has outlined an agricultural transition plan that focuses on investing in innovation and improving agricultural production, food production, and non-human animal health and welfare.¹⁸³ Other schemes, such as the Sustainable Farming Incentive, are available to support farmers to improve environmental sustainability and maintain animal welfare standards.¹⁸⁴ Some agricultural companies are taking the lead in addressing their own carbon emissions by developing sustainable practices. For example, Ivy's Reserve – an English company – has developed practices that have led to the world's first carbon-neutral cheddar.¹⁸⁵

However, additional measures may be needed in order to rapidly reduce agricultural contributions to climate change and its adverse health outcomes. A wealth of different measures have been identified across the agriculture sector that may make climate-positive changes to land use and food systems. Mitigation measures include nature-based solutions and alternative land use, such as peatland restoration, tree planting, rewilding and using existing agricultural land to facilitate renewable energy sources.¹⁸⁶ Other suggested mitigation measures include limiting meat production or restricting it to practices that are environmentally sustainable. At the same time, adaptation measures are required to address the adverse impacts that climate change may have on agricultural workers and livestock, and on food security. Adaptation measures include farm water management and storage, soil moisture conservation, agroforestry, and restoration of wetlands and forest ecosystems.¹⁸⁷ As well as addressing climate change, action in these areas may enhance biodiversity and ecosystem functions and benefit employment and local livelihoods.¹⁸⁸

Emerging techniques, such as genome editing in farmed animal breeding, are also being proposed as potential solutions. However, there are numerous ethical issues that need to be considered, as explored in our [2021 report](#).¹⁸⁹

181 NFU (2019) *Achieving net zero: farming's 2040 goal*, available at: www.who.int/teams/health-ethics-governance/health-and-climate-change.

182 NFU Scotland (2024) *NFU Scotland comment on Climate Change Target changes*, available at: www.nfus.org.uk/news/blog/nfu-scotland-comment-on-climate-change-target-changes.

183 Department for Environment, Food and Rural Affairs (2024) *Agricultural transition plan update January 2024*, available at: www.gov.uk/government/publications/agricultural-transition-plan-2021-to-2024/agricultural-transition-plan-update-january-2024.

184 Department for Environment, Food and Rural Affairs and Rural Payments Agency (2024) *Sustainable farming incentive: guidance for applicants and agreement holders*, available at: www.gov.uk/government/collections/sustainable-farming-incentive-guidance.

185 Ivy's Reserve, *The world's first carbon neutral cheddar*, available at: www.ivys-reserve.com/carbon-neutral.

186 European Environment Agency (2024) *European climate risk assessment*, available at: www.eea.europa.eu/publications/european-climate-risk-assessment.

187 Intergovernmental Panel on Climate Change (2023) *Climate change 2023 synthesis report: summary for policymakers*, available at: www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_SPM.pdf.

188 Intergovernmental Panel on Climate Change (2023) *Climate change 2023 synthesis report: summary for policymakers*, available at: www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_SPM.pdf.

189 Nuffield Council on Bioethics (2021) *Genome editing and farmed animal breeding: social and ethical issues*, available at: <https://cdn.nuffieldbioethics.org/wp-content/uploads/Genome-editing-and-farmed-animal-breeding-FINAL-WEB-PDF.pdf>.

Ethical considerations

Ethical analysis needs to be embedded in the development of all climate change measures so that harmful and inequitable unintended consequences can be avoided.¹⁹⁰ In this section we focus on four live issues in relation to agriculture, climate change and health: employment and livelihoods, meat consumption, meat alternatives, and human/non-human animal interactions.

A concern highlighted throughout our research was that both climate change and the measures pursued across agriculture to address it may result in job losses and increased food costs. Concerns like these have led to the development of concepts such as the need for a 'just transition', which asks, in part, questions about how best to support workers in sectors where measures to address climate change are required and where communities may be adversely impacted as a result.¹⁹¹ Others have argued that the agricultural transition can create jobs and increase employment. Working towards a just transition may also emphasise the importance of considering how to balance potential benefits and harms of mitigation and adaptation and of identifying ways to avoid or limit negative and inequitable consequences for specific populations or sectors.

Transitioning away from the present level of meat production and consumption was another key area identified in the research and is one that could benefit from closer ethical analysis. This issue is already receiving attention from numerous individuals and organisations. For example, the Lancet Countdown's 2023 UK Policy Brief recommends that the government should implement measures aimed at reducing consumption of red and processed meat and dairy products.¹⁹² As well as reducing emissions, this would reduce risks to human health, such as cardiovascular disease, stroke, and some cancers associated with diets high in beef, lamb and pork.¹⁹³ It would also reduce the number of non-human animals bred, raised and killed each year for human consumption.

There are also contrasting concerns about animal welfare and equity that need consideration. Animal welfare conditions could be negatively affected by swapping one form of meat production for another. For example, beef farming – which uses the most land and produces the most methane – may be substituted with chicken

190 Nuffield Council on Bioethics (2023) *Health, climate change and ethics: an overview*, available at: www.nuffieldbioethics.org/publication/health-climate-change-and-ethics-an-overview.

191 Climate Change Committee (2024) *UK off track for net zero says country's climate advisors*, available at: www.theccc.org.uk/2024/07/18/uk-off-track-for-net-zero-say-countrys-climate-advisors.

192 The Lancet Countdown, UK Health Alliance on Climate Change, British Medical Association and Royal College of General Practitioners (2023) *Policy brief for the UK*, available at: www.bma.org.uk/media/vv3nxqkh/uk-lancet-countdown-policy-brief-2023-v1.pdf.

193 Tusso P, Ismail M, Ha B and Bartolotto C (2013) Nutritional update for physicians: plant-based diets *The Permanente Journal* **17(2)**: 61–6; and McGeoch (2023) *Net zero care: what will it take?* The Health Foundation, available at: www.health.org.uk/publications/long-reads/net-zero-care-what-will-it-take.

farming to reduce emissions.¹⁹⁴ However, intensive chicken farming harms more animals per meal, due to the factory farming conditions in which chickens are often raised.¹⁹⁵ Intensive farming also increases the risks of antibiotic resistance and pandemics, which could in turn have consequences for both human and non-human animal health.¹⁹⁶ Ethical questions are therefore raised in relation to multispecies justice, extending moral concern to other animals, and the concept of 'rights' for non-human animals.¹⁹⁷ This may extend to considering the benefits and risks of effective adaptation measures that respond to the direct impacts that climate change has on livestock, and to questions about how to balance non-human animal interests with human interests, especially when they are in tension.

While plant-based diets are widely accepted to have numerous health and climate benefits, issues can arise where foods are not easily accessible or may lead to health issues for some individuals. In the UK, healthy foods, including plant-based foods, are more than twice as expensive as less healthy products, per calorie.¹⁹⁸ Without considering how efforts to transition diets may affect different individuals, policy and practice may risk exacerbating poor health outcomes. For some, a plant-forward diet, which focuses on limiting rather than removing meat and dairy products, may be more achievable.¹⁹⁹ However, not everyone will feel motivated to make this change. This may lead to some individuals 'free-riding', presuming that others will take responsibility for making the necessary changes. This raises ethical considerations relating to collective action and individual choice.

The German Ethics Council has recently argued that non-governmental and private organisations have a moral responsibility to enable individuals to develop climate-friendly consumption behaviours.²⁰⁰ The German Council recognises that, at the political level, the social conditions and the legal framework need to be developed so that behaviours which may cause lower emissions are possible, and so that the burdens are fairly distributed. In relation to shifting diets, the Lancet Countdown report also highlights that solutions will need to enable equitable access to affordable, healthy, low-carbon diets, which must also meet local nutritional and cultural

194 Scherer L, Behrens P and Tukker A (2019) Opportunity for a dietary win-win-win in nutrition, environment, and animal welfare *One Earth* **1(3)**: 349–60; and Centre for Environmental and Animal Protection (2021) *Towards plant-forward diets: a toolkit for local policymakers*, available at: <https://guarinicenter.org/wp-content/uploads/2022/11/2021-10-04-Guarini-CEAP-Towards-Plant-Forward-Diets.pdf>.

195 Centre for Environmental and Animal Protection (2021) *Towards plant-forward diets: a toolkit for local policymakers*, available at: <https://guarinicenter.org/wp-content/uploads/2022/11/2021-10-04-Guarini-CEAP-Towards-Plant-Forward-Diets.pdf>.

196 Godfray HCJ, Aveyard P, Garnett T, *et al.* (2018) Meat consumption, health, and the environment *Science* **20(361)**: 5324.

197 For further information on some of the ethical issues that relate to farmed animals, see Nuffield Council on Bioethics (2021) *Genome editing and fanned animal breeding: social and ethical issues*, available at: www.nuffieldbioethics.org/publication/genome-editing-and-farmed-animal-breeding-social-and-ethical-issues.

198 The Food Foundation (2023) *The broken plate 2023: the state of the nation's food system*, available at: <https://foodfoundation.org.uk/publication/broken-plate-2023>.

199 EAT Lancet Commission on Food, Planet and Health, *The planetary health diet*, available at: <https://eatforum.org/eat-lancet-commission/the-planetary-health-diet-and-you>.

200 German Ethics Council (2024) *Climate justice*, available at: www.ethikrat.org/fileadmin/Publikationen/Stellungnahmen/englisch/climate-justice-summary.pdf.

requirements.²⁰¹ This may include evaluating and implementing alternative agricultural practices that can reduce emissions, promote livestock health and welfare, and ensure equitable outcomes without fully eliminating meat and dairy production.

Related to initiatives to reduce meat consumption are ethical questions raised by meat alternatives, which we explored in our 2020 [policy briefing](#). While the sustainability profiles of meat alternatives look promising in some scenarios, energy-intensive processes could reduce their sustainability, and more evidence is needed on the effects of production and the health implications of eating meat alternatives, some of which are highly processed. Many sustainable plant-based alternatives are also more expensive. For example, sustainable plant-based alternatives to chicken are currently around 27% more expensive than chicken breast.²⁰² On the other hand, it might not be appropriate or fair to hold meat alternatives to higher standards of healthiness than conventional meat, given their potential positive environmental and animal welfare profiles.²⁰³ These considerations are particularly relevant as the UK has recently become the first country in Europe to approve the use of laboratory-grown meat.²⁰⁴

Finally, it is important to consider the interaction between human and non-human animals when transitioning the agricultural sector towards net zero and developing climate change adaptation measures. One potential harm identified in our 2023 '[Health, climate change and ethics](#)' report is that some land restoration initiatives, such as rewilding, may increase animal–human conflict by increasing human proximity to wildlife, pests and vector-borne diseases (which harm both humans and non-human animals).²⁰⁵ Integrated concepts of health, such as One Health, Planetary Health, and some Indigenous peoples' and non-Western perspectives, often seek to address some of these issues. These approaches acknowledge the interconnectedness of human health and wellbeing with the state of non-human animals, plants and entire ecosystems as well as natural systems and processes such as the global climate. Drawing on such approaches may help to identify what benefits this interaction can have while avoiding any potential risks.

In summary, the following key questions arose from our research:

- How can a just transition for the agriculture sector be secured? Does this include only the protection of jobs and livelihoods, or should it also include considerations around global justice and interspecies justice? How should different stakeholders be involved in deciding what targets need to be met to

201 Romanello M, Napoli C, Green C *et al.* (2023) The 2023 report of the *Lancet* Countdown on health and climate change: the imperative for a health centred response in a world facing irreversible harms *The Lancet* **402(10419)**: P2346–94, available at: [https://doi.org/10.1016/S0140-6736\(23\)01859-7](https://doi.org/10.1016/S0140-6736(23)01859-7).

202 The Food Foundation (2023) *The broken plate 2023: the state of the nation's food system*, available at: <https://foodfoundation.org.uk/publication/broken-plate-2023>.

203 Nuffield Council on Bioethics (2022) *Meat alternatives*, available at: <https://s47055.pcdn.co/wp-content/uploads/Meat-alternatives-bioethics-briefing-note-1.pdf>.

204 Meatly (2024) *Press release: world first regulatory approval*, available at: <https://meatly.pet/meatly-approval>.

205 The Academy of Medical Science and The Royal Society (2022) *A healthy future: tackling climate change mitigation and human health together*, available at: <https://acmedsci.ac.uk/file-download/94272758>.

reach this outcome?

- How can we navigate individual responsibility, collective responsibility and the responsibility of the state in relation to behaviour change, for example encouraging limited consumption of non-human animal products?
- How should different human and non-human animal interests be considered and balanced when implementing measures across agricultural systems, especially when they may be in tension with each other?
- When developing new techniques or technologies that may reduce the agricultural sector's climate change impact, such as meat alternatives, how can we ensure that health is prioritised in the short and long term?

Geoengineering

New technologies and techniques are being proposed and used as adaptation and mitigation measures. Some technologies – including solar and wind energy – are well established, cost effective and generally supported by the public, especially when they are implemented with consideration for how they will impact local communities and wildlife.²⁰⁶ Some interventions may result in positive health outcomes if they can be proven to address climate change. But those that – for example – unintentionally change global precipitation patterns or disturb prevailing winds or oceanic currents could have disastrous and unpredictable consequences.²⁰⁷

Large-scale interventions which deliberately manipulate the Earth's natural environment, known as geoengineering, are less supported and may pose significant risks without caution and further evaluation. Geoengineering has received criticism as it is expensive, its long-term suitability is unproven, the off-target impacts are uncertain, and there is a risk that it will reduce the incentive for individuals and organisations – including fossil fuel industries and their funders – to implement proven mitigation measures.²⁰⁸

There are several ways that geoengineering can be undertaken, including removing or capturing CO₂ from the atmosphere using various technologies and methods. Some forms of geoengineering rely on natural techniques such as rewilding and reforestation, sometimes called 'nature-based solutions'. Others depend on technologies which are still in the development and experimental phase, and it is these on which we will focus our ethical considerations. For example, one potential method is solar radiation management. This involves techniques aimed at reflecting a small percentage of the Sun's light and heat back into space to cool the planet, including stratospheric aerosol injection and cloud brightening. Other methods include transporting and storing CO₂ in deep, underground locations.

206 Intergovernmental Panel on Climate Change (2023) *Climate change 2023 synthesis report: summary for policymakers*, available at: www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_SPM.pdf.

207 Nuffield Council on Bioethics (2023) *Health, climate change and ethics: an overview*, available at: www.nuffieldbioethics.org/publication/health-climate-change-and-ethics-an-overview.

208 UNESCO (2023) *Report of the World Commission on the Ethics of Scientific Knowledge and Technology on the ethics of climate engineering*, available at: <https://unesdoc.unesco.org/ark:/48223/pf00000386677>.

In the UK, there is interest in exploring geoengineering as a potential technological solution. In 2024, the UK's Advanced Research and Invention Agency committed to providing £56.8 million to explore climate cooling.²⁰⁹ However, the funding call notes the paucity of robust data and limited understanding of the full extent of its potential impacts. The Met Office has called for impartial research to further understand geoengineering to ensure that any future discussion of options to tackle climate change is based on the best available evidence and information.²¹⁰

Ethical considerations

Some ethical issues related to identifying and managing the risks of planet-scale interventions such as geoengineering were identified in our 2023 '[Health, climate change and ethics](#)' report:

- There is a need to balance benefit and harm and make sure they are distributed fairly. It may be difficult to do this effectively, as assessments of benefits and harms are speculative and probabilistic given the highly uncertain effects and high risks of such interventions.²¹¹ We therefore need to ask whether it is permissible to pursue a novel technology when the harms and benefits cannot be understood fully and it could have significant adverse impacts that we may be unable to alleviate.
- The potential rights and interests of non-human animals, whose health may be affected by changes in the Earth's system, need to be considered. As the technology may alter or intervene in the Earth's 'natural' processes, this may include exploring the normative content of concepts such as 'naturalness', which are more significant to some populations than to others, depending in part on relationships with the land and natural environments. Naturalness was the subject of work by the Nuffield Council on Bioethics in 2015.²¹²
- Issues of potential moral hazard in technological solutionism – e.g. the idea that we don't need behaviour change because technology will fix the climate – require ethical interrogation.²¹³ There are concerns that geoengineering will be considered an alternative to doing what we already know works, such as pursuing renewable energy instead of fossil fuels and protecting biodiversity. This could lead to well-established methods of mitigation not being pursued, and health suffering as a result.

209 ARIA (2024) *Exploring options for actively cooling on the early*, available at: [ARIA-Actively-cooling-the-earth-programme.pdf](#).

210 Met Office, *Met Office position on geoengineering research*, available at: www.metoffice.gov.uk/research/climate/earth-system-science/met-office-position-on-geoengineering-research.

211 Nuffield Council on Bioethics (2023) *Health, climate change and ethics: an overview*, available at: www.nuffieldbioethics.org/publication/health-climate-change-and-ethics-an-overview.

212 Nuffield Council on Bioethics (2015), *Issues about naturalness in public and political debates about science, technology and medicine: analysis paper*, available at: <https://cdn.nuffieldbioethics.org/wp-content/uploads/Naturalness-analysis-paper-1.pdf>.

213 Nuffield Council on Bioethics (2023) *Health, climate change and ethics: an overview*, available at: www.nuffieldbioethics.org/publication/health-climate-change-and-ethics-an-overview.

Geoengineering has the potential to change the Earth's systems into the future, so it also raises ethical questions relating to intergenerational responsibility. This includes trying to determine what is owed to emerging, future and hypothetical generations, and how to act when the interests of different generations conflict.²¹⁴ Some changes to the world's atmosphere may be irreversible, and so consideration is required about whether it is justifiable to take this risk, given that any burdens or negative consequences will fall on future generations. Alternatively, if there is potential for geoengineering to significantly address climate change and associated poor health outcomes for future generations, we may need to ask whether it is justifiable to limit its development.

Geoengineering also has the potential to affect populations around the world, even if development is undertaken in the UK. This raises questions about how to ensure the just division, and equitable distribution of the potential benefits and burdens of the technology. It may also raise questions about solidarity, in terms of developing shared practices reflecting a collective commitment to carrying the costs (financial, social, emotional or otherwise). This requires thinking about how the consequences of geoengineering may be experienced in locations other than where it is implemented, and about what measures could help to share any benefits and reduce negative consequences.

There are also links to questions of international inequities, as explored in Section 3. In our engagement activities, we heard that geoengineering could present itself as a neocolonial solution, as it is mainly countries in the Global North that are pursuing and seeking profit from it, despite potentially severe negative impacts for countries around the world that may not be included in decision making. It could also be argued that the money being put into geoengineering could instead be used to support the countries most affected by climate change. On a practical level, geoengineering that directly or indirectly affects a broad section of the Earth may cross jurisdictional boundaries and therefore raises novel legal questions about how accountability and authorisation can be assured and managed.

As geoengineering is a research activity and still in development, there are existing ethical frameworks that could support decision making. For example, the 2010 Asilomar Principles aim to guide research, including:

- **Promoting collective benefit:** Promoting the collective benefit of humankind and the environment must be the primary purpose of research.
- **Establishing responsibility and liability:** Responsibilities for the governance and oversight of large-scale climate engineering research activities must be **clarified or created**.
- **Open and cooperative research:** Research must be conducted openly and cooperatively, within a framework that has broad international support.

214 Nuffield Council on Bioethics (2023) *Health, climate change and ethics: an overview*, available at: www.nuffieldbioethics.org/publication/health-climate-change-and-ethics-an-overview.

- **Iterative evaluation and assessment:** Progress on climate engineering must be assessed through iterative, independent mechanisms.
- **Public involvement and consent:** Public participation and consultation must be engaged in research planning and oversight, assessments, and development of decision-making mechanisms.²¹⁵

Another more recent example is the American Geophysical Union's ethical framework principles for climate intervention research to ensure responsible research, climate justice, inclusive public participation, transparency and informed governance.²¹⁶

These frameworks are likely to form a sound basis on which ethical analysis can be developed, but were not designed to apply specifically to geoengineering being developed in the UK and the novel issues that it could raise. Building on this foundation will also require consideration of questions in procedural justice and equitable decision-making processes.

In summary, the following key questions arose from our research:

- How can we ensure that any benefits of geoengineering technologies are distributed fairly and any potential harms are identified and mitigated?
- How should limited resources be spent in tackling climate change and health? If solutions already exist, in what circumstances is it appropriate to pursue technologies where there is a lack of certainty about their effectiveness and long-term consequences?
- If geoengineering techniques have the potential to alter the Earth's 'natural' processes, how should we consider the interests of the non-human world in decision making and prioritisation?
- How can we navigate the potential changes that geoengineering may make to human relationships with the environment?
- Given that the value of interconnectedness between humans and the non-human world is experienced differently across individuals and communities globally, how can we ensure that these experiences are considered appropriately if geoengineering is pursued?
- If geoengineering crosses national and international boundaries, how can legal and regulatory instruments be adapted to ensure that it is developed appropriately and that there are accountability structures in place?

²¹⁵ Asilomar Scientific Organizing Committee (2010) *The Asilomar Conference recommendations on principles for research into climate engineering techniques: conference report* (Washington DC: Climate Institute).

²¹⁶ AGU (2024) *Ethical framework principles for climate intervention research*, available at: <https://agu.media.valet.com/portals/ethicalframework>.

Conclusion

This report urges policy and decision makers in the UK who are responsible for developing and implementing climate measures to recognise, consider and address to the health impacts of climate change and the measures which seek to address it, and to embed ethics into policy and decision making from the outset.

It is clear that interventions to both adapt to and mitigate the effects of climate change must be prioritised to limit or avoid serious adverse health impacts, nationally and internationally. There are opportunities to identify solutions with co-benefits, which can simultaneously limit climate change and address negative health outcomes for humans, non-human animals and the environment that health is dependent upon.

In identifying solutions, ethics is an essential tool to assess and overcome potential challenges, and identify what solutions should look like. Climate change, and the measures which seek to address it, can give rise to numerous issues which require ethical analysis to avoid maladaptive or unjust outcomes. For example, considerations around equity and justice need to be embedded in decision making to ensure that climate measures do not exacerbate or create new health inequalities. Similarly, ensuring that non-human interests and the interests of future human generations are considered in climate measures can raise questions about to whom and what we have a moral duty and what weight any such duty should have in decision making.

Policy and decision makers should take the time to engage relevant collaborators, identify the ethical considerations relevant to their context, and seek to achieve consensus through accessible and inclusive decision-making procedures. By doing so, they can have more confidence that climate measures will address both climate change and health in an ethically defensible manner, resulting in better outcomes for humans, non-human animals and the environment, both in the UK and globally.

We are open to working in partnership to support policy and decision makers in developing and implementing ethically informed climate change measures, and to identify future topics of work at the Nuffield Council on Bioethics.

Appendices

Methods of evidence gathering and acknowledgements

Background

The Nuffield Council on Bioethics initiated this research in January 2024 to explore the ethical issues involved at the intersection of climate change, health and the environment and how these issues applied to policy development and decision-making in the UK.

This report builds on our 2023 report [‘Health, climate change and ethics – an overview.’](#) which scoped ethical principles relevant to the area but identified that further work would be required to elucidate how these ethical issues operate in the context of policy responses to the health impacts of climate change.

Evidence Gathering and Deliberation

In addition to desk-based research, we undertook three main forms of evidence gathering:

- one-to-one meetings with individual experts in the UK and internationally;
- two commissioned literature reviews exploring the ethical approaches at the intersection of climate change, the environment and health and the relevant legal and regulatory landscape; and
- two workshops with experts in September 2024, exploring emerging themes and questions.

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The ethics literature review was authored by Cristian Timmermann, Katharina Wabnitz and Verina Wild, University of Augsburg, Institute for Ethics and History of Health in Society.

The legal and regulatory review was authored by Richard Caddell, Cardiff University.

Experts that participated in our meetings and workshops included:

- Andy Haines, Professor of Environmental Change and Public Health, London School of Hygiene and Tropical Medicine
- Anna Wienhues, KU Leuven
- Anne Barnhill, John Hopkins Berman Institute of Bioethics
- Bridget Pratt, Queensland Bioethics Centre, Australian Catholic University
- Caradee Y. Wright, South African Medical Research Council
- Carleigh Krubiner, Wellcome
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- Chris Degeling, University of Wollongong
- Christopher Shaw, University of Sussex
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- Stephen Turner, University of Essex
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