



a
manifesto
for
transformative
change

(what really should have
come out of cop26)

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About the Institution of Environmental Sciences (IES):

The IES is a visionary organisation leading debate, dissemination and promotion of environmental science and sustainability. We promote an evidence-based approach to decision and policy making.

We are devoted to championing the crucial role of environmental science in ensuring the well-being of humanity now and in the future.

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Executive summary

Humanity faces a profound reality: the decisions we make now will be historic ones, and they will decide the stories we tell to generations to come about the fight against climate change. The UN's COP26 climate change summit has been portrayed as the 'final stand' in that battle, though in reality it will have been the first of many to come as we work to create a better world for nature, people, and the planet.

This manifesto sets out 54 recommendations for global climate action, as well as the analysis and evidence to support them. Aimed at influencing COP26, those recommendations now provide us with an ideal point of comparison between what was achieved at the summit and what still needs to happen.

Climate change has been caused by complex interactions between social, economic, and natural systems. Our response should reflect that, transforming those systems to become more sustainable and employing systems thinking approaches to achieve multiple benefits for the environment, society, and the economy. Science has a crucial role to play by providing the evidence people need to understand the outcomes of different options and the potential to create a future which improves everyone's lives.

Finance will drive the transition, so the work done at COP26 to begin aligning finance, innovation, and skills must continue. Clear taxonomies and the facilitation of a level playing field will be essential to mobilise the private sector. Businesses can also drive change through new business models, ESG principles, and sector-by-sector strategies, but action must be credible and transparent. As we move on from COP26, sustainable businesses will be rewarded by engaged consumers while those that do not take sustainability seriously will be left behind.

The global community understands the need to transition energy systems away from carbon-intensive production, though different approaches will be required in different places, down to the level of specific localities and communities. Investment is needed to upscale and deliver renewable energy sources and to transfer knowledge between global partners and communities to support the identification of appropriate contextual solutions.

One of the greatest assets in the battle against climate change is an engaged global public that wants to be part of achieving climate ambitions. Not only can communities share evidence of what works on the ground through co-production, they can drive forward change that avoids injustice or economic challenge through 'just transitions' and democratic empowerment.

Nature is a complex system which connects to human lives and livelihoods in many ways. To that end, our interactions with nature must reflect the multiple benefits we can achieve from interventions, so multi-functional approaches such as nature-based solutions will be crucial. Fundamental ecological principles, particularly the mitigation hierarchy, must be embedded at every level of action, and humanity must seek a better relationship with the natural world which underpins so many of the 'ecosystem services' our society needs.

Design will be crucial to embedding sustainability into our economic systems. Circular economy principles are essential to reaching our climate goals, and businesses must address the unsustainable production and consumption which underpins their business models. Governments and consumers have a key role to play in supporting that transition, with greater transparency, regulation, and consumer choice at the heart of shifting the burden of our economy away from materials and unsustainable pressures on nature.

Adaptation and resilience must be an equal part of our battle against climate change. Even as we push for greater mitigation, we are already faced with changing climates which have real consequences for communities. A systems approach to the built environment and land use is essential to embedding resilience, particularly to systemic risk vulnerabilities and the risk of cascading failures which are likely to increase as we undergo decarbonisation. Our land use and food systems also require transformative change to meet the dual goals of climate mitigation and creating sustainable and resilient food systems.

Science will be at the heart of our action to combat climate change, and innovation is crucial to delivering new solutions and scaling-up existing ones. Both require sufficient funding for research and development, as well as realistic timeframes to achieve what is asked of them. Innovation also requires 'level playing fields' to drive private sector action. Robust science based on systematic reviews can communicate the risk and reward associated with different pathways, helping communities to choose the decarbonised future that suits their needs.

Our mobility systems require fundamental change from the design stage to become sustainable, recognising the extent to which demand, affordability, and speed shape those systems. Active travel must become accessible and widespread for shorter journeys. Infrastructure and subsidies must be in place to allow consumers to make sustainable choices for their journeys in both urban and rural contexts. Governments must facilitate the creation of sector-by-sector strategies for decarbonisation, particularly for hard-to-abate sectors such as freight and aviation.

Cities, regions, and Local Authorities will play a crucial role in the transition, as they deliver climate action on the front lines. Knowledge-sharing, monitoring, and innovation all have the potential for transformation across communities and localities, scaling-up change to the national and international levels. Appropriate resources, capacity, and cooperation must be in place to allow those processes of transformation to take place.

When future generations hear stories about the fight against climate change and the role COP26 played in that battle, they cannot be stories of inaction or inertia. As we take the work of COP26 forwards, the stories told by our actions must be about ambition and the commitment to seeing our aspirations materialise through transformative change.

This profound moment in history offers two polarised types of change. The first is climate change, where our inaction leads us on the road to overwhelmed human resilience, degraded natural environments, and an existential threat to our planet. The second is transformative change, where our collective journey of action brings us to a future which is sustainable, resilient, and which meets the needs of global communities that share in the benefits of the natural world.

It is our imperative as those with the power to make historic decisions that we create that better future.

List of recommendations

Following is the full list of recommendations presented in this manifesto for change. For the rationale behind each recommendation, please consult the relevant chapter.

Rather than dictating specific policy instruments, these recommendations are targeted at a level of generality where they can be adopted across scales of governance, national contexts, and political divides. Ultimately, some solutions will

apply only to certain contexts and may require adaptation to given circumstances. Crucially, while these recommendations provide guidance to accelerate effective action, the best solutions will often be those co-created with the stakeholders and communities needed to implement them and live with their consequences.

The Institution of Environmental Sciences recommends:

Climate leadership

1. Our goal must be transformative change of the systems of consumption and production which embed unsustainable consequences for our climate, society, and natural world.
2. Systems thinking must be a core part of our approach to addressing all social and natural challenges at every level. Barriers should be broken down between disciplines and government departments to reorient decision making towards functionality and systems thinking.
3. Wherever possible, we should seek multiple benefits or functions from our solutions to climate change, even where it costs more in the short-term to avoid increased costs in the long-term.
4. Policy should be science-led wherever possible, with stronger collaboration between science and decision makers across disciplines and policy areas.
5. Where appropriate, climate solutions should be co-created with stakeholders who are needed for implementation and communities who must live with the consequences of those decisions.



Finance

6. Governments, international organisations, and businesses should work together to develop and align taxonomies and definitions for green finance, responsible investments, and 'net zero' commitments to create a certain and stable market. Definitions should be specific enough to prevent 'greenwashing' but not so specific that they preclude potentially positive financial instruments.
7. Governments should support funding for green finance projects, mobilising private sector funds by creating facilitating infrastructure, supporting innovation funds, and setting clear sector-by-sector strategies, roadmaps, and skills pipelines.

8. Governments should work together to create a global 'level playing field' for finance, dis-incentivising high emissions projects while setting appropriate regulations, including further requirements for transparency and disclosures. Where transparency frameworks are not yet mandatory, businesses should voluntarily opt-in.
9. Businesses need clear, credible, meaningful ESG strategies across their assets, investments, and value chains. Businesses should utilise science-based targets and strategies, providing transparent explanations for the sustainability choices they have made and adopting best practice, making additional commitments wherever possible.
10. Where appropriate, businesses should finance carbon offsetting to account for the residual emissions which they cannot mitigate after transitioning to more sustainable business models. Offsetting should not be a substitute for action to reduce the carbon impact of a business, or used as an excuse for inaction.

Energy transitions

11. Governments must support the rollout of large and small-scale renewable energy which is aligned with the needs and resources of the locality it is serving; a 'one size fits all' approach will not be effective.
12. CCUS should be used as a last resort and investment should instead be focused on phasing-out the use of fossil fuels.
13. Governments should promote the benefits of renewable technology and support implementation through clear communication and education, financial support and improved accessibility, and modification to the needs and resources of particular communities.
14. Governments should make significant investments in robust renewable energy infrastructure, research and innovation, and continual supply chain optimisation.
15. National governments should support mutual knowledge transfer and resource-sharing between non-industrialised and industrialised nations to support effective climate action, ecosystem restoration, and implementation of sustainable technologies, such as renewable energy. The global community must provide finance to support resilience in vulnerable nations.
16. Governments should improve access to education and training on low-carbon technologies and sustainability principles to support decision making and to ensure that the environmental principles are embedded throughout the workforce.



Empowerment

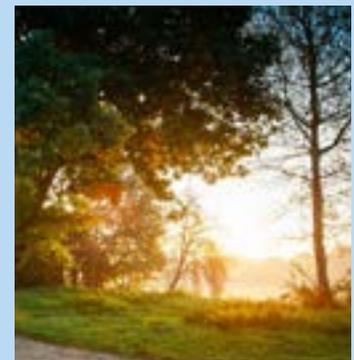
17. Action on climate change must account for environmental justice and climate justice, and we should seek to create a ‘just transition’ which fairly distributes the costs and benefits of the transition.
18. Governments should facilitate greater integration of science and society, where all science disciplines can play a role in explaining the risks and opportunities of different pathways and help communities to visualise different options for the future.
19. Governments should seek to make climate literacy, carbon literacy, environmental science, and systems thinking part of all curricula and education, encouraging lifelong learning to upskill, reskill, and embed ‘net zero’ skills across the workforce.



20. Governments, international organisations, and all scales of climate action must increase capacity-building, empowerment, and participation of all groups which are under-represented in climate action, with an emphasis on monitoring progress.
21. Governments should integrate gender equality and empowerment into their approaches to climate change, as well as broader Equality, Diversity, & Inclusion (ED&I) principles.
22. Citizens should make use of existing tools of empowerment, including elected representatives, to share their perspectives on the likely effects of climate change and climate action. This should not be a substitute for increased democratisation and co-production of responses to climate change.

Nature

23. When employing nature-based solutions, multi-functionality should be prioritised to support multiple co-benefits for climate action, biodiversity and society. Nature-based solutions should not be used as a one-issue ‘tick-box’ exercise, and the benefits of increased resilience should be recognised even where they are hard to financially quantify.
24. One size does not fit all when it comes to nature-based solutions. Tailored approaches should be used to ensure that the most effective solution is used in the right locality.
25. The mitigation hierarchy of avoid, minimise, restore and offset should be followed to minimise the overuse of offsetting.
26. Governments should give nature a home in Local Authorities and each Local Authority should employ ecologists. Planners should be trained in key ecological principles.
27. A combination of land sharing and sparing approaches should be used, with a focus on protecting multi-functional ecosystems, increasing connectivity between ecosystems, and regenerating degraded ecosystems.



Circular economy

28. Governments should increasingly emphasise the design stage in their approaches to resource use, encouraging the use of mono-materials and modular construction where appropriate. Governments should take additional steps to prevent planned obsolescence, and to encourage the recycling or upcycling of defunct devices currently stockpiled by consumers.
29. Single-use packaging and products should be actively discouraged through taxes and regulations. Governments must adopt Extended Producer Responsibility approaches to incentivise resource efficiency and circularity at the design stage.



30. Regulation should seek to enforce greater product transparency, giving consumers more information about carbon footprints, product lifecycles, places of origin, and other key determinants of product sustainability. Where appropriate, this data should be accompanied by ratings or other systems to easily translate the environmental impact of a product.
31. Governments should utilise Deposit Return Schemes and integrate them with existing recycling programmes.
32. Producers, manufacturers, and consumers should embrace innovative business models which build-in circularity at the design stage, embracing 'servitisation', less resource-intensive approaches, and rental or repair schemes as alternatives to replacing high-impact products like furniture or technology.

Adaptation and resilience

33. Governments, international organisations, and all scales of climate action must recognise and promote the importance of adaptation and resilience, which is necessary regardless of action to mitigate climate change and which requires simultaneous attention.
34. Governments must take a systems approach to land use, utilising scientific insights to maximise the 'ecosystem services' which land can provide and environmental land management approaches where appropriate to safeguard natural resources.
35. Adaptation, resilience, and co-benefits must be systematically considered during the design and planning stage of new infrastructure wherever possible. These considerations must extend across threats to long-term resilience including flood risk, extreme weather events, energy security, and supply chain security.



36. Governments and developers should seek to better utilise the existing built environment before extending urbanisation. Where urbanisation takes place, sustainability, resilience, and connectivity should be embedded at the design stage, and national planning guidance should promote sustainable design standards, providing a baseline which Local Authorities can innovate beyond.
37. Governments, international organisations, and businesses must support transformative change of global food systems and supply chains, refocusing agriculture away from productivity and quantity of output towards a system which prioritises co-benefits for sustainability, resilience, healthy diets, soil health, and long-term food security, balancing between those priorities as appropriate.
38. Governments should adopt measures to buffer against the risk of cascading failures and compound risk vulnerabilities caused by climate change or climate action, embedding resilience in approaches to carbon mitigation. In particular, governments should ensure that increased electrification takes place alongside increased resilience to the risk of the failure of electrified systems.
39. Consumers should transition towards diets which are healthy and sustainable, though behavioural change cannot be a substitute for direct action to transform systems of production or an excuse for inaction.



Science and innovation

40. Decisions by governments, international organisations, and communities should be made with reference to the best-available science, based on systematic reviews where possible. Science should be provided with appropriate timescales to produce rigorous and comprehensive expertise.
41. Governments should fund research to fill gaps in evidence where there is not sufficient information or where greater certainty would support effective decision making.
42. Governments and communities must recognise the levels of certainty underpinning scientific conclusions, taking appropriate measures to account for degrees of risk and using smaller-scale pilots to reduce binary decision making.
43. Governments must provide appropriate regulations and policies to support private innovation by providing 'level-playing-fields' to drive uptake of existing technologies and assure the private sector of the 'return on investment' associated with competitive research and innovation.

Transport

44. Governments should commit to phasing-out petrol and diesel cars at the earliest opportunity.
45. Governments should support and finance greater research and innovation for alternative fuels and fuel efficiency in the context of both aircraft and land vehicles.
46. Governments should facilitate the infrastructure needed for sustainable transport in both urban and rural contexts, particularly for electric vehicles where appropriate. At the same time, the embodied carbon cost of new infrastructure must be properly accounted for and addressed.
47. Governments should work with hard-to-abate sectors, including shipping and aviation, to produce detailed strategies for decarbonisation, with plans for how to address residual emissions which cannot be abated.
48. Governments and businesses should cooperate to provide consumers with accessible and affordable sustainable transport options through subsidies, dis-incentives for high-emission transport, and sustainable business models.
49. Governments should promote, and ensure the accessibility of, ‘active travel’ and low-carbon public transport options through financial support, the sharing economy, and by embedding connectivity and sustainable neighbourhoods at the design and planning stage of new developments and during the re-purposing of existing developments.
50. Transport projects and planning systems must consider more than economic impacts during the design stage; social and environmental impacts must be considered alongside long-term risks associated with a project.



Cities and regions

51. Cities and regions should participate in knowledge-sharing networks to exchange innovative ideas on climate change.
52. Cities and regions must increase monitoring, including through interim progress monitoring against medium and long-term plans. Local climate plans must be consistently monitored against, even if strategies adapt and develop in response to monitoring or new governance.
53. Cities, regions, and governments should embrace pilot schemes, ‘living labs’, and other forms of innovation which allow for action without raising concerns about limited resources.
54. Cities and regions should be provided with the necessary resources to achieve transformative changes at local scales.

Introduction

One of the purposes of the Institution of Environmental Sciences is “to unite science and people to resolve environmental challenges”. The transition to a sustainable society must be underpinned by science and evidence, and the IES is well-placed to facilitate the transition by supporting environmental scientists to feed into decision-making, and by equipping society with the knowledge it needs to adapt to the systemic changes necessary for effective climate action.

At the heart of everything we do is the push for transformative change. Climate solutions must involve many specialisms and stakeholders, underpinned by the principle of systems thinking. Over the last year the IES brought together organisations, experts, and professionals to shape our contribution to the discussion. In November 2020, when we were still a year away from COP26, the IES began a programme of action to bring together voices from across the environmental sector. That programme: STAGES on the road to COP26, centred on six key themes.

The first was ‘Sustainability’, exploring the synergies and trade-offs that exist between sustainable development and climate action, and the ways we can support both agendas. The second was ‘Transformation’, referencing the transformative change which will be necessary to achieve climate solutions that will be truly sustainable.

Our third theme was ‘Adaptation’, reminding us of the need for multifunctional solutions to adapt to climate change whilst also addressing interlinked crises, such as the ecological emergency. Our fourth and fifth themes were ‘Green Society’ and ‘Economy’, where we outlined a vision for a future which offers positive social and economic change through widespread climate literacy, re-designed economic systems, and upskilling and reskilling of the workforce to ensure a ‘just transition’.

The final theme of our programme of work was ‘Solutions’. At the end of that long programme of activity, we arrive back where we began: bringing together scientific voices to give us the evidence we need to find effective solutions. In order to find solutions to climate change and create a better future, science needs to be leading the conversations that will decide how we respond. Science should be integrated into decision making, should support our communities with the challenges facing them, and should drive the world-leading innovation and research necessary to create a world free of environmental crises.

“The knowledge that is represented in this document, and the environmental scientists who helped to create it, are crucial to resolving the environmental challenge posed by climate change.”

There is still a long way to go to make all that ambition real. This manifesto for change sets out just a handful of the recommendations we need to achieve that positive future. Integral to all of them is the need for the voice of environmental scientists to be amplified.

The knowledge that is represented in this document, and the environmental scientists who helped to create it, are crucial to resolving the environmental challenge posed by climate change. The purpose of our work now is to unite science and people to make that possible.



Context of COP26

The first part of the IPCC's Sixth Assessment Report, '*Climate Change 2021: The Physical Science Basis*' is unequivocal: human actions are driving the crisis; human actions need to change. Our governments, our economy, and our actions as individuals are causing unsustainable changes to our planet's climate. We need to act now.

We have the impetus to act, and we also have the opportunity. COP26 may prove to be a decisive moment in the history of our battle against climate change, but the opportunity must be seized for a plan of action which aligns international governments with their climate ambitions, gives businesses the certainty to transition away from activities causing climate pressures, and brings communities on the journey they need to transform our society in a way that is just and equitable.

COP26 has motivated widespread increases in climate ambition. In advance of the conference, there have been enhanced commitments from governments worldwide, including some of the biggest polluters. These have set the scene for significant progress to meeting our climate goals, as long as those aspirations are met with action. Between climate action summits, G20 meetings, and strengthened NDC commitments, the promise of international action has become more plausible. The same motivation has been seen in some parts of the private sector, with investments and pledges from some of the key sectors which will need to change. Again, the test will be whether those commitments materialise into action in the months ahead.

“Now that COP26 has come to an end, we need to maintain the momentum and allow it to drive further action forwards.”

The conference itself had a specific mandate and a crucial role: putting global partners on the same page and setting the pace of climate action for the years to come. We entered COP26 hoping for the next iteration on the Paris Agreement; something to make the road ahead clear and to unite the world in its approach to the challenge of climate change. Optimists may not have received everything they were hoping for, but pessimists may be pleased to see a genuine willingness to make a difference from a number of the major players.

Now that COP26 has come to an end, we need to maintain the momentum and allow it to drive further action forwards. Where COP26 failed to deliver, it will be the standard we use to catch up to our initial ambitions. Where the conference did meet expectations,

it will be the beacon we call upon to go beyond that and to find transformative solutions. COP26 will remind us that we can exceed the minimum needed to halt the degradation of natural systems, actively improving humanity's relationship with the natural world.

COP26 has been more than just a UN climate change conference in Glasgow; for more than a year, it has been the hope of international partners brought together across borders, across languages, across political divides, across public and private spheres, and across generations. COP26 has been the symbol of a real solution to the climate crisis. It may not have delivered on that promise in every way, but the symbol of what COP26 was may be enough to help urge our planet to make the rest of the journey in the months and years to come.

In that context, this manifesto for change sets out what must happen, theme by theme, if we are going to use the opportunity of COP26 and all it represents to fight back against climate change in the name of science, scientists, and the natural world.

Climate leadership

Our lives are governed by complex interactions between the natural, social, and economic systems we live in. To be successful, all these systems must be accounted for in our response to climate change. Ahead of COP26, the UK's Net Zero Research and Innovation Framework recognised that "a systems approach can... help to identify potential co-benefits or tensions, manage uncertainty, target points of greatest leverage, mitigate unintended consequences, identify highest value and minimum cost pathways, maximise benefits and ensure an agile and dynamic approach to decision-making".

The potential for systems to influence our lives and embed pressures on the environment reveals the same potential for those systems to become positive influences for humanity and the natural world. Transformative change across interlinking systems of consumption and production will be crucial to deliver the multiple co-benefits necessary to meet our ambitions for climate and nature while operating within our limited time and resources.

How do we move from incremental solutions to transformative ones?

Our instincts drive us to make small, simple changes which we view as cause-to-effect solutions to individual issues. To combat a challenge like climate change which has been caused by more complicated

interactions spanning our society and economy, we need faster action which works to transform the pressures which embed environmental degradation throughout those systems into sustainable alternatives.

The key lever to drive that change will be to embed systems thinking at every level of action on climate change. It must be a priority for global leaders to think beyond the matter at hand to consider other natural systems as we work towards solutions. Those systems must be acknowledged in the plans and commitments of each nation as they outline how they intend to achieve their promises and NDCs. Even at the delivery stage, as climate ambition turns into action, we must reflect on natural systems and the way our social actions place pressure on them.

How can we achieve multiple co-benefits for sustainability goals?

As we approach our climate action from the perspective of systems and the positive transformative changes we can make to embed sustainability, we naturally attain the ability to achieve multiple co-benefits, not just for nature but for human livelihoods as well. Crucially, we need to recognise that climate change, the ecological emergency, and other natural and social crises are interlinked and have mutual causes, inviting the potential for mutually-beneficial responses.



Our solutions should be designed with the goal of multi-functionality, rather than as atomistic responses to single problems which may result in missed opportunities and unintended consequences. Where there are inevitable trade-offs between different environmental goals, environmental science is well-placed to highlight the most critical action and to provide insights and interpretations of the probable consequences of different choices.

We therefore need a better relationship between science and society. Decisions should be led by science, and the environmental science profession needs a much greater degree of integration with decision makers, designers, and implementers. This will support a system-wide approach to using science where it can help to put solutions in place and provide technical knowledge to help communities make choices, while avoiding unintended risks in the future.

Similarly, we need greater cooperation across and between disciplines of science to share insights for the mutual benefit of society. Collaboration between environmental science, social sciences, and arts or humanities disciplines will help us to unlock the interdisciplinary perspectives necessary to find solutions which align with science and work for humanity. To apply and implement those solutions, further co-production will be necessary with communities, businesses, and academia.

How do we ensure science-led solutions also work for society?

There should be a stronger relationship between science, society, and decision makers. To achieve this, the environmental profession should be better integrated with society. Greater transparency about the scientific method and the means by which decisions are reached is essential to helping communities select and understand solutions. Crucial empowerment tools should be more widespread, especially climate literacy and collaboration networks between science and communities.

Co-production will be crucial; not only evidence from science, but also evidence of what works for communities will be crucial to finding solutions which work for both humanity and nature. To build trust, people need to understand that science can be a tool which works for them and which society can collectively have a stake in. Rebuilding society's collective belief in science and the scientific method is crucial to ensuring its success in a modern world.

Recommendations

1. Our goal must be transformative change of the systems of consumption and production which embed unsustainable consequences for our climate, society, and natural world.
2. Systems thinking must be a core part of our approach to addressing all social and natural challenges at every level. Barriers should be broken down between disciplines and government departments to reorient decision making towards functionality and systems thinking.
3. Wherever possible, we should seek multiple benefits or functions from our solutions to climate change, even where it costs more in the short-term to avoid increased costs in the long-term.
4. Policy should be science-led wherever possible, with stronger collaboration between science and decision makers across disciplines and policy areas.
5. Where appropriate, climate solutions should be co-created with stakeholders who are needed for implementation and communities who must live with the consequences of those decisions.

Finance

As outlined in the third goal of COP26, securing net zero globally will require us to “unleash ... trillions in private and public sector finance”, especially the \$100 billion a year for vulnerable nations, originally promised for 2020. An issue as complex as climate change spans social, national, and cultural contexts, though finance could be considered the common language connecting them all.

Uniting the world of finance and economics with the complex natural systems linked to climate change requires widespread adoption of science-based targets and greater harmonisation of multiple sustainability ambitions to provide markets with the certainty needed to drive forward green investments. The relationship between environmental science and economics must become more systematic, preventing ‘greenwashing’ and policy failures which have historically undermined the trust and confidence needed to mobilise capital for climate action.

How can taxonomies and definitions mobilise finance?

The market needs certainty to mobilise the finance and investments necessary to both mitigate and adapt to climate change while achieving co-benefits for people and nature. Clear definitions and robust taxonomies are crucial to providing that certainty and will help to accelerate the meaningful allocation of capital and underpin the credibility of a burgeoning green bond market.

Ambiguity of language around ‘green finance’, responsible investments, ‘net zero’, sustainability, and climate finance may lead to different approaches, the inability to mobilise finance, or ‘greenwashing’, where inaction is portrayed as action by businesses without making meaningful progress. It will therefore be necessary to have definitions which are both specific enough to avoid ‘greenwashing’ and broad enough to mobilise a wide range of investment opportunities,

including during the climate transition where different measures may be needed to those in a post-transition society, or where investments in low-carbon technology may need to be financed.

Having a common ‘rule book’ provided by taxonomies will be necessary to assure businesses that their investments will be rewarded and to set clear and robust standards to hold them accountable. More work will be needed to ensure that taxonomies are aligned, robust, and effective, including the European Union Platform for Sustainable Finance’s upcoming social taxonomy. Taxonomies need to avoid over-rigidity and allow the market to operate, but must balance that goal with close alignment and the provision of real scrutiny. Finance must be employed beyond efficiency improvements to allow it to contribute more substantially to the mitigation and adaptation agendas.

What should businesses and the financial sector do to support climate action?

All businesses need to take the scale of climate change and the inevitable transition seriously. Businesses need credible, clear, meaningful strategies, incorporating ESG principles where appropriate. The sustainability strategies of businesses need to properly cover their assets, investments, and value chains, and must utilise science-based targets wherever possible. Businesses should take a ‘whole business model’ approach to sustainability, fully accounting for the lifecycles of their products and their entire value chain. Business models which are not sustainable are unlikely to remain viable in a world where climate change is increasingly prolific.

Where it is not possible to be fully sustainable, businesses should provide transparent explanations for the sustainability choices they have made and continue to adopt the best practice available



to them, going beyond minimum statutory compliance to make additional commitments in line with sustainability across the different 'scopes' of their emissions. Minimum standards, such as the Equator Principles, may provide guidance on where businesses can take necessary action, but can only be part of the solution to a business's contribution to fighting climate change. Businesses must work towards carbon mitigation, and not just carbon displacement by investing in removal or abatement elsewhere.

Sustainability also requires businesses to properly account for the potential of displacing risks to other social or natural systems. Business strategies should seek to avoid unintended consequences by using systems thinking approaches and building-in commitments above basic requirements to account for probable risk factors, such as biodiversity loss, material inefficiency, or displacing the burden of risk to indigenous or vulnerable communities. Frameworks such as the IFC Performance Standards may help to guide investors and businesses, though they are not substitutes for systematically addressing the interconnected environmental and social risks associated with climate change.

Green finance provides businesses with a significant opportunity to gain competitive advantages by becoming leaders on sustainability and developing innovative business models. The risk-opportunity landscape around green investments has altered in the light of government commitments and ambitions, with sustainable investments now seen as more desirable. Businesses will be able to absorb residual risk in their investments to different extents, so may have different levels of willingness to make sustainable investments and alter their business practices.

There may be a place in climate action for different degrees of investment, particularly during the transition where investments will be needed in transitional technology. Hydrogen and lithium investments are likely to increase in the short-term, though may be associated with more complex long-term risks, so investment in longer-term approaches will also be necessary.

Businesses should consider the extent to which they are able to invest and commit to the largest extent possible, taking assurance from governments and international taxonomies that their work will be rewarded. The benefits which businesses take from investing should be properly reflected against their own emission scopes. It is insufficient for businesses to avoid climate action by offsetting their emissions through investments; mitigation and transformation of business models will still be required to achieve a sustainable society. Investors and consumers are increasingly aware of the level of change needed, so businesses which innovate and act quickly are likely to be rewarded by the market.

Businesses should embrace transparency, particularly around their investments. Where disclosures are not mandatory, businesses should voluntarily adopt them to demonstrate their willingness to act and to increase their resilience to potential regulations in the future. Some businesses will require greater clarity and support from governments as they transition towards more sustainable practices,

so facilitating public sector finance, clear taxonomies, and effective regulation may all be necessary to mobilise the whole economy.

Not all business emissions will be able to be mitigated, even after significant changes to business models. There is an opportunity for carbon offsetting to mobilise finance to address the residual emissions which businesses are not able to reduce or abate, though it will require a consistent and robust global framework underpinned by scientific evidence. Voluntary carbon markets may be a useful starting point to addressing long-term hard-to-abate emissions, though further action is needed.

Carbon offsetting cannot be a substitute for businesses reducing their own emissions and adapting their business models to become more sustainable. If a business seeks to use carbon offsetting to address its unabated carbon emissions, this must be underpinned by robust and transparent evidence. Currently, there is insufficient capacity for offsetting to address all business emissions, and no business should consider themselves to be exceptions to the need for action across their business models.

How can the public sector and consumers support green finance?

The private sector has a phenomenal capacity to promote action and mobilise finance to address climate change. However, the public sector must act to facilitate that investment by aligning networks, setting regulations, and providing the certainty needed for the market to act. Governments should work internationally with key sectors to co-produce clear, robust sector-level strategies and roadmaps to 'net zero', including the details for different pathways and the changes needed on an individual business level. This will be especially important for the decarbonisation of carbon-intensive industries.

Public sector support and funding will be crucial to driving innovation and providing assurance that sustainability will be viable and beneficial for businesses which adapt quickly. Simultaneously, the public sector must support the creation of the infrastructure needed to facilitate the transition and mobilise the potential for private sector investment, particularly in innovative technology. In order to make some technology commercially viable and accessible, such as electric vehicles, significant upfront infrastructure will be necessary. Decarbonisation of the grid will play a crucial role in driving private investment.

Governments can also provide certainty and align the action of stakeholders across the private and voluntary sectors. Decarbonisation will not be possible if investment is competing to decarbonise the same carbon pressures while leaving others unaddressed, so governments must support a systems approach to acting on a strategic level. Similarly, governments need to set clear expectations for how green finance investments will be rewarded or classified, to prevent the same investment being recorded against action in multiple localities or carbon budgets.

Demand for sustainable finance will ultimately be driven by the ability of governments to set the global agenda and demonstrate that action is an opportunity rather than a risk. As consumers and governments indicate a clear direction of travel the market is likely to follow, developing new financial products and increasing demand by asset holders for more sustainable alternatives.

Practically, governments can also influence the action taken by businesses by incentivising sustainable practices while levying financial dis-incentives on unsustainable practices. A careful balance is needed between discouraging status quo thinking or inaction, and ensuring that consumers have accessible options which do not make sustainable consumption unaffordable. In many cases, innovation funding or grants for research and development may serve as an appropriate incentive without driving-up costs for consumers.

Consumers require the ability to shape the market with their decisions. The biggest potential mobiliser of capital flows into sustainable assets is greater transparency and mandating of disclosures by businesses, enabling consumers to drive the market through their own behavioural change. Simultaneously, enhanced transparency can support the clarity, consistency, and surety of information about investments without excluding consumers.

In some contexts, finance may be able to support the transition by facilitating sustainable consumer choices. Where appropriate, there may be some capacity for financial schemes and instruments to accelerate transitions, such as REGOs, RECs, and I-RECs during the process of grid decarbonisation.

Any measures of this nature should be used appropriately, should take account of the potential for unintended consequences, and should not be substitutes for green finance which directly supports mitigation and adaptation. Simultaneously, incentives to innovate and government investment in facilitating infrastructure will also be crucial to securing transition and cannot be displaced.

Recommendations

1. Governments, international organisations, and businesses should work together to develop and align taxonomies and definitions for green finance, responsible investments, and 'net zero' commitments to create a certain and stable market. Definitions should be specific enough to prevent 'greenwashing' but not so specific that they preclude potentially positive financial instruments.
2. Governments should support funding for green finance projects, mobilising private sector funds by creating facilitating infrastructure, supporting innovation funds, and setting clear sector-by-sector strategies, roadmaps, and skills pipelines.
3. Governments should work together to create a global 'level playing field' for finance, dis-incentivising high emissions projects while setting appropriate regulations, including further requirements for transparency and disclosures. Where transparency frameworks are not yet mandatory, businesses should voluntarily opt-in.
4. Businesses need clear, credible, meaningful ESG strategies across their assets, investments, and value chains. Businesses should utilise science-based targets and strategies, providing transparent explanations for the sustainability choices they have made and adopting best practice, making additional commitments wherever possible.
5. Where appropriate, businesses should finance carbon offsetting to account for the residual emissions which they cannot mitigate after transitioning to more sustainable business models. Offsetting should not be a substitute for action to reduce the carbon impact of a business, or used as an excuse for inaction.

Note that these recommendations should be read in the context of the manifesto's full list of recommendations, particularly those relating to the circular economy.

Energy transitions

An energy transition is needed to support the transformation of the energy sector and our reliance on fossil fuels to zero-carbon, renewable energy systems. This is central to achieving climate ambitions and meeting net zero targets. This transition is already underway; in the first quarter of 2020, 28% of global electricity generation was from renewable sources.

The energy transition will involve a variety of technologies and methods, including traditional renewable energy sources, such as wind, hydroelectric and solar, as well as emerging technologies such as the use of hydrogen as an alternative fuel and carbon capture, utilisation and storage (CCUS). While the energy sector is one of the biggest emitters of greenhouse gases, there are a number of solutions on the horizon to support a successful transition.

What would the overall picture of energy composition look like in a transformed society?

Energy composition will vary depending on the scale being explored and there will not be a 'one-solution-fits-all' way to manage the energy transition. There will need to be an increase in both large-scale and small-scale renewables, including self-generation by businesses, as well as in domestic settings. Throughout the transition, it is likely that fossil fuels will continue to play a role in global energy composition, but this needs to be prioritised where it is most needed in the short-term, fully phasing-out fossil fuels in the long-term.

There will also need to be an increase in alternative fuels, such as hydrogen. The type of hydrogen being used is an important consideration, as currently only ~1% of total hydrogen produced

is green. Moreover, producing hydrogen using renewable energy is still less efficient than using renewable energy directly.

The composition of energy generation is likely to differ significantly at both the international and national levels. The best energy generation methods will depend on a number of factors, such as resource availability and geographical features. For example, the UK has a significant offshore wind potential, whereas Norway could produce a large proportion of its energy needs from hydropower. This diversity is also reflected at the microscale, such as in the ways we heat our homes. The electrification of heating, district heating, and alternative forms of gas such as hydrogen are all viable approaches and the method utilised will depend on local factors.

How can we ensure renewable energy is a genuine option for all countries and communities during the climate transition?

Renewable energy solutions need to be affordable, accessible and tailored to local systems in order to support a just climate transition. A key part of ensuring this is communicating the options available to people and how renewable energy can be incorporated into their homes and lives.

When implementing renewable energy solutions, it is essential that the practicalities of the solution in terms of supporting infrastructure and supply chains are robust and have built-in longevity. To ensure that the infrastructure is in place, significant investment is needed by governments. Knowledge-sharing between nations will also be vital to support uptake, and industrialised



nations should lead the way with implementation and support the roll-out of renewable energy in non-industrialised nations.

To support renewable energy take-up, it is also important to highlight the benefits of renewable energy for myriad other issues beyond reducing carbon emissions and many of the Sustainable Development Goals. Robust renewable energy infrastructure will support increased autonomy and resilience for nations, increased energy access, and reductions in air pollution.

How should Carbon Capture, Utilisation and Storage (CCUS) fit into our approach to the transition?

The aim of the energy transition should be to phase-out the use of fossil fuels. Therefore, CCUS should be seen as a ‘last resort’ for reaching climate and ‘net zero’ targets and not as an excuse to continue using fossil fuels. Instead, focus and investment should be made to scale-up renewable energy technology.

Despite widespread support and rhetoric surrounding CCUS, a significant proportion of commercial CCUS projects end in failure. This highlights the importance of focusing on alternative technologies to support the transition.

How can we embed science and evidence during the energy transition?

Science and evidence are at the heart of the energy transition. Much of the science and evidence needed already exists, but requires more accessible and informative communication across society to support decision making.

Both innovation and intervention are needed to support a successful energy transition and subsequent transformative change. Top-down intervention through regulation and policy is needed to incentivise investment in research and innovation both from businesses and governments. Targets, such as ‘net zero’ by 2050, are important signals to support this, but need to be followed up with strategic plans and policy levers to drive forward ambition.

In certain areas, much of the technology needed is already established, though it will be necessary to have further intervention to support behavioural change and communicate the benefits of adoption. In other cases, innovation and technological development are needed to find solutions to complex issues. For example, much of the technology needed for home energy conservation and efficiency already exists, with further intervention needed to support uptake, and further innovation and development required for solutions to low carbon heating.

Testing the science in real-world scenarios and collating case studies will also support the transition and facilitate the sharing of best practice. The science and evidence behind the energy transition is not static: as we implement and scale-up renewable energy solutions we will need to build on the science and

evidence to allow for continual optimisation and overcome unforeseen challenges.

Recommendations

1. Governments must support the rollout of large and small-scale renewable energy which is aligned with the needs and resources of the locality it is serving; a ‘one size fits all’ approach will not be effective.
2. CCUS should be used as a last resort and investment should instead be focused on phasing-out the use of fossil fuels.
3. Governments should promote the benefits of renewable technology and support implementation through clear communication and education, financial support and improved accessibility, and modification to the needs and resources of particular communities.
4. Governments should make significant investments in robust renewable energy infrastructure, research and innovation, and continual supply chain optimisation.
5. National governments should support mutual knowledge transfer and resource-sharing between non-industrialised and industrialised nations to support effective climate action, ecosystem restoration, and implementation of sustainable technologies, such as renewable energy. The global community must provide finance to support resilience in vulnerable nations.
6. Governments should improve access to education and training on low-carbon technologies and sustainability principles to support decision making and to ensure that the environmental principles are embedded through the workforce.

Empowerment

Environmental justice and equity are crucial elements of our response to the climate crisis, however all nations and sectors of society can benefit from the green transition, as long as social considerations are properly included in our decision making.

Significant transformation of global economic structures is inevitable, which provides a substantial opportunity to include co-benefits for all communities and avoid stranded industries or regions being left behind. Highlighting those positive aspects of the transition may also help to make it more appealing for society as a whole.

How can we empower a ‘whole society’ approach to climate action?

Co-production should be used where possible to draw on the knowledge of communities and to avoid top-down imposition of policies which do not align with local contexts. Science can play a key facilitating role in those interactions, though the social element is also key to understanding which policies can work to make a positive difference. Climate pressures exist within social systems as well as natural ones, so transformative change necessitates solutions to more fundamental social challenges as well as environmental ones.

To succeed, co-production relies on creating a positive vision that communities can align themselves with, inspiring them to see the potential for the transition to create mutually-beneficial change. Before they can commit to the action needed to combat climate

change, people need to know how the changes will affect their lives, and that it will be positive change that helps them to thrive. The collective response to climate change must give communities that assurance, which must be realistic and able to be clearly visualised across society. Likewise, science can help communities visualise the risks and challenges associated with different options for addressing climate change.

Better use of democratic tools by citizens can help to create the dialogue we need to improve co-production of solutions. Elected representatives at local and national levels are crucial mechanisms to share the expertise and concerns of their communities at different scales. Engagement with local communities, especially during the planning process, can facilitate those insights at a faster pace, allowing for more dynamic change. To that end, improving democratisation is a crucial step towards effective climate action.

What knowledge and skills do communities need to engage with climate action?

Climate literacy and carbon literacy are essential elements to a society which is capable of long-term sustainability. Ensuring that the population at large has an understanding of the basics of climate science, the ability to participate in conversations about their options for the future, and the empowerment to take positive commitments in their own lives will be essential to the behavioural change needed to combat climate change.



Spreading climate literacy requires co-production and interdisciplinary cooperation so that it can be effectively embedded across the curricula of different streams of education and made available to the whole workforce, whether through training providers, peer-to-peer training, or individual learning. Businesses need the leadership of governments to know where to prioritise their investments in training for sustainability.

Similarly, the ‘net zero skills’ needed for the transition must become more widespread through training, upskilling, and reskilling. Amongst those skills, sustainability and systems thinking, communication, transferable skills, and digital skills will be especially important. National governments and individual sectors should seek to identify the need for specific skills and set out specific strategies for realising them, in partnership with higher education, further education, and the private sector. Many of those who require new or updated skills are already in the global workforce, so solutions to the current deficit in ‘net zero skills’ must embrace lifelong learning.

Where the transition poses the risk of creating stranded industries, dedicated plans should be put in place for retraining and ‘skills pipelines’ to ensure ‘just transitions’ where the burdens and benefits of the transition are equally shared. To facilitate those transitions, skills audits and government funding may be necessary to set out pathways for what is required, giving businesses the certainty needed to make their own investments and to work collaboratively with providers.

How can action promote equity, diversity, inclusion, and climate justice?

Climate action has not consistently represented the voices of all those who are likely to suffer the consequences of climate change, and more needs to be done to empower everyone within society to be fully represented within the push for climate action and the policies which will support the transition towards ‘net zero’.

Existing means of collective and individual empowerment should be utilised wherever possible, and where that is not possible, further democratisation and co-production should be promoted. This will allow for climate action which not only addresses environmental issues, but has multiple benefits for social issues as well. Climate action should thus be well-integrated within the wider sustainability agenda and a running theme throughout work towards the Sustainable Development Goals.

Inclusion should be at the heart of a movement which centres on multi-disciplinary challenges and interlinking systems, and empowering diverse views and experiences will be essential to finding collaborative solutions which work for all of society. More action is still needed, and Equality, Diversity & Inclusion (ED&I) principles can promote better capacity-building, integration, and participation from a wider cross-section of social and economic perspectives.

Our response to climate change need not be at the expense of environmental justice. By designing policy in collaboration with the communities which are likely to be affected, we can ensure that the burdens of the transition are distributed fairly and that the rewards of an environmentally-positive society are shared universally.

Recommendations

1. Action on climate change must account for environmental justice and climate justice, and we should seek to create a ‘just transition’ which fairly distributes the costs and benefits of the transition.
2. Governments should facilitate greater integration of science and society, where all science disciplines can play a role in explaining the risks and opportunities of different pathways and help communities to visualise different options for the future.
3. Governments should seek to make climate literacy, carbon literacy, environmental science, and systems thinking part of all curricula and education, encouraging lifelong learning to upskill, reskill, and embed ‘net zero’ skills across the workforce.
4. Governments, international organisations, and all scales of climate action must increase capacity-building, empowerment, and participation of all groups which are under-represented in climate action, with an emphasis on monitoring progress.
5. Governments should integrate gender equality and empowerment into their approaches to climate change, as well as broader Equality, Diversity, & Inclusion (ED&I) principles.
6. Citizens should make use of existing tools of empowerment, including elected representatives, to share their perspectives on the likely effects of climate change and climate action. This should not be a substitute for increased democratisation and co-production of responses to climate change.

Note that these recommendations should be read in the context of the manifesto’s full list of recommendations, particularly those relating to climate leadership.

Nature

Safeguarding and restoring natural ecosystems and employing nature-based solutions to address the interlinked crises of climate change and biodiversity loss is a key theme throughout climate discussions. Utilising nature-based solutions will allow us to adapt and mitigate climate impacts, whilst simultaneously delivering benefits for wider society and biodiversity.

Nothing has highlighted the ways in which human health and wellbeing are intimately connected to nature as strongly as the COVID-19 pandemic. Research has shown that ecosystem degradation results in much higher likelihoods of zoonotic disease outbreaks, like COVID-19, bringing into focus the dependence we have on natural systems.

Nature-based solutions seek to recognise and build-upon this reliance, allowing us to address societal challenges in a way that is in sync with the natural world and protects biodiversity. This in turn will help rebuild robust and resilient ecosystems that provide us with the myriad ‘ecosystem services’ we need to survive. By placing climate action within the wider agenda of protecting the natural world we will be able to take advantage of the synergies between them.

How can we take nature-based solutions from rhetoric to reality?

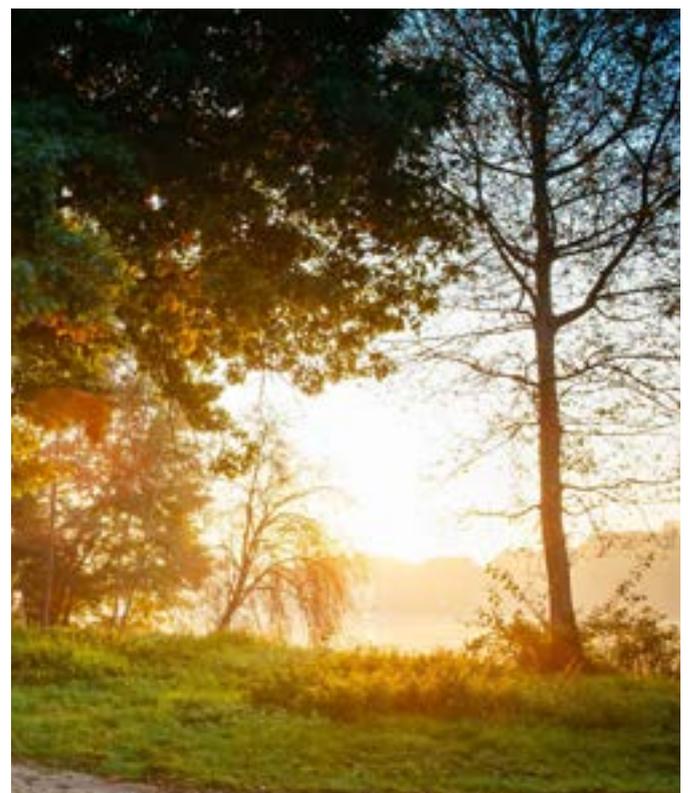
Although the rhetoric around nature-based solutions has taken off in the past year, they are not new. Many non-industrialised societies already use approaches that are equivalent to nature-based solutions. Facilitating knowledge transfer between both industrialised and non-industrialised societies will allow for new solutions to be discovered and employed. Nature-based solutions also underpin all policy areas – recognising the multiple benefits they can provide for different policy priorities will solidify their value. Considering the multiple benefits of nature-based solutions will also help us to move beyond the technocentric view of solving problems in a siloed manner, to one of systems thinking and functional ecosystems.

A key part of ensuring the widespread use of nature-based solutions will be highlighting to businesses and stakeholders both the risks arising from a changing climate, and the opportunities that exist through nature-based solutions to resolve those risks and deliver multiple benefits. Environmental professionals will play an integral role by opening up these challenges, articulating the benefits of nature and equipping people with the knowledge they need to use nature-based solutions. Environmental professionals should embed these principles throughout their work, whether explicitly part of their projects or not. Reframing our language and policy focus to reflect positive opportunities and solutions, rather than negative restrictions and minimum compliance is important to eliciting action.

The applicability of nature-based solutions will depend on local factors; there is not a ‘one-size-fits-all’ approach. For example, planting trees is often lauded as environmentally friendly, but monoculture tree plantations can negatively impact biodiversity and carbon sequestration, especially if natural habitats are converted. Effective land management and tailored approaches to climate and biodiversity action should be implemented where they are likely to have the most benefit, considering the unique conditions of each location. Land management approaches are also an important part of ensuring that different land types maximise their carbon storage and sequestration abilities.

How should offsetting and nature be used to support our response to climate change?

Offsetting can be effective, however it should not be used as the default option for projects. The mitigation hierarchy of avoid, minimise, restore and offset should be followed to minimise the overuse of offsetting, which can be problematic when used as the ‘easy’ option or for ‘greenwashing’. The latter presents a number of issues related to international and intergenerational inequity as well as monetising nature. Instead we should utilise the most effective mitigation strategy for a specific project, and consider the ways that it may affect ecosystems in an integrated way.



Offsetting cannot be the norm – it should be the last resort for the majority of projects, and when used it must take into account the wider ecological repercussions.

To take forward nature-based solutions, biodiversity net gain and ecological restoration, as well as the monitoring which goes hand-in-hand with these, it is essential that nature is given a home in Local Authorities. Every Local Authority should employ ecologists and they should be seen as an essential component in delivering climate ambitions and ecosystem restoration. In order for this tailored approach to be taken, Local Authorities, which often bear the brunt of delivering climate action, must be properly resourced.

How can we input multi-functionality into the ways we use nature on a strategic level?

The false dichotomy between land sparing and sharing should be avoided in future rhetoric surrounding conservation, as a combination of the two will be needed to meet climate ambitions and protect biodiversity. It is implicit in the mitigation hierarchy that the type of approach taken will depend on the unique factors of the locality. For example, given that the UK is densely populated, the default is likely to be land sharing in many areas.

Where land sparing is an option, this should be focused on protecting multifunctional ecosystems which we depend on for ecosystem services. In order to identify multifunctionality of ecosystems it is important to move beyond the use of single metrics and consider ecosystems in a holistic manner. Given the depleted and declining ecosystem resource base it is also important to move beyond sustainability thinking to regenerative thinking.

Interconnectivity between spared ecosystems is also imperative to maintain functionality, and effective “sharing” approaches should be utilised in intervening ecosystems. Land sharing approaches such as green infrastructure provide myriad opportunities for supporting biodiversity and climate action, however to deliver effective sharing approaches it is vital that planners have access to the right information and expertise to make decisions. Foundational ecological training for planners could be a key strategy for supporting this.

How can the natural environment support transformative change?

Systemic solutions are needed to tackle systemic problems. Climate change is the product of unsustainable systems of production and consumption and affects all natural and social systems. The scale of the problem means that we must break out of siloed thinking, and instead must use systems-thinking to devise systemic solutions.

This will require a paradigm shift in the way we think about the environment, towards a functional view of ecosystems. Functions don't follow physical attributes and spatial boundaries – there needs to be acknowledgement that different areas and issues cannot be treated in isolation and will have repercussions beyond the spatial boundary of the intervention.

We also need to move away from reactive actions to proactive, regenerative ones that utilise systems thinking. It is only through applying this way of thinking that we can deliver the truly transformative change needed to meet climate ambitions, whilst restoring ecosystems and protecting biodiversity.



How can we embed science and evidence in our approach to nature?

To facilitate the development of new solutions for meeting climate ambitions and protecting nature, it is essential that there is a dialogue between experts to debate ideas and identify effective measures. Often decision-makers have to act on limited information, and do not always have the right expertise to critically assess options. Breaking down the barriers between disciplines and government departments will allow for integration between policy areas and increase the uptake of science and evidence to support decision-making in line with systems-thinking.

Professional bodies should use their convening power to support debate and discussion, particularly across and between disciplines, and to consolidate the flow of science and evidence to decision-makers. Moreover, ecologists need to be recognised as professionals with expertise and information rather than barriers to planning or environmental activists.

To truly deliver on the transformative change needed to meet climate ambitions and support systems thinking, we must tackle the siloed nature of work, education, and politics. In order to support a functional approach, environmental science needs to be more closely integrated with other disciplines to allow for knowledge transfer. We have long used science and evidence to support decision-making, but we now need to consider which science and evidence we are using. This needs to be science that is holistic and interdisciplinary in nature, highlighting functionality.

Recommendations

1. When employing nature-based solutions, multi-functionality should be prioritised to support multiple co-benefits for climate action, biodiversity and society. Nature-based solutions should not be used as a one-issue 'tick-box' exercise, and the benefits of increased resilience should be recognised even where they are hard to financially quantify.
2. One size does not fit all when it comes to nature-based solutions. Tailored approaches should be used to ensure that the most effective solution is used in the right locality.
3. The mitigation hierarchy of avoid, minimise, restore and offset should be followed to minimise the overuse of offsetting.
4. Governments should give nature a home in Local Authorities and each Local Authority should employ ecologists. Planners should be trained in key ecological principles.
5. A combination of land sharing and sparing approaches should be used, with a focus on protecting multi-functional ecosystems, increasing connectivity between ecosystems, and regenerating degraded ecosystems.

Circular economy

Humanity's relationship with resources, materials, and products is the cause of significant pressures on the climate, nature, and the wider environment. Although the circular economy was not one of the themes for COP26's programme of negotiations, the concepts it represents will be crucial to achieving our aspirations for tackling climate change.

How can the circular economy decouple economic growth from resource use?

In the context of increasing demand for goods to cater to growing and developing populations worldwide, as well as the gradual shift of populations into more urban environments, the average strain placed on the environment by each of those resources needs to decrease significantly.

Not only do we need to address the production and consumption of resources now, we also need to recognise that the action needed to mitigate climate change will itself require the use of resources for infrastructure, which will need to be less carbon-intensive to have the desired consequences. In that context, "green" does not always mean "sustainable": many "green" technologies require the use of finite materials (such as minerals and heavy metals used in photovoltaic cells). Embedding circular economy principles throughout the economy will help to align decarbonisation strategies with sustainability principles.

With a linear economy, we extract materials, turn them into products, consume them, and eventually those products become waste. A circular economy seeks to get more efficiency out of everything we use, replaces wasteful production and consumption with economic value gained from services, and seeks to reuse, recycle, or replace anything that it can, mitigating the effects of climate change through more resilient processes.

The climate transition will require business models to adapt in innovative ways. 'Servitisation', where the burden of economic growth shifts onto services rather than physical products, will play a key role in reducing the carbon intensity of the global economy and the links it has to human wellbeing.

Producers: how can we leverage effective action?

Producers are well-placed to significantly influence the landscape of products and goods circulating within the economy. In some sectors there is a strong drive to increase sustainability, though the scope for producers and manufacturers to take action is often dictated by economic forces. Private companies need assurance that there will be a level-playing field with their competitors so that their investments in sustainable practices and products will be rewarded.



There are a number of key policy mechanisms which could help to leverage businesses to adapt their business models and seek out innovative sustainable practices. Stable and transparent regulations can secure investor confidence and help to drive the private sector investment in innovation and transition towards more circular business models.

In that context, Extended Producer Responsibility (EPR) will be a crucial step to incentivising businesses to address waste and product lifespans at the design stage. Cornerstone legislation, such as the Environment Bill in the UK, will be well-positioned to regulate the future of plastics and other unsustainable products.

To shift businesses away from certain practices which are unsustainable, it may also be necessary to utilise tax mechanisms. Taxes on wasteful or inefficient products, particularly single-use plastic packaging, can serve a crucial role in rebalancing the market towards more sustainable practices. Similarly, consumers can significantly influence the financial viability of unsustainable products, and on a larger scale, divestment from high-carbon businesses can be a key means to leverage greater action at a whole-business scale.

What change can be embedded at the design stage?

Design approaches such as ‘planned obsolescence’, where a product is designed to become obsolete, encouraging consumers to buy more, will not be viable within the resource constraints of a sustainable world. They also hinder innovation and competition by removing the option for consumers to select more sustainable options. By comparison, products which are designed for easy repair may still produce economically beneficial business models for producers by fitting with the move towards increased servitisation, whilst also naturally resulting in increased circularity.

The selection of materials also provides opportunities to make more sustainable design choices. The use of ‘mono-materials’ in design and development, where products are made from only one type of material, makes recycling of products easier and generally reduces the energy cost associated with the product’s creation, resulting in a product lifecycle which is more efficient, less energy intensive, and often more cost-effective as well. Core natural resources like soil entering landfills should be avoided whenever possible.

Circular economy concepts can also be applied to the built environment. Core elements of construction like sand and cement require significant resource extraction and carbon-intensity. As a result, cycles of construction and demolition have the potential to embed unsustainable pressures for the climate and nature.

By contrast, sustainable urban planning can integrate the built environment, public transport, and nature to create environments

which are sustainable and do not need to be reconstructed over time. If place-making, modular housing, and sustainable materials are entrenched in the built environment at the design stage, circular economy principles can also be embedded across the construction value chain.

Consumers: how can we promote behavioural change?

The burden of embedding the circular economy cannot fall on producers alone: we also need significant changes to global consumption habits. Crucially, a shift in mind-set is needed to reduce consumption, reuse where it is possible, and recycle (or upcycle) where it is not.

Many consumers have shown a strong conscience to change their behaviour, but often lack the necessary information to know when their choices are able to make a difference. Greater transparency about products helps consumers to make positive decisions about the products they purchase, rewarding producers who embrace sustainability. Similarly, standards or ratings can help to inform consumers and encourage more responsible decisions.

The past two decades have seen a stark increase in technological development, but it has brought with it the desire for consumers to always have the latest iteration of a product. Upgrading to a new device is often based on trends, rather than necessity. This behaviour must change to avoid spiralling resource intensity. Consumers need the assurance and incentives to use existing technology for longer, and to feel comfortable recycling their former devices rather than stockpiling them for fear that the recycling process may expose their personal information.

More can be done to equip consumers with the tools they need to make responsible decisions. Deposit Return Schemes (DRS) can promote recycling where they are effectively integrated with existing local recycling programmes. Rental schemes for technology, furniture, or other high-impact goods can also create systems of reuse across time and give consumers the option of smaller upfront payments.

What answers can technology and data provide?

Innovative use of technology and information can help to promote behavioural change by consumers while rewarding proactive decisions by producers. Linking products to data about their value chain can provide consumers with the information they need to act on their conscience and can continue to discourage wasteful activity throughout the lifecycle of a product by tracking its chain of custody. Data can also support Extended Producer Responsibility and give consumers the information they need about how to recycle or reuse a product.

New technological processes, like 3D printing and upcycling of plastic waste, are beginning to create the possibility of less wasteful and carbon-intensive production. Modular design allows for bespoke construction while the printing of spare parts encourages repair of less complex products without requiring companies to store, transport, or deliver spare parts to consumers. Businesses which take full advantage of these technological advances will be able to gain a competitive advantage while also reducing their carbon footprints.

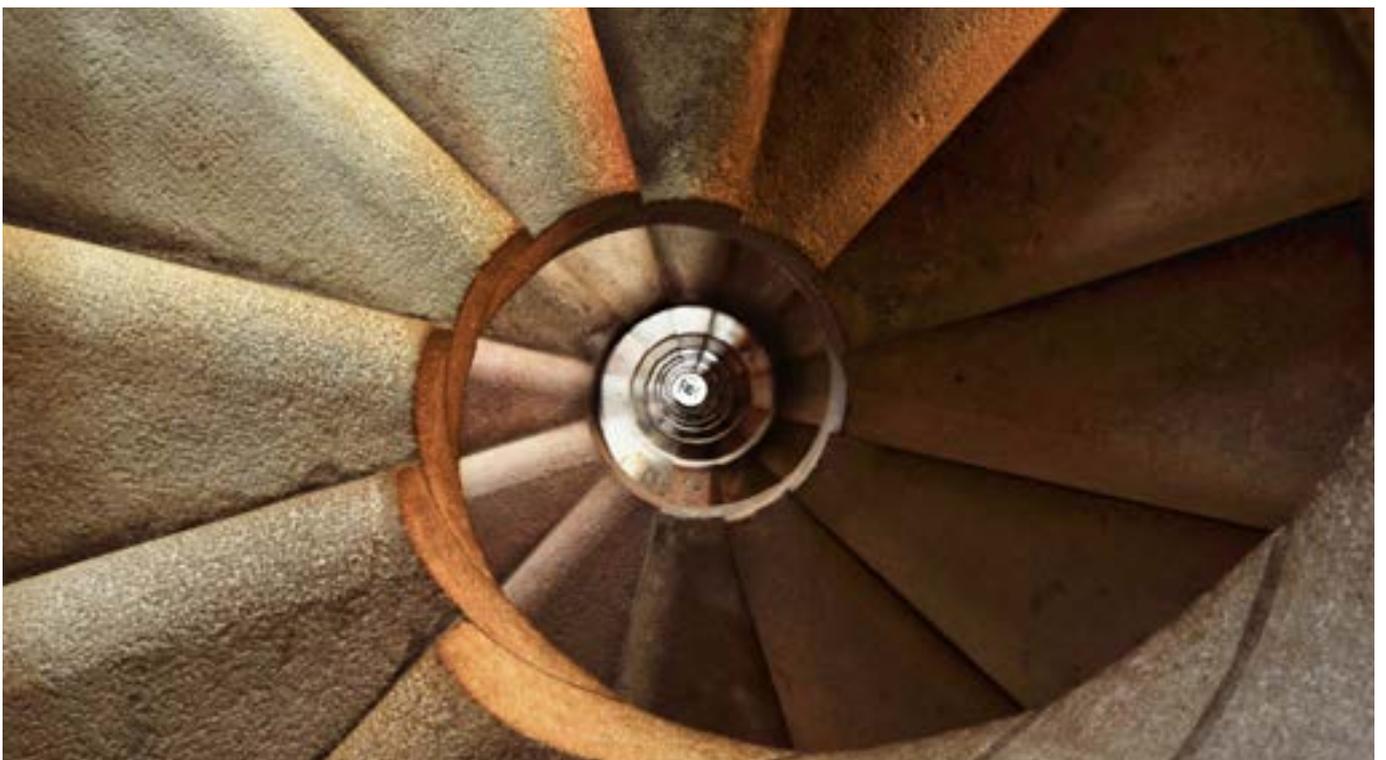
Does the circular economy create challenges for climate justice?

Our approach to creating a more circular economy must not make it too expensive for people to access the products and services they need. Approaching resource efficiency and product lifecycle from the design level can avoid the burden of the transition falling on those least able to afford it.

If the workforce is given appropriate opportunities for upskilling, particularly where new technology and data usage is increasingly involved in the lifecycle of products, there is a potential for new, more sustainable jobs in recycling and upcycling. If those technological developments are integrated into the economy incrementally, there is a possibility for a 'just transition' which improves the ability of communities to adapt to the climate transition, offering them skills and jobs, reducing challenges for climate justice rather than creating them.

Recommendations

1. Governments should increasingly emphasise the design stage in their approaches to resource use, encouraging the use of mono-materials and modular construction where appropriate. Governments should take additional steps to prevent planned obsolescence, and to encourage the recycling or upcycling of defunct devices currently stockpiled by consumers.
2. Single-use packaging and products should be actively discouraged through taxes and regulations. Governments must adopt Extended Producer Responsibility approaches to incentivise resource efficiency and circularity at the design stage.
3. Regulation should seek to enforce greater product transparency, giving consumers more information about carbon footprints, product lifecycles, places of origin, and other key determinants of product sustainability. Where appropriate, this data should be accompanied by ratings or other systems to easily translate the environmental impact of a product.
4. Governments should utilise Deposit Return Schemes and integrate them with existing recycling programmes.
5. Producers, manufacturers, and consumers should embrace innovative business models which build-in circularity at the design stage, embracing 'servitisation', less resource-intensive approaches, and rental or repair schemes as alternatives to replacing high-impact products like furniture or technology.



Adaptation and resilience

Climate action has historically focused on mitigating the likelihood of climate change, rather than adapting to its consequences. That approach is no longer appropriate for a world which has already experienced significant changes to its climate and ecology. The momentum towards greater adaptation and resilience around COP26 must be maintained, and both mitigation and adaptation must be properly recognised and resourced parts of our approach going forwards.

With significant amounts of greenhouse gases already in the atmosphere, and significant action still needed to remove them and mitigate future emissions, the need for adaptation must be accepted as an inevitability. While the effects of climate change so far have been most viscerally experienced by the developing world, consequences such as flooding, extreme weather events, and heatwaves are now widespread realities. Limiting the worst effects will be crucial for all countries and communities, even while greater action will be needed to support vulnerable nations.

While our ambition for adaptation and resilience must increase, a multi-functional systems approach may make both goals more accessible. The opportunity for approaches which support both mitigation and adaptation, particularly nature-based solutions, cannot be understated. With effective knowledge-sharing, appropriate resources, and science-led, systems-focused solutions, long-term resilience can be embedded globally while also working to mitigate the risks of climate change at their source.

How can we support both mitigation and adaptation through multi-functionality at the design stage?

It is possible to achieve both mitigation and adaptation while developing the infrastructure needed for the future. Multi-functionality must be embedded at the design stage to promote resilience, though more needs to be done to make these considerations more widespread. Considerations such as energy supply resilience, flood risk resilience, connectivity, and supply chain resilience should be more widespread in all new developments.

As society moves towards decarbonisation, the potential for systemic risk vulnerabilities and ‘cascading failures’ caused by both climate change and climate action increases, so greater resilience to those risks must be embedded across our systems. For example, increased electrification increases the burden on grid capacity and district networks, particularly for rural or disconnected communities, so long-term resilience of those systems must be considered as we accelerate our mitigation commitments.

The benefits of resilience and risk avoidance are often harder to quantify than benefits to mitigation or decarbonisation, though they are still crucial. While many governments and businesses are already working to embed multi-functional approaches that achieve both mitigation and adaptation, greater efforts must be taken to make those considerations more widespread, embrace nature-based solutions where appropriate, and increase understandings of the environmental, social, and economic benefits of a multi-functional approach.

Where we are faced with long-term challenges for resilience, we should take dynamic and adaptive approaches to solutions. Rather than committing to infrastructure now that may persist for decades with a high embodied carbon cost, we should consider natural approaches to resilience which can meet the challenge of adaptation while contributing to carbon sequestration or other ecological goals. In the long-term, further technological developments and knowledge-sharing may offer solutions which avoid the need for high-carbon infrastructure.



Systematic approaches to managing risk and embedding resilience across different scales are essential. Risk assessments are crucial to establishing the needs of a particular community or area and outlining goals, but rely on appropriate assessments, particularly those conducted in the field, to avoid unintended consequences or displacing risks to other social or natural systems. Where possible, adaptation plans should be co-produced with communities who understand local risks and may be well-placed to identify appropriate co-benefits such as carbon sequestration, air quality improvements, or social benefits including jobs and amenities.

Nature-based solutions are particularly useful for reducing systemic risks, often utilising natural systems to buffer against environmental hazards, with tree-planting offering the potential for binding slopes against landslides, greater water absorption through roots to protect against flooding, and co-benefits for carbon sequestration and habitat creation. Nature-based solutions are often low-cost with better outcomes for resilience than equivalent infrastructure investments. However, there is no 'one-size-fits-all' approach and benefits for resilience will depend on microclimates, adjacent natural systems, and an understanding of the risks associated with a specific locality.

How can we adapt our food systems to climate change?

Our food systems are a crucial example of a system which requires significant transformative change in order to meet global commitments to achieve 'net zero', but which also plays a crucial role in the ability of humanity to adapt to changing climates. As increased supply chain pressures become more widespread, the need for resilience to those risks also increases.

Behavioural change will play a key role in the mutual goals of making our food system more resilient and more climate-friendly. Dietary choices have direct ramifications for land use, and the potential for future land use change represents a significant challenge for both climate action and habitat conservation.

While significant changes to diets will not be accessible for all people or communities, consumers need greater capacity to make sustainable choices, which governments and businesses should facilitate wherever possible. Businesses may need to prioritise the provision of sustainable choices ahead of the overall quantity of choices available to consumers, and some products are unlikely to be sustainable in a 'net zero' world at the extent of availability that currently exists.

Food security within a single nation is unlikely to be an option for all countries without creating unintended social and environmental consequences. Therefore, international supply chain resilience is an important part of long-term climate resilience. Sustainable food systems rely on the decarbonisation of those supply chains and significant reductions in food waste, embedded from a design perspective.

Many farming practices need to change to protect natural systems such as soil which are crucial for both mitigation and adaptation. At the same time, we must recognise the potential of agriculture to embed long-term land stewardship and co-benefits for adjacent natural systems, as long as farmers and land managers are given appropriate incentives to take environmental approaches to land management.

Agricultural productivity and product quantity must be de-prioritised in favour of co-benefits for sustainability, resilience, healthy diets, soil health, and long-term food security, with recognition for the need to balance between those priorities using science-led systems approaches which consider the full potential for land to achieve diverse 'ecosystem services'.

How can sustainable design adapt the built environment while addressing housing capacity?

Many countries are facing increased demand for housing capacity as they address the climate crisis. While addressing housing supply and the development of infrastructure and the built environment, resilience and adaptation are achievable as co-benefits of a process which embeds sustainability at the design stage. Likewise, planning processes which do not account for long-term climate resilience are likely to significantly increase exposure to risk.

New infrastructure should consider the potential for sustainability to be embedded through increased connectivity, decisions about materials, orientation and passive temperature control, and circular design principles. Resilience should be a required consideration during planning and design processes. Often, environmental assessments which do consider resilience may not prioritise it as highly as the potential for mitigation, or may only address some adaptation needs, such as flood risk, to the exclusion of others.

Urbanisation creates the potential for increased climate-related risks, particularly surface flooding and displacement, so resilience must be embedded at the design stage and adaptive measures such as Sustainable Drainage Systems (SuDS) should be employed where appropriate. Where possible, existing infrastructure should be utilised instead of expanding urbanisation. Unused properties should be re-purposed to meet social demands, as long as appropriate adaptations are made to embed sustainability.

Driving planning policy change requires action by national governments. While some action can be driven at local scales through innovation or supplementary guidance, the market for housing development requires certainty to be provided at a national scale and there may be barriers to embedding higher standards in different national contexts. Further action must be taken to democratise and devolve planning systems, embedding co-production at the design stage and allowing communities to innovate towards sustainability.

What skills and funding will be needed to facilitate adaptation to climate change?

Adaptation and resilience have been historically under-resourced compared to mitigation efforts, and as funding increases for both goals, there needs to be a significant drive for the resources necessary to achieve long-term resilience, particularly for vulnerable nations and those without existing capacity to address resilience. Resources need to be accompanied by systematic knowledge-sharing between developing and developed countries to identify risks at an early stage rather than reacting to climate-associated damage after it has taken place.

In many cases, resource gaps and social needs are linked to historic injustices, so environmental justice will be crucial to facilitating effective adaptation and resilience. In particular, it will be necessary to address skills gaps ahead of the transition, not only to realise adaptation measures but to ensure that communities experience a ‘just transition’ which mitigates the economic consequences of stranded industries and provides communities with livelihoods which are resilient to the risks associated with the transition.

Governments should help to facilitate the development of skills and sustainable jobs across different learning pathways, demonstrating the potential for jobs in adaptation, resilience, and environmental science. Funding and strategies should be aligned to identify and develop the expertise needed to implement adaptation solutions. At local scales, the responsibility for environmental resilience is often combined with wider public health responsibilities, diminishing the expertise and capacity to address either issue completely.

As all education pathways increase their commitments to embedding climate literacy and sustainable thinking, they also need to include the skills and knowledge necessary to address adaptation, resilience, and risk across disciplines. Governments should seek to promote the development of those skills wherever possible, utilising further education, higher education, technical education, graduate programmes, apprenticeships, lifelong learning, retraining, and peer-to-peer learning where appropriate. Professional bodies may be well-placed to help distribute adaptation skills and demonstrate their members’ expertise in climate resilience.

Resilience also relies on the facilitating role of science to give communities the tools they need to identify potential options and explain their consequences. Environmental expertise should be utilised to translate projections for different mitigation pathways into realistic understandings of the need for adaptation and the associated burden of risk. Science has a key role to play in translating abstract risk into the ramifications it will have for communities.

Recommendations

1. Governments, international organisations, and all scales of climate action must recognise and promote the importance of adaptation and resilience, which is necessary regardless of action to mitigate climate change and which requires simultaneous attention.
2. Governments must take a systems approach to land use, utilising scientific insights to maximise the ‘ecosystem services’ which land can provide and environmental land management approaches where appropriate to safeguard natural resources.
3. Adaptation, resilience, and co-benefits must be systematically considered during the design and planning stage of new infrastructure wherever possible. These considerations must extend across threats to long-term resilience including flood risk, extreme weather events, energy security, and supply chain security.
4. Governments and developers should seek to better utilise the existing built environment before extending urbanisation. Where urbanisation takes place, sustainability, resilience, and connectivity should be embedded at the design stage, and national planning guidance should promote sustainable design standards, providing a baseline which Local Authorities can innovate beyond.
5. Governments, international organisations, and businesses must support transformative change of global food systems and supply chains, refocusing agriculture away from productivity and quantity of output towards a system which prioritises co-benefits for sustainability, resilience, healthy diets, soil health, and long-term food security, balancing between those priorities as appropriate.
6. Governments should adopt measures to buffer against the risk of cascading failures and compound risk vulnerabilities caused by climate change or climate action, embedding resilience in approaches to carbon mitigation. In particular, governments should ensure that increased electrification takes place alongside increased resilience to the risk of the failure of electrified systems.
7. Consumers should transition towards diets which are healthy and sustainable, though behavioural change cannot be a substitute for direct action to transform systems of production or an excuse for inaction.

Science and innovation

A crucial element of pursuing science-led policy is to ensure that we are asking the right questions: after decades of sustainability frameworks with mixed results, there is finally a recognition of multiple crises connected by interlinking natural systems. However, we must still ensure that we use the right evidence to find solutions to those crises.

How can we embed science and evidence-based solutions in our approach to addressing climate change?

Appropriate and robust evidence should be used to inform decisions, especially where trade-offs and complex systems are involved. Where possible, systematic reviews of evidence should be utilised and research should be supported to fill gaps where evidence does not yet exist. While seeking high levels of rigour, we should also try to ensure our science is transparent, fair, just, understandable, and that it is as free as possible at the point of use.

Though historic inaction on environmental crises has left us with expedited timeframes to find solutions, rushing towards solutions at the expense of systematic consideration of evidence may lead to further delays and the potential for policy failures or unintended consequences which take more time to resolve in the long-term. Solutions require appropriate time to properly utilise expertise and evidence, co-producing answers which are backed by science while also representing the interests of the communities who need to live with those solutions.

If expedited deadlines are inevitable, efforts must be taken to make clearer the risks and consequences associated with that haste, while systematically accounting for that risk in the ways we design policies. Different approaches can be piloted at smaller scales to generate evidence and promote innovation while avoiding binary decisions at a large scale without the data to support them. Rather than seeking to attribute blame for situations which go wrong, we should find ways to take responsibility for putting them right.

How can we support innovation to find solutions to climate change?

Innovation requires a level-playing-field for businesses. While many large companies lead by example and can develop competitive advantages through increased sustainability, that is not always an option and regulation may be necessary to assure businesses that their investments in green innovation will be rewarded. Effective regulation can also show businesses the direction of travel, allowing them to safeguard themselves against risk by staying ahead of the global transition.

Innovative solutions to mitigation and adaptation can also be promoted at local scales, absorbing the risk of otherwise binary solutions by allowing for pilots and testing of different approaches before rolling them out at the national scale. Innovation is crucial to avoiding single points of failure and mitigating against systemic risk vulnerabilities.

Where governments support innovation through funds and regulations, businesses and Local Authorities can be encouraged to take additional action beyond regulations or requirements, setting standards and driving sustainability and the uptake of existing technology.

Recommendations

1. Decisions by governments, international organisations, and communities should be made with reference to the best-available science, based on systematic reviews where possible. Science should be provided with appropriate timescales to produce rigorous and comprehensive expertise.
2. Governments should fund research to fill gaps in evidence where there is not sufficient information or where greater certainty would support effective decision making.
3. Governments and communities must recognise the levels of certainty underpinning scientific conclusions, taking appropriate measures to account for degrees of risk and using smaller-scale pilots to reduce binary decision making.
4. Governments must provide appropriate regulations and policies to support private innovation by providing 'level-playing-fields' to drive uptake of existing technologies and assure the private sector of the 'return on investment' associated with competitive research and innovation.

Note that these recommendations should be read in the context of the manifesto's full list of recommendations, particularly those relating to climate leadership.

Transport

The COVID-19 pandemic provided us with a stark reality about the scale of the challenge ahead; even with some of the most dramatic restrictions on human mobility in the last century, the drop in emissions we saw during the pandemic was not sufficient to put us on a pathway towards 'net zero'. Our mobility systems are so deeply interwoven with some of the most carbon-intensive materials we use that we require fast, nuanced, and transformative change across the ways we travel.

Energy, infrastructure, technology, and connectivity are all fundamentally connected to transport, so the goal of clean and sustainable transport is even more reliant on systems thinking and science-led approaches than other social systems. While positive change is beginning to take off in some areas, action to decarbonise transport must accelerate to meet our ambitions within the tightly-contracted timelines we are facing.

How do we accelerate towards transformation of the whole mobility system?

Efforts to decarbonise transport have historically been incremental and atomistic, lacking the coordination and scale of change needed to transform the system as a whole. Proposed solutions, such as electric vehicles, are beginning to become commercially viable but often lack the necessary infrastructure to become real options for the majority of consumers to utilise, or remain prohibitively expensive so continue to have low uptake. The accessibility of transport options must be systematically addressed so that consumers have a real and fair ability to make sustainable choices.

Attitudes towards the use of fossil fuels have changed significantly, though consumers and businesses need alternatives to become viable. There is a strong tendency towards risk aversion, particularly for businesses which need certainty that technology will be viable and supported by infrastructure before they invest, or those who have already committed to particular technology or infrastructure. The result is a considerable degree of inertia in the transport system which must be accounted for as we drive change forwards. To some extent, governments and Local Authorities exhibit the same degree of inertia, so the identification of uncontroversial and easy-to-adopt solutions will be essential.

Relying exclusively on supply and demand will not overcome this inherent resistance to change. Travel demand is likely to continue growing, and some of that growth may be difficult to mitigate without unintended consequences for environmental justice, which relies on the ability of people to travel to access jobs and amenities. The relative cost of transport options to consumers must be recognised, particularly when privately-owned cars often represent increased comfort and value where a consumer has already paid the upfront cost of acquiring the vehicle. By comparison, environmental considerations such as the carbon cost of transport are harder for consumers both to visualise and internalise so are less likely to influence the market.

Novel business models which embrace circular economy principles, such as cost-sharing and community ownership, should be encouraged and incentivised wherever possible. Public investment in infrastructure will be crucial to making sustainable travel choices viable. Projects should be planned with a view to the environmental



and social consequences of the project, rather than purely on an economic basis. At the same time, public awareness needs to increase so that consumers have a greater understanding of the options available and the consequences of their travel choices. Giving consumers a full understanding of the positive and negative impacts of their decisions, particularly on future generations, will be crucial to supporting the behavioural change needed to mitigate the carbon impact of mobility systems.

Active travel options must be available to consumers, particularly for the shorter journeys which form the majority of travel. Schemes to encourage cycling and make it more accessible, particularly at a young age, will be crucial to changing habits which drive the demand for more sustainable transport options. Promoting active travel relies on making it appealing to consumers and co-producing schemes locally to ensure they meet the needs of given communities. Many of the barriers to uptake of active travel, including safety, connectivity, and accessibility, can be addressed at the design stage through holistic approaches to design.

How can the design stage support decarbonisation, connectivity, and consumer choices?

Decarbonising transport systems relies on understanding the reasons why people travel and addressing the causes of demand. Many journeys are short and active travel could be used instead of cars. For medium and long length trips, the business case for developing sustainable infrastructure is often easier to accept, with a larger benefit to time and cost spread over large numbers of people. Despite this, governments and business must support innovation on transport for longer journeys, particularly for freight and long-distance travel which may require new technology to significantly reduce associated emissions.

For shorter journeys it can be harder to promote changes to infrastructure and quantify the benefits. Regardless, changing the carbon-intensity of short personal journeys will be crucial to addressing climate change, with the potential to also unlock co-benefits for connectivity, congestion, air quality, and public health.

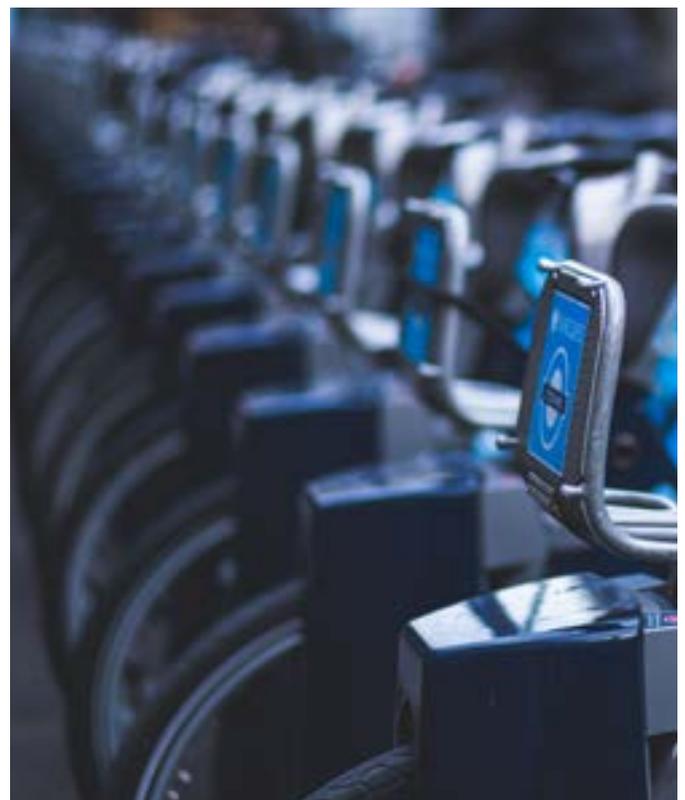
Proper utilisation of the design stage will be crucial to the decarbonisation of transport; setting sustainability standards, addressing embodied carbon, selecting materials and construction methods, and connecting a given transport mode to communities all provide options for decarbonisation which can be embedded by increasing systems thinking at the design stage.

Some changes will have associated costs, so businesses should work with contractors and supply chains to address them early in the process and work towards solutions, which will minimise those costs and deliver better decarbonisation outcomes. Where new solutions can be embedded in the design stage, governments and investors should provide innovation funding to drive those changes forwards, recognising the wider sectoral benefits to innovating towards decarbonisation.

Across the transition towards 'net zero', a holistic approach needs to be taken towards embodied carbon in transport infrastructure and vehicles. The transition will place a high burden on the creation of new transport infrastructure, including new rail links, new vehicles, and vehicle charging points. Much of the infrastructure also relies on materials like steel, concrete, and plastic which have an associated carbon cost. The embodied carbon in that new infrastructure must be recognised from an early stage in the process and accounted for in the process of decarbonisation. Where alternative processes are available to minimise the carbon-intensity of infrastructure, these should be utilised, and appropriate research and development funding should be available to make these options accessible.

Consumer choices have the potential to drive widespread decarbonisation of the transport sector, where the carbon associated with fuel is directly linked to demand. Before widespread changes in consumer choice will take place, consumers need assurance that sustainable transport options will be affordable and timely. Investing in alternatives which provide health co-benefits and which are easy to implement, such as active travel, trams, and local public transport, could support early progress.

Investing in new road infrastructure should be strictly limited to where it is needed, instead reinvesting the same capital towards integrating sustainable transport links and infrastructure, particularly for detached or rural communities. Transitioning towards neighbourhood design which promotes connectivity has the potential to address daily transport needs and significantly drive down transport demand while securing multiple benefits.



How can innovative technology and fuel support transport decarbonisation, particularly for hard-to-abate sectors?

Past innovation in the transport sector has slowed the increase in related carbon emissions, while achieving several key co-benefits for society and the environment. However, transport still represents a significant percentage of global carbon emissions and more new technology will be needed at previously unseen scales. Vehicles, fuels, and batteries are particularly in need of transformative change that drastically reduces their embodied carbon, material cost, and carbon-intensity. Businesses should be well-placed to support innovation where they will be primary beneficiaries of new business models with greater sustainability and reduced risk exposure.

While all transport sectors will benefit from developments in technology, hard-to-abate sectors including freight and air travel are most in need of innovative solutions to remain viable in a 'net zero' world. While road travel contributes more emissions globally than shipping and aviation, the potential for progress for passenger and freight road travel is less reliant on innovation, with many solutions already beginning to become available, subject to increased infrastructure commitments from governments.

Innovative solutions in one mode of transport may also have co-benefits for others. Different approaches to hydrogen technology may be necessary throughout the transition, with the potential to support multiple transport modes to reduce their carbon emissions, as long as the approach appropriately accounts for scientific evidence and leads to genuine reductions in carbon emissions.

Action on hard-to-abate sectors must be carefully balanced between robustly dis-incentivising unsustainable forms of transport while also not displacing costs to consumers. The latter may not promote actual reductions in emissions and may create climate injustices by denying access to forms of travel needed for social wellbeing. Emissions caused by international travel also need international solutions, to avoid shifting emissions to the most-permissive country, so joined-up solutions and collaboration are essential. However, the challenge presented by hard-to-abate sectors should not be a cause for further inaction, and solutions must be agreed at the earliest opportunity. Driving forwards innovation will be crucial to demonstrating that there are viable opportunities to decarbonise hard-to-abate transport sectors.

How can we embed science and evidence as we seek to make transport cleaner?

Where our mobility systems are intertwined in complex ways with our lives and livelihoods, we require systems thinking to support decarbonisation. Science must be embedded in our approach, with legally-binding science-based targets wherever possible, particularly where co-benefits are easily achievable. Those targets should be represented at all scales of action in the transport sector, from international bodies and whole sectors to individual

governments and businesses. Co-producing those goals will be crucial to ensuring they are ambitious, robust, and achievable.

Embedding science means more than setting ambitions; science will play a crucial role in the delivery of strategies and decarbonisation plans in the transport sector. Science must also play a key facilitating role in demonstrating where targets are not being met in practice and providing a joined-up systems perspective to the sector as a whole. Where carbon offsetting may become inevitable, particularly in hard-to-abate sectors, the role of science will be to ensure that those approaches are supported by evidence and represent a genuine move towards transforming the mobility system as a whole.

Science is essential to delivering whole system approaches upfront, preventing future challenges rather than relying on reactions to individual pressures or challenges as they arise. That approach will be crucial to developing transport systems which are well-connected, accessible to consumers, and suitable for a more sustainable world.

Recommendations

1. Governments should commit to phasing-out petrol and diesel cars at the earliest opportunity.
2. Governments should support and finance greater research and innovation for alternative fuels and fuel efficiency in the context of both aircraft and land vehicles.
3. Governments should facilitate the infrastructure needed for sustainable transport in both urban and rural contexts, particularly for electric vehicles where appropriate. At the same time, the embodied carbon cost of new infrastructure must be properly accounted for and addressed.
4. Governments should work with hard-to-abate sectors, including shipping and aviation, to produce detailed strategies for decarbonisation, with plans for how to address residual emissions which cannot be abated.
5. Governments and businesses should cooperate to provide consumers with accessible and affordable sustainable transport options through subsidies, dis-incentives for high-emission transport, and sustainable business models.
6. Governments should promote, and ensure the accessibility of, 'active travel' and low-carbon public transport options through financial support, the sharing economy, and by embedding connectivity and sustainable neighbourhoods at the design and planning stage of new developments and during the re-purposing of existing developments.
7. Transport projects and planning systems must consider more than economic impacts during the design stage; social and environmental impacts must be considered alongside long-term risks associated with a project.

Cities and regions

Effective action against climate change relies on delivery at every scale. International negotiations like COP26 and the national governments that attend them are crucial for setting ambition and making commitments for mitigating and adapting to climate change, though it often falls on Local Authorities and communities to deliver on those commitments.

Cities and regions provide a major opportunity for piloting policies and scaling them up to wider contexts, while also holding responsibility for a number of policy areas which have the potential to address interconnected climate pressures. In that context, the built environment is especially important, contributing to nearly 40% of global carbon emissions.

What barriers prevent climate action at local scales and how can we overcome them?

The limitations associated with resources, capacity, and political pressures often mean that Local Authorities and communities are highly risk averse when it comes to making changes. Ahead of the inevitable climate transition, these necessary changes need to be presented as an opportunity, rather than a risk, with a positive vision for the mutual benefits to communities and the environment.

Long-term progress is often limited by inconsistent approaches to monitoring or changing governance which alters targets and causes climate plans to be re-written or replaced by successive leaders. Monitoring is a crucial part of the evidence base needed to confirm that progress is being made towards climate goals, and that the consequences of policies on interconnected natural systems are measured against expectations.

Those complex and interconnected natural systems pose their own challenges, often stretching across local boundaries or experiencing unexpected effects of policies in other spheres.



Cities and regions need to feel able to take innovative approaches to seeking solutions, and should ensure that they cooperate and learn from one another across boundaries, sharing ideas to minimise the risks of innovation through collective learning.

How can we transform global climate objectives into delivery at local scales?

Local Authorities and communities need appropriate guidance and clarity from national governments on how to proceed with the implementation of global ambitions and goals. With appropriate funding and clarity, local scales are well-placed to push targets and specific policies at the level where they are most likely to make a difference and garner support from communities.

Regions also need national regulation to allow them to innovate successfully, so that novel sustainable solutions do not cause a city, region, or locality to be disadvantaged compared to adjacent localities which are not as ambitious. National governments should make the direction of travel clear and support local delivery to ensure that action is rewarded.

Conversely, local communities are well-placed to push upwards for greater action, collectively shifting the national picture and driving action at a national scale through collaboration and knowledge-sharing. Local Authorities provide excellent resources to test policies, gather evidence of success and challenges, and then feed policy ideas back to the national scale. For this kind of local action to be successful, innovative action should be rewarded and resources must be in place to help achieve transformative change.

Recommendations

1. Cities and regions should participate in knowledge-sharing networks to exchange innovative ideas on climate change.
2. Cities and regions must increase monitoring, including through interim progress monitoring against medium and long-term plans. Local climate plans must be consistently monitored against, even if strategies adapt and develop in response to monitoring or new governance.
3. Cities, regions, and governments should embrace pilot schemes, 'living labs', and other forms of innovation which allow for action without raising concerns about limited resources.
4. Cities and regions should be provided with the necessary resources to achieve transformative changes at local scales.

What next?

The end of COP26 is, tautologically, the beginning of what comes next. As much of a cliché as that sounds, the environmental science community knows all too well that it is often the quality of implementation, and not the quality of negotiations, that determines the success of major environmental commitments. It is therefore essential that we maintain, and accelerate, the momentum of change.

Scrutiny and accountability cannot end with COP26, and the attention to detail of the global community will need to increase as we see the agreements made between parties translated into action to mitigate and adapt to climate change. Commitments such as the Glasgow Leaders' Declaration on Forests and Land Use, aimed at halting deforestation and land degradation, have the potential to transform some of the most unsustainable pressures on our climate and the natural world. In order to do so, those commitments must be adhered to and delivered appropriately and transparently.

At the heart of COP26 negotiations are the Nationally-Determined Contributions (NDCs) of individual party states. The summit saw an increase in ambition from the initial submissions which would have been insufficient to meet global climate goals. More still needs to be done, and the role of future summits will be to continue accelerating ambitions until the world is on a genuine pathway to limiting the global rise in temperatures to 1.5°C.

Simultaneously, the NDCs and the ambition they represent only matter if they are translated into timely action. The most crucial aspect of the work to come will be to bring communities, businesses, and lagging governments along with the changes which are needed. Collaboration, co-production, and knowledge transfer will be invaluable tools as we drive action forward. Regulations, financial incentives, and transparent information all need to be aligned to ensure that necessary action can take place at every scale.

COP26 started that alignment with funding and commitments on nature restoration, adaptation and resilience, mitigation, and capacity-building. The Glasgow Financial Alliance for Net Zero has demonstrated the willingness of financial institutions and the private sector to collaborate to mobilise capital towards solutions. As those investments manifest many crucial aspects of the transition, the same level of cooperation will be essential to guaranteeing a joined-up approach. Only through a systems approach to the crisis will it be possible to achieve the goal of 'net zero'.

“With the collective aspirations of a planet hungry for action and the robust rigour of scientific evidence, there is no denying that a positive vision for the future is within our reach.”

To that end, science needs a better relationship with the people on this planet. Climate literacy and science should be integrated with community and government decision making, and everyone needs to feel empowered to be champions for climate action. The platform of COP26 has demonstrated an unprecedented global interest in the battle against climate change and the social and economic systems which underpin it. Science must now play a role in highlighting the different pathways for delivering on the commitments made in Glasgow and what they will mean for people and communities.

With the collective aspirations of a planet hungry for action and the robust rigour of scientific evidence, there is no denying that a positive vision for the future is within our reach. In the days that follow COP26, we must be willing to seize that future, as well as the promise of a better world for humanity and nature.





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