

Guide to the Science of Climate Change in the 21st Century

Chapter 24 IPCC 2023 AR6 Synthesis Report

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Table of Contents

Chapter 24	IPCC 2023 AR6 Synthesis Report
	24.1 AR6 Synthesis Report
	24.2 Carbon Brief Q&A
	24.3 World Resources Institute
	24.3 Information Support

December 12, 2020 – Fifth Anniversary of the Paris Agreement

August 9, 2021 – Publication of IPCC AR6 WGI, Climate Change: The Physical Science Basis, February 28, 2022 IPCC AR6 WGII, Climate Change: Impacts, Adaptability and Vulnerability and April 4, 2022 IPCC AR6 WGIII, Climate Change: Mitigation

Guide to the Science of Climate Change in the 21st Century, August 14, 2021

Chapter 24.0 IPCC 2023 AR6 Synthesis Report

24.1 AR6 Synthesis Report

The IPCC AR6 Synthesis Report may be found in <https://www.ipcc.ch/report/ar6/syr/> and, https://www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_LongerReport.pdf . The Synthesis Report Summary for Policymakers may be found in specifically, www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_FullVolume.pdf . There is a ‘Summary for Policymakers’ and press release material named ‘Headline Statements’.

The authors describe the Synthesis Report as follows:

“This Synthesis Report (SYR) of the IPCC Sixth Assessment Report (AR6) summarises the state of knowledge of climate change, its widespread impacts and risks, and climate change mitigation and adaptation, based on the peer-reviewed scientific, technical and socio-economic literature since the publication of the IPCC’s Fifth Assessment Report (AR5) in 2014.”

“This report integrates the main findings of the AR6 Working Group reports and the three AR6 Special Reports. It recognizes the interdependence of climate, ecosystems and biodiversity, and human societies; the value of diverse forms of knowledge; and the close linkages between climate change adaptation, mitigation, ecosystem health, human well-being and sustainable development. Building on multiple analytical frameworks, including those from the physical and social sciences, this report identifies opportunities for transformative action which are effective, feasible, just and equitable using concepts of systems transitions and resilient development pathways. Different regional classification schemes are used for physical, social and economic aspects, reflecting the underlying literature.”

The ‘Headline Statements’ (<https://www.ipcc.ch/report/ar6/syr/resources/spm-headline-statements>) are the overarching conclusions of the approved Summary for Policymakers, https://www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_SPM.pdf which taken together, provide a concise narrative.” The figures and tables referred to are in the Summary for Policymakers.

A	Current Status and Trends
	Observed Warming and its Causes
A.1	Human activities, principally through emissions of greenhouse gases, have unequivocally caused global warming, with global surface temperature reaching 1.1°C above 1850–1900 in 2011–2020. Global greenhouse gas emissions have continued to increase, with unequal historical and ongoing contributions arising

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Guide to the Science of Climate Change in the 21st Century, August 14, 2021

	from unsustainable energy use, land use and land-use change, lifestyles and patterns of consumption and production across regions, between and within countries, and among individuals (<i>high confidence</i>). {2.1, Figure 2.1, Figure 2.2}.
	Observed Changes and Impacts
A.2	Widespread and rapid changes in the atmosphere, ocean, cryosphere and biosphere have occurred. Human-caused climate change is already affecting many weather and climate extremes in every region across the globe. This has led to widespread adverse impacts and related losses and damages to nature and people (<i>high confidence</i>). Vulnerable communities who have historically contributed the least to current climate change are disproportionately affected (<i>high confidence</i>). {2.1, Table 2.1, Figure 2.2 and 2.3} (Figure SPM.1)
	Current Progress in Adaptation and Gaps and Challenges
A.3	Adaptation planning and implementation has progressed across all sectors and regions, with documented benefits and varying effectiveness. Despite progress, adaptation gaps exist, and will continue to grow at current rates of implementation. Hard and soft limits to adaptation have been reached in some ecosystems and regions. Maladaptation is happening in some sectors and regions. Current global financial flows for adaptation are insufficient for, and constrain implementation of, adaptation options, especially in developing countries (<i>high confidence</i>). {2.2, 2.3}
	Current Mitigation Progress, Gaps and Challenges
A.4	Policies and laws addressing mitigation have consistently expanded since AR5. Global GHG emissions in 2030 implied by nationally determined contributions (NDCs) announced by October 2021 make it likely that warming will exceed 1.5°C during the 21st century and make it harder to limit warming below 2°C. There are gaps between projected emissions from implemented policies and those from NDCs and finance flows fall short of the levels needed to meet climate goals across all sectors and regions. (<i>high confidence</i>) {2.2, 2.3, Figure 2.5, Table 2.2}
B	Future Climate Change, Risks, and Long-Term Responses
	Future Climate Change
B.1	Continued greenhouse gas emissions will lead to increasing global warming, with the best estimate of reaching 1.5°C in the near term in considered scenarios and modelled pathways. Every increment of global warming will intensify multiple and concurrent hazards (<i>high confidence</i>). Deep, rapid, and sustained reductions in greenhouse gas emissions would lead to a discernible slowdown in global warming within around two decades, and also to discernible changes in atmospheric

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Guide to the Science of Climate Change in the 21st Century, August 14, 2021

	composition within a few years (<i>high confidence</i>). {Cross-Section Boxes 1 and 2, 3.1, 3.3, Table 3.1, Figure 3.1, 4.3} (Figure SPM.2, Box SPM.1)
	Climate Change Impacts and Climate-Related Risks
B.2	For any given future warming level, many climate-related risks are higher than assessed in AR5, and projected long-term impacts are up to multiple times higher than currently observed (<i>high confidence</i>). Risks and projected adverse impacts and related losses and damages from climate change escalate with every increment of global warming (<i>very high confidence</i>). Climatic and non-climatic risks will increasingly interact, creating compound and cascading risks that are more complex and difficult to manage (<i>high confidence</i>). {Cross-Section Box.2, 3.1, 4.3, Figure 3.3, Figure 4.3} (Figure SPM.3, Figure SPM.4)
	Likelihood and Risks of Unavoidable, Irreversible or Abrupt Changes
B.3	Some future changes are unavoidable and/or irreversible but can be limited by deep, rapid and sustained global greenhouse gas emissions reduction. The likelihood of abrupt and/or irreversible changes increases with higher global warming levels. Similarly, the probability of low-likelihood outcomes associated with potentially very large adverse impacts increases with higher global warming levels. (<i>high confidence</i>) {3.1}
	Adaptation Options and their Limits in a Warmer World
B.4	Adaptation options that are feasible and effective today will become constrained and less effective with increasing global warming. With increasing global warming, losses and damages will increase and additional human and natural systems will reach adaptation limits. Maladaptation can be avoided by flexible, multi-sectoral, inclusive, long-term planning and implementation of adaptation actions, with co-benefits to many sectors and systems. (<i>high confidence</i>) {3.2, 4.1, 4.2, 4.3}
	Carbon Budgets and Net Zero Emissions
B.5	Limiting human-caused global warming requires net zero CO ₂ emissions. Cumulative carbon emissions until the time of reaching net-zero CO ₂ emissions and the level of greenhouse gas emission reductions this decade largely determine whether warming can be limited to 1.5°C or 2°C (<i>high confidence</i>). Projected CO ₂ emissions from existing fossil fuel infrastructure without additional abatement would exceed the remaining carbon budget for 1.5°C (50%) (<i>high confidence</i>). {2.3, 3.1, 3.3, Table 3.1}
	Mitigation Pathways

B.6	All global modelled pathways that limit warming to 1.5°C (>50%) with no or limited overshoot, and those that limit warming to 2°C (>67%), involve rapid and deep and, in most cases, immediate greenhouse gas emissions reductions in all sectors this decade. Global net zero CO ₂ emissions are reached for these pathway categories, in the early 2050s and around the early 2070s, respectively. (<i>high confidence</i>) {3.3, 3.4, 4.1, 4.5, Table 3.1} (Figure SPM.5, Box SPM.1)
Overshoot: Exceeding a Warming Level and Returning	
B.7	If warming exceeds a specified level such as 1.5°C, it could gradually be reduced again by achieving and sustaining net negative global CO ₂ emissions. This would require additional deployment of carbon dioxide removal, compared to pathways without overshoot, leading to greater feasibility and sustainability concerns. Overshoot entails adverse impacts, some irreversible, and additional risks for human and natural systems, all growing with the magnitude and duration of overshoot. (<i>high confidence</i>) {3.1, 3.3, 3.4, Table 3.1, Figure 3.6}
C	Responses in the Near Term
Urgency of Near-Term Integrated Climate Action	
C.1	Climate change is a threat to human well-being and planetary health (<i>very high confidence</i>). There is a rapidly closing window of opportunity to secure a liveable and sustainable future for all (<i>very high confidence</i>). Climate resilient development integrates adaptation and mitigation to advance sustainable development for all, and is enabled by increased international cooperation including improved access to adequate financial resources, particularly for vulnerable regions, sectors and groups, and inclusive governance and coordinated policies (<i>high confidence</i>). The choices and actions implemented in this decade will have impacts now and for thousands of years (<i>high confidence</i>). {3.1, 3.3, 4.1, 4.2, 4.3, 4.4, 4.7, 4.8, 4.9, Figure 3.1, Figure 3.3, Figure 4.2} (Figure SPM.1; Figure SPM.6)
The Benefits of Near-Term Action	
C.2	Deep, rapid and sustained mitigation and accelerated implementation of adaptation actions in this decade would reduce projected losses and damages for humans and ecosystems (<i>very high confidence</i>), and deliver many co-benefits, especially for air quality and health (<i>high confidence</i>). Delayed mitigation and adaptation action would lock-in high-emissions infrastructure, raise risks of stranded assets and cost-escalation, reduce feasibility, and increase losses and damages (<i>high confidence</i>). Near-term actions involve high up-front investments and potentially disruptive changes that can be lessened by a range of enabling policies (<i>high confidence</i>). {2.1, 2.2, 3.1, 3.2, 3.3, 3.4, 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8}

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Guide to the Science of Climate Change in the 21st Century, August 14, 2021

	Mitigation and Adaptation Options across Systems
C.3	Rapid and far-reaching transitions across all sectors and systems are necessary to achieve deep and sustained emissions reductions and secure a liveable and sustainable future for all. These system transitions involve a significant upscaling of a wide portfolio of mitigation and adaptation options. Feasible, effective, and low-cost options for mitigation and adaptation are already available, with differences across systems and regions. (<i>high confidence</i>) {4.1, 4.5, 4.6} (Figure SPM.7)
	Synergies and Trade-Offs with Sustainable Development
C.4	Accelerated and equitable action in mitigating and adapting to climate change impacts is critical to sustainable development. Mitigation and adaptation actions have more synergies than trade-offs with Sustainable Development Goals. Synergies and trade-offs depend on context and scale of implementation. (<i>high confidence</i>) {3.4, 4.2, 4.4, 4.5, 4.6, 4.9, Figure 4.5}
	Equity and Inclusion
C.5	Prioritising equity, climate justice, social justice, inclusion and just transition processes can enable adaptation and ambitious mitigation actions and climate resilient development. Adaptation outcomes are enhanced by increased support to regions and people with the highest vulnerability to climatic hazards. Integrating climate adaptation into social protection programs improves resilience. Many options are available for reducing emission-intensive consumption, including through behavioural and lifestyle changes, with co-benefits for societal well-being. (<i>high confidence</i>) {4.4, 4.5}
	Governance and Policies
C.6	Effective climate action is enabled by political commitment, well-aligned multilevel governance, institutional frameworks, laws, policies and strategies and enhanced access to finance and technology. Clear goals, coordination across multiple policy domains, and inclusive governance processes facilitate effective climate action. Regulatory and economic instruments can support deep emissions reductions and climate resilience if scaled up and applied widely. Climate resilient development benefits from drawing on diverse knowledge. (<i>high confidence</i>) {2.2, 4.4, 4.5, 4.7}
	Finance, Technology and International Cooperation
C.7	Finance, technology and international cooperation are critical enablers for accelerated climate action. If climate goals are to be achieved, both adaptation and mitigation financing would need to increase many-fold. There is sufficient global capital to close the global investment gaps but there are barriers to redirect capital to climate action. Enhancing technology innovation systems is key to accelerate the

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Guide to the Science of Climate Change in the 21st Century, August 14, 2021

	widespread adoption of technologies and practices. Enhancing international cooperation is possible through multiple channels. (<i>high confidence</i>) {2.3, 4.8}

24.2 Carbon Brief Q&A

The newsletter, Carbon Brief, published a question and answer article, pertaining to the AR6 Synthesis Report, 23 March 2023 <https://www.carbonbrief.org/qa-ipcc-wraps-up-its-most-in-depth-assessment-of-climate-change/> . The newsletter provides a ‘digestible summary of the key findings and graphics’. Questions addressed include:

- [1. What is this report?](#)
- [2. How is the Earth’s climate changing?](#)
- [3. How are human-caused emissions driving global warming?](#)
- [4. How much hotter will the world get this century?](#)
- [5. What are the potential impacts at different warming levels?](#)
- [6. How could warming cause abrupt and irreversible change?](#)
- [7. What does the report say on loss and damage?](#)
- [8. Why is climate action currently ‘falling short’?](#)
- [9. What is needed to stop climate change?](#)
- [10. How can individual sectors scale up climate action?](#)
- [11. What does the report say about adaptation?](#)
- [12. What are the benefits of near-term climate action?](#)
- [13. Why is finance an ‘enabler’ and ‘barrier’ for climate action?](#)
- [14. What are the co-benefits for the Sustainable Development Goals?](#)
- [15. What does the report say about equity and inclusion?](#)

24.3 World Resources Institute

The World Resources Institute provides ‘10 Big Findings from the 2023 IPCC Report on Climate Change’ March 20, 2023, <https://www.wri.org/insights/2023-ipcc-ar6-synthesis-report-climate->

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Guide to the Science of Climate Change in the 21st Century, August 14, 2021

[change-findings?utm_campaign=WRICities&utm_source=WRICitiesNewsletter-2023-3&utm_medium=email&utm_content=title](https://www.wri.org/news/2023/08/climate-change-findings?utm_campaign=WRICities&utm_source=WRICitiesNewsletter-2023-3&utm_medium=email&utm_content=title) . The 'Big Findings' are:

1. Human-induced global warming of 1.1 degrees C has spurred changes to the Earth's climate that are unprecedented in recent human history.
2. Climate impacts on people and ecosystems are more widespread and severe than expected, and future risks will escalate rapidly with every fraction of a degree of warming.
3. Adaptation measures can effectively build resilience, but more finance is needed to scale solutions.
4. Some climate impacts are already so severe they cannot be adapted to, leading to losses and damages.
5. Global GHG emissions peak before 2025 in 1.5 degrees C-aligned pathways.
6. The world must rapidly shift away from burning fossil fuels – the number one cause of the climate crisis.
7. We also need urgent, systemwide transformations to secure a net-zero, climate resilient future.
8. Carbon removal is now essential to limit global temperature rise to 1.5 degrees C.
9. Climate finance for both mitigation and adaptation must increase dramatically this decade.
10. Climate change – as well as our collective efforts to adapt and mitigate it – will exacerbate inequity should we fail to ensure a just transition.

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Guide to the Science of Climate Change in the 21st Century, August 14, 2021

24.3 Information Support

1. IPCC AR6 Synthesis Report March 2023 <https://www.ipcc.ch/report/ar6/syr/> and https://www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_LongerReport.pdf .
2. The IPCC AR6 Synthesis Report Summary for Policymakers may be found in www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_FullVolume.pdf .
3. IPCC AR6 Synthesis Report 'Headline Statements', <https://www.ipcc.ch/report/ar6/syr/resources/spm-headline-statements> .
4. Q&A: IPCC wraps up its most in-depth assessment of climate change, Carbon Brief, 23.03.2023, <https://www.carbonbrief.org/qa-ipcc-wraps-up-its-most-in-depth-assessment-of-climate-change/>
5. 10 Big Findings from the 2023 IPCC Report on Climate Change, World Resources Institute, March 20, 2023, https://www.wri.org/insights/2023-ipcc-ar6-synthesis-report-climate-change-findings?utm_campaign=WRICities&utm_source=WRICitiesNewsletter-2023-3&utm_medium=email&utm_content=title .

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