

About CLICCS

Researchers from a wide range of disciplines have joined forces at the Cluster of Excellence CLICCS (Climate, Climatic Change, and Society) to investigate how climate and society co-evolve. The CLICCS program is coordinated through Universität Hamburg's Center for Earth System Research and Sustainability (CEN) in close collaboration with multiple partner institutions and is funded by the Deutsche Forschungsgemeinschaft (DFG), EXC 2037 „CLICCS – Klima, Klimawandel und Gesellschaft“ – Projektnummer: 390683824.

About the Outlook

In the annual Hamburg Climate Futures Outlook, CLICCS researchers make the first systematic attempt to assess which climate futures are plausible, by combining multidisciplinary assessments of plausibility. The 2024 Hamburg Climate Futures Outlook addresses the question: Under which conditions is sustainable climate change adaptation plausible?

DOI: <https://doi.org/10.14361/9783839470817>

URL: www.cliccs.uni-hamburg.de/results/hamburg-climate-futures-outlook.html

Citation

Engels, Anita; Jochem Marotzke; Beate Ratter; Eduardo Gonçalves Gresse; Andrés López-Rivera; Anna Pagnone; Jan Wilkens (eds.); 2024. Hamburg Climate Futures Outlook 2024. Conditions for Sustainable Climate Change Adaptation. Cluster of Excellence Climate, Climatic Change, and Society (CLICCS). transcript Verlag, Bielefeld.

Key Findings

In a world with global greenhouse gas emissions still on the rise, higher temperatures, more extreme weather and climate events, and multiple impacts of climate change, communities face big challenges. Adaptation to climate change is needed, but not all adaptation measures are sustainable; some even worsen conditions, especially in the long run. Sustainable climate change adaptation cannot be taken for granted since whether and how local communities succeed in enhancing resilience depends on a variety of social conditions. Based on nine case studies, the Hamburg Climate Futures Outlook 2024 identifies key conditions that influence the plausibility of achieving sustainable climate change adaptation and their connections to mitigation goals. The current Outlook provides a realistic assessment that sets expectations straight and helps to identify social conditions for effective climate action.

► The *Social Plausibility Assessment* confirms our previous finding that achieving deep decarbonization, that is, net-zero CO₂ emissions by 2050, is not plausible. No overall shift can be observed since the previous assessment in 2023. Therefore, meeting the Paris Agreement goal of limiting the temperature increase to 1.5°C remains not plausible. Currently, none of the 10 social drivers supports deep decarbonization by 2050, with only six social drivers supporting decarbonization. These are: UN climate governance, transnational cooperation, climate-related regulation, climate activism and social mobilization, climate litigation, and knowledge production. The media driver remains ambivalent as it sometimes supports and sometimes inhibits deep decarbonization. Since 2023, fossil-fuel divestment showed a significant change, from a social driver that supported decarbonization to one inhibiting deep decarbonization. This, along with corporate responses and consumption trends, makes three drivers that currently inhibit deep decarbonization by 2050.

► Social drivers relate to and affect each other in different ways. All social drivers offer empirical evidence for an increase in their dynamics contributing to climate action. This happens also by creating new resources for other drivers, for instance new court rulings, new forms of knowledge, and increased political pressure. Nevertheless, despite the plethora of new resources, there is less change affecting key structural and institutional context conditions of drivers, and therefore no qualitative transformative shift toward deep decarbonization can be observed. Some driver dynamics highlight that available resources may also be used to undermine or counteract climate action.

► Internal climate variability arises spontaneously and randomly within the climate system. The assessment emphasizes that it is essential to explicitly consider internal variability to better predict changes in extreme events. The quality of

these predictions is affected by the uncertainties and limitations of climate models. Knowledge and understanding of these uncertainties and limitations are crucial for communities facing adaptation challenges to climate change. They need to adapt to extreme events, which are strongly influenced by internal climate variability. Such knowledge can make a difference in effective and sustainable climate change adaptation strategies to high-impact events with respect to time-horizons, plans, or expenses.

► The interplay of climate change and internal variability can lead to ecosystem and socio-economic disruptions with potentially devastating consequences. Adaptation strategies are needed, for example in compound extreme events in crop-growing regions that may threaten local and global food security, in costly precipitation extremes and severe floodings that damage infrastructure and cause fatalities, and in marine heatwaves that are powerful catalysts of ecosystem disruption, with severe consequences for local communities.

► The analysis of nine case studies emphasizes key conditions that affect the plausibility of achieving sustainable climate change adaptation. Long-standing political conflicts, social inequalities, and other structural problems ought to be addressed for sustainable adaption to become plausible. The same is true of increasing socio-cultural embedded capacities so as to bridge the gap between adaptive capacities and local climate vulnerabilities. Establishing climate-friendly laws, regulations, and adaptation plans are not sufficient unless the people who have to implement adaptation are involved, unless the measures are actively put into practice, and unless the plans are connected to clear indicators and measurable goals based on both scientific assessments and climate justice principles. It is essential to strengthen enabling conditions for sustainable climate change adaptation.

► Engaging social actors and communities through participatory, trustworthy, and mobilizing strategies is key to foster social involvement and to hold policymakers accountable for their commitments. There is significant potential for collective social action to co-produce knowledge and tackle challenges related to sustainable climate change adaptation. Leveraging past experiences and local knowledge in handling extreme events and climate risks can inform public policies that align climate change adaptation with socio-economic development, as well as the promotion of health and well-being.

► Sustainable climate change adaptation requires substantial changes on different levels. Key aspects include improving knowledge about interdependencies between mitigation and adaptation

scenarios, and increasing considerations of localities and socio-cultural dimensions in the processes of designing and implementing climate adaptation strategies. Sustainable climate change adaptation further requires considering trade-offs and potential synergies as well as reconsidering current path dependencies in coping strategies that reproduce unsustainable adaptation practices, and an increase in the societal support for and political action toward structural transformations.

► The assessment underlines how ambition and implementation gaps are reproduced. For example, the integration of empirical findings shows how these gaps are the outcome of (1) existing power dynamics and inequalities, (2) different ways of understanding, interpreting, and translating climate change-related norms and practices, (3) a lack of political coherence on different scales of climate governance, and (4) climate change mitigation and adaptation as multifaceted and wicked problems. In addition, uncertainty in social and physical dynamics as well as the interrelation of global and local dynamics affect the plausibility of sustainable climate change adaptation in different ways.

There is never just one agreed climate goal or one way to achieve that goal. To increase the future plausibility of climate change mitigation and adaptation, it is just as important to fight back constraining conditions as it is to strengthen enabling conditions in order to achieve qualitative shifts. The integration of diverse ways of knowing, for instance from local communities or Indigenous Peoples, is crucial for mitigation and adaptation practices, as it is to reduce social inequalities, foster just negotiation processes, and create synergies toward effective climate action.

Author List

- 1 The Hamburg Climate Futures Outlook 2024: Goals and Structure
Eduardo Gonçalves Gresse, Andrés López-Rivera, Anna Pagnone, Jan Wilkens, Anita Engels, Jochem Marotzke, Beate Ratter
- 2 The Plausibility of Climate Futures: Explaining the Methodology
Anita Engels, Jan Wilkens, Andrés López-Rivera, Eduardo Gonçalves Gresse, Anna Pagnone, Beate Ratter, Martin Döring, Jochem Marotzke, Stefan C. Aykut, Antje Wiener
- Box 1: The Implications of Degrowth Scenarios for the Plausibility of Climate Futures
Eduardo Gonçalves Gresse, Anita Engels, Jan Wilkens
- Box 2: The Costs of Military Spending, Wars and the Plausibility of Climate Futures
Michael Brzoska
- 3 The Plausibility of Achieving Deep Decarbonization by 2050
Jan Wilkens, Andrés López-Rivera, Anita Engels, Eduardo Gonçalves Gresse
- 3.1 The Social Plausibility Assessment Framework
Stefan C. Aykut, Antje Wiener, Anita Engels, Jan Wilkens, Andrés López-Rivera
- 3.2 UN Climate Governance
Stefan C. Aykut, Emilie D'Amico, Anna Fünfgeld, Jan Wilkens
- 3.3 Transnational Cooperation
Thomas Frisch, Emilie D'Amico, Cathrin Zengerling
- 3.4 Climate-Related Regulation
Grischa Perino, Anne Gerstenberg, Steffen Haag, Franziska Müller, Martin Wickel, Cathrin Zengerling
- 3.5 Climate Activism and Social Mobilization
Charlotte Huch, Christopher Pavenstädt, Jan Wilkens
- 3.6 Climate Litigation
Cathrin Zengerling, Stefan C. Aykut, Antje Wiener, Jill Bähring, Lea Frerichs
- 3.7 Corporate Responses
Matthew Philip Johnson, Theresa Rötzel, Thomas Frisch, Solange Commelin, Timo Busch, Anita Engels
- 3.8 Fossil-Fuel Divestment
Anita Engels, Steffen Haag, Franziska Müller, Timo Busch, Theresa Rötzel
- 3.9 Consumption Trends
Eduardo Gonçalves Gresse, Anita Engels, Svenja Struve, Erika Soans
- 3.10 Media Debates
Katharina Kleinen-von Königslöw, Michael Brügge-mann, Lars Guenther
- 3.11 Knowledge Production
Delf Rothe, Andrés López-Rivera, Jan Wilkens
- 3.12 Summary of Social Driver Assessments
Jan Wilkens, Andrés López-Rivera, Eduardo Gonçalves Gresse
- 4 Regional Climate Variability and Extremes: Challenges for Adaptation
Anna Pagnone, Jochem Marotzke
- 4.1 Introduction
Jochem Marotzke, Anna Pagnone
- 4.2 Single-Model Initial-Condition Large Ensembles Quantify Internal Climate Variability and its Changes
Dirk Olonscheck, Leonard Borchert, Adrien Deroubaix
- 4.3 Are Recently Observed Heavy Precipitation Extremes Realistically Represented by State-of-the-art Spatial Resolutions of Global Climate Models?
Dirk Olonscheck and Franziska S. Hanf
- 4.4 High-Impact Marine Heatwaves
Armineh Barkhordarian
- 4.5 How Will Extreme Heat in the World's Bread-basket Regions Change in the Future?
Leonard Borchert, Victoria Dietz, Joscha N. Becker, Kerstin Jantke
- 4.6 Summary
Anna Pagnone
- 5 Sustainable Climate Change Adaptation: Insights and Reflections from the Field
Beate Ratter, Martin Döring, Eduardo Gonçalves Gresse
- 5.1 Introduction
Martin Döring, Beate Ratter, Eduardo Gonçalves Gresse
- 5.2 Towards Plausible Sustainable Climate Change Adaptation in Urban, Rural, and Coastal Areas
Martin Döring, Beate Ratter, Eduardo Gonçalves Gresse

- 5.3 Hamburg, Germany
Franziska S. Hanf, Jörg Knieling, Malte von Szombathely, Martin Wickel, Jürgen Oßenbrügge, Sonja Schlipf, Jana Sillmann
- 5.4 São Paulo, Brazil
Eduardo Gonçalves Gresse, Marcelo Soeira, Gabriela Di Giulio, Denise Duarte, Anita Engels
- 5.5 Ho Chi Minh City, Vietnam
Michael Waibel, Thuy Thi Thu Nguyen, Pham Tran Hai, Steven Petit, Le Hong Nhat
- 5.6 Rural Areas of Northeast Lower Saxony, Germany
Uwe Schneider, Kerstin Jantke, Michael Köhl, Annette Eschenbach, Martina Neuburger
- 5.7 Rural Communities in Nepalese highlands, Nepal
Prem Raj Neupane, Kumar Bahadur Darjee, Jürgen Böhner, Michael Köhl
- 5.8 Pastoralists in Kunene, Namibia
Michael Schnegg, Kerstin Jantke, Annette Eschenbach, Uwe Schneider
- 5.9 Coastal Adaptation in North Frisia, Germany
Martin Döring, Philipp Jordan, Kirstin Dähnke, Johannes Pein, Beate Ratter, Peter Fröhle
- 5.10 Small Islands Adaptation in the Maldives
Beate Ratter, Arne Hennig, Zahid
- 5.11 Coastal Adaptation in Taiwan
Hsiao-Wen Wang, Peter Fröhle, Natasa Manojlovic, Dong-Jiing Doong
- 5.12 Conclusion and Assessment
Martin Döring, Beate Ratter, Eduardo Gonçalves Gresse
- 6 Integration and Synthesis of Assessments
Andrés López-Rivera, Jan Wilkens, Eduardo Gonçalves Gresse, Anna Pagnone, Anita Engels, Jochem Marotzke, Beate Ratter, Antje Wiener, Achim Oberg, Martin Döring
- Box 3: Toward a More Inclusive and Connected Repertoire of Climate Action
Anita Engels, Jochem Marotzke, Beate Ratter, Eduardo Gonçalves Gresse, Andrés López-Rivera, Anna Pagnone, Jan Wilkens
- 7 Implications for Shaping Climate Futures
Anita Engels, Jochem Marotzke, Beate Ratter, Eduardo Gonçalves Gresse, Andrés López-Rivera, Anna Pagnone, Jan Wilkens

External Authors and Contributions
Gabriela Di Giulio, University of São Paulo (USP), São Paulo, Brazil

Denise Duarte, University of São Paulo (USP), São Paulo, Brazil

Dong-Jiing Doong, National Cheng Kung University, Tainan City, Taiwan

Le Hong Nhat, Trends & Technologies Inc. Vietnam, Ho Chi Minh City, Vietnam

Arne Hennig, Arepo Consult, Berlin, Germany

Natasa Manojlovic, Hamburg University of Technology, Hamburg, Germany

Steven Petit, Institute of Smart City and Management, Ho Chi Minh City, Vietnam

Sonja Schlipf, Hamburg Wasser, Hamburg, Germany

Marcelo Soeira, State University of Campinas, Brazil

Thuy Thi Thu Nguyen, Hong Bang International University, Ho Chi Minh City, Vietnam

Pham Tran Hai, Ho Chi Minh City Institute for Development Studies, Ho Chi Minh City, Vietnam

Hsiao-Wen Wang, National Cheng Kung University, Tainan City, Taiwan

Zahid, Male' Envergy Consultancy Pvt Ltd., Maldives

Reviewers

Julia Arieira, Johanna Baehr, Stefan C. Aykut, Peter Driessen, Simin Davoudi, Greg Flato, Pierre Friedlingstein, Oliver Geden, Franziska S. Hanf, Gabriele Hegerl, Jim Hall, Peter Haugan, Lars Kutzbach, Michael Köhl, David Marcolino Nielsen, Nicola Maher, Vladimir Metelitsa, Carlos Nobre, Achim Oberg, Grischa Perino, Simone Pulver, Karl Steininger, Rodolfo Salm, Uwe Schimank, Detlef van Vuuren, Ingrid van Putten, Karin von Schmalz, Anke Weidlich

CLICCS Scientific Steering Committee

Johanna Baehr, Anita Engels, Annette Eschenbach, Eduardo Gonçalves Gresse, Lars Kutzbach, Andreas Lange, Jochem Marotzke, Achim Oberg, Grischa Perino, Corinna Schrum, Jana Sillmann