

Research for climate adaptation

Bruce Currie-Alder¹ , Cynthia Rosenzweig², Minpeng Chen³,
Johanna Nalau⁴, Anand Patwardhan⁵ & Yang Wang⁶

Adaptation to climate change must be ramped up urgently. We propose three avenues to transform ambition to action: improve tracking of actions and progress, upscale investment especially in critical areas, and accelerate learning through practice.

Ongoing climate impacts are outpacing global mitigation efforts. The reports from the Intergovernmental Panel on Climate Change (IPCC) show that extreme events are increasing in frequency, intensity, and duration throughout the world. We have entered a climate beyond the range experienced in human history and we must learn to live in that emerging reality. As a result, adaptation needs to ‘increase ambition’ in the terminology of the upcoming 26th Conference of the Parties (COP26) of the United Nations Framework Convention on Climate Change in Glasgow.



Adaptation is the process of adjustment to actual or expected climate change and its effects. Regardless of how quickly societies decarbonize, global temperatures are already more than 1 °C above the 1850-to-1900 baseline and will continue to rise through mid-century and very likely beyond. 2021 is a year of record-breaking extremes from massive heatwaves and wildfires in the United States and Canada, to deadly floods in China and Germany. In the coming decades, climate change will go on to affect the lives, health, and livelihoods of billions of people. Along with the need to accelerate mitigation, an equally important goal of COP26 is to protect people and nature by increasing ambition for adaptation. We must seize the opportunity for research to

¹International Development Research Centre, Ottawa, Canada. ²Columbia University, New York, NY, USA. ³Renmin University, Beijing, China. ⁴Griffith University, Brisbane, QLD, Australia. ⁵University of Maryland, College Park, MD, USA. ⁶United Nations Environment Programme, Nairobi, Kenya.
✉email: bcurrie-alder@idrc.ca

enhance its usefulness and usability in order to rapidly upscale adaptation action, now needed more than ever.



Here we outline opportunities for research to accelerate adaptation, based on consultations and interviews with representatives of the United Nations Environment Programme (UNEP), the secretariats of United Nations Framework Convention on Climate Change (UNFCCC) and Intergovernmental Panel on Climate Change (IPCC), World Meteorological Organization (WMO), United Nations University (UNU), the Global Environment Facility (GEF), and the Green Climate Fund (GCF), that is, the organizations that convene the World Adaptation Science Programme (WASP)¹.

We identify three promising opportunities for progress. First, the Paris Agreement mechanisms to raise ambition, such as the global stocktake, requires research to establish what adaptation is being undertaken, whether it is effective, and if it is adequate in the face of a rapidly changing climate. Secondly, we need to ensure the resilience of—and resilience through—multilateral, domestic, and private investment. This will require research to make risk visible in decisions, to identify scalable and transferable practices, and to look ahead to how such investments perform into the future. Thirdly, research must accompany adaptation actions by communities and professionals, through creative and interactive co-production to enable learning by doing.

Informing the global stocktake

The global stocktake is mandated under Article 14 of the Paris Agreement with the purpose of assessing collective progress on climate change mitigation, adaptation, and the means of implementation, in the light of equity and the best available science. A global goal on adaptation is described under Article 7 as enhancing adaptive capacity, strengthening resilience, and reducing vulnerability to climate change. The first stocktake is expected in 2023 and will reoccur every 5 years.

One particular challenge for measuring actions and progress is the wide diversity of climate and socioeconomic conditions as well as of adaptation strategies undertaken by countries and communities around the globe. The knowledge base that underpins the global stocktake needs to embrace the heterogeneity that exists at the national level, and at the same time synthesize

information so that global progress can be assessed. Connecting the global goal on adaptation with the myriad of practical actions on the ground, and tracking them through time, is no simple task.

We need practical, and transparent ways of assessing adaptation, underpinned by clear definitions and consistent terminology. At one level, we heard an aspiration for metrics and indicators to monitor and assess progress towards the global goal on adaptation, in a manner that enables comparison across locations and over time. Yet such efforts also raise conceptual issues regarding what counts as adaptation, what constitutes effectiveness, how to respect the diversity of local contexts, and how do they differ from climate-resilient development^{2–4}.

Adaptation scholarship is growing in volume and sophistication, the sheer number of articles grew more than five-fold over the most recent decade. Techniques such as systematic literature reviews and machine learning promise to offer new perspective on the state of knowledge and breadth of experience^{5–8}. Such efforts also reveal places where evidence is less readily available, whether due to lack of research or that experience is shared in local languages. This provides a rich opportunity to place increasing focus on locations where evidence is weaker, assessing and synthesising experience-based knowledge from grey literature and making practitioner experience more visible at the global scale.

Guiding climate finance

The Adaptation Gap Report estimates that the annual costs of adaptation in developing countries could range from US\$140 billion to US\$300 billion annually by 2030 and rise from US\$280 billion to US\$500 billion by 2050⁹. Addressing these costs will require a drastic increase in the flows of public and private finance. Research needs to make the business case for funding adaptation, demonstrate the returns on investment, and ensuring its delivery where it is most needed. Unlocking finance depends on prioritizing among diverse options to invest in adaptation, assessing the synergies and trade-offs between climate action and development objectives.

Actors differ with respect to what counts as useful information and in what form. Some agencies have in-house units that scan and distill the academic literature, but others require more tailored advice on project proposals. Multilateral, national, and private sources of finance all have distinct knowledge needs, risk appetites, and ways of using evidence. For example, three-quarters of global climate finance is deployed in the country in which it is sourced¹⁰. In the near-term, research can work with climate finance to strengthen the evidence base and appetite for adaptation-based investment. Even the relatively large Green Climate Fund still relies heavily on grant finance for adaptation and has only two approved projects that leverage private sector funding¹¹.

We note some frustration regarding the burden of proof placed upon prospective adaptation investments, the requirement to provide detailed climate scenarios on specific impacts, vulnerabilities, and risks in order to receive funding. Adaptation planning and project proposals are based on understanding the specific climate hazards, the livelihoods and assets at risk, and how investment will address those hazards and create value. Scenarios can also examine how a project might fare under a range of potential climate futures, thus anticipating limits to adaptation or avoiding maladaptation. While logical enough in principle, preparing such a climate justification can become burdensome if information must be continuously redone. Streamlined approaches are needed that are founded on climate science but that can be updated as the climate system and its impacts evolve.

Our discussions also identified instances where proposals were not funded due to a lack of historical climate data. Data collection is essential to strengthen the case for adaptation, in tandem with research that collates, curates, and archives the data so that both short-term and long-term learning can ensue.

Guiding climate finance requires rigorous science as well as sending the right signals to the market and removing barriers to investment. Ultimately research has a role in ensuring all financial flows are compliant with the Paris Agreement are supported by robust evidence, not merely those flows dedicated to assisting developing countries. The research community can help local people, policymakers, farmers, and urban planners make informed decisions by co-developing climate risk information, vulnerability assessments, and adaptation pathways.

Learning through practice

Rapid climate change is now upon us. This requires ongoing engagement among research, policy and practice. Policy and action cannot wait for the slow cycle of research-to-publication-to-recommendation. This decisive decade demands embedded approaches to research, that accompany the pursuit of massively scaled-up climate action. A renewed paradigm of solution- and action-oriented research is emerging. COP26 will see the launch of a new Adaptation Research Alliance to catalyze increased investment in action-oriented research driven by end-user needs.

Research must be integrated into practice: from problem definition to solution implementation, from program design to evaluation. There are, however, multiple barriers—social, economic, political, and institutional—to embracing action research within adaptation. We need to speak to the distinct styles of communication and the incentives that motivate research and policy communities. Research is often painstakingly careful and cautious, whereas policy and practice need timely advice and are deeply grounded in political and practical considerations.

Our interviews tapped into tremendous enthusiasm for adaptation research that is embedded in action. There is an openness for research to accompany implementation of adaptation plans, to catalyze learning from the results of practice, to rapidly scale up what works and let go of what is not effective. Specific expectations raised include the potential for research to facilitate cost-effective action, to provide practical guidance and toolboxes that can be easily accessed and used, and to go further to demonstrate outcomes in practice. Researchers need to understand the decisions practitioners are facing, the information that they need, and contexts in which they operate. This does not mean making research subservient to the pursuit of climate action, but rather to bring its critical eye to refining and enhancing that practice.

Three ways to facilitate action

We have highlighted opportunities for research to inform the global stocktake, guide climate finance, and learn through practice. These three opportunities are all part of the overall shift in adaptation research to move beyond identifying climate risks and vulnerability towards providing a full suite of the knowledge required to implement solutions and improve outcomes in the light of equity and the best available science.

Increasing ambition for adaptation to the climate crisis requires collaboration and change in both the world of science and the world of policy and practice. Policymakers and practitioners need to engage more with researchers, just as researchers need to engage more with policymakers and practitioners. This deeper integration between research and society is beginning to emerge, as scientists are striving much harder to make their

findings usable and useful, and policymakers and practitioners are engaging much more directly with the research community. These are the efforts that will elevate adaptation ambition and action across the globe.

Received: 3 September 2021; Accepted: 29 September 2021;

Published online: 18 October 2021

References

1. World Adaptation Science Programme. <http://wasp-adaptation.org>.
2. Singh, C. et al. Interrogating effectiveness in climate change adaptation. *Clim. Dev.* <https://doi.org/10.1080/17565529.2021.1964937> (2021).
3. Dupuis, J. et al. Comparing apples and oranges: the dependent variable problem in comparing and evaluating climate change adaptation policies. *Glob. Environ. Change* **23**, 1476–1487 (2013).
4. AC-LEG/INFO/2. *Methodologies for Reviewing the Adequacy and Effectiveness of Adaptation and Support* (Adaptation Committee, accessed 8 March 2021); <https://unfccc.int/documents/268842>.
5. Thomas, A. et al. Global evidence of constraints and limits to human adaptation. *Reg. Environ. Change* **21**, 85 (2021).
6. Nalau, J. et al. Mapping the evolution and current trends in climate change adaptation science. *Clim. Risk Manag.* **32**, 100290 (2021).
7. Sietsma, A. J. et al. Progress in climate change adaptation research. *Environ. Res. Lett.* **16**, 054038 (2021).
8. Vincent, K. et al. The evolution of empirical adaptation research in the global South from 2010 to 2020. *Clim. Dev.* <https://doi.org/10.1080/17565529.2021.1877104> (2021).
9. Pauw, P. et al. Global progress on financing for adaptation in *Adaptation Gap Report* (UNEP, accessed 15 Jan 2021); <https://www.unep.org/resources/adaptation-gap-report-2020>.
10. Hourcade, J.C. et al. *Scaling up Climate Finance in the Context of Covid-19* (Green Climate Fund, accessed 1 June 2021); <https://www.greenclimate.fund/scaling-up-climate-finance>.
11. Binet, S. et al. *Independent Evaluation of the Adaptation Portfolio and Approach of the Green Climate Fund* (GCF, accessed 13 July 2021); <https://ieu.greenclimate.fund/node/1171>.

Author contributions

B.C. and C.R. conducted the interviews and wrote the paper. All authors (B.C., C.R., M.P.C., J.N., A.P. and Y.W.) contributed to data interpretation, and provided inputs and edits throughout the process.

Competing interests

The authors declare no competing interests.

Additional information

Correspondence and requests for materials should be addressed to Bruce Currie-Alder.

Reprints and permission information is available at <http://www.nature.com/reprints>

Publisher's note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.



Open Access This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this license, visit <http://creativecommons.org/licenses/by/4.0/>.

© Crown 2021