WORKSHOP REPORT

UEA Workshop on the Intergovernmental Panel on Climate Change (IPCC).

5th – 6th July 2023
University of East Anglia, Norwich, UK

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Organizers

Prof Rachel Warren, Professor of Global Change and Environmental Biology, Tyndall Centre for Climate Change Research and School of Environmental Sciences, UEA.

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Executive Summary

This report presents a summary of the ideas and discussions held during the UEA Workshop on the Intergovernmental Panel on Climate Change (IPCC). UEA has played a unique role in the IPCC, making a continuous contribution from the First Assessment Report (AR) through to the most recent AR. This workshop brings together academics and early career researchers from UEA with a select group of external invitees to reflect on some key challenges and opportunities for the IPCC as we move into the next assessment and reporting cycle. The aims of the workshop are to (1) reflect on the strengths and weakness of the IPCC working modalities, (2) provide recommendations for ways in which the IPCC can improve how it operates and (3) suggest key areas for consideration in the AR7 assessment cycle (and beyond) to support greater action on climate change. The workshop took place over two days in July 2023 and consisted of a series of small group discussions. Day 1 focuses on issues related to the content of AR7 and topics included modelling, representing plurality and diverse worldviews, adaptation, and issues linked to consensus building. Day 2 addresses specific issues linked to the IPCC ARs and its working modalities, the frequency and thematic structure of reports, challenges of an expanding literature base, treatment of uncertainty, dissemination and design as well as ways in which the reports could be made more actionable.

Through small group discussions participants generated a set of ideas and issues for consideration both within and outside of the IPCC AR process. Two major themes emerged, focusing on (1) the need for a greater diversity of ideas and approaches to support inclusivity, transparency and the acceleration of climate change action and (2) enhancement of working modalities and of the usability of reports.

The first theme addressed the need to recognize and support diverse approaches to scenario development and the mix of polices which they encompass, the representation of diverse worldviews and under-represented forms of knowledge, as well as approaches to the understanding and measurement of adaptation. Potential implications of a consensual approach to scientific assessment which can lead to over-conservative statements were also discussed, in the light of the urgency of action on climate change. It was suggested that a focus on the assessment of barriers to climate change action, a greater focus on 'on the ground' examples evidencing successful climate change action, might help in accelerating action.

The second theme addressed potential enhancements of the working modalities of the IPCC and of the usability of its reports. These included greater use of smaller and more frequently produced reports to address emerging issues, enhanced deployment of AI and machine learning to support synthesis, staggering the production of WG reports to enhance cross-WG consistency, development of graphics and visuals to consider diverse target audiences, re-specification of uncertainty protocols to work across disciplines, enhanced communication and outreach to support impact, and creating more actionable summaries for policy makers.

It was noted that as the IPCC's role is to assess the literature, academics will continue to play a pivotal role in addressing knowledge gaps, improving research practices (such as scenario development and documentation of integrated assessment models), fostering discussions, and enhancing the relevance and transparency of research for policymakers.

The workshop identified a set of recommendations concerning:

- Key topics or issues to include within the AR7 cycle (and beyond) and suggestions for Expert Meeting topics and Special Reports
- Acceleration of the translation of IPCC findings into action through increased awareness and capacity building
- Enhancement of the usability of IPCC reports
- Improvement of practice outside the IPCC remit

In summary, the ideas and recommendations within this report highlight that there are real opportunities to enhance the working modalities of the IPCC and to create more useable and actionable reports. Moreover, the

report also highlights that there are actions that can be taken within academia more generally that will further support the IPCC processes and outputs.

Attendees

Rachel Warren; Mark Tebboth; Robert Nicholls; Asher Minns; Naomi Vaughan; Joanne Clarke; Jeff Price; Jordan Harold; Roger Few; Irene Lorenzoni; Katie Jenkins; Adam Smith; Phil Jones; Millie Prosser; Alfie Gaffney; Roland Smith; Harry Smith; Manasa Sharma; Anna Lau and Rita Issa. (University of East Anglia, UK.)

Terry Barker[1]; Sarah Connors[2]; Jolene Cook[3]; Nick Brooks[4] and Rachael Steller[5].

Welcome and Introductions

Rachel Warren (RW) opened the workshop by thanking the UEA science community for their sustained contributions to Intergovernmental Panel on Climate Change (IPCC) outputs. The goals of the workshop were to explore challenges to and opportunities for IPCC. The workshop addressed the following questions:

- How can the academic community assist the IPCC?
- What might improve IPCC procedures and modalities?
- How might IPCC material better facilitate climate action, for example in outreach and communication?

In addressing the goals of the workshop, it was noted that it was important to bear in mind three further points: firstly, that the IPCC does not create new research but rather reviews and synthesizes the existing state of current knowledge; secondly, that the IPCC is vital to inform the United Nations Framework Convention on Climate Change (UNFCCC) process; Thirdly, that one of the strengths of the IPCC, is the central role that governments play in approving the final reports which helps to ensure that governments have an active stake in the outputs and recommendations.

IPCC and UK Government

The opening plenary was given by Jolene Cook (JC), the UK Government's IPCC Focal Point. JC leads a team in the Department for Energy Security and Net Zero (DESNZ) that ensures climate science drives international climate policymaking. The team acts as conduit through which science can find representation within UNFCCC negotiations. IPCC reports provide the scientific foundation for international negotiations within the UNFCCC ambit (e.g., Second Assessment Report (AR2) informing the Kyoto Protocol, AR3 informing climate negotiations on adaptation, AR4 supported moves towards a temperature goal, AR5 informs the Paris negotiations) and domestically, underpin national reporting obligations including Nationally Determined Contributions (NDCs), adaptation plans, government communications, and public-facing information.

JC outlined some of the key issues associated with the upcoming AR7 cycle:

- Understanding what policymakers need to guide actions and, therefore, what academics and researchers practically can do to enable action.
- Climate adaptation may prove a greater challenge than mitigation, owing to less instructive messaging from IPCC to governments.
- The increasing volume of published material that needs reviewing, the limited assessment of non-English publications and the requirement of formal peer-review which means that research by practitioners is not captured.
- During the preparatory phases of AR7, the UNFCCC will undertake the Global Stocktake but AR7 will not be completed in time to influence this process. This highlights a general issue around the length of time it takes to produce reports and hence a potential for mismatch with climate policy procedures.

1. Senior Department Fellow, University of Cambridge, UK, and Honorary Professor, University of East Anglia, UK.
2. Climate Applications Scientist at European Space Agency, formally IPCC Head of Science Team for the Working Group I Technical Support Unit.
3. UK IPCC Focal Point and UK Head of Science for UNFCCC.
4. Director, Garama 3C Ltd, UK.
5. Senior Consultant, Climate Action Planning and Transparency, Ricardo Energy and Environment, UK.

The Process of Producing an IPCC Report

Sarah Connors (SC) outlined the process through which the IPCC reports are produced and the role of the Technical Support Unit (TSU). Once the Bureau is elected to manage the assessment process culminating in the working group assessment and special reports (e.g., on cities), outlines are produced down to the chapter level (through e.g., expert scoping meetings). These outlines are approved by the bureau. The official approved outlines are used as the basis to inform the nomination of authors (via government focal points). Once authors are selected, typically 18 months after the report is initiated, a first Lead Author Meeting is held (LAM1). Typically, two LAMs (LAM1 & LAM2) are held prior to reaching a 'First Order Draft' (FOD). The FOD goes out to expert review, with reviewers nominated through the IPCC website. Expert review generates 1000s of comments, each of which must be assessed, leading to a high workload for IPCC authors. Once expert review is complete, authors must respond to individual comments. LAM3 produces a 'Second Order Draft' or 'SOD', in addition to a Technical Summary and Summary for Policymakers or 'SPM'. LAM4 leads to final draft submission, with the SPM subsequently proceeding to government review. Once approved, the report proceeds to formal production, including copyediting and figure production. The total report process can take between two to four years (without the final production step). It should be noted that assessment differs from review. The IPCC produces assessments which include the consideration of the level of understanding, assigning calibrated language to discern uncertainty and confidence. IPCC reports are not prescriptive but policy neutral in language, for example, they include no strict requirements, such as 'should' or 'must'.

Key issues raised during the plenary discussion:

- With the recognition that we need to move from diagnosis of the problem to action, some felt that although the IPCC's mandate is not to be policy prescriptive, that it should in fact adopt a more prescriptive language particularly with regard to policy formation. Relatedly, the type of information that is needed by decision makers is changing as we are increasingly concerned with tracking action and implementation as opposed to evidence gathering in relation to the science of climate change.
- The strength of the IPCC is governing by consensus. Whilst this approach helps to ensure buy-in from countries and supports the legitimacy of the reports it does slow the pace of publication. Where possible, the processes and procedures through which the reports are produced should be reviewed and streamlined. The necessity of the consensus model remains, however, with final approval of the SPM by governments taking place in the presence of IPCC authors.
- Demand on academics is increasing owing to the volume of papers published – this workload is unsustainable in the long term. Any changes that are made to IPCC processes need to be undertaken with the intention on reducing the overall burden on academics.
- Some participants questioned whether the current working group structure is still fit for purpose. It was suggested that a change of emphasis towards more special reports could address the potential for mismatch with the timelines of UNFCCC policy processes.
- There is a lack of urgency within the IPCC process. The timeframe for producing WG reports is argued to be too long. It is therefore necessary to explore ways in which different knowledge components can be updated at different intervals with some knowledge better suited to e.g., annual (or more frequent) updates compared to current assessment report cycles. Additionally, there could be an opportunity towards updates in real-time, for example, a series of fiscal indicators with a standardized the methodology which is approved by the IPCC.
- There may be a benefit to aligning IPCC cycles to timings of the Global Stocktake although concerns have been raised about the feasibility of this with some in the modelling community questioning the feasibility of that alignment.
- There remains a critical question on the appropriate audience for the IPCC. Governments are a key stakeholder but other actors operating in the climate and development space are also key users of IPCC knowledge synthesis products.

Introduction to Breakout Session 1: 'What' are the High-Level Scientific Challenges for AR7 and Beyond?

Breakout Group A1 – Using and Applying Scenarios.

The session focused on the role of scenarios in climate change research, emphasizing their utility in asking questions about what can and should happen. The discussion referenced the three main modelling approaches (Earth System Modelling, Impact Modelling, and Integrated Assessment Models (IAMs)) and the upcoming model and scenario development for the next assessment report (AR7, seventh phase of Coupled Model Intercomparison Project (CMIP7)). The Breakout Group (BOG) underscores the challenges, biases, and communication gaps inherent in the existing process, particularly the over-representation of the global north within the modelling community and the potential inflexibility in model conception and development. Three key questions for discussion are presented on the communication of underlying assumptions, conceptualization of poorly represented aspects within models, and the involvement of academic institutions like UEA in scenario development for AR7.

Improving Transparency in Assumptions:

- The value of more actively involving the modelling team was emphasized to support greater understanding and communication of the assumptions that underly the models in outputs.
- Lack of metadata and documentation standards across modelling approaches remains a challenge, suggesting a need for improved communication around these issues.
- The importance of detailing assumptions, especially in economic components of IAMs, was stressed. The suggestion was made for the IPCC to set standards to encourage and reward good documentation of models in the literature.

Conceptualizing Scenarios:

- The need to contextualize model outputs with information from other sources was discussed. Questions were raised about skill of current models, particularly IAMs, to adequately capture human behavior and whether Agent-Based Modelling could enhance this aspect.
- Concerns were raised about the efficacy of current models, especially in capturing adaptation approaches and climate impacts/risks. There was a call for a new generation of IAMs that better represent these aspects.
- The importance of regional disaggregation for policy relevance was highlighted, noting the global north bias in modelling. The importance of increasing the representation of the global south was stressed as a necessity to support inclusivity and improving understanding of behavior and risk in different parts of the globe.

Involvement of Academic Institutions:

- The participants highlighted that new approaches are required to engage a broader audience for the CMIP7 process to help solicit input from the wider community (for instance, more proactive attempts to engage through webinars and open discussion formats).
- Recommendations included: greater clarity and guidance on reporting standards, clearer statements concerning what is excluded from models, and guidance from the IPCC on use of model outputs (to avoid misuse).
- Academic institutions, including UEA, can support the ways in which models are developed and used by commenting on scenarios, engaging with the fundamental assumptions that underpin model development, and proposing reporting standards to enhance the robustness and applicability of future scenarios.

In summary, the breakout group highlighted the complexities in current scenario development, advocating for transparency, improved conceptualization, and active involvement of academic institutions to enhance the effectiveness and inclusivity in the design and use of climate change scenarios in future assessments.

Feedback Breakout Group A1: Appropriate Use of Scenarios and What They Contain.
This BOG considered not only what IPCC could do, but what academics could do to enhance the IPCC. The key recommendations were that:

- Reporting standards for computer modelling work need to be introduced. IPCC could propose guidance concerning model outputs and clear reporting on e.g., assumptions that underpin them.
- There is a lack of cross working group integration (e.g., WG3 does not draw on the modelling outputs of WG1 and WG2) and some issues, such as climate feedback or effects of climate change on water resources, are not integrated across WGs.
- The academic community needs to engage more extensively with the body of work that looks at how different scenarios are generated, selected, and designed and used by the rest of the academic community (ScenarioMIP).
- Scenario design when representing humans should be expanded to include more diverse behaviors based on insights from (for example) the global south.

Breakout Group A2 – Representing Alternate World Views.
The participants raised concerns about the dominance of the mainstream Global North / High Income Country scientific worldview in IPCC reports, excluding voices from Low- and Middle-Income Countries (LMICs), different disciplines, and Indigenous, Local, and Traditional Knowledge (ILTK). While ILTK is acknowledged in AR6, it is often disconnected from broader discussions and remains marginal to mainstream literature within the reports. Incorporating diverse perspectives will be challenging owing to the criteria through which knowledge is included within the IPCC process (e.g., the difficulty in quantifying non-scientific knowledge, and the tendency to privilege certain groups) and the rigid format of IPCC reports. The discussion explored ways to bridge the gap between dominant and vulnerable voices, emphasizing justice, equity, and the potential inclusion of non-human voices. It also questioned the format of future assessment reports, suggesting reforms for credibility and relevance.

Key Learning Points:
Inclusivity of Worldviews:

- Need for Diverse Perspectives: The discussion underscored the importance of incorporating diverse voices, including ILTK, from LMICs and various academic disciplines. It highlighted the challenge of privileging certain groups and called for a more inclusive representation in IPCC reports.
- Alternative Economic Models: Consideration of alternative economic models and philosophies challenging the current growth-oriented system was suggested. This acknowledges the importance of diverse perspectives in addressing the multifaceted challenges posed by climate change.

Bridging Gaps and Justice and Equity:

- Bridging the gap between vulnerable groups, such as indigenous communities and LMICs on the one hand, and the dominant voices in IPCC reports on the other hand, was identified as a crucial concern. The recommendation was to recognize the specific challenges faced by these groups and to ensure that their perspectives were integrated into the assessments.
- Justice and Equity: The importance of justice and equity, including intergenerational perspectives and the valuation of elements at risk, was highlighted. The participants encouraged a comprehensive approach to understand and address issues related to loss, damage, and the climate crisis.

Reforming IPCC Process:

- Reform for Inclusivity: The group questioned whether the existing IPCC format can adequately accommodate alternative worldviews, or if a separate entity is needed. There was a suggestion to provide epistemic freedom to other communities for self-expression.
- To address broader sustainability issues beyond climate change, the group considered options such as additional special reports or a fourth Working Group (WG IV).
- Monitoring and Communication: The peer review system was critiqued for being overstretched, and concerns about accuracy and equity were raised. The importance of positive communication, balancing urgency with practical solutions, and showcasing success stories was highlighted. The BOG called for the need to address barriers to action, and the need to motivate governments through showcasing successful on-the-ground action.

In conclusion, the key takeaways emphasize the imperative of incorporating diverse worldviews, addressing justice and equity concerns, and reforming the IPCC process to remain relevant and credible in the face of evolving global challenges. The need for solutions-oriented communication and a more inclusive approach to knowledge generation and dissemination are critical components for effective climate change assessment and action.

Feedback Breakout Group A2: Alternate World View.

Considerably more effort is needed to increase the representation of diverse views and perspectives from across the world. But bridging the gap between recognizing the need for more inclusive practices and delivering those inclusive practices is difficult.

Breakout Group A3: Does Consensus Lead to Conservatism, and is This a Bad Thing?

The discussion centered on the potential risks associated with the consensus-driven approach of the IPCC and its impact on the accuracy and urgency of climate change assessments. The discussion identified conservatism as a potential risk stemming from the consensus approach, the participants explored ways to improve the IPCC process, considering the inclusion of diverse perspectives, the challenge of word limits, and the need for real-time assessments to address urgent and pressing issues that are not catered for with the longer assessment cycle.

Key Learning Points:

Consensus vs. Urgency:

- Risk of Conservatism: The discussion raised the issue of consensus potentially leading to conservatism, citing AR4's projections on sea level rise as an example. It emphasized the trade-off between achieving consensus and accurately representing the urgency of certain climate-related issues.
- Impact on Low Frequency/High Impact Events: For events with limited evidence, the tendency to opt for the lowest-common-denominator view was noted. In these cases, the challenges of consensus-driven assessments may be problematic as there is little basis upon which consensus can be founded.

Limitations and Procedural Concerns:

- Constraints of Word Limits: The constraints of word limits, especially in drafting summaries for policymakers, were underscored. This limitation affects the inclusion of details and caveats, potentially hindering the comprehensiveness of the assessment.
- Diplomatic Dynamics: The influence of diplomatic dynamics, power imbalances, and the nature of consensus in the UNFCCC process are considered. The discussion acknowledges the potential impact of influential actors on the final outputs (e.g., the SPM), echoing the challenges of diplomacy within the global political economy.

Improving the IPCC Process:

- Real-Time Assessments and Artificial Intelligence (AI): The production of real-time, focused assessments outside the traditional seven-year IPCC cycle was proposed. ScienceBrief is an example of a process that produces shorter, topic-specific assessments with targeted summaries for policymakers, and the idea of using a similar approach within the IPCC was discussed. AI was highlighted as a potential tool to support the synthesis process although the precise means through which this could happen are uncertain at this stage.
- Policy-Relevant Outputs: The potential for co-producing chapters with policymakers, scientists, and practitioners was suggested to improve the policy-relevance of outputs. This requires a shift toward a more dynamic and adaptable process that acknowledges the evolving nature of climate discourse.
- Documenting Disagreement: the importance of also documenting differences in expert judgement between authors. It reflected the need for transparency and recognition of diverse perspectives within the assessment process.

In conclusion, the key takeaways include the delicate balance between consensus and urgency, procedural limitations influencing IPCC assessments, and the importance of evolving the process to address pressing issues in real-time. The discussion encouraged a re-evaluation of the current consensus-driven model to enhance responsiveness, inclusivity, and relevance of climate change assessments.

Feedback Breakout Group A3: Does Consensus Lead to Conservatism?

The desire for consensus can lead to conservatism. The discussion reached agreement that there needs to be more tolerance of difference and disagreement (for example by using asterisks on certain statements, using minority reports, or flagging the number of countries that disagreed (and why) with a particular statement). It is important to ensure more equitable processes around the issue of inclusivity and plurality as we increasingly move into the realm of what should be done and the prospects for disagreement will likely increase.

Day 1 Lunchtime Plenary

In addition to the feedback on the three BOGs the following points were discussed:

- The long lead time of reports hampers action and greater use of continuous assessment approaches with more discrete focused reports is one solution. For instance, a report could focus on a particular issue such as sea level rise, or a policy solution, and synthesize knowledge on this issue. This approach would be more responsive and focused and would direct attention on areas where knowledge is under-developed or of low confidence. Another option would be to separate out what we understand well and focus instead on areas where our knowledge is less developed or established. Such signposting would also help the research community and policy makers to focus efforts on these topics.
- How might the IPCC evolve? The IPCC has been drawing on an inequitable academic system. Low- and Middle-Income Countries don't have capacity to access journals, whether that's for reading or publishing, because of online pay walls (although this is slowly being addressed by the publishing community) and other barriers. Similarly, there is limited capacity to use climate models, and generate vernacular models. These sorts of issues act to exclude the participation of people and places within the synthesis and generation of IPCC reports.
- AR7 can't look like AR6. By the time AR7 comes out it is likely we will have missed the UN's Sustainable Development Goals (SDGs) and we may have overshot the target of 1.5°C of warming. How does IPCC remain credible in this context? In this post Paris, post 1.5 landscape? Reform is needed in the next five years, but it will be challenging given highly unequal hierarchies of knowledge that are present.
- In short term the IPCC will not be able to change significantly but we can be, open about some of the limitations and seek to address them as best we can. For instance, by exploring the scope to draw on more special reports or to explore other synthesis modalities outside of the IPCC

process. Alternatively, increasing the diversity of content particularly into WG2 and WG3 would help to address some issues around plurality and diversity.

- Recognizing that action on climate could be faster, a useful addition to the IPCC process would be to include a greater focus on and recognition of barriers to action (and not just in a technocratic way). Such insights would be very helpful to support actors advocate and lobby for change but would still allow the IPCC to work within the mandate of policy neutrality.

Breakout Group B1: Integrated Modelling and Quantification

The Breakout Group concentrated on refining IAMs used in the production of literature that the IPCC assesses to better align with the urgency of climate action.

Key Suggestions:

Diversification of Policy Instruments:

- Current Issue: The reliance on a uniform optimal global carbon price was critiqued. The group proposed incorporating a mix of policies within IAMs that mirror real-world government actions, such as regulations, subsidies for renewable energy, and direct investments in infrastructure.
- Learning Point: IAMs should reflect a diversity of policy instruments beyond a singular carbon price, acknowledging the various approaches governments take globally in climate mitigation.

Equity and Sustainable Development Integration:

- Equity Concerns: Policymakers' emphasis on equity led the group to suggest that IAM models include climate finance and strengthen their representation of the UN's SDGs. The models should go beyond climate and economy, considering indicators related to e.g., health, biodiversity, and climate impacts.
- Learning Point: IAMs need to evolve to address equity concerns and align with broader sustainability goals, offering a more comprehensive assessment for policymakers as well as greater insights regarding the direction of travel necessary for a just transition underscoring the importance of social considerations in climate action.

Transparency, Inclusivity, and Regional Considerations:

- Diversity: The group advocated for increased engagement/collaboration with researchers from the Global South to increase the diversity of IAMs and the modelling community itself.
- Model Assumptions: The group advocated for greater transparency in model assumptions, encouraging open commentary on model design.
- Learning Point: The encouragement for transparency in model assumptions, along with the inclusion of voices from the global south, is a key takeaway. This promotes a more inclusive, objective, and robust assessment of climate scenarios, reflecting diverse perspectives and considerations beyond Western or European-centric models. The consideration of regional performance in certain climate models highlights the importance of a global perspective in assessing climate scenarios.

Breakout Group B2: Adaptation: Inventories, Limits and Global Aspiration.

The Breakout Group focused its discussion around three key questions, aiming to identify missing elements in adaptation research, understand the needs of the most vulnerable, and determine priorities for future IPCC support for adaptation.

Summary: The group acknowledged a shift in the role of the IPCC from merely informing policymakers to playing a more supportive role in climate action. This transition raised questions about how the IPCC's review process could better support on-the-ground adaptation efforts. The discussions emphasized the need to

categorize adaptation types, distinguishing between incremental, transformational, and transformative adaptation. Additionally, the group pondered whether the IPCC should systematically review how risks and vulnerabilities are assessed, particularly focusing on large and existential threats.

The conversation delved into the challenge of measuring successful adaptation, highlighting the distinction between adaptation and mitigation. Participants recognized the difficulty in predicting avoided impacts, a unique aspect of adaptation compared to mitigation. The analogy of chess was used to emphasize the temporal dimension of adaptation assessment, where the effectiveness of an intervention may only become apparent years later.

Furthermore, the group explored the importance of assessing and addressing political and social factors contributing to vulnerability. The discussion turned to the role of the IPCC in supporting actionable adaptation beyond traditional policy circles. Questions were raised about the IPCC's relevance to and support for the Global Stocktake, which assesses progress against the Paris Agreement.

Participants noted the complexity of tracking adaptation progress, given its context-specific and messy nature. The group proposed potential ways to make adaptation more measurable, including the development of recognized indicators and a framework for assessing adaptation methodologies. The importance of open access to data and reproducibility was emphasized, drawing on successful examples from IPCC reports.

Key Learning Points:

- *Distinguishing Adaptation Types:* Recognizing the different types of adaptation—incremental, transformational, and transformative—can help tailor strategies to specific contexts and needs. Categorizing these adaptation types may guide policymakers and practitioners in choosing suitable approaches.
- *Measuring Adaptation Effectiveness:* Measuring the success of adaptation is challenging due to its temporal nature and the difficulty of predicting avoided impacts. The group discussed the importance of focusing on process indicators and methodologies for assessing adaptation, acknowledging the multifaceted nature of successful adaptation.
- *Role of IPCC in Supporting Action:* The group explored ways the IPCC can play a more supportive role in actionable adaptation efforts, emphasizing the need for clear communication, actionable information, and the development of recognized indicators to bridge the gap between science and policy.

In summary, the Breakout Group's discussions highlighted the nuanced nature of adaptation, the challenges in assessing its success, and the evolving role of the IPCC in supporting effective adaptation actions.

Day 2

Plenary panel discussion with RW, Jeff Price, Irene Lorenzoni, and Jordan Harold during which the IPCC authors shared experiences of their engagement with the IPCC.

Breakout Group A1: Frequency, Thematic and Geographic Coverage of Reports

The discussion focused on potential enhancement of effectiveness and efficiency of IPCC assessments. Participants expressed concerns about the seven-year cycle of ARs, highlighting the need for more frequent, up-to-date, and accessible information. Three key points emerged during the discussion.

Frequency of Assessments and Special Reports:

- Participants discussed the challenges of the current seven-year cycle for ARs, finding it increasingly cumbersome and slow to respond to rapidly unfolding events. The proposal to consider more special reports or even annual assessments was introduced to address this issue.
- The idea of having special reports on specific topics, such as adaptation or assessment methodologies, was suggested as a means of providing more systematic and timely knowledge. Special reports were seen as breaking down the silos that exist in the current structure.

Use of AI and Machine Learning:

- There was a recognition of the potential of AI and machine learning to support more rapid assessment of data. However, caution was advised, emphasizing the need for careful deployment and human oversight. Current AI-synthesized literature was acknowledged as needing improvement.
- The proposal included leveraging AI for more efficient synthesis of knowledge, aiding in the faster assessment of data and events. The need for human intelligence alongside AI was emphasized.

Enhanced Graphics, Data Accessibility, and Regionalization:

- Participants highlighted the underutilized potential of digitized graphics to support scientific assessments. Generating agreed sets of data with regularly updated graphics, potentially on an annual basis, was proposed to ensure that key insights remain current and support actionable policy measures.
- The call for better regionalization was made, suggesting a focus on regions instead of, or in addition to, global assessments. Regional reports were seen as reducing the demands on scientists and enabling more tailored insights for specific issues.

Key Learning Points:

- *Adaptation to a Changing Landscape*: The discussion underscored the need for the IPCC to adapt to the rapidly changing landscape of climate science and policy. The existing seven-year cycle was considered insufficient to respond to emerging events and issues. The suggestion of more frequent assessments or special reports reflects a recognition of the evolving nature of climate-related challenges.
- *Synergy Between Technology and Human Oversight:* The incorporation of AI and machine learning in the synthesis of knowledge was acknowledged, emphasizing the potential for these technologies to expedite the assessment process. However, participants stressed the importance of careful deployment and the necessity of human oversight to ensure the reliability and accuracy of synthesized information.
- *Accessibility and Tailoring for Diverse Audiences:* The importance of accessible and regularly updated graphics was highlighted, emphasizing their potential to support responsive and actionable policy measures. Additionally, the discussion emphasized the need to consider diverse audiences, particularly policymakers, and suggested tailoring content and employing knowledge brokers to translate and adapt information for different user groups.

In conclusion, the conversation reflected a collective effort to explore innovative approaches to improve the efficiency and relevance of IPCC assessments in addressing the urgent challenges posed by climate change. The proposed ideas aim to strike a balance between technological advancements, regular updates, and audience-specific tailoring to enhance the impact of IPCC reports.

Breakout Group A2: Addressing the Challenge of a Rapidly Expanding Literature-
Discuss ways the IPCC could adapt to cope with ever expanding literature.

The discussion addressed the challenge posed by the overwhelming volume of scientific literature on climate change, especially during the Sixth Assessment Report (AR6) cycle, where over 230,000 papers were published, averaging almost 80 papers per day. It highlighted the need for technology to assist academics and IPCC authors in tracking, categorizing, and synthesizing this vast amount of information. The ScienceBrief platform is presented as an example, aiming to visualize consensus on specific climate change topics quickly. The integration of technologies and potential roles of AI in capturing and synthesizing literature are explored, along with considerations for resourcing author teams.

Key Learning Points:

Technology Integration for Literature Management:

- The sheer volume of climate change literature poses a challenge for IPCC authors, leading to the potential omission of key papers and biases in representation, especially from underrepresented regions like China and South Asia. The discussion underscores the need for technology to assist in tracking and categorizing literature comprehensively.
- Various existing technologies, such as ScienceBrief, Web of Science, Scopus, and AI tools, are explored as potential aids. The importance of efficient integration of these tools into IPCC working practices is emphasized, suggesting a post-zero order draft call for evidence to fill gaps and address biases.

Role of AI in Literature Synthesis:

- The discussion recognized the role of AI in managing the growing literature, suggesting that AI tools could be employed for initial screening, summarizing papers, and identifying gaps. The goal would be to enhance efficiency and save time for expert author teams, allowing them to focus on evaluation and synthesis.
- Concerns about potential misuse of AI, including the automated generation of 'peer-review' comments and intentional delays, are acknowledged. Policymaking around AI use and its integration with expert author teams needs careful consideration to ensure its beneficial application in the synthesis process.

Considerations for Author Team Resourcing:

- The question of whether resourcing of author teams should change arose, especially given considerations of potentially expanding teams to better cover the extensive literature. However, caveats related to funding, team management, and equitable representation from Global North and South are acknowledged.
- Recommendations included holding an IPCC-expert meeting to address challenges related to expanding literature, author bias, underrepresentation, and missed literature. Additionally, there was a suggestion to explore partnerships with companies, philanthropy, or large-scale assessments for technology development, ensuring a robust review of existing tools and methodologies.

In conclusion, the BOG highlighted an urgent need for technology integration, particularly of AI, to help manage the growing body of climate change literature effectively. The proposed solutions aim to enhance the efficiency of IPCC assessments, address biases, and maintain the credibility and trustworthiness of the process amid the increasing complexity of scientific information.

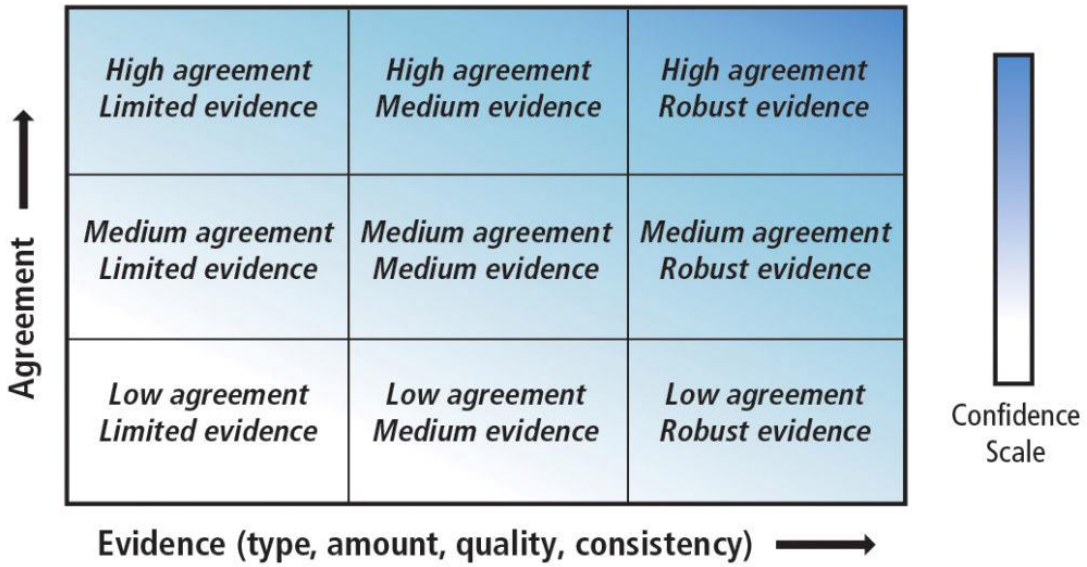
Breakout Group A3: Treatment of Uncertainty

Uncertainty is part and parcel of science, but policymakers find uncertainty challenging and sometimes uncomfortable. As such, IPCC has two measures to assess uncertainty:

- Confidence in the validity of a finding, based on the type, amount, quality and consistency of evidence (e.g., mechanistic understanding, theory, data, models, expert judgement) and the degree of agreement. Confidence is expressed qualitatively.
- Quantified measures of uncertainty in a finding expressed probabilistically (based on statistical analysis of observations or model results, or expert judgement).

The IPCC has developed a guidance note for the consistent treatment of uncertainty (see Figure 1).

Figure 1 - A depiction of evidence and agreement statements and their relationship to confidence. Confidence increases toward the top right corner as suggested by the increasing strength of shading. Generally, evidence is most robust when there are multiple, consistent independent lines of high quality.



The discussion focused on the challenges associated with uncertainty in climate science in relation to the IPCC, including qualitative confidence statements and quantified probabilistic expressions. The guidance note provided by the IPCC for treating uncertainty consistently was discussed. Three key questions were raised for consideration: the support for IPCC uncertainty guidance in natural sciences and the role of academics, the assessment of uncertainty in less comparable literature, and the dissemination of uncertainty information post-IPCC report publication.

Key Learning Points:

Challenges in Applying IPCC Uncertainty Guidance:

- The quantification of uncertainty, which has a historical context, was acknowledged, alongside challenges that arise when moving away from specific methodologies or models, especially in interdisciplinary scenarios.
- The existing IPCC guidance on uncertainty might not be universally applicable across different disciplines, models, or ways of knowing. For instance, IAMs present challenges in applying traditional uncertainty language.
- The importance of considering language variations, such as 'known unknowns' or 'unknown unknowns,' was noted, particularly for effective communication with policymakers.

- The importance of understanding what information policymakers value in uncertainty statements, particularly given a hierarchy of uncertainty statements, was considered vital. The need to recognize the potential for bias was also noted.

Improving Practices and Collaboration:

- Recommendations included initiating collaborations and discussions between statisticians in different IPCC working groups, fostering interdisciplinary dialogues, and developing standardized practices for presenting data and metadata in academic journals.
- Academic contributions could involve opinion pieces or commentaries comparing how uncertainty is handled in different disciplines, ensuring relevance across IPCC working groups.
- Addressing issues related to data standardization, transparency, and clear communication of implications and caveats in academic articles was identified as being crucial for making research more policy relevant.

Dissemination of Uncertainty Information:

- Understanding the differential knowledge and perceptions of climate change and its impacts was considered vital for disseminating uncertainty information effectively.
- Considerations for different types of data, the utility of uncertainty guidelines, and the role of different forms of evidence in building confidence statements were emphasized.
- Collaboration across IPCC working groups to share approaches and insights, especially in fostering shared understanding and the use of evidence and agreement statements, was suggested.
- The importance of addressing emergent risks, acknowledging scientific conservatism in projections, and identifying unknowns, especially in complex ecosystems, was highlighted.
- Adapting to changing information landscapes, considering daily data updates, and validating new data sources to maintain relevance for the upcoming IPCC reports were noted as crucial aspects to be addressed.

In conclusion, addressing uncertainty in climate science requires interdisciplinary collaboration, standardized practices, and effective communication strategies. Academics play a pivotal role in improving practices, fostering discussions, and enhancing the relevance and transparency of research for policymakers. The focus on uncertainty dissemination and adapting to evolving data landscapes will be critical for the effectiveness of future IPCC reports.

Lunchtime Plenary

Breakout Group A1 - Frequency, Thematic and Geographic Coverage

The plenary summarized the discussion from the morning session focusing on the potential for greater use of rolling assessments, databases that are updated more frequently and the gap between the production of reports and subsequent dissemination, disaggregating the report to address areas with low levels of knowledge / agreement or hot topics, and greater regionalization (although there was no consensus as to whether this was desirable or not). A further additional discussion point concerning the report timing of the reporting cycle between the working groups was made and, the group explored whether a greater gap between the reports would be beneficial. The gap could enable more of the insights from the e.g., first report to be included in the second report. Conversely, if produced concurrently there would be increased scope for cross-working and iteration between and Working Groups.

Breakout Group A2 - Addressing the Challenge of a Rapidly Expanding Literature:

The challenge is that with approximately 80 new climate papers published per day, it is impossible to review this amount of material on a seven-year cycle. New tools are available to support reviews of knowledge including ScienceBrief which focuses on specific topics and carries out rapid reviews. Tools such as ScienceBrief

can support the IPCC reviews by showing how the knowledge is evolving and, crucially, identifying gaps in knowledge. Harnessing the use of AI to support rapid assessments of large volumes of knowledge. There are risks in terms of ensuring integrity and robustness (for instance, applicability to non-English literature and grey literature is currently unknown).

Recommendations:

- Expert meetings on how authors address the bias in the literature (regions, personal contacts).
- Series of systematic reviews in certain areas.

Breakout Group A3 - Treatment of Uncertainty

Guidance around uncertainty has a long history and has evolved over time. Definitions and working understanding that is currently used might not be best suited depending on where and how it is applied (e.g., in WG2 and 3). Understanding levels of and comparing uncertainty across different knowledge domains is open to interpretation and can be problematic e.g., between quantitative and qualitative analysis. Moreover, the types of uncertainty are not explicit and are often derived in different ways (through e.g., error bars, theoretical assumptions, etc.) Recommendations focused on encouraging publishing conventions to state the relevance of different sources their implication for e.g., policymakers; to work more closely with journals/ platforms where data is represented and published; and to be transparent about the data generation and analysis approach to enable uncertainty to be independently assessed if necessary.

Breakout Group B1: Dissemination, Design and Process

The discussion focused on the efforts made during the AR6 cycle of the IPCC to improve the accessibility of its outputs, aligning with the goal of making climate change information more understandable for non-specialists. Three main questions were addressed in a breakout group: the approaches and innovations applied in designing AR6 SPMs and FAQs, existing communication challenges and gaps, and potential refinements for the process and design of official IPCC products.

Key Learning Points:

Communication Initiatives and Challenges:

- The IPCC employed various communication initiatives in AR6, including SPMs, FAQs, figures, interactive atlases, and regional/sectoral factsheets, among others. These initiatives aimed to balance scientific rigor, limited resources, and established review processes while making the content more accessible.
- Policymakers, especially on a national level, utilize IPCC reports as foundational resources for policy discussions and negotiations. The reports are valued for their unbiased, globally recognized information. However, policymakers often prefer concise summaries to navigate the vast content efficiently.
- The challenge lies in tailoring IPCC communications to diverse audiences with different needs in varied regional, national, and local contexts. The accessibility of IPCC reports is hindered by issues such as the time it takes for print versions to become available and difficulties in navigating and searching the reports, particularly for non-specialists.
- The inconsistency in approaches across the three working groups, challenges in navigating the AR6 scenario database, and disparities in factsheet production were identified as key challenges. Potential solutions include creating larger gaps between the publication of WG reports.

Communication Challenges and Suggestions:

- Format challenges were highlighted, including delays in obtaining print versions and difficulties for users in communities with limited internet access. Digital formats were acknowledged for providing quicker accessibility.

- Challenges in locating information within IPCC reports were emphasized, and suggestions included keyword searchable databases, AI-powered climate chat tools (e.g., ChatClimate), and involvement of library scientists to enhance content packaging.
- The AR6 scenario database was deemed complex, and the need for improved meta-data, openness, and co-production with the user community was emphasized.
- Inconsistencies between working groups' communication outputs were identified, leading to a recommendation for evaluating synergies and ensuring consistency for improved user accessibility.

Enhancing Accessibility and User Engagement:

- Strategies to enhance user engagement and accessibility include mapping key audiences, understanding specific needs through engagement with users and stakeholders, and focusing on new information and areas with evidence gaps.
- Recommendations include improving the utility of the synthesis report, raising its prominence, and publishing reports in a strategic sequence, such as focusing on solutions in WG II and III before the physical science basis.
- Tools like interactive atlases, chatbots, and digital signposting resources were suggested to improve the accessibility of IPCC-related content.
- Ensuring inclusivity and addressing concerns of the global South were highlighted for a comprehensive representation of knowledge and perspectives.

In conclusion, the AR6 communication initiatives have made strides in improving accessibility, but challenges remain in tailoring content to diverse audiences. Efforts to enhance user engagement, accessibility, and consistency across working groups are essential for the IPCC's goal of making climate change information clear and user-friendly.

Breakout Group B2: – Creating Actionable Summaries for Policymakers (Climate Action: the Missing Middle)
The breakout group focused on creating actionable summaries for policymakers, discussing the potential gaps between scientific and technological knowledge and policy-related issues. The conversation touched on several key points, including the need for more actionable and policy-prescriptive items distilled from IPCC reports, the challenges of addressing the fast-changing barriers to climate action, and the importance of involving other societal actors in conveying IPCC messages to a wider audience.

Key Learning Points:
Need for Actionable Summaries:

- Policymakers and businesses often rely on IPCC headline statements for guidance, preferring high-level statements focused on impact, urgency, barriers, obstacles, and actor motivations. There is a potential role for boundary organizations to extract key themes from IPCC reports, facilitating wider communication strategies.
- A shift toward more action-oriented approaches was noted between AR6 and AR7, emphasizing the need for specific, policy-prescriptive, and actionable items distilled from IPCC reports. This could be undertaken by relevant IPCC-affiliated organizations to maintain the IPCC's policy-relevant but not policy-prescriptive role.

Avoiding Prescriptiveness and Inclusivity:

- To avoid imposing prescriptive approaches and potential North-South inequalities, the IPCC should collate and package information for diverse uses. Advocacy for climate action should align with local, place-based specificities and be just, effective, and sustainable. The consensus format and inclusivity should be maintained.

- Authors have a responsibility to push back against environmentally destructive organizations, promoting the end of 'extractivist' approaches. An analysis of values, norms, and framings within IPCC reports over time was suggested.

Enhancing IPCC Impact and Democratizing Information:

- Despite the wealth of literature on climate action, there's limited use of IPCC reports in catalyzing action. There is a call for clear, policy-prescriptive, and actionable items to be distilled and communicated to specific actor groups. Other forms of communication, such as flashy infographics, could also be explored for wider impact.
- The slow temporality of IPCC reporting was acknowledged, and advocacy organizations equipped with tools to track changes in barriers to climate action were proposed. The co-benefits of climate action could be systematically summarized and presented to relevant actors.
- The need to democratize the use of IPCC information and acknowledge the misalignment of politics with IPCC findings was discussed. Governance gaps, such as tracking nation-state activity, were identified, suggesting a potential role expansion for the IPCC.

In conclusion, the breakout group emphasized the importance of creating actionable summaries from IPCC reports, avoiding prescriptiveness, maintaining inclusivity, and enhancing the impact of IPCC information. The role of other societal actors, including boundary organizations, advocacy groups, and city networks, was highlighted in distilling and disseminating IPCC messages to diverse audiences for effective climate action.

Final Plenary Notes

Dissemination and Design Breakout Group

There is clear evolution in the dissemination of data, and presentation and communication and headline summaries are more available than they ever have been (even if not everyone knows about these products). However, the knowledge generated by the IPCC needs to be more discoverable, perhaps through an online tool or even a chat bot which would enhance the searchability of IPCC reports. Third parties / knowledge brokers are key actors in translating IPCC material, so it is more accessible to a wider audience. There is a long list of products that already disseminate data and other forms of knowledge, but it is unclear how much are they used and by whom. More insights on these issues would be helpful to support greater targeting and design of dissemination materials. The need to tailor outputs for different audiences was noted. This however highlighted the difficulties that the IPCC faces in this respect, given that their primary audience are policymakers in governments. Whilst the reports are translated into a wide range of languages, additional translation of material into yet other languages, and tailoring of material for specific audiences, would be really valuable to help engage diverse audiences but is not within the core remit of the IPCC. When The Task Group on Data and Scenario Support for Impact and Climate Analysis (TGICA) became the Task Group on Data Support for Climate Change Assessments (TG-Data), a considerable improvement in dataset archival took place, but there has been a loss of capacity building, since TGICA used to arrange training workshops for scientists from the global South (for example) to help them understand how to use the data for risk assessment and adaptation planning.

Missing Middle and Climate Action

The focus of the group was to think about how the IPCC might have a role in connecting its work to policy and related issues. Constraints and barriers to action were identified as a critical area to be addressed, since many barriers are social and/or political in nature. There is a strong consensus around the physical science of climate change and associated risks, but less consensus on understanding why we don't, won't, or can't take action. A considerable amount of literature exists on barriers to action (behavioral elements, political aspects) and on how countries can leapfrog to low carbon pathways. Despite the presence of this literature some disciplines are under-represented for example, psychology and political studies – if these areas are not strong enough in terms of evidence, scientists need to fill those knowledge gaps by researching these issues in the field.

Other issues the group raised in the plenary feedback included:

- The relevance of the IPCC reports to the private sector.
- The value of brokering organizations in translating knowledge so it is relevant for different audiences.
- Gap reports were highlighted as useful knowledge products that are more focused and produced more quickly than IPCC reports. These reports are not as authoritative but help to distil information and are more focused.
- Reviewing the successes or failures of NDCs would be helpful.

Key Priorities for Actions Arising from Workshop

AR7 cycle

- Ensure focus on emerging issues, knowledge gaps and changes to confidence in existing knowledge (helps with targeting of research and knowledge generation effort).
- More critical engagement with low frequency/high impact events where evidence has been limited.
- Adequately address large and existential climate change risks.
- Continue the process of engaging more concretely with indigenous knowledge and evidence from practitioners.
- Make more use of best practice case studies and real-world e.g., adaptation actions highlighted through chapter boxes to showcase 'on-the-ground' examples.
- Consider addressing inconsistencies between WG by staggering their production.

Proposed Expert Meetings [EM] and Special Report [SR]

- [EM] How to address the exponential **increase in literature** which can lead to author bias? Meeting to review existing tools and methods.
- [EM] Greater use of **AI and machine learning** to synthesize knowledge (e.g., Science Brief continuous assessment model).
- [SR] Focus on how to **measure outcomes** (draw from Monitoring Evaluation and Learning literature) to support work to generate a **universal metric for adaptation**?

Beyond AR7

- Annual reporting periodically assessed (e.g., ea. 5 yr.).
- Special reports to replace or augment ARs.
- Solutions focus needed – yet not policy prescriptive.
- Focus on barriers to action and how to address.
- Real time expert review of specific themes (e.g., Sea Level Rise).
- Smaller projects with targeted SPMs for policymakers and media.

Acceleration of the Translation of IPCC Findings into Action –Increased Awareness of IPCC Findings

- Enhance use of graphics and figures to support dissemination.
- Closer cooperation between policymakers and scientists in producing chapters of IPCC report to ensure outputs are policy relevant.

Acceleration of the Translation of IPCC Findings into Action – Capacity Building

- Partnerships between academics and their cities.
- Co-productive research on costs/benefits of mitigation including health and well-being.
- Use of economic analyses that don't assume that mitigation diverts the economy away from a supposed perfect state and therefore is inherently expensive.
- Arranging workshops to train decision makers (especially from the global South) to use IPCC datasets and information appropriately.

- Link potential action lists with groups of actors as in *Making Peace with Nature*?

Enhancement of the Usability of IPCC Reports

- Produce curated papers extracting IPCC synthesis for specific topics.
- Create a shortened SPM.
- Publicize FAQ and the interactive atlas: these are underutilized/not well known.
- Create a searchable intuitive database on IPCC website.
- Assess /evaluate the use of the interactive atlas.
- Create digital tools to signpost various IPCC-related resources/tools.

Improvement of Practice Outside of IPCC Remit

- Meta data / standardization within modelling community so assumptions / limitations etc. are more visible (support integration).
- Identify topics / data which require insights closer to real time and more regular updating (e.g., similar to carbon budget).
- Undertake a series of reviews / syntheses to support incorporation of under-represented forms of knowledge within the IPCC process.
- Encourage 'review calls' to direct academics to where efforts are needed to support synthesis.
- Key role of societal actors to distill IPCC knowledge for use and uptake.

Topics to Explore via Publications / Synthesis for Incorporation into the IPCC

- Synthesis of existing low confidence statements (in past reports).
- Catalyze research-based findings.
- (Systematic) reviews in problem areas where synthesis is challenging.
- Guidance document on uncertainty treatments for all three WG.
- Review methods to assess adaptation efficacy: methodologies for assessing or identifying adaptation, consider principles of adaptation assessment and adaptation 'success' incorporating N/S perspectives.
- Adaptation inventory reform: use of grey literature essential.
- Review of country NDC (e.g., does NDC policy align with stated targets).
- Annual synthetic updates in sea level rise, erosion, etc. where methods clear (follow C budget model).