

Summary report on the SBSTA–IPCC special event: Unpacking the new scientific knowledge and key findings in the Working Group II contribution to the Sixth Assessment report: Impacts, Adaptation and Vulnerability

Bonn, Germany, 6 June 2022

Note by the Chairs of the SBSTA and the IPCC

6 October 2022

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I. Introduction

A. Background

1. The Intergovernmental Panel on Climate Change (IPCC) finalized the Working Group II (WGII) contribution to the Sixth Assessment Report (AR6) (referred to in this document as the WGII report) at the 12th session of the WGII and the 55th Session of the IPCC held on 14 to 27 February 2022. The WGII contribution's Summary for Policymakers (SPM) was released on 28 February 2022.¹
2. The report builds upon the 2014 WGII contribution to the IPCC's Fifth Assessment Report and the 2018–2019 IPCC Special Reports² of the AR6 cycle and incorporates subsequent new evidence from climate science.
3. The WGII contribution benefited from 270 authors from 67 countries and 675 contributing authors with over 34,000 scientific publications assessed and over 62,000 expert and government review comments provided and addressed.
4. The WGII contribution examines the impacts of climate change on nature and people around the globe. It explores future impacts at different levels of warming and the resulting risks and offers options to strengthen nature's and society's resilience to ongoing climate change, to fight hunger, poverty, and inequality and keep Earth a place worth living on – for current as well as for future generations.

B. General objective and approach for the special event

5. The special event of the SBSTA and the IPCC on the WGII report was organized by Mr. Tosi Mpanu-Mpanu, the Chair of the Subsidiary Body for Scientific and Technological Advice (SBSTA), and Mr. Hoesung Lee, the Chair of the IPCC.
6. The event was organized to enhance a better understanding of the key findings of the WGII report of the AR6 through a direct exchange of views between Parties and IPCC experts, by unpacking the new scientific knowledge and key findings.
7. In the lead up to the special event, the SBSTA and the IPCC Chairs and WGII Co-Chairs issued an information note,³ which provided background information on the WGII report and proposed an approach for the special event, including the agenda and main topics of discussion.
8. The special event focused on the three themes of the SPM through presentations from the WGII Co-Chairs and IPCC authors and discussions between attendees, co-chairs and authors. The themes were:
 - (a) Observed and Projected Impacts and Risks;
 - (b) Adaptation Measures and Enabling Conditions;
 - (c) Climate Resilient Development.
9. The special event on the WGI contribution to AR6 took place in conjunction with SBSTA 52–55 in Glasgow on 4 November 2021.⁴ The special event on WGIII component of AR6 took place on 8 June 2022.⁵

II. Summary of the special event

10. The special event was held in conjunction with SBSTA 56 in Bonn, Germany, on the 6 June 2022, from 15:00 to 18:00 in Plenary Chamber Hall.⁶ The event was open to all attendees at SBSTA 56 and webcast.⁷ The

¹ See <https://www.ipcc.ch/report/sixth-assessment-report-working-group-ii/>.

² Global warming of 1.5: <https://www.ipcc.ch/sr15/>; Climate Change and Land: <https://www.ipcc.ch/srccl/>; and Ocean and Cryosphere in a Changing Climate: <https://www.ipcc.ch/srocc/>.

³ See https://unfccc.int/sites/default/files/resource/AR6WG2Adaptation_InfoNote_SBSTA_IPCC_SB56.pdf.

⁴ See <https://unfccc.int/event/ar6wgi-special-event>.

⁵ See <https://unfccc.int/event/ar6wgiii-special-event>.

⁶ See <https://unfccc.int/event/ar6wgii-special-event>.

⁷ See <https://unfccc.int/event/sbsta-ipcc-special-event-unpacking-the-new-scientific-knowledge-and-key-findings-in-the-working>.

event was jointly chaired by the SBSTA and IPCC Chairs. The SBSTA rapporteur, Ms. Zita Wilks took over chairing from the Chair of SBSTA for the latter part of the event.

11. All information on the special event is available from the [event webpage](#).

A. Opening

12. The SBSTA Chair welcomed all participants to the special event and thanked Mr. Hans-Otto Pörtner and Ms. Debra Roberts, the IPCC Working Group II Co-Chairs, as well as Ms. Joy Pereira, IPCC WGII vice-chair who was deputizing for Ms. Roberts in person on the day, and all the IPCC authors present.

13. The SBSTA Chair stressed the importance of science in informing the UNFCCC process and hoped that the special event would inform the activities of delegates and all other participants to push for urgent and strengthened action to address climate change.

14. The SBSTA Chair highlighted some of the messages from the WGII report including that: opportunities for adaptation to many climate risks will likely become constrained and have reduced effectiveness should 1.5 °C global warming be exceeded; the capacity for adaptation is already significantly limited for many locations on Earth; and multiple pathways are still possible by which communities, the private sector, governments, nations and the world can pursue climate resilient development.

15. The IPCC Chair highlighted that the WGII report is a dire warning about the consequences of inaction on climate change. It provides an assessment of the impacts of climate change with a lens on ecosystems, biodiversity, and human communities and their interconnections at global and regional levels. It also includes future impacts and risks at different levels of warming, and the options and limits to strengthen society and nature's resilience to climate change.

16. An introductory video on the WGII report was shown to introduce the main findings of each section of the report. The video included relevant information and figures, as well as interviews with the WGII Co-Chairs and various authors.

B. Presentations by experts on unpacking the new scientific knowledge and key findings

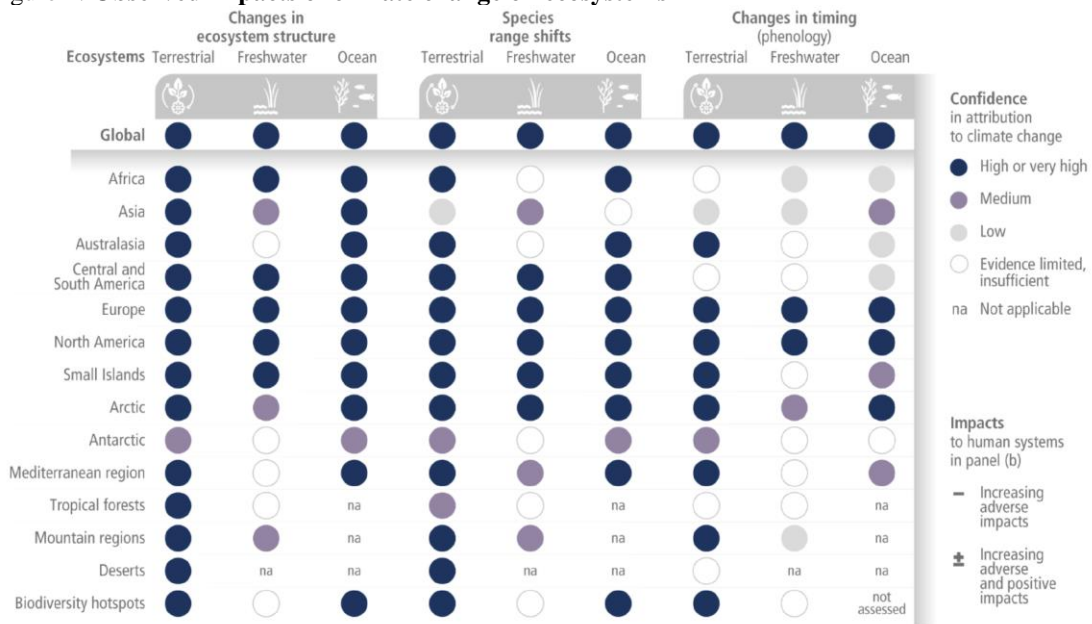
1. Observed and projected impacts and risks from climate change

17. Mr. Hans-Otto Pörtner, WG II co-chair opened the presentations by speaking on “Observed and Projected Impacts and Risks.” He stated that the one overarching message is: the scientific evidence is very clear - climate change is a threat to human wellbeing and the health of the planet.

18. The WGII report focuses on the interactions among the interdependent systems: climate change, ecosystems (including their biodiversity) and human society. These interactions are the basis of emerging risks from climate change, ecosystem degradation and biodiversity loss. Mr. Pörtner highlighted that timely actions are needed where these interactions occur, including mitigation of climate change, human systems transitions, and ecosystem transitions. Enablers of action include governance, finance, knowledge, and capacity, catalyzing conditions, and technologies in order to lead human societies into a sustainable future. The WGII report presents the concept of climate resilient development - the process of implementing greenhouse gas mitigation and adaptation measures to support sustainable development.

19. Global warming has caused dangerous and widespread disruption in nature. The increased frequency, intensity and duration of extreme events on land and in the ocean are driving mass mortalities worldwide (Figure 1). The assessment of the observed impacts on ecosystems covers terrestrial, freshwater and ocean ecosystems and shows changes in ecosystem structure, species' geographic range shifts, and changes in timing of seasonal events in species' life cycles. Impacts of climate change on ecosystems are observed worldwide, across all the regions assessed, and the nature of all of these impacts have specific implications for ecosystem resilience and for efforts towards sustainable development.

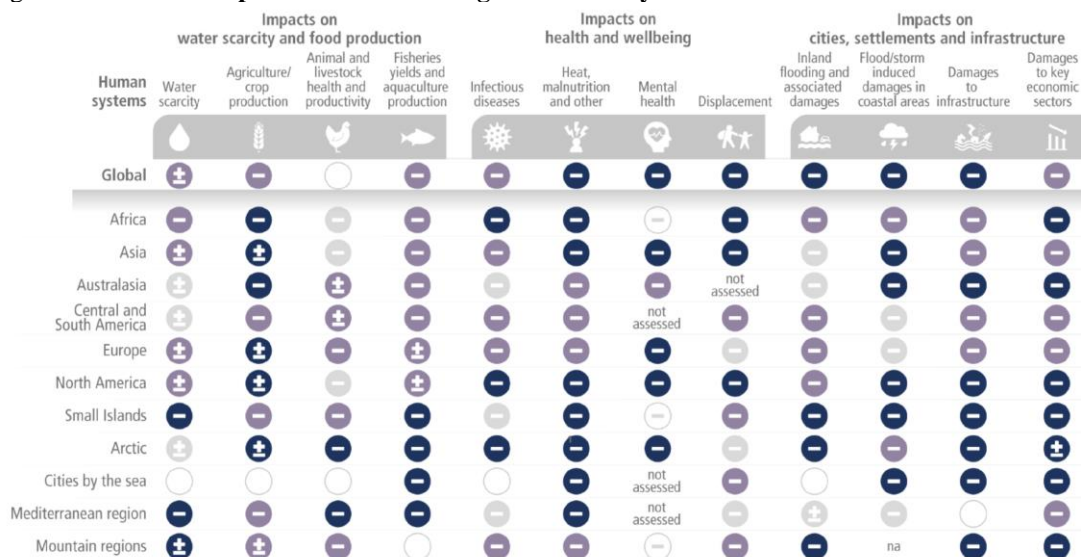
Figure 1: Observed impacts of climate change on ecosystems



Source: Slide 5 of the presentation of the IPCC Co-Chairs, 2022. SPM Figure 2, IPCC WGII AR6: Observed global and regional impacts on ecosystems and human systems attributed to climate change, 2022.

20. Mr. Pörtner emphasized that climate change is affecting the lives of billions of people despite efforts to adapt. Impacts have been observed from warming and extreme climatic events including high intensity cyclones, sea level rise, and heavy rainfall. Furthermore, diverse adverse impacts of climate change on ecosystems, human health, wellbeing and livelihoods have been observed worldwide and across all regions, including on water security and food production, and cities, settlements and infrastructure (Figure 2). Impacts can be magnified in cities where over half the world's population lives.

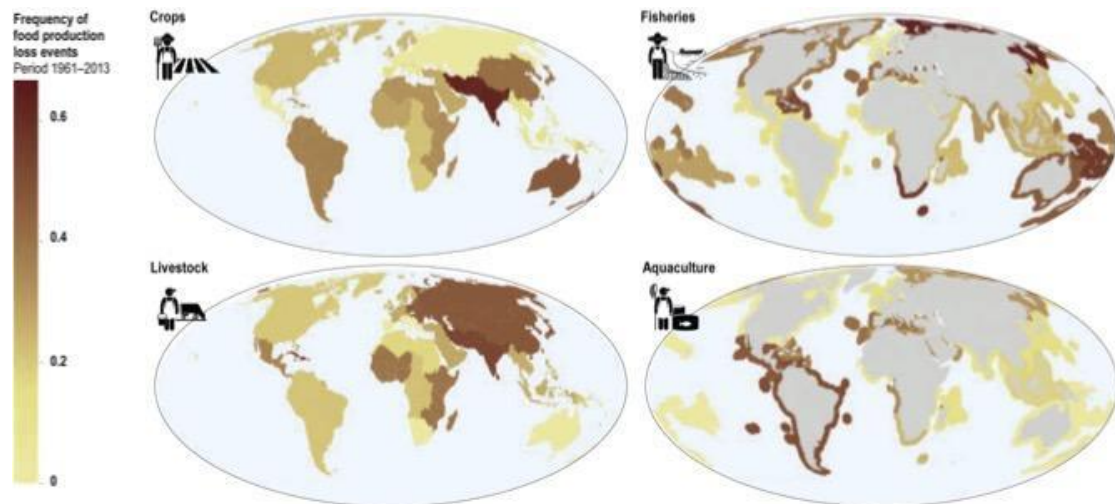
Figure 2: Observed impacts of climate change on human system



Source: Slide 8 of the presentation of the IPCC Co-Chairs, 2022. SPM Figure 2, IPCC WGII AR6: Observed global and regional impacts on ecosystems and human systems attributed to climate change, 2022.

21. The regional impacts of climate change on major crop yields and food production such as production loss events are observed worldwide including for crops, fisheries, livestock productivity, and aquaculture results (Figure 3). All of these sectors are important for food security. Over the past 30 years, major crop yields decreased by 4–10% globally due to climate change, and losses are often due to extreme events.

Figure 3: Regional impacts on major crop yields and food production loss events



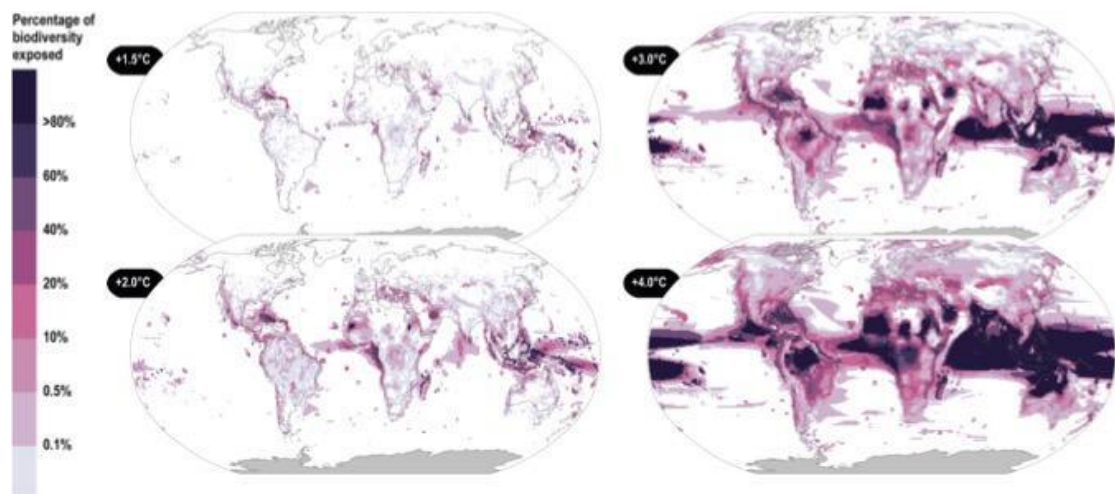
Source: Slide 9 of the presentation of IPCC Co-Chairs, 2022. IPCC WGII AR6 Report Figure AI.17, still subject to edits.

22. Mr. Pörtner further highlighted that more than one impact can happen at the same time. Successive impacts and extreme events bring compounding risks and additional stresses such as increased food prices, reduced household incomes, with local effects but also global transboundary consequences. Climate change combined with the unsustainable use of natural resources, habitat destruction, growing urbanization, and inequity, reduce the capacity of humankind and also of ecosystems and species to adapt.

23. 3.3 to 3.6 billion people live in global hotspots of high vulnerability to climate change. These hotspots are across large parts of Africa, as well as South Asia, Central and South America, small islands and the Arctic. These hotspots have overlapping challenges including limited access to water, sanitation and health services. High levels of climate-sensitive livelihoods in these areas, such as small-holder farming communities and fishing communities, all increase vulnerability. High levels of poverty, weak leadership, lack of funding, and lack of accountability and trust in government also play a part in vulnerability.

24. Globally, the assessment of the percentage of species exposed to potentially dangerous climate conditions beyond physiological tolerance limits at different warming levels of 1.5 °C, 2 °C, 3 °C and 4 °C (Figure 4) indicated that already at 1.5 °C global warming, on some tropical landscapes and coastlines, more than 20% of species will face temperatures beyond their historical experience and tolerance. The risk escalates with warming: with warming of 3 °C, >80% of marine species across large parts of the tropical Indian and Pacific Ocean will experience potentially dangerous climate conditions; and with warming of 4 °C, the area where more than 80% of species are exposed to dangerous climate conditions expands even more, putting about 50% of tropical marine species at risk of at least local extinction.

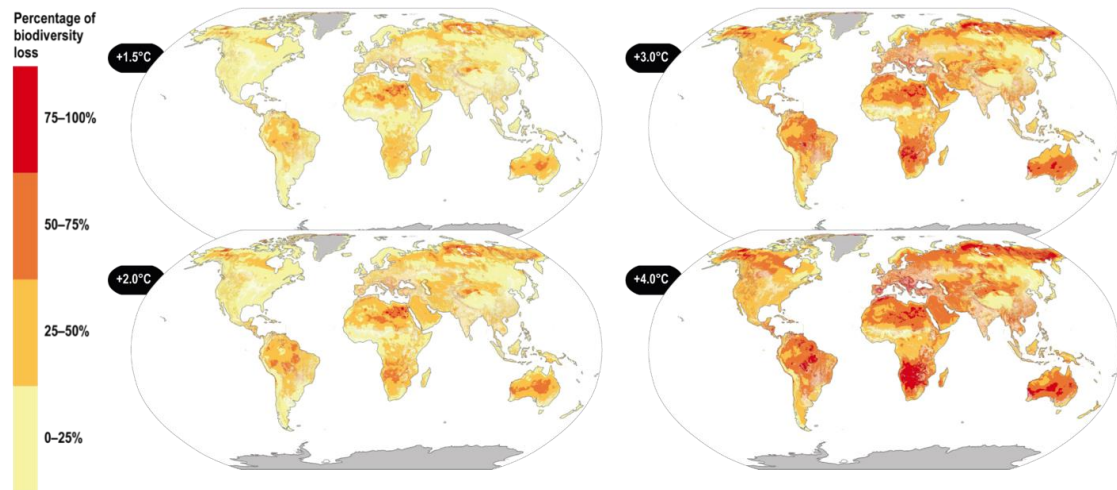
Figure 4: Species exposed to potentially dangerous climate conditions



Source: Slide 14 of the presentation of IPCC Co-Chairs, 2022. IPCC WGII AR6 Report Figure AI.15, still subject to edits.

25. The projected biodiversity loss in terrestrial and freshwater ecosystems at different warming levels from 1.5 to 4 °C (Figure 5) also illustrated that beyond 1.5 °C warming, even if transiently for several decades, temperature rise would lead to species extinctions and losses of entire ecosystems such as at mountain tops and in coastal wetlands. Extinction risk increases disproportionately with every increment of warming and in biodiversity hotspots the risk increases by about 10-fold as warming rises from 1.5 to 3 °C.

Figure 5: Projected loss of terrestrial and freshwater biodiversity

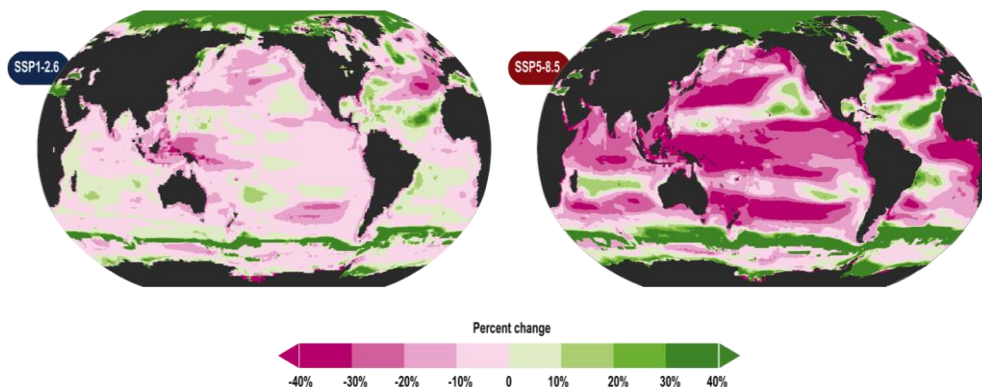


Source: Slide 15 of the presentation of IPCC Co-Chairs, 2022. IPCC WGII AR6 Report Figure AI.16, still subject to edits.

26. Global biomass distribution will change with increasing warming. Taking marine fish biomass as an example, losses are projected to be especially large in the lower latitudes and decrease by more than 40% at higher warming levels in vast areas (Figure 6). In some areas, in particular towards high latitudes, fish biomass is projected to increase, primarily due to the pole wards shift in distribution of species that is already being observed.

27. A key message from the WGII report is that nature's crucial services are at risk in a warming world. These impacts on ecosystems will affect all of us, as nature's services support all aspects of our lives. The WGII report emphasizes that every small increase in warming will result in increased risks.

Figure 6: Projected change in marine fish biomass

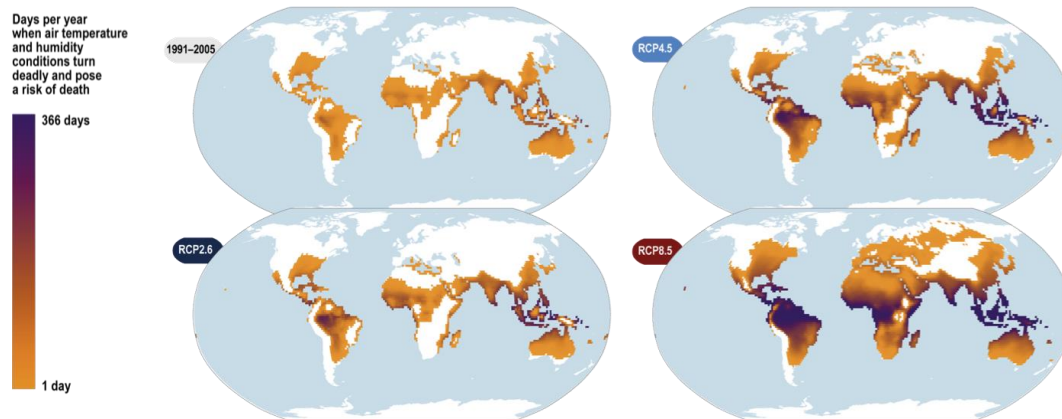


Source: Slide 16 of the presentation of IPCC Co-Chairs, 2022. IPCC WGII AR6 Report Figure AI.11, still subject to edits.

28. In the case of human society, humans are not only at risk from indirect impacts of climate change, but are increasingly affected by the four primary global climate risks: heat stress, water scarcity, food security and flood risk.

29. Heat stress (hyperthermia) is a major concern as the global distribution of the exposed human population increases with global warming (Figure 7). Depending on the future emission scenario, between half (RCP2.6–1.6 °C warming) to three-quarters (RCP8.5–4.3 °C warming) of the human population could be exposed to periods of life-threatening climatic conditions by 2100.

Figure 7: Global distribution of population exposed to hyperthermia from extreme heat and humidity

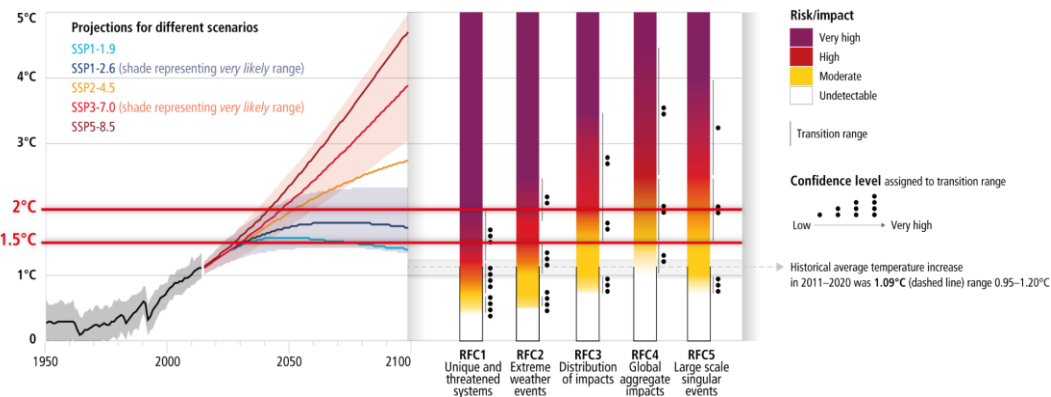


Source: Slide 18 of the presentation of IPCC Co-Chairs, 2022. IPCC WGII AR6 Report Figure AI.29, still subject to edits.

30. Examples of other risks include exposure to heat waves which will continue to increase globally with additional warming, affecting crops, ecosystems and people. About a billion people living in low-lying cities and other settlements on the coast are projected to be at risk from sea level rise and other climatic hazards by mid-century. At approximately 2 °C, regions that are highly dependent on snowmelt for freshwater could experience a 20% decline in water availability for agriculture beyond 2050. Also, at 2 °C warming, by 2050, people in sub-Saharan Africa, South Asia, Central and South America and on small islands are likely to experience food shortages, leading to malnutrition.

31. Knowledge of global and regional risks is crucial and provides orientation for action, in terms of adaptation as well as mitigation. IPCC experts compiled its risk assessment with respect to the vulnerability, exposure and specific hazards, and provided a global integration of risk levels (Figure 8). At current levels of warming, some risks have already transitioned from moderate to high risk level. For example, warm water coral reefs are declining, and most will disappear at 2 °C warming.

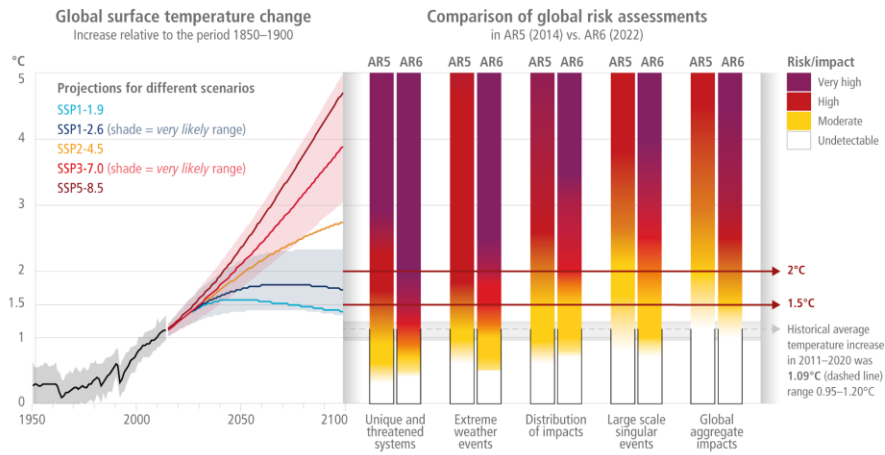
Figure 8: Global and regional risk



Source: Slide 20 of the presentation of the IPCC Co-Chairs, 2022. SPM Figure 3, IPCC WGII AR6: Synthetic diagrams of global and sectorial assessments and examples of regional key risks, 2022.

32. Mr. Pörtner further presented a comparison of the AR6 and AR5 report that indicated that risks are developing sooner and that previous estimates in AR5 have been too conservative (Figure 9), calling for higher ambition to mitigate and adapt.

Figure 9: Comparison of global risk assessment

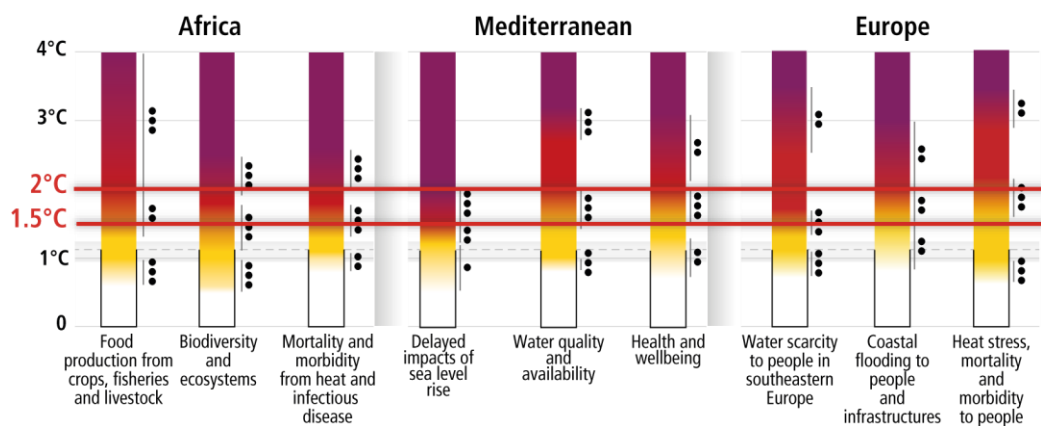


Source: Slide 21 of the presentation of the IPCC Co-Chairs, 2022. SPM Figure 3, IPCC WGII AR6 and AR5 assessment box SPM 1 Figure 1.

33. Key risks differ between regions (Figure 10). The figure shows the 1.5 °C temperature line which indicates the transition between moderate to high risks, emphasizing that risk can be minimized by keeping global warming below 1.5 °C. For example, the climate risks for the regions in the figure are:

- (a) In Africa, food production from crops, fisheries and livestock, biodiversity and ecosystems, mortality and morbidity from heat and infectious disease;
- (b) In the Mediterranean, the impacts of sea level rise, the availability of water and its quality, and health and well-being;
- (c) For Europe, water scarcity to people in south eastern Europe, coastal flooding, and overall, heat stress, mortality and morbidity of people.

Figure 10: Global and regional risk



Source: Slide 22 of the presentation of the IPCC Co-Chairs, 2022. SPM Figure 3, IPCC WGII AR6: Synthetic diagrams of global and sectorial assessments and examples of regional key risks, 2022.

Summary of the Q&A session for theme 1: Observed and projected impacts and risks from climate change

34. Could the experts provide more detailed insights on climate impacts of the different levels of warming? What are some of the most significant differences in impacts on today's level of warming versus 1.5 °C of warming and 2 °C of warming?

IPCC experts: These impacts, including both natural and human systems, are most substantial in areas that are already the most vulnerable including small island developing states (SIDS), the Arctic areas and coastal areas. Furthermore, increases in impacts of extreme events are where we see the most concerning differences between 1.5 °C and 2 °C of warming.

35. What information does the assessment provide on the risk of irreversible impacts if we exceed 1.5 °C? What are the risks if we temporarily overshoot 1.5 °C and should return back to below 1.5 °C? In this context, specifically on the issue of sea level rise, irreversibility and feedbacks in the carbon cycle?

IPCC experts: Building on the SR1.5 and the multiple lines of evidence, we know that exceeding the 1.5 °C threshold will lead to more irreversible impacts, especially to those who rely upon the most vulnerable ecosystems. It also implies greater uncertainty. There are feedback effects of the carbon cycle that may further hinder our ability to return to 1.5 °C.

36. Could the authors provide more detailed information on compound and cascading risk as assessed in the report? Specifically, examples relevant for the most vulnerable countries and LDCs, what these risks are with 1.5 °C warming, and how these risks could develop under different levels of future global warming?

IPCC experts: The assessment of these complex cascading compound risks is an important new element of the WGII report as a first step to what will be a much bigger literature availability and assessment in AR7. The confluence of different extreme events including flood risk, and combination of heat and droughts aggravate the vulnerability of people to climate shocks, especially in the countries you mentioned. The future depends a lot on how we develop and adapt, and how we manage exposure and vulnerability, the risks are going up with every little bit of warming.

37. How did the IPCC address the gap on literature, from risks and adaptation as well as from developing and developed countries?

IPCC experts: The imbalance in literature between developing and developed countries is systematic and deep, it also goes beyond climate change and the IPCC, and impacts the delivery of assessments in certain regions in particular. Some of the reasons come from imbalanced research funding from natural sciences versus social sciences in general. More work needs to be done to integrate traditional knowledge and indigenous knowledge. As one of our findings from AR6, it is clear that more diverse knowledge would actually enable and facilitate climate resilient development.

38. Africa has various ecosystems and giving a single figure does create an impression that there are just one size fits all for Africa. How can we make a separation so as to understand how the assessments were conducted?

IPCC experts: The AR6 report presented and highlighted the differences in the African regions in detail. There were seven regional chapters including one on Africa and the IPCC has conducted its assessment across five African sub regions.

39. Could the authors provide some background on how the loss and damage has been covered in the new WGII report as compared to previous assessments? What does the report say about loss and damage already occurring? Additionally, what role does limiting warming to 1.5 °C degrees play for experiencing loss and damage compared to higher warming levels, especially with relation to SIDS?

IPCC experts: In AR6, we use the term losses and damages to broadly refer to harm from observed impacts and projected risks where it can be either economic or non-economic. In the WG II report, we conducted a broad assessment of losses and damages across all regions, which makes it the most robust assessment that we have done to date. Some of the key findings are that dangerous and widespread losses and damages to nature and to billions of people around the world are already happening and projected to increase with increased global warming and they occur even despite effective adaptation.

For small islands, in particular, we see loss of terrestrial marine and coastal biodiversity and ecosystem services, loss of lives and assets, economic decline, reduced stability of reef and non-reef islands, increased displacement due to sea level rise, and risk to water security in almost every small island.

40. The observed trends of tropical cyclones have not been very clear, do the recent findings and signs help to produce more robust results on tropical cyclone risk in the future?

IPCC experts: The WGII report assessed that there are already cases where damages are directly attributable to global warming in the context of, for instance, more extreme rainfall in tropical cyclones. Also, there have been big differences in how tropical cyclone risk was managed in the past, for instance, the availability early warning systems has an important bearing on capacity to manage future risk.

There is now a strong understanding on the link between tropical cyclones and short-term changes in economic growth, which has implications again for adaptation management and capacity. Tropical cyclones and these extreme events are also leading to displacement. Displacement can have multiple cascading and compounding risks as people try to cope with this changing climate.

41. The impact of climate change on the Antarctic will have very large impacts on the rest of the world, while the data on the Antarctic is often missing in a number of the charts. How can we improve this aspect of the report for future IPCC reports?

IPCC experts: We need more observations from oceanic to terrestrial and regular site visits for long-term data series. The WGII report covers the Arctic in the chapter on the Polar Regions, and also provided some comparison with respect to the risks development in the Arctic and in the Antarctic. However, certainly the research on the Antarctic is lagging behind with respect to its global importance, especially for the issue of sea level rise.

2. Adaptation Measures and Enabling Conditions

42. Ms. Joy Pereira, IPCC Working Group II Vice-Chair, presented on “Adaptation Measures and Enabling Conditions” based on the findings from the Working Group II contribution to the Sixth Assessment report.

43. Ms. Pereira began by highlighting that the growing public and political awareness of climate impacts and risks has resulted in at least 170 countries and many cities including adaptation in their climate policies and planning. The WGII report shows that action on adaptation has increased, but progress is uneven and we are not adapting fast enough.

44. There are increasing gaps between the adaptation action taken and what’s actually needed to tackle current and future challenges. These gaps are largest among lower income populations. At the current rate of planning and implementation, these adaptation gaps will continue to grow.

45. There are options we can take to reduce the risks to people and nature, but the effectiveness of these options decreases with increasing warming. New findings in the WGII report show a number of options for risk management:

(a) **Strengthening health systems** can reduce impacts of infectious diseases, heat stress and trauma related to extreme events, and that combined measures are more effective, examples include disease surveillance, early warning systems and improved access to potable water.

(b) **Water management** includes options on farms for irrigation, rainwater storage, water-saving technologies, moisture conservation in soils that produce economic and ecological benefits and provide reduced vulnerability. Wider benefits cover securing drinking water, flood and drought risk management and working with nature and land use planning.

(c) **Improving food security** options include cultivar improvements, agroforestry, farm and landscape diversification, community-based adaptation and strengthening biodiversity. These all bring a range of other benefits for food security and nutrition, health and well-being and livelihoods.

(d) **Transformations of cities** include nature-based and engineering approaches implement together, establishing green and blue spaces, urban agriculture and social-safety nets for disaster management, with wider benefits to public health improvements and ecosystem conservation.

46. Adaptation options must include local knowledge, adequate capacity to information funding and tools, engagement of policymakers, and involvement of residents in decision making, as well as institutional change for accountability, commitment and transparency.

47. The AR6 report warns on the risks of maladaptation with accompanying evidence. Maladaptation refers to adaptation that results in unintended consequences, for example increased climate-related risks, or increased greenhouse gas emissions. Indigenous peoples, ethnic minorities and disadvantaged groups – for example low-income households and those living in informal settlements – are some of the most affected by maladaptation, which reinforces and entrenches existing inequalities.

48. The AR6 report also emphasizes that there are adaptation limits. There are already limits to adaptation in many regions and these limits will increase with higher levels of warming. Effective adaptation also cannot prevent all losses and damages. For example, above 1.5 °C warming some natural solutions will no longer work. Also above 1.5 °C a lack of freshwater could mean that people living on small islands and those dependent on glaciers and snowmelt can no longer adapt. By 2 °C, it may be especially challenging to farm multiple staple crops in many current growing areas, particularly in tropical regions.

49. Highlighted in the AR6 report are the **finance constraints for adaptation**. Current financial flows are insufficient for the adaptation needed, particularly in developing countries. The overwhelming majority of global-tracked climate finance is targeted at emissions reductions while a small proportion goes on adaptation. Climate impacts that result in higher levels of losses and damages also slow down economic growth and thus reduce the availability of financial resources.

50. Transformation towards a just and climate resilient future entails **system transitions** strengthening the resilience of ecosystems and humans and society. The WGII report identifies 5 main system transitions: land, ocean, coastal and freshwater ecosystems; urban, rural and infrastructure; energy; industry and society.

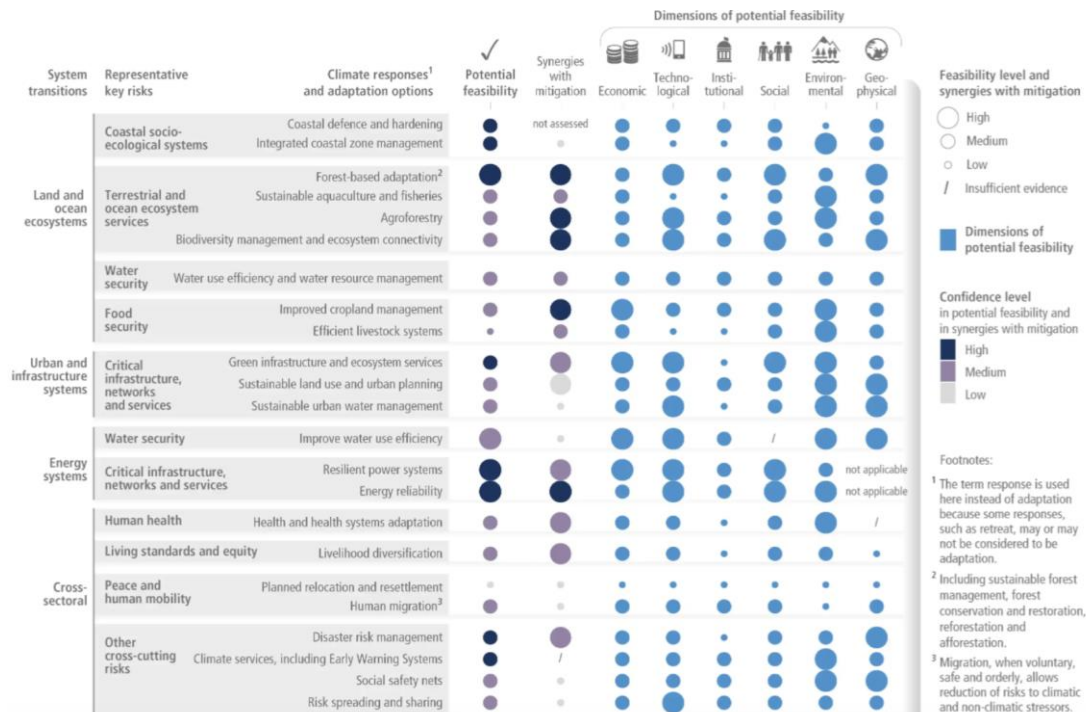
51. These system transitions make possible the adaptation required for high levels of human health and well-being, economic and social resilience, ecosystem health, and planetary health. They are vital for achieving the low global warming levels that would avoid many limits to adaptation. Climate responses and adaptation options are available in each of these systems, many with high potential feasibility (Figure 11).

52. The climate responses and adaptation options organized by systems transitions and key risks have been assessed in the WG II report for their potential feasibility across multiple dimensions at global scale, in the near term and up to 1.5 °C global warming:

- (a) In land and ocean ecosystems, a variety of feasible options is available to adapt to the major key risks to coastal socio-ecological systems, to ecosystem services and to water and food security;
- (b) In urban systems, critical infrastructure, networks and services, options include green infrastructure and ecosystem services, sustainable land use and urban planning and sustainable urban water management;
- (c) In energy systems, key risks include water security, critical infrastructure, network and services, options with high feasibility are available across many dimensions for improving water use efficiency, resilient power systems and energy reliability;
- (d) Across all systems, disaster risk management, climate services, including early warning systems, social safety nets, risk spreading and sharing are all feasible and important.

53. Ms. Pereira highlighted that adaptation brings wider benefits for more than 3.4 billion people in rural areas, many of whom are highly vulnerable to climate change, resilience can be improved by providing social safety nets, improved roads, reliable energy, clean water and improved food security. These measures not only build climate resilience but also go hand in hand with helping to lift people out of poverty and achieving both SDG 1 and SDG 10.

Figure 11: **The feasibility of adaptation measures: overview**

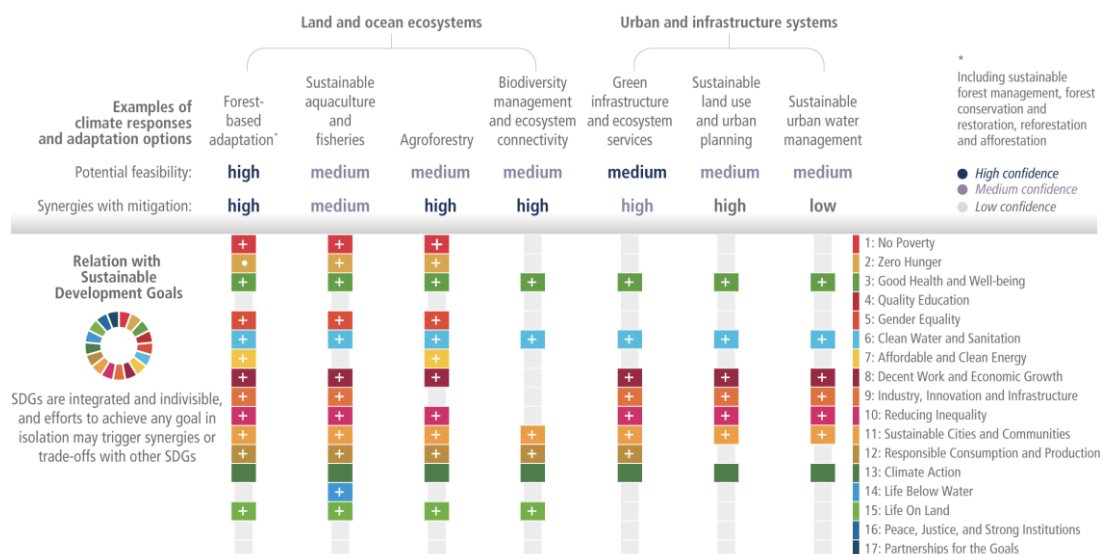


Source: Slide 37 of the presentation of the IPCC Co-Chairs, 2022. SPM Figure 4a, IPCC WGII AR6: Diverse feasible climate response and adaptation options exist to respond to Representative Key Risk of climate change, with varying synergies with mitigation, 2022.

54. Ms. Pereira outlined the assessed multiple benefits of adaptation across the 17 sustainable development Goals (Figure 12). These include the potential for forest-based adaptation which has high feasibility and high synergies with mitigation, where forests also absorb and store carbon, and consequently contribute to achieving

multiple SDGs. Urban and green infrastructure, including green roofs, parks and street trees, provide shade and water management and also absorb and store carbon, as well as providing high synergies with mitigation.

Figure 12: Mitigation and SDG co-benefits: urban and green infrastructure



Source: Slide 44 of the presentation of the IPCC Co-Chairs, 2022. SPM Figure 4v, IPCC WGII AR6: Climate responses and adaptation options have benefits for ecosystems, ethnic groups, gender equity, low-income groups and the SDGs, 2022.

Summary of the Q&A session for theme 2: Adaptation Measures and Enabling Conditions

55. What are the most relevant gaps in adaptation and barriers to successful adaptation efforts in the assessment, especially in the most vulnerable countries including LDCs? What would be the most important elements to overcome this, for instance finance?

IPCC experts: Figure 11 indicates some of the gaps where there is lower feasibility for adaptation and consequently there are significant barriers and specific indicators for these, for instance intergenerational equity, gender equity and institutional regulatory policy issues. Even though an option can have high feasibility, its success depends on a series of enablers such as governance, institutional support, values and knowledge systems and finance. Most of the adaptation efforts to date are incremental. Evidence shows that we need to move towards transformational adaptation, to adapt to the global warming levels of 1.5 °C and move on to the climate resilient development pathways.

56. Could the authors provide further details on the issue of limits to adaptation as assessed in the report? For example, what does the report say about limits to adaptation already reached? What role does limiting warming to 1.5 °C play for reaching limits to adaptation compared to higher warming? And could the authors comment on this globally as well as specifically for SIDS?

IPCC experts: Adaptation is differentiated between soft limits and hard limits in the WGII report. Soft limits are when adaptation options may exist, but they are not currently available, largely due to constraints that make it harder to plan or implement adaptation. Hard limits are where no adaptation is possible. The WGII report global assessment found that limits and constraints to adaptation differ among sectors and regions. Soft limits to some human adaptation have already been reached but can be overcome by addressing a range of constraints which are prevalently financial, governance, institutional and policy constraints. For small islands in particular, we see that individuals and households in low-lying areas are already facing limits. In regard to the 1.5 °C, some ecosystem based adaptation measures will actually lose their effectiveness at 1.5 °C and reach adaptation limits, which will then result in losses and damages.

57. What information does the report contain with regards to finance flows, both public and private? What assessment information is there on adaptation finance needs, particularly for developing countries and SIDS?

IPCC experts: Financial constraints are one of the main soft limits to adaptation. In the SPM, we have statements on the tracked flows of climate finance as they relate to adaptation. We find that currently the majority of the climate finance flows are going to mitigation and not to adaptation and are severely insufficient to meet the level of adaptation needed. But finance is also something that needs to be enabled, and the SPM highlights enablers that should be associated with finance, both public and private. Enablers

include both increased ability in the financial sector to understand the benefits and costs related to adaptation, as well as the governance needs associated with these flows.

Health is one sector that is a good illustration of the consequences of the finance gap for adaptation. Health is listed among the top five prioritized determined objectives in countries NAPs, while less than 1% of multilateral funding goes to the health sector.

58. How do adaptation opportunities and needs differ for different mitigation pathways? Where are the limits?

IPCC experts: There are higher needs for adaptation with higher global warming levels. Both adaptation and mitigation efforts need to move in parallel.

59. If current adaptation approaches are suitable, especially when thinking of the compounding effects, what would be the most effective and efficient adaptation approaches highlighted in the report, especially those which have a strong link to mitigation?

IPCC experts: The synergies and trade-off with mitigation of each adaptation measure are tested, and the recommended adaptation measures are the ones that have a high to medium synergy and that try to avoid a high trade-off. If there is insufficient mitigation, at higher levels of warming, both the feasibility and the effectiveness of adaptation decrease.

With regard to the biosciences, it is a question on the capacity of ecosystems to absorb carbon. However, the tropical forests and other ecosystems are being weakened with respect to their carbon uptake capacities, and are at their physiological limits.

Risk assessment on those compound risks is in a relatively early stage compared to some of the more simple single risks assessed. A key message from WG II report is that there are a number of solutions that buffer against a number of shocks at the same time, and these solutions need good social protection systems and good risk informed governance that reduce inequalities in general.

The WGII report looked in a very consolidated manner into adaptation and how it is being reported. The report clearly shows a two-fold picture that is emerging. On the one hand, we see a lot of adaptation progress in all sectors in all regions across the globe. But on the other hand, we see that a lot of the adaptation we are observing is project-based or test-based. It's oftentimes not as forward looking as it would need to be in order to really prepare for these long-term compound risks. It is also not as consolidated and as organized across different adaptation domains and sectors as it would need to be when moving towards more transformative adaptation and climate resilient development.

60. Could you give a sense of the use of the terminology of losses and damages?

IPCC experts: In our glossary, we very clearly say that losses and damages refers to harm from observed impacts and projected risks, whereas capital loss and damage refers to the political debate under the UNFCCC. To inform the loss and damage process that's happening in the UNFCCC process, we do recognize that not all of our assessment of losses and damages may be directly relevant to the loss and damage negotiations, but we do hope that this provides relevant inputs.

61. What is the potential of nature-based solutions for adaptation to climate change? It would be useful to hear a little bit more about the role of nature and ecosystem-based adaptation towards being used as a solution to avoid maladaptation.

IPCC experts: There are lots of options for ecosystem-based adaptation and the WGII report emphasizes the role of nature as part of adaptation solutions, whilst also identifying that there are limits to nature-based solutions related to increasing levels of global warming.

With respect to SIDS, there are some examples where adaptation can lead to maladaptation, for example removal of mangroves to introduce boardwalks have cascading effects, also reforestation in some islands is causing poverty and potential job impacts.

Experts emphasized that the effectiveness of nature-based solutions and the contribution to long-term adaptation will only work under the conditions of ambitious mitigation. This is an important message from the WGII report.

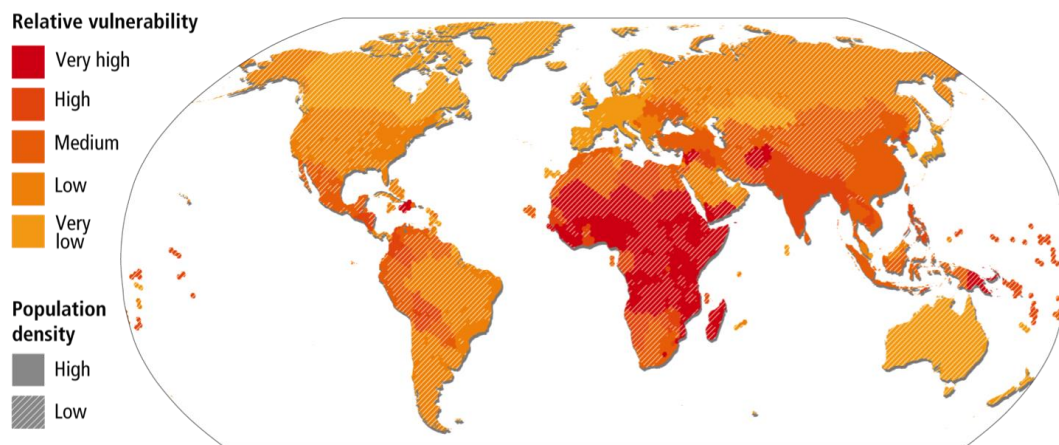
3. Climate Resilient development

62. Mr. Pörtner opened the final presentation on "Climate Resilient Development." He explained that the impacts of climate change have already significantly affected the livelihoods and living conditions, especially of the poorest and most vulnerable, and will continue to undermine development during the coming century. Climate resilient development is the solution space to address vulnerability and development.

63. The adverse impacts of climate change, development deficits and inequality exacerbate each other, particularly in the hotspots of high vulnerability to climate change (see para. 23 above). These impacts disproportionately affect marginalized groups, including women, indigenous peoples and ethnic minorities. They are amplifying inequalities and undermining sustainable development across all regions. Many poor and vulnerable communities are less resilient to climate change due to their socio-economic conditions and the broader development context, especially in regions with high levels of vulnerability and inequality.

64. The map of human vulnerability to climate change impacts combines information about the level of vulnerability (from very low in light orange to very high in dark red) with the population density to show where both high vulnerability and high population density coincide (Figure 13). Levels of vulnerability differ between and within regions and there are densely populated areas of the world that are highly vulnerable, but also highly vulnerable populations in more sparsely populated areas.

Figure 13: **Human vulnerability to climate change impacts**



Source: Slide 50 of the presentation of the IPCC Co-Chairs, 2022. IPCC WGII AR6 Chapter 8: the global distribution of observed relative human vulnerability, 2022.

65. Mr. Pörtner further highlighted that vulnerable population groups in most vulnerable regions have the most urgent need for adaptation. Social and economic inequities linked to gender, poverty, race/ethnicity, religion, age, or geographic location compound vulnerability to climate change and have created and could further exacerbate injustices. It is critical to prioritize equity and justice in decision-making and investment.

66. The WGII report outlines the urgency for climate resilient development to build a world of high resilience and low risk. This high-resilience, low-risk world has reduced climate risks through adaptation, reduced GHG emissions through mitigation and enhanced biodiversity. These measures together support sustainable development - no poverty, zero hunger, good health and well-being, and access to clean water and sanitation.

67. For a high-resilience, low-risk world, adaptation must be accelerated to fill the adaptation gap. The WGII report identifies that this requires:

- (a) Political commitment and follow-through across all levels of government;
- (b) Institutional framework to provide clear goals, priorities that define responsibilities;
- (c) Enhancing knowledge of impacts and risks improves responses;
- (d) Monitoring and evaluation of adaptation measures are essential to track progress;
- (e) Inclusive governance that prioritizes equity and justice with inclusive direct participation in the adaptation process;
- (f) Overcoming financial constraints is a precondition.

68. The WGII report also identifies that the solutions framework for climate resilient development must:

- (a) Be considered across government and all of civil society;
- (b) Involve everyone and forming partnerships among them;
- (c) Draw on wide-ranging knowledge, where scientific, Indigenous, local, practical knowhow come together to provide more relevant effective actions;
- (d) Involve marginalized groups;

- (e) Prioritize equity and justice;
- (f) Reconcile different interests, values and world views.

69. Ecosystem health has an important role in climate resilient development. It supports livelihoods, provides ecosystem services and nature's contribution to people. Human societies must move from the current system where human activities degrade ecosystems which in turn drives global warming and negatively impacts nature and people, to a situation where human activities protect conserve and restore ecosystems, and thereby contribute to climate resilient development.

70. Ecosystem stewardship is key to a healthy planet and fundamental to climate resilient development. Components of this stewardship include:

- (a) Effective and equitable conservation and restoration of approximately 30–50% of land, freshwater and ocean ecosystems can help ensure a healthy planet; conservation needs are specific for different ecosystem types;
- (b) Ecosystem-based adaptation and approaches to climate mitigation based on ecosystems (that are more effective at lower levels of global warming).

71. Stewardship must also consider the trend of urbanisation as a critical opportunity in the solution framework. Integrated, inclusive planning and investment in everyday decision-making about urban infrastructure, including social, ecological and grey/physical infrastructures, can significantly increase the adaptive capacity of urban and rural settlements.

72. The WGII report emphasizes the importance of scaled up investment and international cooperation in achieving climate resilient development.

73. Mr. Pörtner concluded his presentation highlighting that the WGII report shows that worldwide action is more urgent than previously assessed in AR5. Climate resilient development is already challenging at current global warming levels. The science is clear, any further delay in concerted global action will miss a brief and rapidly closing window to secure a liveable future.

Summary of the Q&A session for theme 3: Climate Resilient Development

74. What is the implication on sustainable development of limiting warming to 1.5 °C, compared to overshooting?

IPCC experts: The IPCC have not been able to assess climate resilient development pathways across various global warming levels. However, it is clear that there is a link between sustainable development and 1.5 °C as above this temperature threshold the global warming becomes a constraint to climate resilient development in the context of sustainable development.

75. Why does the report assess the prospects of climate resilience development under these levels of global warming specifically? If comparing the prospects at 1.5 °C and 2 °C, what happens to these prospects? Should the world exceed 1.5 °C of warming, even if only by small increments, and temporarily?

IPCC experts: Global warming must be limited to reduce the risks and impacts of extreme events and future climate risks. These risks impact on human and environmental systems in ways that limit our prospects for well-being, ecosystem integrity, equity, injustice and so on. In particular, we will see that there are certain areas and certain groups that would not be able to reach the higher climate resilient development as warming increased and goes beyond 1.5 °C. There are also irreversible changes, which occur as warming goes beyond 1.5 °C degrees, which will also limit the long-term prospects both globally and locally to achieve climate resilience development.

76. To what extent have the impacts on children and youth have been assessed? What is the possibility to include the younger generation better in the process?

IPCC experts: There are some aspects that are relevant. One finding is that children are amongst the most vulnerable groups for health-related impacts. This vulnerability is created by the intersection of different social markets including age, gender, ethnicity, etc. The WGII report also highlights social equity and distributional and procedural justice is important in this regard. Distributional justice is important in terms of impact, for example the health impacts on children and youth. Procedural justice is important in terms of participation and meaningful participation by groups, including indigenous groups, children and youth.

77. Could the experts provide more details on the reality of justice, equality, cooperation and partnership? What are the barriers?

IPCC experts: It's correct that equity and justice are enormous concepts, which include gender inequality, differential impacts of climate change between men and women, marginalization of groups, differences in political commitment, access to information and knowledge and technology. Key issues across the report include the importance of climate literacy as identified in the SIDS chapter, the Africa chapter talks about the differences in understanding what climate change actually means for people on the ground. Many processes such as lack of governance, weak institutions, and finance are part of the equity injustice picture.

78. Can you explain the imbalanced treatment of technology between Working Group II and III, where technology is highlighted in WGII and treated as contested in WG III?

IPCC experts: Technology has been featured many times in the SPM, namely, as one of the key enablers for adaptation, with financial and technological resources enabling effective and ongoing implementation of adaptation, especially when supported by institutions with a strong understanding of adaptation needs.

There are a significant number of adaptation options assessed in the feasibility assessment that include technology in all of the system transitions. For example, in the agricultural sector, it includes land and land-based ecosystem adaptation and efficient agriculture and agro-ecology practices. For cities and infrastructure, the assessment discusses infrastructure, energy and water technology. The WGII report also highlights the importance of implementing in a manner that does not bring injustice or inequities or create any disruptions to the places where it is being implemented. WG III also analyses the synergies and trade-offs between mitigation and adaptation with different technologies and their impacts on the different vulnerabilities. There are also regional and sectoral chapters highlighting impacts on equity and justice within the different countries and regions.

79. How can the IPCC engage indigenous people as they can bring indigenous knowledge contributing to the building of a carbon neutral future?

IPCC experts: The role of indigenous knowledge and the role of indigenous scholars in AR6 have been more pronounced than in previous assessments. Specifically, in Chapter 14 and for the North America chapter in particular, there is a full section written by indigenous scholars about indigenous responsibilities, and what we can learn from those critical perspectives. The IPCC also continues to improve its efforts to include all relevant voices in the reports.

Youth and indigenous people are all among the most vulnerable groups when it comes to health. The health and wellbeing chapter, box 7.1, covers the health of indigenous people as well as several examples in that box.

C. Summary of the general discussion and interventions from Parties

80. A total of 19 Parties and one Observer posed questions and/or provided comments. Overall, participants expressed their gratitude to the IPCC for their continued work, with particular to the authors of WGII for providing crucial information regarding impacts, adaptation and vulnerability. Participants also welcomed the report and thanked the SBSTA and IPCC for organizing the event, which was deemed a useful opportunity to discuss the report's findings.

81. Many parties expressed their concerns on the impacts and their increments with different levels of warming, risk of irreversible impacts of exceeding 1.5 °C, as well as the compounding cascading risk as assessed in the report, especially for SIDS and LDCs with regard to loss and damage that is already occurring and anticipated to increase.

82. Parties also expressed their concerns on the systematic and deep data gaps and imbalance in different regional information and literature, especially in developing countries and the Antarctic region, which reduces levels of certainty. The panel acknowledged this issue as an area of focus for future observation and research, and also highlighted the importance of including more diverse knowledge in research and decision making to enable and facilitate climate resilient development.

83. Several parties used the opportunity to seek more information and clarification on the assessed gaps and barriers to successful adaptation, synergies between mitigation and adaptation, as well as the effective and efficient adaptation approaches with consideration to the compounding effects at different levels of warming. The financial constraints as one of the main limits to adaptation were underlined. The important role of ecosystem-based solutions and nature-based solutions in effective adaptation and avoiding maladaptation was highlighted. There was also the urgent message that the effectiveness of adaptation solutions rely on effective and successful mitigation.

84. One participant showed interest in new findings on effectiveness of partnerships with marginalized groups, including indigenous people, children and youth, especially the health impacts on children and youth. One observer also emphasized the importance of engaging youth groups and indigenous people in the assessment process.

D. Closing remarks

85. In his closing remarks, the IPCC Chair, Mr. Hoesung Lee thanked the SBSTA for organizing the session, and thanked the speakers for their contribution from the WGII. He also thanked delegates for the rich interventions and expressed the hope that the findings of WGII will inform discussion during SB 56 in Bonn and COP 27 in Sharm el Sheikh with the view to enhancing the implementation of the Convention and the Paris Agreement.

86. In closing, the SBSTA Rapporteur, Ms. Zita Wilks, also extended her gratitude to the IPCC Chair, the WGII co-chairs, the IPCC experts joining the session, as well as the over 270 authors that made it possible to benefit from the best knowledge that the scientific community around the world has made available in the WGII report. She also thanked participants for the engaging and enriching discussions. Ms. Wilks also expressed the hope that the information presented can provide a solid ground for the UNFCCC process contributing to a successful and ambitious outcome from SB56, COP 27 and beyond.
