Global Sustainability Research
https://doi.org/10.56556/gssr.v2i1.429
ISSN: 2833-986X

RESEARCH ARTICLE

The Path to Climate Sustainability: A Review of IPCC 2022

Kowser Ali Jan[1*], Asif Ali Rather[2], R. Balaji[3]

[1]Department of Economics, Annamalai University, Chidambaram, India-608002
[2]Department of Economics, University of Kashmir, Srinagar, India-190006
[3]Department of Economics, Thiru Kolanjiappar Govt. Arts College, Virdhachalam, India-606001

Corresponding Author: Kowser Ali Jan; jnkowz@gmail.com
Received: 04 January, 2023, Accepted: 21 March, 2023, Published: 22 March, 2023

Abstract
Working Group II of the IPCC Sixth Assessment Report focuses on climate change impacts, adaptation, and vulnerability in the context of sustainable development. This IPCC evaluates climate model simulations from CMIP5 and CMIP6 of the World Climate Research Programme. Depending on global warming levels after 2040, climate change will threaten natural and human systems. Mid- and long-term consequences are several times higher for 127 identified major hazards. Climate change is having increasingly dire, interconnected, and often irreversible effects on ecosystems, biodiversity, and human systems, and risk provides a framework for comprehending these effects and for devising strategies to prevent unfavourable outcomes for present and future generations. As climate change implications and actions are enacted, more is known about how they affect justice and socioeconomic advancement. AR6 emphasises change and quick climate action to achieve such goals.

Keywords: Climate change; IPCC; risk; disaster; adaptation

Introduction

In the last two decades of the twenty-first century, life expectancy, per capita income, and education have experienced unparalleled growth. However, the scale and intensity of human activity have also increased, leading to more negative environmental impacts. In this framework, the purposeful and unintentional human effects on the background cause the most urgent environmental issues, which are genuinely global: decreasing forests, expanding deserts, eroding soils, deteriorating rangelands, rising carbon dioxide levels, dropping water tables, rising temperature, more destructive storms, melting glaciers, rising sea level, increasing floods and forest fires. Timely examples include global climate change, which reduces human-managed natural resources (such as biodiversity, landscapes, and wildness), natural resource productivity (such as agriculture), damage to the built environment (such as flash floods from cloud burst has risen), and dangers to humans due to extreme weather changes.
Intergovernmental Panel on Climate change (IPCC 2022) is, therefore, the only event of its kind that focuses specifically on in-pit crushing and conveying on a global scale. The sixth episode of a conference series has been a significant success. When it comes to quantifying the global impact of climate change, no other organisation compares to the Intergovernmental Panel on Climate Change (IPCC) (Rama et al., 2022). They are crucial sources of scientific data and technical advice for the UNFCCC, Kyoto Protocol, and Paris Agreement. After a successful event in Chile in 2018 (Birkmann, J et al., 2022), this meeting will continue the tradition of offering a forum for high-level networking and conversations on IPCC in all its forms. Impacts, adaptability, and susceptibility to climate change were the focal points of IPCC's 2022 report. By maximising synergies and minimising duplication, integrating adaptation and mitigation with the SDGs can boost the effectiveness of both. Literature, research, practice, and decision-making related to climate change have all elevated the importance of the notions of risk and risk management (Caretta et al., 2022). The AR6 report addresses adaptation options and their efficacy and adequacy in achieving societal goals related to climate change, such as decreasing vulnerability and boosting resilience. Three aspects of climate justice are highlighted in AR6: distributive justice, procedural justice, and acknowledgement (Shaw, R et al., 2022).
This study examines how IPCC Working Group II Assessment Report 6 (AR6), with three subsequent special reports, might help mitigate climate change and flood disasters. Because of their role in regulating temperature and natural hazards.

A Changing Climate in a Changing World

Since the IPCC Fifth Assessment Report (AR5) publication in 2014, many significant climate-related developments have occurred worldwide. That report indicated many simultaneous changes in the physical climate system, including higher average world temperatures, lower ice volumes, higher sea levels, and different global precipitation patterns. Globally, both

natural and human ecosystems have been affected by changes in the physical climate system, particularly more intense extreme events. Water and food security were affected; infrastructure was damaged to a larger extent; more deaths and illnesses were documented; people were uprooted or relocated; their livelihoods were ruined; mental health issues were increased; and inequalities widened.

Additionally, since AR5, a growing number of individuals around the world have learned about climate change, found it to be a severe issue, and believe it to be an emergency that needs rapid attention (New, M et al., 2022). Compared to 2013, when just half of respondents in 23 countries saw climate change as a pressing issue, in 2017 nearly two-thirds of respondents from 50 countries—representing over half of the world's population—held this view (Fagan, M et al., 2019).

Since AR5, there has been a substantial rise in planning and initiatives to mitigate the current and future risks associated with climate change. Concerns about climate change have prompted actions from governments, businesses, and individuals (O'Neill, B et al., 2022). However, as the report details, current climate policies and efforts are insufficient on their own to meet these goals. The world is in the midst of some of the most profound cultural and environmental upheavals in decades when people take action on climate change (Parmesan, C et al., 2022). Rising inequities along gender, wealth, age, race, and ethnicity, as well as a rapidly urbanising world population, are all examples of Gendered Issues. While economic disparities between countries have narrowed globally, they are increasing domestically (Bongaarts, J, 2020).

Observed Changes to Hazards and Extreme Events

"Climatic impact drivers" (CIDs) are what Working Group I of AR6 refers to when discussing the causes of negative, positive, or neutral changes in the physical climate systems. Hazards, on the other hand, are frequently the subject of discussion in natural systems literature Physical occurrences with the potential to have a detrimental impact on ecosystems and environmental resources can be classified as hazards, and these hazards can be either natural or manmade in origin(Allan, R et al., 2021). Extreme weather events and other natural disasters can happen rapidly, but the cumulative effects of various climate risks might take decades or longer to manifest in the form of soil degradation and erosion. Risks to protected areas are evaluated based on observations of exposure.

The frequency and severity of disasters like floods, droughts, cyclones, heat waves, and fires have increased as a result of climate change and other disturbance regime alterations. To better represent both small-scale processes and exceptional occurrences, climate models with increased resolution would be very useful. These disruptions have a significant negative effect on ecosystem functioning, biodiversity, and ecosystem services, but are rarely taken into consideration in impact models. Many ecosystems rely on the regular occurrence of extreme events, and many species have adapted to the long- and short-term climate swings within the disturbance regime they have experienced (Cissé, G et al., 2022).

Extreme episodic occurrences can alter or disrupt ecosystems' functionality, which is essential for such adaptive strategies. While we have a good handle on the primary climatic hazards on a global scale, we know far less about the impact of many disasters on ecosystems at once, making it difficult to quantify the results in future forecasts. Even if individual occurrences are not particularly severe, the combination of several can have a devastating effect (Sharrief, A et al., 2019). Examples include sea level rise, exceptional coastal high tides, storm surges, and river flows can all have a multiplicative influence on flood risk and freshwater system consequences. The extensive dieback of some forests (for example, in Australian eucalypt forests) may be caused by a combination of causes, including changes in rainfall and heat, altered plant growth and nutrient allocation under elevated CO2, and the rates of herbivores and insect outbreaks. Risk assessments usually consider a single climatic hazard with constant variability (Zscheischler, J et al., 2018).

Ecosystems And Disaster Risk Reduction

Reduced disaster risk is a stated goal of several environmental policies and strategies under the Hyogo Framework for Action (HFA), which includes land use, natural resource management, and adaptation to climate change. A key component of the HFA's approach to increasing the robustness of societies and states is the management of ecosystems. The 2011 Global Assessment Report on Disaster Risk Reduction stresses the importance of integrating ecosystem-based approaches into disaster management (Schipper, E et al., 2022). Disaster risk and the effects of climate change can be mitigated, thanks in large part to the regulatory and provisioning functions supplied by ecosystems. The ability of ecosystems to reduce risks has numerous positive effects on human security. Numerous studies have demonstrated the crucial role ecosystems play in mitigating dangers. Various names are used to describe ecosystems in the disaster literature. Some examples include: natural buffers, natural barriers, natural infrastructures, green and blue infrastructures, bio shields, and protective greenbelts. Therefore, they protect individuals from the worst of what nature can throw at them. Example: studies done after the 2004 Indian Ocean Tsunami demonstrate the value of coastal forests and plants (such as mangroves) in protecting lives, property, and resources from the devastation of tsunamis(O'Neill et al., 2022).

Water Security in Climate Change and Climate Resilient Development

For a population to be considered water secure, they must be able to guarantee that they will always have

access to sufficient supplies of high-quality water in an environment free from violence and political unrest. This water must be used to maintain livelihoods, human health and social progress, as well as to safeguard against water pollution and natural disasters. Water insecurity risks are a global issue. Water crises have been one of the top five threats in the World Economic Forum's Global Risks Report since 2015. Water is a crucial component in the necessary system transitions for climate-resilient development, and it is given significant attention in the SDGs. A majority of the SDGs will not be achieved unless everyone has access to clean water. Without effective adaptation, future water-related climate change impacts on many economic sectors are estimated to reduce global GDP by mid-century, with higher projected losses in low- and middle-income nations (Pörtner, H et al., 2022).

Second, freshwater availability across places and time is directly impacted by climate change, which also impacts water demands for various applications like irrigation and may exacerbate pre-existing social difficulties. Vulnerability to water-related consequences of climate change and extreme weather is now felt in all key sectors and is predicted to grow in the future, including agriculture, energy, industry, and water for health and sanitation. Agriculture and irrigation comprise 60–70% of all water withdrawals. Lack of clean water and sanitation causes several water-borne diseases. In 2017, 2.2 billion people needed adequate drinking water, and 4.2 billion lacked safe sanitation. The present COVID-19 outbreak is exacerbating water inequities. Droughts and other extreme occurrences have damaged hydropower and thermal power production globally. Between 1971 and 2000, 16% to 39% of cities faced surface-water shortages. More than 440.5 million city dwellers would experience water scarcity by the year 2050 (Dodman, D et al., 2022). In South America, not many people have access to clean drinking water. If global warming is limited to 1.5 degrees Celsius, risks to water-intensive businesses can be reduced and flexibility can be maintained. The future of water security is in jeopardy due to the proliferation of mitigating strategies. Afforestation and reforestation can have major effects on water supplies, but only if they are carried out correctly. The risks associated with climate change on water security can be mitigated by considering the direct and indirect effects of mitigation efforts on water resources(Shaw, R et al., 2022).

Climate change impacts are stressing agriculture, forestry, fisheries, and aquaculture

Short-term food shortages and price increases caused by weather extremes related to climate change exacerbate already severe food insecurity in some parts of the world. As a result of changes in agricultural output, food prices, and household incomes, the number of people who go hungry will rise as a result of climate change. Extreme climate occurrences will increase, forcing particular food-producing locations beyond safe climatic space. One study predicted that in Sub-Saharan Africa and Southeast Asia, heat stress from projected three °C warming over baseline (1986-2005) will lower labour capacity by 30-50%, contributing to a 5% increase in crop prices due to greater labour costs and production losses, so affecting food supply, access, and livelihoods (Morecroft, M et al., 2022). They are anticipated that by 2100, climate change might harm agricultural and marine fisheries in 90% of the world's countries. Globally, shellfish aquaculture habitat suitability will drop after 2060, but sooner in several Asian countries (Cooley, S et al., 2022). Climate change will raise food costs and management issues. Pathogens, HAB, and toxic inorganic bioaccumulation pose safety issues. Micronutrient insufficiency is widespread and will be a concern throughout the first half of the century, with serious health consequences. Damage to pollinator populations, soil biodiversity, and water infrastructure, thereby reducing agricultural employment and threatening human health are additional dangers to food safety and nutritional balance posed by climate mitigation plans, that ignore the possibility for increased rivalry between food production and other uses for scarce land and water(New, M. et al., 2022).

Policy

The IPCC WGII AR6 builds on the AR5, three special reports, and the simultaneous WGI and WGIII AR6 assessments. The findings and assessment methodologies employed across these reports influence the WGII AR6 starting point. They include the strong acknowledgement of the need for climate action, the increased attention to risk, and the effort to combine near-term climate solutions with longer-term changes.

The conference's consensus was that human activity had a noticeable impact on the global climate.

Climate change has affected human and ecological systems.

Unchecked greenhouse gas emissions increase the risk of severe, pervasive, and irreversible impacts on people and ecosystems due to increased warmth and longer-lasting changes in all elements of the climate system.

A substantial cut in emissions over the next few decades can lessen 21st century climate risks, increase opportunities for effective adaptation, lessen mitigation costs and impediments, and help pave the way for climate-resilient pathways to sustainable development. Policies, partnerships, and integrated measures that connect adaptation and mitigation with other societal goals are essential for successful implementation.

At the time of the IPCC AR5, there was little scientific research on 1.5°C global warmings. In 2018, the IPCC released a Special Report on the implications of global warming of 1.5°C and corresponding global GHG emission scenarios. The analysis compared global warming at 1.5°C and two °C over pre-industrial levels(Schoeman et al., 2022). It discussed solutions to achieve the Paris Agreement's aims. Quoted report findings:

If warming continues at the current rate, 1.5°C might be reached by 2052.

• Global warming of 1.5°C increases climate-related dangers for natural and human systems compared to 2°C. 1.5°C warming will require less adaption than 2°C.

Models show that if global warming stays below 1.5°C, global net anthropogenic CO2 emissions will fall to zero by 2050 from their 2010 levels (interquartile range: -40% to 60%). Interquartile range (IQR): 2045–2055.

• Even with extremely ambitious improvements in emissions reductions beyond 2030, national mitigation efforts as represented by the Paris Agreement would not be sufficient to keep global warming below 1.5°C.

Nature-based solutions not only help with adaptation and mitigation of climate change, but also with the achievement of other Sustainable Development Goals. Nature-based climate change mitigation relies on the creation of climate-resilient systems that serve various sustainable development goals, which in turn requires participatory decision-making and adaptive management. A move to more deliberate decision-making is required to keep management on track as the effects of climate change reverberate across infrastructure. Poorly managed, nature-based mitigation strategies could have negative effects on human health, reduce the amount of usable land and water, and compromise long-term sustainability.

Restoring natural ecosystems and natural processes that have been damaged or destroyed is an important adaptation and mitigation strategy. Landscape, marine, and biological community species composition are all at risk from the effects of climate change, and restoration efforts must account for this. When an ecosystem is nearing its tipping point, as is the case with tropical coral reefs, climate change may overwhelm efforts to restore or maintain the environment. Carbon is stored and many species are supported by thriving forest ecosystems that are lost in degraded areas. In low, boreal, and temperate biome regions, natural forest ecosystems survive but are managed, degraded, or removed in many parts. Deforestation and land degradation continue to emit GHGs. Protecting natural forests and managing semi-natural forests sustainably are successful.

Urban climate adaptability can be aided by solutions rooted in nature. All of these elements have positive effects on human health and well-being: urban forests and green spaces (parks and green roofs) can provide cooling effects; coastal wetlands and mangroves can minimise storm surges and floods; sustainable drainage systems can prevent surface flooding due to extreme rainfall.

Water shortage is a mismatch between freshwater demand and physical availability.

Socioeconomic and governance inequalities generate water scarcity and insecurity. Climate change-caused water shortages require greater water management. Climate change, agricultural practises, water demand, and governance will influence future water security. Not simply climate change threatens water security. Climate change may affect water supply, water quality, and flooding in many locations, jeopardising water security. Alternative result probabilities rely on regional climate shifts and socioeconomic futures. Future water scarcity predictions complicate water security and adaptation methods due to climate change. Global warming can reduce water security challenges. At these temperatures, regional climate shifts are clearer.

Half of the world population is vulnerable to severe water scarcity for at least part of the year due to climatic and non-climatic variables, which is anticipated to worsen with increased warming. High population densities and insufficient water supply, accessibility, quality, and governance cause water insecurity worldwide, especially in South Asia, North China, Africa, and the Middle East. High-water-availability areas can be water-insecure due to flooding, low water quality, and inadequate governance. Future water security depends on socioeconomic, management, and climate change. Climate change can diminish water supply and increase flooding, contributing to water insecurity. Future socioeconomic conditions are a crucial driver of water insecurity, requiring adaptation to climate change. In many locations, policy problems are considerable due to climate uncertainty. Adaptation solutions in crop production range from the field and farm-level technical alternatives like crop management and cultivar/crop options to income diversification and index-based insurance.

Land use planning helps locate settlements and infrastructure. The built environment and its impact on natural systems are both impacted by climate change, which in turn drives growth in high-risk locations. Despite this, cities in varied situations have restricted climate adaptation zoning and land use regulations. Traditional zoning regulations (those that permit only one use in a given area) and land use planning can be used to mitigate threats by encouraging people to move away from dangerous areas or hide from them. Zones for protective urban infrastructure (such seawalls, levees, dykes, and slope revetments) and avoidance measures that restrict or slow urban expansion are all part of a comprehensive plan for protection (e.g., growth containment and no-build zones). Research from both the Global North and South shows that conventional zoning is not as effective as land use policies for climate adaptation that prevent negative human-nature interactions and that curb spatial inequity, both of which can cause climate gentrification and increase the vulnerability of economically disadvantaged groups to climate-related risk.

Considerable variation exists between nations and regions, making it unlikely that current global efforts in health adaptation would be sufficient to safeguard the health of populations and communities from most climate-sensitive problems. Although health is a priority sector in 54% of NDCs, less than 1% of international climate financing goes toward adaptation to climate change in health.

When planning for and responding to climate change's potential health impacts, it's essential to consider the

wide range of interconnected factors that can impact the health of populations and the efficiency of health care delivery systems. Given the complexity of the interconnected environmental, social, and health systems that are impacted by climate change, a systems-based approach can facilitate the identification, implementation, and evaluation of solutions that support population health and health systems in the short and long term. This approach provides insight into how to enhance health and wellbeing in a variety of contexts. In order to mitigate the risks to human health caused by climate change, it is essential to implement effective governance structures, arrangements, resources, and mandates for adaptation.

Health adaptation might be less successful or destructive if it becomes compartmentalised without integration and collaboration across sectors. Integration and collaboration include working across national ministries and agencies, as well as between federal and municipal governments and the commercial sector, academia, NGOs, and civil society.

In addition to top-down approaches to policy development and implementation, bottom-up efforts, in which community actors are involved in programme design and draw on their local practises, perspectives, ideas, and experiences, are also useful. There is a chance to improve public health by incorporating it into discussions and decisions about climate change and by bolstering public health partnerships and collaborations. Cross-sector cooperation can be facilitated by building networks, integrating organisations, and developing policies.

Results and Conclusion

Working Group authors follow IPCC recommendations on expert judgement. The IPCC Sixth Assessment Report (AR6) has advanced interdisciplinary climate change assessment from AR5. As a result, assessment findings spanning the entire gamut of climate science, consequences, risks, and policies are more directly comparable. The risks, consequences, vulnerability, societal adaptation, mitigation, and sustainable development associated with climate change have all been better understood because to the utilisation of a plethora of newly available sources of knowledge. Climate change adaptation is successful if reasonable efforts reduce risk and vulnerability and achieve their aims. Goals of this nature are established and monitored globally following pre existing international frameworks and norms. Achievable objectives for impact management at the local and national levels are conditional on the effects under consideration, the nature of the measures being taken, and the scale at which they are being implemented.

For a comprehensive evaluation of the impact of an act, it is essential to consider how well the adaptation serves its intended purpose, how well it works, and how well it fits with the principles of justice. Six reports have been released by the IPCC documenting climate and ecological changes brought about by humans. There is no hiding from these shifts; they are happening now and will only accelerate in the years and decades to come. As part of its AR6 report, the IPCC also highlights the efforts people are doing to adapt to climate change. Even positive adaptation might have negative effects on existing structures. When other acts are performed, the underlying structure of the system is altered. Example: constructing a seawall to defend a coastal neighbourhood from flooding. Changing land use restrictions and implementing a managed retreat programme may be a transformational adaptation.

A seemingly insignificant factor, climate risk in mortgages and insurance is actually quite game-changing. Because the amount of greenhouse gas (GHG) mitigation influences the amount of transformational adaptation required to prevent intolerable dangers, some transformations may be inevitable. Rapid adjustments in energy, land, urban, and industrial systems are needed to get on a low-emissions path that is in line with Paris Agreement goals. Dangers must be mitigated even on low-concentration paths, and transformational adaptation is essential for this. In order to mitigate (but not eliminate) intolerable dangers along higher concentration trajectories, superior transformative adaptation is required. If a transformation isn't well thought out, it may be necessary to make alterations along the way.

Water scarcity and insecurity are caused by socioeconomic and governance disparities. Better water management is needed to adapt to climate-caused water shortages. Future water security will depend on climate change, agricultural practises, water demand, and governance. Water security is endangered by more than climate change. Climate change may threaten water security in many countries by affecting water supply, quality, and flooding. Regional climatic alterations and socioeconomic futures are needed to evaluate potential outcomes. Predictions of future water scarcity complicate climate change risks to water security and adaptation methods. Water security challenges can be alleviated if global warming is limited. Because at these temperatures, regional climate shifts are less obvious.

Climate change has monetary effects, some of which are precipitated by slow-onset and extreme weather events. The economies of those areas that use less energy and have a competitive edge in sectors like agriculture and tourism are doing well. Short-term economic growth has been slowed by some extreme weather occurrences like tropical cyclones. More assets have been exposed to extreme climate hazards due to non-climatic characteristics such as settlement patterns and infrastructure sitting, leading to greater losses. Individual lives have been disturbed due to changes in agricultural productivity, repercussions on health and food security, damage to homes and infrastructure, and loss of property and income, which in turn has affected gender and social equity.

AR6 emphasises social justice and knowledge. As climate change consequences and actions are implemented, more is known about how they affect

justice and socioeconomic progress. The AR6 emphasises transformation and swift climate action to satisfy societal goals.

Funding: Regarding funding, there is not one single source of funding for this study. Everything revolves around the aims of the curriculum

Acknowledgments: This work would not be finished without the assistance of co-author Mr Asif Ali Rather

Conflict of interest: The authors whose names are listed above certify that they have NO affiliations with or involvement in any organization or entity with any financial interest (such as honoraria; educational grants; participation in speakers' bureaus; membership, employment, consultancies, stock ownership, or other equity interest; and expert testimony or patent-licensing arrangements), or non-financial interest (such as personal or professional relationships, affiliations, knowledge or beliefs) in the subject matter or materials discussed in this manuscript.

References

Rama, H.-O., Roberts, D., Tignor, M., Poloczanska, E. S., Mintenbeck, K., Alegría, A., Craig, M., Langsdorf, S., Löschke, S., Möller, V., Okem, A., Rama, B., & Ayanlade, S. (2022). *Climate Change 2022: Impacts, Adaptation and Vulnerability Working Group II Contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. https://doi.org/10.1017/9781009325844

Birkmann, J., Liwenga, E., Pandey, R., Boyd, E., Djalante, R., Gemenne, F., Filho, W. L., Pinho, P. F., Stringer, L., & Wrathall, D. (2022). Poverty, livelihoods and sustainable development. In H.-O. Pörtner, D. C. Roberts, M. M. B. Tignor, E. S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, & B. Rama (Eds.), *Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press.

Caretta, M. A., Mukherji, A., Arfanuzzaman, M., Betts, R. A., Gelfan, A., Hirabayashi, Y., Lissner, T. K., Lopez Gunn, E., Liu, J., Morgan, R., Mwanga, S., & Supratid, S. (2022). Water. In H.-O. Pörtner, D. C. Roberts, M. M. B. Tignor, E. S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, & B. Rama (Eds.), *Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press.

Shaw, R., Luo, Y., Cheong, T. S., Abdul Halim, S., Chaturvedi, S., Hashizume, M., Insarov, G. E., Ishikawa, Y., Jafari, M., Kitoh, A., Pulhin, J., Singh, C., Vasant, K., & Zhang, Z. (2022). Asia. In H.-O. Pörtner, D. C. Roberts, M. M. B. Tignor, E. S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, & B. Rama (Eds.), *Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press.

New, M., Reckien, D., Viner, D., Adler, C., Cheong, S.-M., Conde, C., Constable, A., Coughlan de Perez, E., Lammel, A., Mechler, R., Orlove, B., & Solecki, W. (2022). Decision-making options for managing risk. In H.-O. Pörtner, D. C. Roberts, M. M. B. Tignor, E. S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, & B. Rama (Eds.), *Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press.

Fagan, M., & Huang, C. (2019). *A look at how people around the world view climate change*. https://policycommons.net/artifacts/616841/a-look-at-how-people-around-the-world-view-climate-change/1597536/

O'Neill, B., van Aalst, M., Ibrahim, Z. Z., Berrang Ford, L., Bhadwal, S., Buhaug, H., Diaz, D., Frieler, K., Garschagen, M., Magnan, A., Midgley, G., Mirzabaev, A., Thomas, A., & Warren, R. (2022). Key risks across sectors and regions. In H.-O. Pörtner, D. C. Roberts, M. M. B. Tignor, E. S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, & B. Rama (Eds.), *Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press.

Parmesan, C., Morecroft, M. D., Trisurat, Y., Adrian, R., Anshari, G. Z., Arneth, A., Gao, Q., Gonzalez, P., Harris, R., Price, J., Stevens, N., & Talukdar, G. H. (2022). Terrestrial and freshwater ecosystems and their services. In H.-O. Pörtner, D. C. Roberts, M. M. B. Tignor, E. S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, & B. Rama (Eds.), *Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press.

Bongaarts, J. (2020). United Nations Department of Economic and Social Affairs, Population Division

World Family Planning 2020: Highlights, United Nations Publications, 2020. 46 p. *Population and Development Review*, *46*(4), 857–858. https://doi.org/10.1111/padr.12377

Allan, R. P., Hawkins, E., Bellouin, N., & Collins, B. (2021). *IPCC, 2021: Summary for Policymakers* (V. Masson-Delmotte, P. Zhai, A. Pirani, S. L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M. I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J. B. R. Matthews, T. K. Maycock, T. Waterfield, O. Yelekçi, R. Yu, & B. Zhou, Eds.; pp. 3–32). Cambridge University Press. https://centaur.reading.ac.uk/101317/

Cissé, G., McLeman, R., Adams, H., Aldunce, P., Bowen, K., Campbell-Lendrum, D., Clayton, S., Ebi, K. L., Hess, J., Huang, C., Liu, Q., McGregor, G., Semenza, J., & Tirado, M. C. (2022). Health, wellbeing and the changing structure of communities. In H.-O. Pörtner, D. C. Roberts, M. M. B. Tignor, E. S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, & B. Rama (Eds.), *Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press.

Sharrief, A. Z., Hinojosa, E., Cooksey, G., Okpala, M. N., Avritscher, E. B., Pedroza, C., Denny, M. C., Samuels, J., Tyson, J. E., & Savitz, S. I. (2019). Does care in a specialised stroke prevention clinic improve poststroke blood pressure control: A protocol for a randomised comparative effectiveness study. *BMJ Open*, *9*(2), e024695. https://doi.org/10.1136/bmjopen-2018-024695

Zscheischler, J., Westra, S., van den Hurk, B. J. J. M., Seneviratne, S. I., Ward, P. J., Pitman, A., AghaKouchak, A., Bresch, D. N., Leonard, M., Wahl, T., & Zhang, X. (2018). Future climate risk from compound events. *Nature Climate Change*, *8*(6), 469–477. https://doi.org/10.1038/s41558-018-0156-3

Schipper, E. L. F., Revi, A., Preston, B. L., Carr, E. R., Eriksen, S. H., Fernández-Carril, L. R., Glavovic, B., Hilmi, N. J. M., Ley, D., Mukerji, R., Araujo, M. S. M. de, Perez, R., Rose, S. K., & Singh, P. K. (2022). Climate resilient development pathways. In H.-O. Pörtner, D. C. Roberts, M. M. B. Tignor, E. S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, & B. Rama (Eds.), *Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press.

O'Neill, B., van Aalst, M., Ibrahim, Z. Z., Berrang Ford, L., Bhadwal, S., Buhaug, H., Diaz, D., Frieler, K., Garschagen, M., Magnan, A., Midgley, G., Mirzabaev, A., Thomas, A., & Warren, R. (2022). Key risks across sectors and regions. In H.-O. Pörtner, D. C. Roberts, M. M. B. Tignor, E. S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, & B. Rama (Eds.), *Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press.

Pörtner, H.-O., Roberts, D. C., Tignor, M. M. B., Poloczanska, E. S., Mintenbeck, K., Alegría, A., Craig, M., Langsdorf, S., Löschke, S., Möller, V., Okem, A., & Rama, B. (Eds.). (2022). *Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change.*

Dodman, D., Hayward, B., Pelling, M., Broto, V. C., Chow, W., Chu, E., Dawson, R., Khirfan, L., McPhearson, T., Prakash, A., Zheng, Y., & Ziervogel, G. (2022). Cities, settlements and key infrastructure. In H.-O. Pörtner, D. C. Roberts, M. M. B. Tignor, E. S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, & B. Rama (Eds.), *Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press.

Shaw, R., Luo, Y., Cheong, T. S., Abdul Halim, S., Chaturvedi, S., Hashizume, M., Insarov, G. E., Ishikawa, Y., Jafari, M., Kitoh, A., Pulhin, J., Singh, C., Vasant, K., & Zhang, Z. (2022). Asia. In H.-O. Pörtner, D. C. Roberts, M. M. B. Tignor, E. S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, & B. Rama (Eds.), *Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press.

Parmesan, C., Morecroft, M. D., Trisurat, Y., Adrian, R., Anshari, G. Z., Arneth, A., Gao, Q., Gonzalez, P., Harris, R., Price, J., Stevens, N., & Talukdar, G. H. (2022). Terrestrial and freshwater ecosystems and their services. In H.-O. Pörtner, D. C. Roberts, M. M. B. Tignor, E. S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, & B. Rama (Eds.), *Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press.

Cooley, S., Schoeman, D., Bopp, L., Boyd, P., Donner, S., Ito, S.-I., Kiessling, W., Martinetto, P., Ojea, E., Racault, M.-F., Rost, B., Skern-Mauritzen, M.,

& Ghebrehiwet, D. Y. (2022). Ocean and coastal ecosystems and their services. In H.-O. Pörtner, D. C. Roberts, M. M. B. Tignor, E. S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, & B. Rama (Eds.), *Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press.

New, M., Reckien, D., Viner, D., Adler, C., Cheong, S.-M., Conde, C., Constable, A., Coughlan de Perez, E., Lammel, A., Mechler, R., Orlove, B., & Solecki, W. (2022). Decision-making options for managing risk. In H.-O. Pörtner, D. C. Roberts, M. M. B. Tignor, E. S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, & B. Rama (Eds.), *Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press.

Schoeman, D., Bopp, L., Boyd, P., Donner, S., Ito, S.-I., Kiessling, W., Martinetto, P., Ojea, E., Racault, M.-F., Rost, B., Skern-Mauritzen, M., & Ghebrehiwet, D. Y. (2022). Ocean and coastal ecosystems and their services. In H.-O. Pörtner, D. C. Roberts, M. M. B. Tignor, E. S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, & B. Rama (Eds.), *Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press.