Testimony of William Solecki, Ph.D., Professor
Dept. of Geography and Environmental Science, Hunter College-City University of New York
U.S. House of Representatives Select Committee on the Climate Crisis

Report from the *Intergovernmental Panel on Climate Change, Working Group II Report: Impacts, Adaptation, and Vulnerability*
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Chair Castor, Ranking Member Graves, and members of the Select Committee, thank you for inviting me here today and for your commitment to the climate change issue.

The key concluding statement from the *IPCC Working Group II Report, Summary for Policymakers* released on Monday February 28, 2022 is that, **the cumulative scientific evidence is unequivocal: climate change is a threat to human wellbeing and the health of the planet. Any further delay in concerted global action will miss a brief and rapidly closing window to secure a liveable future.**

The report highlights an advanced understanding of climate change driven impacts, including many significant shifts that increase the risks faced by world's ecosystems and society. Simply put, climate change at the national and global scales is not something that can be ignored, it is not going away, and the impacts are going to become increasingly worse, but we do have a clear window of opportunity if we are able to act in the near term, especially in the next decade.[1]

The report presents a clear and compelling assessment of the widespread global impacts of climate change. Impacts are being observed everywhere on the globe. This is a significant advance over the previous IPCC report released in March of 2014. Key issues now noted include compound and cascading risks, a wide spatial variation in the level of risk, and deepening vulnerability of ecosystems and society. For example, 3.3 to 3.6 billion people now live in global hotspots of high vulnerability to climate change. These are across large parts of Africa, as well as South Asia, Central and South America, small islands and the Arctic. Coastal tidal sites and small islands are also especially at risk and vulnerable. Evidence continues to strengthen assessment that climate impacts will increase significantly if and when global warming exceeds 1.5°C (2.7°F) with approximately 1.1°C of warming already observed.

In North America, key impacts include the following observations. Climate change has negatively impacted human health and wellbeing; food production is increasingly affected by climate change; extreme events and climate hazards are adversely affecting economic activities across the U.S. and have disrupted supply-chain infrastructure and trade; North American cities and settlements have been affected by increasing severity and frequency of climate hazards and extreme events; which have contributed to infrastructure damage, livelihood losses, damage to heritage resources, and safety concerns. Terrestrial, marine, and freshwater ecosystems also are being profoundly altered by climate change across the region. Given these observations, the report assesses what we can expect about the near-term future risk (current to 2040) and beyond, and where and why climate adaptation might be effective or not.

[1] This statement includes a distillation of the key points from the IPCC Working Group II Report with interpretation and review by the author. The full report can be found at https://report.ipcc.ch/ar6wg2/pdf/IPCC_AR6_WGII_FinalDraft_FullReport.pdf.

1. NEAR-TERM FUTURE RISK (2021-2040) AND BEYOND

In Chapter 14 of the report key near-term future risks for North America are assessed (Note – confidence levels from the report are included). Climate hazards are projected to intensify further across North America (very high confidence). Heat waves over land and in the ocean as well as wildfire activity will intensify; sub-Arctic snowpack, glacial mass and sea ice will decline (virtually certain); and sea level rise will increase at geographically differential rates (virtually certain). Humidity-enhanced heat stress, aridification, and extreme precipitation events that lead to severe flooding, erosion, debris flows, and ultimately loss of ecosystem function, life and property are projected to intensify (high confidence). With respect to specifics, health risks are projected to increase this century under all future emissions scenarios (very high confidence). Climate-induced redistribution and declines in North American food production are a risk to future food and nutritional security (very high confidence). Escalating climate change impacts on marine, freshwater, and terrestrial ecosystems (high confidence) will alter ecological processes (high confidence) and amplify other anthropogenic threats to protected and iconic species and habitats (high confidence).

2. CLIMATE ADAPTATION – WHAT IS WORKING, WHAT IS NOT, AND WHAT IS NEEDED

Climate adaptation is a broad term associated with development of actions including policies and strategies that reduce the exposure, risk, and vulnerability of communities, assets, and economies and ecosystems to climate change. The good news is that the assessment reported that adaptation strategies are being planned, developed, and implemented to a greater and greater amount. Many pilot projects and local experiments are ongoing and exploring various types of infrastructural, technical, societal and ecosystem-based adaptation, providing a basis for ongoing improvement and scaling up. The bad news is that the scale of adaptation is not sufficient to meet the challenge of climate change, is in some cases leading to unintended outcomes, is not well coordinated, monitored or evaluated, and is at risk of rapidly losing its effectiveness because of shifts driven by climate change itself. Several key terms and concepts assessed in the report and presented below are relevant to this discussion.

2.1 Adaptation gap - The capacity to adapt to climate change is highly variable and there are increasing gaps between adaptation action taken and what's needed. Action on adaptation has increased but progress is uneven and societies are not adapting fast enough. This adaptation gap is largest among lower income marginalized communities. At the current rate of planning and implementation, the adaptation gap will continue to grow. In cities for example, we see globally that the gap between what can be adapted to and what has been implemented is uneven. The gap is larger for the poorest 20% of the population than for the wealthiest 20%. Adaptation options can be taken in every region and every sector to respond to climate change however, the assessment finds that the effectiveness of some action declines with increased warming, in turn, also creating a wider adaptation gap.

2.2 Hard and soft limits to adaptation – The capacity to adapt to climate change is associated with limits. Adaptation limits point to conditions at which an actor's objectives (or system needs) cannot be secured from intolerable risks through adaptive actions. Hard adaptation limits are present when no adaptive actions are possible to avoid intolerable risks. Soft adaptation limits are

present when options may exist but are currently not available to avoid intolerable risks through adaptive action. Poverty and inequality both present significant adaptation limits, resulting in unavoidable impacts for vulnerable groups. In cities, soft limits to adaptation are associated with low governance capacity, limited political commitment, limited financial support, lack of reliable information, and the legacy of past urban infrastructure investment that constrain how cities and settlements are able to adapt.

2.3 Maladaptation – The report also found increased evidence of maladaptation or adaptation actions that have unintended side-effects. Maladaptation may lead to increased risk of adverse climate-related outcomes, including via increased greenhouse gas (GHG) emissions, increased or shifted vulnerability to climate change, more inequitable outcomes, or diminished welfare, now or in the future. One example to highlight are hard infrastructure sea walls to protect against coastal flooding that might be not sufficient to fully protect against increased future risk of flooding. Also in the urban context, the shift to increased air conditioning use to protect against heat stress will increase GHG emissions. Overall, the report highlights that, cities and settlements are best protected when they use a range of strategies to adapt to climate change and hard infrastructure by itself can be maladaptive or less effective over time. Adaptation strategies are most effective when they are diverse and flexible in the face of dynamic climate risk conditions. The report also highlights the value of ecosystem approaches and nature-based strategies - i.e., green infrastructure that could also be considered in the urban adaptation portfolio.

2.4 Climate equity and justice – An emerging significant finding in the report is the critical role that justice and equity[2] play in the levels of climate vulnerability, adaptation and broader scale responses. Vulnerability of populations to climate change differs substantially among and within regions, driven by patterns of intersecting socio-economic development, unsustainable ocean and land use, marginalization, historical and ongoing patterns of inequity, and governance. Inequity and poverty lead to soft adaptation limits, resulting in disproportionate exposure and impacts for most vulnerable groups. Furthermore, adaptation planning and implementation that do not consider adverse outcomes for different groups can lead to maladaptation, increasing exposure to risks, marginalizing people from certain socio-economic or livelihood groups, and exacerbating inequity. Conversely, inclusive governance that prioritizes equity and justice in adaptation planning and implementation leads to more effective and sustainable adaptation outcomes. Integrated and inclusive system-oriented solutions based on equity and social and climate justice reduce risks and enable climate resilient development.

2.5 Enabling conditions for climate adaptation - To accelerate and sustain adaptation requires political commitment and follow-through across all levels of government through legal, legislative and regulatory pathways; clear goals, defined responsibilities and commitments; access to and mobilizing adequate financial and technical resources; decision-support tools, cutting edge, actionable knowledge, and monitoring and evaluation to track progress; and inclusive governance that prioritizes equity and justice in adaptation planning and implementation.

[2] In the report, justice is concerned with setting out the moral or legal principles of fairness and equity in the way people are treated, often based on the ethics and values of society. Social justice comprises just or fair relations within society that seek to address the distribution of wealth, access to resources, opportunity and support according to principles of justice and fairness. Climate justice comprises justice that links development and human rights to achieve a rights-based approach to addressing climate change.

2.6 Monitoring and evaluation of adaptation - Monitoring and evaluation (M&E) are key for iterative climate risk management, in particular tracking adaptation progress and learning about adaptation success and maladaptation. M&E application in the past five years has increased at the local, project and national level, but is still at an early stage and underutilized as a way to assess adaptation outcomes at longer timeframes. About one-third of world's countries have undertaken steps to develop national adaptation M&E systems, but fewer than half of these are reporting on implementation. The relative strength and weaknesses of different M&E approaches and their applicability have not been systematically assessed, but the diversity of approaches being used could provide a more comprehensive assessment of national and global adaptation progress.

3. WINDOW OF OPPORTUNITY AND INTEGRATED FLEXIBLE ADAPTATION RESPONSE

While the report highlights growing climate risk facing ecosystems and society and the challenges associated with ongoing response efforts, the assessment also reveals a series of conditions, situations and pathways that provide increased effectiveness of climate adaptation. The report documents an existing yet rapidly closing window of opportunity to act to limit the most adverse climate change impacts. Action in the next ten years will be crucial. To take full advantage of this window of opportunity, one can consider rapidly enhancing current adaptation practice and simultaneously advancing adaptation practices and link them with strategies to rapidly reduce greenhouse gas emissions and prospects for economic development that will promote sustainable development. Given the rapidly increasing climate risk and complex and diverse local conditions, it is important to advance policies and practices that are flexible and adaptive to specific contexts. Overall, taking integrated action for climate resilience to avoid climate risk requires urgent decision making regarding the new built environment and the retrofitting existing designs, infrastructure and land use. The assessment defines a series of conditions associated with taking advantage of the current window of opportunity.

3.1 Advance enabling conditions for effective adaptation – The promotion of adaptation enabling conditions including political commitment and follow-through, institutional frameworks, policies and instruments with clear goals and priorities, enhanced knowledge on impacts and solutions, mobilization of and access to adequate financial resources, monitoring and evaluation, and inclusive governance processes can lead to more effective and equitable adaptation outcomes.

3.2 Focus on synergies and co-benefits – Investments in effective adaptation can be expected to reduce risks and damages as well as generate multiple benefits including improved productivity, innovation, health and wellbeing, food security and biodiversity conservation.

3.3. Develop monitoring and evaluation capacity – Monitoring and evaluation (M&E) of adaptation are critical for tracking progress and enabling effective adaptation. Although most of the monitoring of adaptation is focused towards planning and implementation, the monitoring of outcomes is critical for tracking the effectiveness and progress of adaptation. M&E facilitates learning on effective adaptation measures, and signals when and where additional action may be needed. M&E systems are most effective when supported by capacities and resources and embedded in enabling governance systems.

3.4 Connect climate adaptation, climate mitigation (reducing GHG emissions) and economic development - Climate adaptation is essential to reduce harm, but if it is to be effective, it must go hand-in-hand with ambitious reductions in greenhouse gas emissions because with increased warming the effectiveness of many adaptation options declines and risks maladaptive responses. These climate adaptation and climate mitigation efforts also can be linked with economic development strategies, together called climate resilient development, and can advance sustainable development.

3.5 Incorporate climate action into the everyday – Incorporating adaptation into departments', agencies', and offices' everyday decision making increases the capacity of cities, rural areas and regions to provide services and adapt to climate change for the wellbeing of all. A key element of this everyday practice is the development and implementation of sector and geography specific climate change relevant metrics, standards and codes.

3.6 Prepare for shocks and stresses and take advantage of them – Unprecedented extreme weather events (e.g., extreme heat wave and precipitation events) and chronic climate risk (e.g., increasingly frequent mean monthly high tide flooding) present challenges often beyond the remit and jurisdiction of federal, state and local agencies. These conditions present catalyzing opportunities for advanced post event government review and coordination of follow-on research, learning, and knowledge generation activities.

3.7 Develop a flexible, adaptive, and diverse portfolio of adaptation strategies - Adaptation in the United States and world will depend largely on the resilience of natural, social and physical infrastructure. Strategies that review and incorporate a range of hard and soft adaptation actions are often most effective, and avoid adaptation lock-in. In cities and settlements, a range of green and blue adaptation strategies are being implemented and now critically assessed. For example, in our cities and elsewhere, trees can provide shade, vegetation can have a cooling effect, green areas can provide drainage and flood water storage and urban agriculture can provide food. Coastal wetlands can protect against coastal erosion and flooding associated with storms and sea level rise.