

Consensus statement from the Regional Action on Climate Change Symposium (RACC-14)<sup>1</sup> held on October 1, 2022: An adjunct session of the Science, Technology and Society Forum (Kyoto)<sup>2</sup>.



## An Urgent Need for CoP27: Confronting Converging Crises

The last twelve months have provided further evidence of the potential for cascading ecological and socio-political crises that some of us warned of twelve months ago.<sup>3</sup> At that time we said: “the Earth’s climatic, ecological, and human systems are converging towards a crisis that threatens to engulf global civilization within the lifetimes of children now living.”<sup>4</sup>

Drivers of this developing crisis include climate change and degradation of biodiversity in the context of globally inadequate health infrastructures, growing conflicts and stark inequalities. Climate change will impact agriculture and ecosystems when at their most vulnerable during what is predicted to be peak human population (around 2090). Just when the world is most crowded is when these combined risks may well be largest and their consequences most likely to interact.

There has been no slowdown in global warming. Reductions in greenhouse gas emissions lag further behind the commitments made in the 2015 Paris Agreement. The effects are already visible.<sup>5</sup> This year additional evidence identifies converging risk mechanisms leading to compounding and cascading impacts. Consequently security and sustainability risks are growing.

For example:

- **New connections are emerging between climate change impacts and human health.** The world is currently experiencing three pandemics – two ongoing: COVID-19 and cholera (of which there are millions of cases each year), and monkeypox. New more highly infective variants of COVID-19 have evolved, creating major health challenges especially in economically vulnerable countries. Satellite data are now showing a clear relationship between warming climate and the water borne diseases carried by zooplankton,<sup>6</sup> exacerbating humanity’s pandemic stress.
- **Large vulnerable populations are already experiencing food crises.** Despite the world’s riches, millions of people still suffer from inadequate nutrition. Some 3.2 billion people were food insecure last year with up to 828 million facing hunger.<sup>7</sup> Those numbers are increasing, especially in Africa. Food systems are highly climate dependent and are being hit hard by climate extremes, geopolitical conflicts, and COVID-19 related economic disruptions, all of which contribute to worsening in food insecurity.
- **The risks of water, food, and climate disruption are converging.** As the planet warms, dryer areas are becoming dryer. Wetter areas are becoming wetter. This will impact crop production, especially in some of the most populated and poorest regions. Water connects everything from energy generation to forestry and food to ecological and human health. But there is growing evidence that the planet’s hydrological systems are already shifting in response to climate change, worsening the mismatch between water supply and demand for food. The “green revolution” – the growth in food productivity to feed an

expanding population – has been founded on massive use of irrigation using groundwater, of which some 30-40% is non-renewable,<sup>8</sup> and is being extracted at increasingly unsustainable rates. As water levels drop, pumping costs and energy demands rise.

In addition, countries in the dry area (such as Egypt, Jordan, Morocco) will suffer from acute water poverty. The green revolution may in the long term seem not so much to have solved the potential world food crisis as to have delayed it. In the highly populated and vulnerable populations of the planet, food is running short not because the world does not grow enough, but because of poverty, conflict and inequitable food distribution. Whilst in the past such risks have been dealt with separately, they are inter-related and must be dealt with jointly.

- **Flows of environmental refugees are already evident and likely to increase as pressures on vulnerable regions grow.** It is estimated that between 200 million and 1.2 billion environmental refugees may be on the move by 2050,<sup>9</sup> creating significant social, economic and political pressures across different regions. Such stresses increase the vulnerability of populations to other stresses. With greater vulnerability comes a reduced resilience to new destabilisations (such as those created as an outcome of the Russia-Ukraine war).<sup>10</sup>

### **Moving forward.**

Previously, international attention and investment have focussed primarily on the challenges of mitigation of climate change. The compounding interactions of converging risks heighten the possibilities of “tipping points”. This adds greater weight to the need to build resilience, especially for the densely populated and economically disadvantaged populations who do not have the resources to cope. It is vital to provide the capacity to assess and monitor these risks, anticipate impacts, and build resilience to them.

In short, there are increasingly serious impacts that mitigation cannot avoid. It is time to recognise that greater support should be given to adaptation. Neither the ability nor resources to adapt are evenly distributed around the world. Often those who have contributed least to the developing crisis suffer most from its effects. Increased international financial, institutional and investment support are needed to address such inequalities.

Effective climate change mitigation strategies depend on vulnerable populations being sufficiently resilient to climate impacts to be able to invest in their transition to a net zero emissions economy. The global community has failed to deliver on undertakings made over the last decade to bring significant resources to developing regions for the task of adaptation (including the promised \$100 billion). This failure should be rectified, and the size of commitments greatly increased.

The UN’s adoption in 2015 of the Sendai Framework for Disaster Risk Reduction (2015-2030)<sup>11</sup> and the Sustainable Development Goals,<sup>12</sup> provide a useful global framework and set of targets on how to build resilience. However, to be effective, implementation efforts require strong collaboration and full implementation by all nation states in a coherent integrated way with comparable levels of investment.

Urgency repeatedly expressed by scientists, and the international mandates promised at meeting after meeting, have proven insufficient to inspire sufficient actions at local levels. Successfully building resilience requires people to recognise their interconnectedness

with nature and each other. It also requires consistent input from the most vulnerable (notably women speaking also for their children). As the Jenna Declaration spells out,<sup>13</sup> sensitivity to these cultural dimensions need to be embedded in strategy, policy making, research and education.<sup>14</sup>

Over its 14 years, RACC has advocated the need to build “knowledge-action networks” that can tailor knowledge from the natural and social sciences to specific adaptation needs as identified by local communities. The UN Sustainable Development Solutions Network,<sup>15</sup> which focuses on the implementation of the SDGs, can play a constructive role in this area.

Water systems are vulnerable to climate and other shocks. The resilience of these systems needs to be expanded in the face of uncertainty. Water systems can be improved and water use can become more equitable and efficient. In 2020 the United Nations estimated some 2 billion people do not have access to safely managed water free from contamination.<sup>16</sup> Work by the Safe Water Network<sup>17</sup> shows how an approach linking leading technical knowledge with local engagement can create access to reliable, equitable, and sustainable water supply.

A wide range of technical assistance is needed, from biotechnology (for example development of crop varieties that are resilient to regional climate changes) to applications of IT, AI, and renewable energy and storage.<sup>18</sup> Africa produces only a fraction of the food output it could with appropriate assistance.<sup>19</sup> At the same time, local communities need to participate in assessing risks in the context of local vulnerabilities and in selecting which tools may be most helpful to reduce those vulnerabilities.

At the regional and national levels, agriculture (which with forestry, land use and food processing represents some 30% of carbon emissions<sup>20</sup>) can play a key role not only as a source but also a key part of the solution to climate change (notably through soil and water management and carbon sequestration).

Adaptation requires change to agricultural and food systems. As proposed at the RACC co-sponsored Drylands Webinar (Egypt September 2022)<sup>21</sup> economic and other measures to assist the most vulnerable are required. Food needs to be grown with greater water efficiency. Food waste (some 14% before retail,<sup>22</sup> and 17% of what is then sold<sup>23</sup>) needs to be significantly reduced. Climate Smart Agriculture should be a national priority with increased R&D funding for scaling innovations around adaptation and mitigation. This requires integrated government action as well as strong engagement and support at the community level. It should be combined with educational efforts to enrich understanding of the human-nature relationship, and blend contemporary scientific approaches with traditional knowledge of the environment.<sup>24,25</sup>

Integrated thinking also means that comprehensive assessment methodologies need to be developed to prevent responses to one set of risks worsening others.<sup>26</sup> Examples of this danger include: increased energy demand from desalination plants in arid regions; more widespread fossil-fuel powered air-conditioning in the face of worsening heat waves; and pressure on agricultural land and increased degradation of biodiversity from production of biofuels, notably in the context of the BECCS (Bio-energy with Carbon Capture and Storage).

State of the art early warning systems should be developed, tailored to the needs of vulnerable regions and able to predict threats to crop production several seasons ahead, with support for small-scale and subsistence farmers who are most vulnerable to these impacts to

utilise such predictions. We stress that at the local level many initiatives by communities have been extremely innovative and effective in building resilience. These community efforts need to be supported and encouraged.

In summary, at all scales adaptation requires globally available local data, reliable analytic techniques, community capacity to plan adaptation strategies, and the resources (scientific, technical, cultural, and economic) to implement them. To date, the rate of growth of the support for climate change resilience lags the rapid growth of cascading and converging risks. Greater emphasis on adaptation is now needed.

We urge that national leaders at COP27 pledge and take action to greatly raise the global investment in intellectual and financial resources required to support adaptation especially for the most vulnerable populations.

**The following contributed as co-authors to this statement:**

- Prof. Jim Falk (RACC-14 Chair), Honorary Professorial Fellow, School of Geography, Earth and Atmospheric Sciences, University of Melbourne, Emeritus Professor, University of Wollongong, Australia.
- Dr. Ebum Akinsete, Head, Department of Stakeholder Analysis and Decision Support Systems, International Centre for Research on the Environment and the Economy/UN Sustainable Development Solutions Network Greece. AE4RIA, Greece.
- Prof. Rita R. Colwell, Distinguished University Professor, Center for Bioinformatics and Computational Biology, University of Maryland College Park; Professor, Johns Hopkins Bloomberg School of Public Health, USA.
- Dr Swadhin Behera, Director, Application Laboratory, JAMSTEC; Adjunct Professor, Department of Ocean Technology, Policy, and Environment, University of Tokyo, Japan.
- Prof. Adel S. El-Beltagy Chair, Int'l Dryland Dev. Commission (IDDC); Prof. at Arid Land Agric. Graduate Studies & Res. Institute, Ain Shams Univ. Egypt; (Chair of Food and Agriculture Council, Egyptian Academy of Science and Technology), Egypt.
- Dr Ashok K. Chapagain, Senior Researcher, Pacific Institute, UK.
- Dr Ismahane Elouafi, Chief Scientist, Food and Agriculture Organisation of the United Nations (FAO), Italy.
- Dr. Peter H. Gleick, President Emeritus, Pacific Institute for Studies in Development, Environment and Security, USA.
- Dr Naota Hanasaki, Head, Center for Climate Change Adaptation (Climate Change Impacts Assessment Research Section), National Institute of Environmental Studies, Japan.
- Dr Haruo Hayashi, President, National Research Institute for Earth Science and Disaster Resilience, Japan.
- Prof. Sachiko Hayashida, Professor, Research Department, Research Institute for Humanity and Nature Faculty of Science (RIHN), Japan.
- Dr Joanne Kauffman, Science for Sustainable Societies, Springer, Germany.
- Prof. Charles F. Kennel, Distinguished Professor and Director Emeritus, Scripps Institution of Oceanography, University of California, San Diego (UCSD); Distinguished Visiting Scholar, Centre for Science and Policy, University of Cambridge, UK.
- Prof. Yuan Tseh Lee, President Emeritus, Academia Sinica [Nobel Laureate in Chemistry 1986], Taiwan.
- Prof. Cherry A. Murray, Benjamin Peirce Professor of Technology and Public Policy and Professor of Physics, Emerita, Harvard University; Deputy Director for Research, Biosphere2 and Professor of Physics, University of Arizona, USA.
- Dr Raj Paroda, Chairman, Trust for Advancement of Agricultural Sciences (TAAS), India.
- Prof. John Rundle, Department of Physics and Astronomy, University of California, Davis, USA.
- Dr Ismail Serageldin, Founding Director Emeritus, The Library of Alexandria, Egypt.
- Dr Kurt Soderland, CEO, Safe Water Network, USA.
- Prof. Kazuhiko Takeuchi, President, Institute for Global Environmental Strategies (IGES); Project Professor, Institute for Future Initiatives (IFI), The University of Tokyo, Japan.

- Dr. Chiho Watanabe – Professor/Executive Advisor to the President (Planetary Health), School of Tropical Medicine and Global Health, Nagasaki University; Professor Emeritus, The University of Tokyo; former President, National Institute for Environmental Studies (NIES), Japan.
- Prof. Tetsuzo Yasunari, Senior Advisor and Professor Emeritus (former DG) of Research Institute for Humanity and Nature (RIHN), Kyoto; Director of Kyoto Climate Change Adaptation Center (KCCAC), Japan.

More details of the RACC and its International Advisory Committee are set out at <https://www.stsforum.org/racc2022/iac/>

<sup>1</sup> Regional Action on Climate Change Symposium (RACC-14), 2022, <https://www.stsforum.org/racc2022/>

<sup>2</sup> The Science, Technology and Society Forum (Kyoto, 2022), <https://www.stsforum.org/kyoto2022/>

<sup>3</sup> Jim Falk, Rita R. Colwell, Charles F. Kennel & Cherry A. Murray, “Link knowledge and action networks to tackle disasters”, *Nature*, 599, 372, 16 November 2021, <https://www.nature.com/articles/d41586-021-03419-0>

<sup>4</sup> Jim Falk, Faten Attig-Bahar, Rita R. Colwell, Swadhin K. Behera, Adel S. El-Beltagy, Joachim von Braun, Partha Dasgupta, Peter H. Gleick, Ryuichi Kaneko, Charles F. Kennel, Phoebe Koundouri, Yuan Tseh Lee, Thomas E. Lovejoy, Amy Luers, Cherry A. Murray, Rattan Lal, Ismail Serageldin, Youba Sokona, Kazuhiko Takeuchi, Makoto Taniguchi, Chiho Watanabe & Tetsuzo Yasunari, “Addressing our planetary crisis”, *Sustainability Science*, 17, 5-7, 2022, DOI: g5bd; 2021

<sup>5</sup> IPCC, 2022: H.O. Pörtner, D.C. Roberts, M. 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, Cambridge, UK and New York, NY, USA, 3056 pp., DOI:10.1017/9781009325844.

<sup>6</sup> Brumfield KD, Leddy M, Usmani M, Cotruvo JA, Tien CT, Dorsey S, Graubics K, Fanelli B, Zhou I, Registe N, Dadlani M, Wimalarante M, Jinasena D, Abayagunawardena R, Withanachchi C, Huq A, Jutla A, Colwell RR. “Microbiome Analysis for Wastewater Surveillance during COVID-19”, *mBio*, 2022 Aug 30;13(4):e0059122. DOI: 10.1128/mbio.00591-22. Epub 2022 Jun 21. PMID: 35726918; PMCID: PMC9426581.

<sup>7</sup> FAO, IFAD, UNICEF, WFP and WHO, *The State of Food Security and Nutrition in the World 2022*, Repurposing food and agricultural policies to make healthy diets more affordable. Rome, FAO, 2022, xiv. DOI: 10.4060/cc0639en.

<sup>8</sup> Mark F.P. Bierkens, and Yoshihide Wada, Non-renewable groundwater use and groundwater depletion: a review, *Environmental Research Letters*, 14(6), 063002, 2019, DOI: 10.1088/1748-9326/ab1a5f/

<sup>9</sup> T. Ida, “Climate refugees – the world’s forgotten victims”, World Economic Forum, 18 Jun 2021, <https://www.weforum.org/agenda/2021/06/climate-refugees-the-world-s-forgotten-victims/>

<sup>10</sup> National Academies of Sciences, Engineering, and Medicine 2022, *Global Food Security and Sustainability Implications of the Ukraine Conflict: Proceedings of a Workshop in Brief*. Washington, DC: The National Academies Press. DOI: 10.17226/26754.

<sup>11</sup> UNDRR, Sendai Framework for Disaster Risk Reduction 2015-2030,

<https://www.undrr.org/publication/sendai-framework-disaster-risk-reduction-2015-2030>

<sup>12</sup> UN General Assembly on 25 September 2015, resolution 70/1, “Transforming our world: the 2030 Agenda for Sustainable Development” [https://documents-](https://documents-ddsny.un.org/doc/UNDOC/GEN/N15/291/89/PDF/N1529189.pdf?OpenElement)

[ddsny.un.org/doc/UNDOC/GEN/N15/291/89/PDF/N1529189.pdf?OpenElement](https://documents-ddsny.un.org/doc/UNDOC/GEN/N15/291/89/PDF/N1529189.pdf?OpenElement)

<sup>13</sup> The Jenna Declaration, <https://www.thejennadeclaration.org/>

<sup>14</sup> Benno Werlen, Joanne Kauffman, Karsten Gaebler, “The Future of Knowledge Mobilization for deep societal transformations” in *Imagining the Future of Knowledge Mobilization: Perspectives from UNESCO Chairs*, Canadian Commission for UNESCO, Social Sciences and Humanities Research Council of Canada, 2019, <file:///Users/ir3s/Downloads/ImaginingFutureOfKnowledgeMobilization.pdf>

<sup>15</sup> UN Sustainable Development Solutions Network, <https://www.unsdsn.org>

<sup>16</sup> World Health Organization and the United Nations Children’s Fund, *Progress on Household Drinking Water, Sanitation and Hygiene: 2000-2020, Five Years into the SDGs*, February 10, 2021, p. 8.

<sup>17</sup> The Safe Water Network, <https://safewaternetwork.org>

<sup>18</sup> Adel El-Beltagy, “Navigation Through uncertainties: Agro-ecosystems Affected by Dynamic Impact of Climate Change”, *Proceedings, 13th International Conference on Development of Dry Land*, International Dryland

---

Development Commission and Arid Zone Research Association of India, Feb 11-14 2019, pp. 3-12. ISBN: 978-81-901024-3-8. <http://www.drylanddevelop.org>.

<sup>19</sup> Lutz Goedde, Amandla Ooko-Ombaka, and Gillian Pais, Winning in Africa's Agricultural Market, McKinsey & Company, 15 Feb 2019, <https://www.mckinsey.com/industries/agriculture/our-insights/winning-in-africas-agricultural-market>

<sup>20</sup> P.R. Shukla, J. Skea, E. Calvo Buendia, V. Masson-Delmotte, H.- O. Pörtner, D. C. Roberts, P. Zhai, R. Slade, S. Connors, R. van Diemen, M. Ferrat, E. Haughey, S. Luz, S. Neogi, M. Pathak, J. Petzold, J. Portugal Pereira, P. Vyas, E. Huntley, K. Kissick, M. Belkacemi, J. Malley, (eds.), IPCC, 2019: Summary for Policymakers. In: Climate Change and Land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems, p. 10.

<sup>21</sup> Hybrid Webinar of Climate Change on Food Production in the Dry Areas, Egypt, September 3-5, 2022

<sup>22</sup> UN Food and Agriculture Organisation, The State of Food and Agriculture, 2019, 2019. <https://www.fao.org/3/ca6030en/ca6030en.pdf>.

<sup>23</sup> UNEP (2021), United Nations Environment Program, Food Waste Index Report 2021, p. 70, <https://www.unep.org/resources/report/unep-food-waste-index-report-2021>.

<sup>24</sup> Aliaa R. Rafea, "Nature and Man: Past and Present in Egypt" in Takako Yamada and Takashi Irimoto Continuity, Symbiosis, and the Mind in Traditional Cultures of Modern Society, Hokkaido University Press, 2011.

<sup>25</sup> Aliaa R. Rafea, "An Integrative Approach for Facing Climate Change Challenges", Proceedings, 13th International Conference on Development of Dry Land, International Dryland Development Commission and Arid Zone Research Association of India, Jodhpur, India, Feb 11-14, pp. 425-437. ISBN: 978-81-901024-3-8. <http://www.drylanddevelop.org>.

<sup>26</sup> Shinichiro Fujimori, Tomoko Hasegawa, Kiyoshi Takahashi, Hancheng Dai, Jing-Yu Liu, Haruka Ohashi, Yang Xie, Yanxu Zhang, Tetsuya Matsui and Yasuaki Hijioka, "Measuring the sustainable development implications of climate change mitigation", Environ. Res. Lett. 15 (2020) 085004 DOI: 10.1088/1748-9326/ab9966