Commentary

COP 27 insights to increase food-systems climate adaptation and resilience

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The limited resilience of agricultural and food systems has become an agenda in the time of more extreme natural hazards. The impact of such events is extensive, and the level of damage and recovery strongly depends on ecosystem services, including their own resilience capacity. Most of the time, ecosystems themselves can offer mitigation measures based on the benefits people get from nature, including cultivated and wild biomass for nutrition, materials, or energy; pest and disease control; and regulation of baseline flows, among others. The 27th Conference of the Parties to the United Nations Framework Convention on Climate Change, held in Sharm el-Sheikh, Egypt, addressed issues related to crop production, food security, and nutrition. The information garnered from this conference provided impetus for actions that we believe can ensure a future with the resources needed for sustainable development and that support the health and nutrition for all the inhabitants on Earth.

In recent years, with an ongoing risk of climate action failure,[1] economic shocks combined with growing inequalities, and the existing geopolitical tension, transformation of the food system is recognized among the top development priorities to achieve better production, better nutrition, a better environment, and a better life, leaving no one behind.[2] The recent 2022 Sustainable Development Goals report[3] emphasizes the need to tackle the climate crisis with decisive actions to make substantial strides toward eliminating hunger, attaining food security and improved nutrition, and promoting sustainable agriculture by 2030.

The impacts of climate-related extremes on food security, nutrition, and livelihoods are particularly acute and severe for people living in sub-Saharan Africa, Asia, Small Island Nations, Central and South America, and the Arctic, and for small-scale food producers globally.[4] As stated by international development agencies, governmental food security and nutrition policy-making bodies, research organizations and consortia, a modern and resilient food system must mitigate disparities in food access and nutritional status of individuals and nations.[4–9]

The 27th session of the Conference of the Parties (COP 27), the 17th session of the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol and the fourth session of the Conference of the Parties serving as the meeting of the Paris Agreement, also referred to as the United Nations Climate Change Conference, was held in Sharm El-Sheikh, Egypt, November 6–18, 2022. The conference brought together more than 40,000 of the world's climate stakeholders represented by Parties to the Convention and Observer States, the United Nations

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System and its Specialized Agencies, intergovernmental organizations, and nongovernmental organizations with the purpose of presenting concrete decisions on keeping global temperature rise to 1.5°C above preindustrial levels. The COP 27 participants endeavored to close the implementation gap by delivering solutions on reducing greenhouse gas emissions; adapting to the foreseeable impacts of climate change; enhancing funding, technology, and capacity building for fighting against the climate emergency; and promoting coordinated action to address climate change.[10]

Debuting at COP 27, the Food and Agriculture Organization, Food Systems, Food4Climate Pavilions, along with >91 other pavilions, featured 14 themed days and provided a discussion platform for leveraging food-systems solutions on climate mitigation, adaptation, and building resilience. Transforming the world's food system could generate US$4.5 trillion annually in new economic opportunities by 2030 and ensure a healthier and more diverse and equitable food system.[10] In this commentary, we attempt to distill priorities for actions that should be taken to transform the food system, including elements and activities related to the production, processing, distribution, and consumption of food that were raised at COP 27.

The panel discussions at COP 27 gravitated toward the following topics: climate change and food insecurity; adaptation and resilience tools to climate-induced shocks and stresses; sustainable, healthy, and nutritious diets; nature-based, climate-smart, and green solutions; climate financing; the water-food-energy-health nexus; and building an equitable and inclusive food system. However, food safety was a missing component during many of the discussions on climate adaptation strategies.

Insights gained from attending COP 27 sessions allow us to set out action points on how to translate food-systems transformation intentions into decisions and actions today, and these are presented herein. This can guide policy makers, food-system actors, and community leaders to formulate and select intervention strategies and take actions to address climate-induced risks to food and nutritional security through changes in agriculture, livestock, hunting, fisheries, and aquaculture productivity and access. Research on and implementation of the following 20 action items are current priorities congruent with 6 dimensions of food security that have come to light from COP 27: availability, access, utilization, stability, agency, and sustainability.

Availability

1. Produce at least 30% of the food demands locally by 2030 to reduce dependence on imports and effectively provide a buffer from food supply disruptions caused by climate risks, price fluctuations, policy changes, and conflicts.
2. Foster fit-for-purpose climate innovations and digitalization for lower-to-neutral carbon production and efficient supply chains.
3. Explore options and manage resources to accelerate sustainable cold- and dry-chain development for reducing food loss and waste and increasing food safety.
4. Mobilize blended financial resources to introduce innovative, climate-smart technologies that simultaneously increase productivity and reduce food-systems emissions (eg, indoor vertical farming, agrivoltaics, solar-powered irrigation, fungus-based insulation, food waste–derived biomaterials).

Access

5. Generate investible business cases harnessing synergies and benefiting biodiversity, water, food security, and health to ensure availability and accessibility of financial resources.
6. Reward and recognize food-system actors financially, including small-scale farmers and ranchers, for climate-positive practices to catalyze production of healthy, nutritious, and sustainably produced food.

Utilization

7. Advance development of diversified sources of protein, including biotechnology-based proteins, to boost healthy, nutrient-dense, sustainable, safe, and affordable eating patterns.
8. Use neglected and underused species to enrich and diversify food systems and improve food biodiversity for meeting the cultural and dietary needs of the communities and people.
9. Scale up plant-based food systems to foster low-emission development and deliver health and socioeconomic benefits at a lower environmental costs.

Stability

10. Improve risk information and early-warning systems of climate-induced shocks and stresses and preposition financial resources for anticipation measures to enhance resilience and protect people's health, well-being, and livelihoods.
11. Develop database and indicators across 6 dimensions of food security: availability, access, use, stability, agency, and sustainability for measuring and monitoring food-systems resilience to identify appropriate climate-change responses in a context of uncertainty.
12. Showcase success stories from the field demonstrating food supply chain, food environment, and consumer-behavior transformation effectiveness to increase evidence-informed decision-making on

mitigation, adaptation, and resilience actions and foster peer-to-peer learning and knowledge sharing.

Agency

13. Intensify engagement of Indigenous people, women, and youth to make food systems more diverse, inclusive, and economically, environmentally, and socially sustainable.
14. Learn from traditional and Indigenous peoples' food systems evolving and co-existing in harmony with ecosystems (eg, desert, grassland, tropical rainforest), and introduce their resilience mechanisms and grassroots innovations to safeguard ecosystem services, and support the preservation and strengthening of Indigenous peoples' food systems.
15. Increase stakeholders' awareness of food-systems climate adaptation and resilience actionable solutions to close the implementation gap.
16. Strengthen climate change education for all food-system actors to build the capacity for better preparedness and response to local, regional, and national climate-induced threats.
17. Build multistakeholder partnerships and trust to ensure a constructive dialog, and codevelop and implement solutions to prevent inequalities within food systems.

Sustainability

18. Mainstream, nature-based climate solutions that are sensitive to local conditions to provide food security and nutrition for all in such a way that human, animal, and environmental health is not compromised.
19. Ensure that actions for food-systems transformation are aligned with national climate-change adaptation strategies to guarantee long-term sustainability.
20. Deploy The Seventh Generation Principle[11] and adaptive learning in decision-making about food, water, energy, biodiversity, and health to ensure sustainable food systems for 7 generations in the future and avoid maladaptation.

Taking into consideration the existing uncertainties, the intention of this study is to bring focus on actions, either globally or those specific to particular countries or sites, that have the utmost importance to COP 27 participants. We believe that as a starting point, it will help different stakeholders (eg, food-system actors, sponsors, policy makers, nongovernmental organizations) to recognize the priorities for activities while engaging with the international climate-change agenda.

Pertinent to solutions for an environmentally sound transformation of the food system, there is a need for them to have multi-stakeholders participation, including small-scale food producers, and to be context and place based. Future, neutral, or low carbon foot- and foodprint solutions must also provide for nourishing diversity and having nutrient-dense food locally available, affordable, and income generative. Having a holistic approach to future food policies include systems that contribute to dietary diversification; empower food sovereignty; deliver socioeconomic and environmental co-benefits; empower Indigenous populations, women, and youth; and protect vulnerable populations. These most-frequently cited attributes are going be required for the adaptation of resilient food systems in response to climatic variations.

At the aggregate level, the success of having an efficient transformation of the food system is based on a strong acknowledgment that the climate crisis is without borders and is everyone's business.

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REFERENCES

1. World Economic Forum. The Global Risks Report. 2022. 17th ed. Available at: https://www.weforum.org/reports/global-risks-risk-2022/
2. The State of Food Security and Nutrition in the World 2022. *Repurposing Food and Agricultural Policies to Make Healthy Diets More Affordable*. Rome, Italy: Food and Agriculture Organization; 2022.
3. SDGs. *The Sustainable Development Goals Report 2022*. United Nations; 2022.
4. IPCC. *Climate Change 2022 Impacts, Adaptation and Vulnerability*. Switzerland: IPCC; 2022.
5. Mohd Saad NS, Neik TX, Thomas WJW, et al. Advancing designer crops for climate resilience through an integrated genomics approach. *Curr Opin Plant Biol*. 2022;67:102220.
6. World Food Program. *Global Report on Food Crises*. World Food Program; 2022.
7. International Food Policy Research Institute. *2022 Global Food Policy Report: Climate Change and Food Systems*. International Food Policy Research Institute; 2022.
8. Gautam M, Laborde D, Mamun A, et al. *Repurposing Agricultural Policies and Support: Options to Transform Agriculture and Food Systems to Better Serve the*

Health of People, Economies, and the Planet. The World Bank and International Food Policy Research Institute; 2022.
9. Global Alliance for the Future of Food. Untapped Opportunities for Climate Action: An Assessment of Food Systems in Nationally Determined Contributions. 2022. Available at: https://futureoffood.org/wp-content/uploads/2022/03/assessment-of-food-systems-in-ndcs.pdf
10. UNFCCC. United Nations Framework Convention on Climate Change. 2022.
11. Da Costa NG, Farias G, Wasieleski D, et al. Seven Principles for Seven Generations: Moral Boundaries for Transformational Change. *Humanist Manag J*. 2021;6:313–328. doi: 10.1007/s41463-021-00116-y