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USAID TECHNICAL BRIEF

Climate and Nutrition: A Summary of Evidence and Considerations for Programs

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Climate and its Links to Nutrition

Introduction

This technical brief provides guidance for taking climate issues into consideration when developing and implementing multi-sectoral nutrition programming in support of the U.S. Agency for International Development (USAID) Climate Strategy 2022–2030,[1] USAID Multi-Sectoral Nutrition Strategy 2014–2025,[2] and the U.S. Government Global Food Security Strategy 2022–2026.[3] It is designed for public and private sector practitioners working across areas that impact nutrition—both within and outside USAID—to apply technical guidance to practice.

The brief summarizes USAID's engagement in nutrition and climate strategies, programs, and learning and the current state of evidence on nutrition and climate change. It provides recommendations for evidence-based actions to build climate resilience across food, health, water and sanitation, social protection, and humanitarian response systems. The brief reinforces the importance of identifying contextual needs to prioritize actions that address barriers and support practices most likely to impact nutrition outcomes. Box 1 provides key takeaways of the brief, and Annex 1 provide definitions of terms used in the brief.

Scope of the Problem

Climate change is one of the greatest threats facing the world today and is challenging the ability to achieve the Sustainable Development Goals (SDGs), including SDG1 and SDG2 related to food security and nutrition.[4] Nutrition and climate change are inextricably linked through complex, multi-directional pathways.[5] The climate crisis disproportionately affects the most vulnerable populations such as women and children and poor and rural households, particularly those living in fragile and conflict-affected states.[6,7,8] There is an urgent need to build upon and create opportunities for different sectors to work together to address these challenges.

USAID Engagement in Nutrition and Climate Strategies, Programs, and Learning

The complex, multidimensional impact of climate change on nutrition requires an integrated perspective and coordinated multidisciplinary approach. Across USAID, the Bureau for Resilience, Environment, and Food Security, the Bureau for Global Health, and the Bureau for Humanitarian Assistance have been actively working together to strengthen the evidence base, improve program design and implementation, and support multi-sectoral strategies, action, collaboration, and learning on nutrition and climate change. The USAID Climate Strategy 2022–2030[1] sets an overarching goal to advance equitable and ambitious actions to confront the climate crisis through improved targeting and systems change. Under the strategy, USAID incorporates five foundational principles that impact food and health systems and nutrition as seen in Box 2. Complementing this strategy are several key documents that identify specific objectives, targets, and key actions to safeguard the nutritional status of vulnerable populations in a changing climate: the USAID Multi-Sectoral Nutrition Strategy 2014–2025;[2] USAID Strategic Framework for Early Recovery, Risk Reduction, and Resilience 2022;[9] U.S. Government Global Food Security Strategy 2022–2026;[3] U.S. Government Global Water Strategy 2022–2027;[10] and USAID Position Statement on One Health 2024[11]. As such, every USAID Bureau, Mission, and Operating Unit has a role in mainstreaming climate mitigation and adaptation within nutrition policy and programming to ultimately enhance the resilience of individuals and communities.

BOX 1: KEY TAKEAWAYS

The USAID Climate Strategy 2022–2030 provides a whole-of-Agency approach to leading the response to climate change across sectors.

Climate change threatens to reverse decades of public health progress. The impact of climate change on nutrition requires attention.

Multi-sectoral nutrition programs should be tailored to local contexts and include climate change adaptation and mitigation approaches.

Collaboration is key. Climate and nutrition work requires cross-sectoral partnerships.

BOX 2: FOUNDATIONAL PRINCIPLES OF THE USAID CLIMATE STRATEGY

The USAID Climate Strategy 2022–2030 identifies five foundational principles to guide planning and activities.

Locally Led Development. Sustainable and equitable climate actions should be locally led, owned, and implemented and be tailored and context appropriate.

Equity and Inclusion. USAID will center its actions in the context of the diverse communities in which we work and will engage local, marginalized, and underrepresented groups as agents of change.

Private-Sector Engagement. USAID will partner with the private sector to expand the scale, impact, and sustainability of our programs.

Nature-Based Solutions. USAID will elevate nature-based solutions as key tools to absorb carbon, reduce disaster risk, support livelihoods, and improve food and water security.

Evidence, Technology, and Innovation. USAID will support the rigorous research, technology, and development needed to identify and deploy effective climate solutions, including those locally known and developed.

Findings from a 2023 USAID review of the evidence linking climate and nutrition, as well as discussions with USAID Missions in Bangladesh, Kenya, Madagascar, and Niger, showed that climate variability, hazards, and shocks are increasing risks to the nutritional status of vulnerable populations.[12] The review identified the need for more high-quality evidence on nutrition interventions that specifically address climate change in low- and middle-income countries.[12] These interventions can be better designed to demonstrate how to improve, maintain, and protect nutrition in the face of climate change. Having additional evidence presents an opportunity to fill critical knowledge gaps and further refine strategies for more effective action, including on geographic and population targeting. In addition, a desk review of national climate, health, and nutrition policies in eight USAID nutrition priority countries (Bangladesh, Ethiopia, Ghana, Malawi, Nepal, Nigeria, Tanzania, and Uganda) analyzed Nationally Determined Contributions, National Adaptation Plans, Climate and Health Vulnerability Assessments, National Nutrition Plans, National Health Sector Plans, WHO Country Cooperation Strategies, Food Based Dietary Guidelines, and Food Systems Pathways.[13] The review found that national contributions and plans across health, agriculture, water, and social protection sectors need to better target climate and nutrition actions for vulnerable populations and address the critical need for coordination across sectors.[13]

USAID recognizes the importance of global commitments to build climate resilience for nutrition. International instruments such as the Paris Agreement and others described in Box 3 offer linked approaches to address food security and nutrition in a changing climate. USAID and the global community can leverage the synergies among climate adaptation, disaster risk reduction, and the One Health approach. This holistic perspective ensures that efforts to combat climate change also promote health, nutrition, and resilience, benefiting both current and future generations.

Impact Pathways and Current Evidence

Climate change and climate variability affect nutrition outcomes through multiple pathways,[5] and the impacts may be felt at the system, community, household, and individual levels. Within the literature, several conceptual frameworks describe the interrelated nature of nutrition and climate. Examples of these frameworks are provided in Annex 2. Practitioners can use impact pathways to identify potential program activities for their contexts and potential risks to program impact.

Climate change and climate variability affect nutrition across various systems, including food, health, water and sanitation, social protection, and humanitarian response.[5] More frequent and extreme weather and climate events can shift how both development programming and humanitarian response can be delivered. The evidence of how the combined impacts of climate change and climate variability negatively impact dietary, health, and nutrition outcomes in development and humanitarian contexts is described in the following section.

BOX 3: INTERNATIONAL CLIMATE RECOGNITION AND RESPONSE

The **Paris Agreement**, particularly the Nationally Determined Contributions and The Global Goal on Adaptation, underscores the critical role of various systems in mitigating and adapting to climate change to safeguard nutrition. Agriculture and public health commitments in the Nationally Determined Contributions provide an opportunity for more ambitious actions, for example through creation of climate-resilient food and/or health systems or through prioritized adaptation actions.

The **Sendai Framework for Disaster Risk Reduction 2015–2030** highlights the necessity of reducing vulnerabilities and enhancing preparedness to safeguard food security with increasing climate-related disasters. The framework advocates for resilient agricultural practices and robust food supply chains to withstand and recover from natural hazards.

The **Quadripartite One Health Joint Plan of Action 2022–2025**, a collaborative effort among the World Health Organization, Food and Agriculture Organization, World Organization for Animal Health, and United Nations Environment Programme, recognizes the interdependence of human, animal, and environmental health. The plan emphasizes holistic, integrated policies that address climate change effects on health and nutrition. The One Health approach aims to support climate actions that contribute to healthier populations and ecosystems by promoting sustainable agricultural practices, reducing antimicrobial resistance, and enhancing food safety.

Systems Impacts

FOOD SYSTEM

The increase in agricultural productivity over the past five decades has shaped today's global food system. This plays a dual role in climate and nutrition: it contributes to climate change and is increasingly susceptible to its effects. Data from 2007–2016 suggest that approximately 21–37 percent of total greenhouse gas emissions stem from activities within the food system, including agricultural production, food loss and waste, land and water use, transportation, storage, processing, packaging, retail, and consumption.[14] Consistent estimates using data from 1990–2018 state food system contributions as approximately one third of greenhouse gas emissions.[15] Emissions from food loss and waste contributed approximately half of global food system emissions in 2017.[16] In 2019, research estimated that on-farm emissions were slightly higher than off-farm emissions, though both were approximately the same in 2018.[17,18] These impacts necessitate interventions that will have catalytic impacts in the food system in terms of both diets and climate. In Feed the Future target countries, working in accordance with local ecosystems and contexts, USAID focuses on sustainable production systems that prioritize diversity, food safety, and reduction of food loss and waste. Tackling food loss and waste through both on-farm and off-farm interventions, including improved processing, is a clear priority. Climate-smart agriculture uptake can reduce on-farm emissions while maintaining diverse food production. Innovative food packaging can reduce waste that harms the environment while improving the shelf life of nutritious, safe food.

Climate change can affect diets, food security, and nutritional status by reducing crop yields, increasing food loss and waste, altering nutritional content of foods, increasing food safety risks, and impacting water availability and quality, as well as contributing to shifting pest and disease patterns.[14]

Changes in average weather patterns and extreme weather events, like floods and droughts, negatively impact the amount, quality, variety, and stability of crop yields. Recent research indicates that higher levels of carbon dioxide (CO_2) in the atmosphere will directly and indirectly affect agricultural production quality and quantity. For example, concentrations of important nutrients like zinc, iron, and proteins may decrease in staple crops such as maize, rice, wheat, and soybeans, potentially lowering their nutritional value by an average of 8 percent.[19,20] Furthermore, increased atmospheric CO_2 is expected to reduce yields of major staple crops such as maize, soybeans, and rice by the end of the century, with maize possibly decreasing by as much as 24 percent in worst-case scenarios.[19] Given these changes, it is anticipated that global agricultural production will need to increase 25–70 percent by 2050 to feed the world's population, depending on the crop, modeling assumptions, and geographical factors.[21] However, this estimate does not account for the diversity of production needed to adequately nourish the population.

Climate change has also resulted in an unprecedented rate of change in agrobiodiversity, which includes genetic resources for food and agriculture from plants, animals, forests, and aquatic sources.[22] In particular, climate change affects ecosystem diversity that is required for sustainable food systems, both directly (increases in temperature, and changes in precipitation, water temperature, and sea level) and indirectly (changes the intensity and frequency of wildfires).[23] This limited diversity means that the availability of diverse food crops has and will continue to fall short of dietary needs.

Growing evidence suggests that climate-driven changes in the environment will lead to an increased burden of food-borne diseases and increased food loss and waste during food production and across the agricultural supply chain.[24] Different crops respond differently to temperature changes, but when temperatures exceed their optimal range, it can harm plant growth, pollination, and reproduction, leading to changes in microbial communities, plant and animal health, and the susceptibility of hosts to diseases and pests.[25,26] This could lead to new diseases emerging, the spread of existing ones, and changes in their intensity, all of which can impact food-borne illnesses that spread from animals to humans (zoonoses).[27] Climate change can also impact food contamination and food safety beyond production, with the potential for increasing pathogens risking safe food processing and storage.[27] Research indicates that the broad effects of climatic hazards on land and marine food supply and reduced concentration of nutrients in crops can lead to malnutrition, which can increase the risk of disease outbreaks in food-deprived populations.[28]

HEALTH SYSTEM

A changing climate threatens the access, affordability, quality, and continuity of essential health and nutrition services provided through health care facilities and by community health workers due to more frequent and severe extreme weather events.[29] Additionally, climate effects on food-, water-, vector-borne and zoonotic diseases, extreme heat exposure, and poor air quality cause negative health impacts across the life course and can exhaust health system resources.[29] Extreme weather events that damage infrastructure can compromise the ability of health systems to deliver essential services, which can weaken service provision, require populations to seek health care elsewhere, and overwhelm health care system capacity, leading to public health emergencies.[29]

Like food systems, health systems have a carbon footprint, contributing 4–5 percent to global greenhouse gas emissions, largely from direct power consumption and materials.[30,31] However, due to limited financial, institutional, or technological capacity, countries most vulnerable to climate impacts also face the most adaptation challenges.[32] Currently, no health system is completely climate resilient or fully decarbonized, although globally, some health systems are advancing towards these aims.[33]

WATER AND SANITATION SYSTEM

Climate change disrupts water systems by altering the timing, location, and intensity of precipitation, and it exacerbates extreme weather events over time, resulting in a less dependable water system. As temperatures increase, freshwater glaciers begin to melt at a rapid rate along with more evaporation, resulting in higher atmospheric water vapor levels and more frequent, intense rainfall.[34] Scientists predict that these changes will increase the frequency of flooding, as land systems cannot absorb the excess precipitation, especially if the infrastructure is lacking or inadequate to support overflow. The increase in stormwater runoff carries contaminants, including heavy metals and pesticides, which pollute lakes and oceans.[35]

Poor water, sanitation, and hygiene may impact nutrition through five pathways: (1) repeated episodes of diarrhea; (2) poor gut health; (3) repeated protozoa and helminth infections; (4) anemia; and (5) significant time and cost spent accessing water and services.[36] Climate-related shifts can also impact the availability and quality of water and sanitation. Additionally, higher temperatures shift geographical and seasonal distribution of pathogens.[37,38] However, there is uncertainty on which pathogenic diseases (e.g., bacteria, viruses, fungi, protozoa) and transmission types (e.g., vector-borne, water-borne, airborne, direct contact) will exacerbate malnutrition, particularly in children and women. The risk of numerous climatic hazards and various pathogens could aggravate human pathogenic diseases, with possible negative implications for nutrition, especially among poor households who may lack adequate sanitation and safe water supplies.[28]

SOCIAL PROTECTION SYSTEM

Climate change and variability threaten to reverse progress on poverty reduction and increase pressure on stretched social protection programs as more people are pushed into poverty.[39] According to a report from UN Women, by 2050, climate change may lead to 158 million more women and girls experiencing poverty and 236 million more facing food insecurity.[40] The climate crisis fuels geographic inequalities, conflict, migration, and exclusionary laws and norms targeting vulnerable groups such as women and refugees.[40]

Social protection programs play a crucial role in helping individuals adjust to and manage climate-related challenges by offering benefits like income security, food security, access to health and nutrition services, and water security.[41] They can be designed to support families, workers, and businesses during the green transition as livelihoods may shift due to a changing climate, which can promote more sustainable agricultural, economic, and dietary practices.[41]

HUMANITARIAN RESPONSE

Climate-related disasters increase vulnerability, contribute to displacement of vulnerable populations, and drive humanitarian crises. In 2023, the Emergency Events Database recorded a total of 399 disasters related to natural hazards.[42] In the same year, 12 of the 15 countries most vulnerable to the climate crisis had an internationally led humanitarian response. Importantly, the precise increase in humanitarian needs due to extreme weather or climate events is unclear. Three-quarters of all people in need of humanitarian assistance may face a combination of climate vulnerability with conflict or socioeconomic vulnerability.[43] In addition, the specific and combined nutrition impact of climate change on individuals and communities already affected by crises such as war, famine, and epidemics is absent in much of the literature.[44] These communities require special considerations in terms of their nutrition risk profiles (e.g., high rates of maternal and child mortality; food and/or nutrition insecurity; lack of access to improved water, sanitation, and hygiene; exposure to communicable diseases; experience of physical and/or psychological trauma, including gender-based violence; and lack of access to care for non-communicable diseases).[44] More action is needed to identify hotspots where people may be most impacted by the climate crisis and at risk for malnutrition in emergencies. While there is no standard definition of what constitutes climate risk at a national or subnational level, several indices have been developed to describe and rank climate risk at a national level, including INFORM Climate Change,[45] Notre Dame Global Adaptation Initiative,[46] and the UNICEF Child Climate Risk Index.[47] These indices are built on different indicators and reflect different elements of risk and impact.

Extreme weather or climate events not only increase humanitarian needs as the number of shocks increases, but also hinder response, impact supply routes, increase displacement, and raise commodity prices. Current systems to identify, anticipate, and guide surge responses were built on data that may not support appropriate decision making in a more variable climate. There are also emerging threats, such as heatwaves and increased disease outbreaks, for which traditional nutrition coordination and response actions have fallen short.[48]

Nutrition Impacts among Women and Children

Evidence on the relationship between climate change and climate variability and nutritional outcomes, including stunting, wasting, micronutrient deficiencies, and other conditions related to malnutrition such as malaria and diarrhea, have largely been drawn from studies that observed populations over shorter time scales (less than 5 years). Considering the complex relationship between climate and nutrition, establishing and validating causal pathways and quantifying the proportion of malnutrition due to a changing climate over the long term remains challenging.[49] This section summarizes existing evidence on pregnant and lactating women and children to highlight considerations for programming that aims to improve nutritional outcomes among these groups. Box 4 highlights gender-specific nutrition impacts of climate change and key United States Government efforts to empower women and girls.

PREGNANT AND LACTATING WOMEN

Exposure to extreme heat has been linked to obstetric complications, gestational hypertension, gestational diabetes, and birth outcomes such as preterm birth, stillbirth, and miscarriage.[50-53] Findings demonstrate the impacts of heat stress on pregnancies and fetal development, including the increased odds of stillbirth and preterm birth.[54] An evidence gap exists on the timing and underlying mechanisms of heat exposure during pregnancy that can cause

BOX 4: PRIORITIZING GENDER

Current evidence suggests that climate change disproportionately impacts the nutritional status of women and girls and threatens to widen gender-based health disparities, especially in low- and middle-income countries.[6] These effects may be seen through increases in food insecurity, decreased income security in the agriculture sector[5], and limited access to reproductive, health, and nutrition services.[8] To empower women and girls through its investments, the United States has integrated cross-cutting climate action and gender equality priorities into strategies, policies, and initiatives. Addressing gender and climate change is a priority of the U.S. National Strategy on Gender Equity and Equality (strategic priority 8), the U.S. Strategy to Prevent and Respond to Gender-Based Violence Globally (objective 2.7), and the Gender Equity and Equality Action (GEEA) Fund. The U.S. Strategy on Global Women's Economic Security recognizes climate change as a context-setting factor, while the Women, Peace, and Security Act of 2017 and U.S. Strategy on Women, Peace, and Security seek to integrate women into conflict and disaster prevention, preparedness, and response. The President's Emergency Plan for Adaptation and Resilience gathers 19 federal agencies to advance adaptation in climate-vulnerable countries and address long-standing climate challenges that disproportionately affect women and others who have historically been excluded. Other relevant policy frameworks and initiatives include but are not limited to: the Adaptation Communication of the United States, Global Fragility Act, U.S. Strategy to Prevent Conflict and Promote Stability, Partnership for Global Infrastructure and Investment, U.S. Government Global Food Security Strategy, U.S. Global Water Strategy, and the White House Action Plan on Global Water Security.

associated risks. Future research is needed to inform clinical and public health strategies to manage heat-related risks and reduce impacts on pregnant women. Among lactating women, some evidence suggests that exclusive breastfeeding practices may be negatively impacted by heat stress.[55]

CHILDREN

Studies have demonstrated a strong correlation between droughts or low precipitation and child stunting (low height-for-age) in Africa[56-62] and Asia.[63-66] A similar effect of precipitation deficits has been observed in studies on weight-for-age, weight-for-height, and infant mortality.[65]

Evidence on the exposure to flooding and child undernutrition remains limited, with stunting the most frequently reported form of undernutrition and the majority of low- and middle-income country evidence from South Asia.[67,68] Changes in precipitation may affect child nutrition through agricultural production,[69] spread of infectious diseases such as malaria[70] and diarrhea,[71] and a lack of safe drinking water. A recent study pooled evidence from surveys conducted by the Demographic and Health Surveys Program in 43 low- and middle-income countries from 2009 through 2019.[71] The study examined diarrhea risk in children under five years in all households from each survey cluster. Findings suggest that exposure to floods was associated with increased diarrhea risk, especially with extreme floods or those lasting more than two weeks.[71]

In addition to changing precipitation, a growing evidence base suggests that exposure to heat stress results in vulnerability of children due to poorer biological resilience (e.g., higher heat production, lower levels of sweating, underdeveloped physiological systems) and social and behavioral factors (e.g., poverty, lack of basic services, lack of fluid replenishment during physical activity).[72] Exposure to elevated ambient temperatures results in a range of immediate health issues in children, including dehydration and heat exhaustion, and higher incidences of vector-borne and diarrheal diseases. This ultimately contributes to a significantly elevated risk of mortality in children under five years, especially neonates exposed to high temperatures.[73] Prolonged exposure to excessive heat can also negatively impact fetal development, resulting in lower birthweight and affecting other gestational conditions, potentially impacting nutritional status.[72]

Although there is better understanding of the mortality and immediate health consequences of heat exposure, the effects of heat on child growth and development remain relatively unexplored, particularly in low-income and lower-middle income countries. The impact of heat on child development is expected to vary depending on the duration of exposure. In the short term, ranging from days to weeks, high temperatures can directly affect a child's ability to maintain their nutritional intake due to factors like reduced appetite, increased dehydration, or more frequent diarrhea. This leads to poor absorption of

nutrients, potentially resulting in acute malnutrition.[74] Reduced crop yields can lead to insufficient household access to food or financial resources to sustain consumption and potential reduction of food intake. Prolonged nutritional deficiencies can lead to chronic malnutrition and stunted growth,[75] making children more susceptible to diseases like malaria and respiratory and intestinal infections, ultimately increasing the risk of mortality.

Climate change is widely anticipated to negatively affect both food security and dietary diversity.[76,77] Notably, there is a lack of evidence on how climate variability affects dietary diversity of children, although one study found that higher temperatures consistently correlated with poorer child dietary diversity in South America, Africa, and Asia.[76] Global food security assessments typically use four main metrics to assess impacts: food demand, populations at risk of hunger, food prices, and childhood undernutrition. These studies often yield widely varying results that are difficult to compare due to differences in methods, assumptions, and definitions of food security, thus limiting further understanding of potential climate effects on diet diversity among children. A comprehensive review of 57 studies modeling various socioeconomic and climate scenario pathways indicates that populations at risk of hunger are expected to fluctuate significantly between 2010 and 2050, ranging from a 91 percent decrease to a 30 percent increase, especially when considering the impacts of climate change.[78]

Less is known about how child micronutrient status will be impacted. An epidemiological investigation in 26 sub-Saharan African countries demonstrated that an increased risk of childhood anemia is associated with higher ambient temperature.[79] The authors suggest that the relationship between high annual mean temperature and childhood anemia is potentially mediated by factors such as childhood malnutrition and malaria infection.[79] Their study provides the first projection on the future burden of childhood anemia posed by global warming in sub-Saharan Africa. It illustrates significant regional disparities and highest burden in Central Africa, followed by Western Africa and Eastern Africa. In addition to higher temperatures, evidence suggests that droughts negatively impact consumption of calories and essential micronutrients such as vitamin A.[80,81] Future research is required to support these findings, given drivers of anemia are multi-factorial in nature.

A Systems Approach for Protecting Nutrition in a Changing Climate

The dynamic relationship between climate change and nutrition requires a multi-system and multi-sectoral lens across contexts to identify "what works." Systems thinking and systems practice are required to strengthen resilience and protect nutrition. Systems thinking refers to a set of analytic approaches and tools that seek to understand how systems behave, interact with their environments, and influence each other, thus prioritizing understanding of interactions among system elements for understanding actions and outcomes.[82] Systems practice applies this thinking throughout program design, implementation, monitoring, evaluation, and adaptation.[82] For nutrition and climate policies and programs, this means that a shared understanding of problems is required to develop solutions that are contextually appropriate, effective, and locally led and owned. A transparent and deliberative process can help identify political and material risks, improve communication between decision makers and the public, and give agency to socially and economically marginalized groups. Programs that address climate risks for nutrition and minimize unintended consequences can benefit from convening stakeholders from multiple technical sectors, local community-based civil society organizations, non-governmental organizations, government ministries, and academia. Coordination among sectors is key for multi-sectoral programs that consider climate issues while aiming to improve nutrition. The USAID Multi-Sectoral Nutrition Strategy provides examples of actions for multi-sectoral nutrition coordination and collaboration; climate issues should be incorporated into these types of actions.[2] Programs can plan for various types of collaboration based on their needs and ensure monitoring and measurement of collaboration occur to help prioritize efforts, improve accountability, monitor progress, and adapt efforts as needed.[83]

The humanitarian-development-peace nexus approach is critical to develop risk-informed programming capable of responding to shocks and stressors.[84] Poverty and inadequate preparedness amplify the effects of climate-related disasters, while development efforts are regularly compromised by the consequences of recurrent climate-related disasters.[85] Using a systems approach can bring together development and humanitarian actors to design actions for prevention and preparedness, as well as response and recovery.

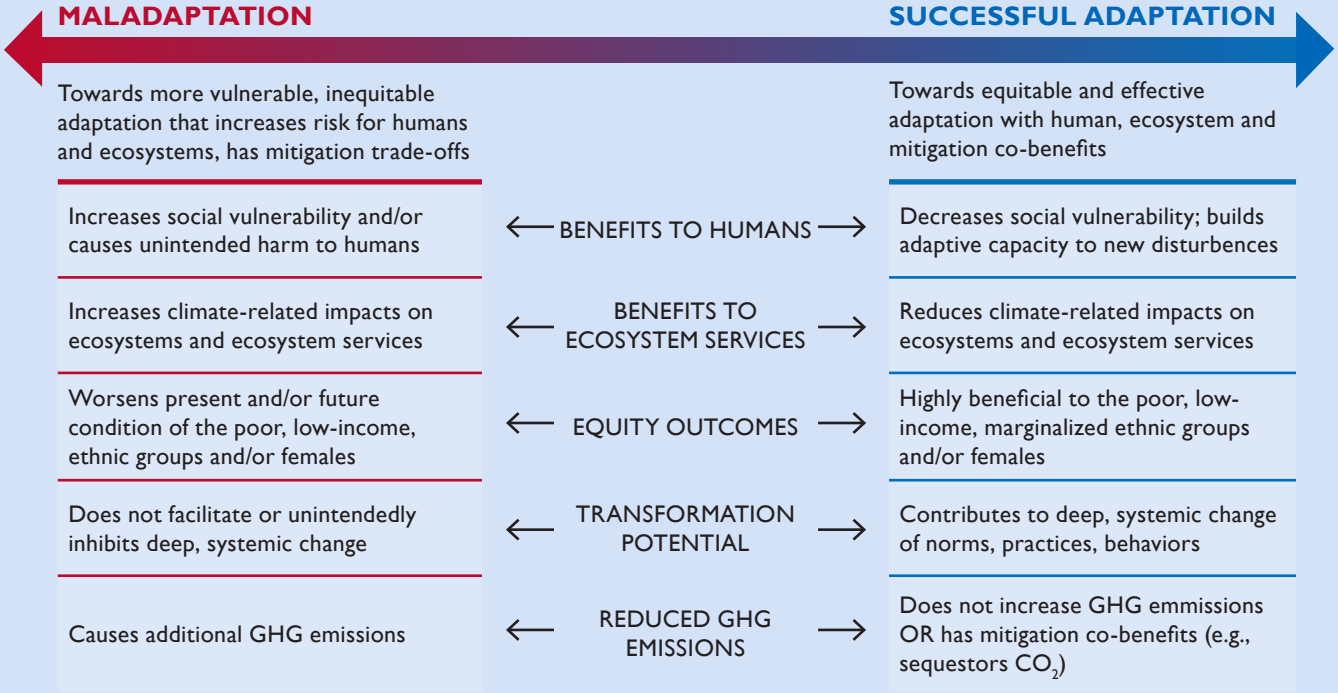
Illustrative Actions

Integrating climate change considerations into development and humanitarian multi-sectoral nutrition policies and programs does not require completely new approaches.[29] Practitioners can assess existing policies and programs and potential climate impacts in their context to identify climate adaptation and mitigation opportunities. The following section provides illustrative actions that nutrition and climate stakeholders working in food, health, social protection, and water systems can take to enhance climate resilience and protect nutrition drawing from existing multi-sectoral strategies, policies, and plans. Actions must be coupled with monitoring of implementation progress and overall outcomes. Practitioners should select appropriate measurement approaches and indicators to monitor progress and identify changes in intended effects.

The multidimensional relationship between climate and nutrition requires integrated efforts, which may necessitate coordinated actions across sectors as described.[13] Additionally, fostering knowledge exchange between the United States and partner countries on policy and innovative practices is critical to building resilience against climate impacts on nutrition.

Across all systems and sectors, including those that impact nutrition outcomes, adapting to climate change is increasing globally. The inclusion of justice (distributive, recognitional, relational, procedural, intergenerational, and transformative) in adaptation policies and programming is uneven and insufficient, leaving marginalized communities more vulnerable and limiting the effectiveness of long-term, equitable climate solutions[87] (Figure 1). Governments, civil society, and the private sector must make inclusive development choices that prioritize risk reduction, equity, and justice to promote climate-resilient development and avoid maladaptation. All partners must ensure decision making and actions are integrated across governance levels, sectors, and timeframes.

FIGURE 1: INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE (IPCC) ADAPTATION AND MALADAPTATION CONTINUUM



Source: Figure 17.10 in New, M., D. Reckien, D. Viner, C. Adler, S.-M. Cheong, C. Conde, A. Constable, E. Coughlan de Perez, A. Lammel, R. Mechler, B. Orlove, and W. Solecki, 2022: Decision-Making Options for Managing Risk. In: Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [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.)]. Cambridge University Press, Cambridge, UK and New York, NY, USA, pp. 2539–2654, doi:10.1017/9781009325844.026.

Transformative actions across systems are required to protect nutrition in a changing climate. Below are summaries of why integrating climate change considerations into development and humanitarian multi-sectoral nutrition policies and programs are critical to ensure we continue to make progress to reduce malnutrition. Practitioners can use the illustrative actions in the table to spark ideas that best fit their contexts.

Food systems. Transforming food systems to provide healthy diets and be resilient, equitable, and sustainable is critical and urgent. More efficient food systems are necessary for alleviating poverty, meeting the world's food and nutrition needs, and shrinking agriculture's environmental impact. Long-term food security and optimal nutrition require that all aspects of the food system can adapt to a warming planet while reducing global emissions.

Health systems. Health systems require capacity to protect and improve nutrition in an unstable and changing climate. Health care facilities should be equipped to be environmentally sustainable by optimizing the use of resources and minimizing the release of waste into the environment. A health system that is climate-resilient requires building blocks—leadership and governance, health workforce, health information systems, essential medical products and technologies, service delivery and financing—that are individually climate resilient.

Social protection systems. Building climate resilience helps people, households, communities, systems, and countries mitigate risk and manage shocks and stresses without compromising their food security, nutrition, livelihoods, and well-being. Core to social protection programming is strengthening linkages among development, humanitarian, and peace programs to foster transitions out of poverty and toward sustainable and productive livelihoods to reduce humanitarian need.

Water systems. To achieve universal access to water, sanitation, and hygiene for all people, health care facilities, and schools by 2030, as targeted by Sustainable Development Goal 6 (SDG 6), the pace of progress to extend services globally must at least quadruple, and must accelerate by between four and seven times in the countries where USAID works. Even without the climate crisis, pandemics, and other global shocks, achieving this will require transformational change. Lasting solutions require coordinated, multilateral actions and multi-stakeholder partnerships and strong local leadership and political will.

Humanitarian response. Early recovery, risk reduction, and resilience activities are a critical means for supporting the most vulnerable households and communities and reinforcing national systems to strengthen resilience and disaster response, thus reducing the future need for humanitarian assistance. Humanitarian nutrition activities save lives and protect nutritional status of vulnerable populations affected by humanitarian crises by strengthening preparedness, response, and recovery through multi-sectoral actions to prevent and treat malnutrition.

TABLE OF ILLUSTRATIVE ACTIONS ACROSS SYSTEMS

System	Illustrative actions
 **Food**	Invest in improved agricultural techniques (e.g., more productive pest-resistant and drought-resistant varieties) that safely and sustainably increase production and consumption of nutrient-dense foods[2]
	Build local and national capacity in climate-smart inputs, services, and practices for crops, aquaculture, animal husbandry, and processing, including on- and off-farm food safety practices[3]
	Increase improved natural resources and water management, land use planning, and tenure security, particularly for women's access to and ownership of land[3]
	Support research on nutrition-sensitive agriculture approaches and outcomes to account for climate change[1]
 **Health**	Mainstream a One Health approach throughout national policy, strategies and plans[1]
	Improve the governance, financing, and workforce flexibility of health systems to deliver nutrition interventions through impacts of climate change[1]
	Increase the availability, timeliness, and utilization of data on nutrition risks from climate change and geographical and individual vulnerabilities[5]
	Make health systems resilient to climate impacts and reduce their environmental footprint through sustainable land use, green and low-carbon building design, safe and sustainable purchases of materials and products, and use of efficient and low-carbon technologies to provide care (e.g., telemedicine, renewable energies, and emergency power generation)[86]
 **Social protection**	Build the capacity of communities and governments to develop and manage community- and national-level risk management and early warning and monitoring systems to track changes in food security, nutrition, coping mechanisms, seasonal weather, and climate change data[3]
	Strengthen the design and implementation of nutrition-sensitive shock-responsive social protection systems linked to longer-term development programs to facilitate more efficient and effective response and recovery[3]
	Strengthen community services to support vulnerable individuals and families, including employment, income generation, microfinance, enterprise development, and child care and development[2]
	Support the use of conditional cash and food transfers, and other assistance such as cash/food assets, food vouchers, and support for inputs such as vegetable seeds and small livestock for ultra- poor and highly vulnerable groups in times of humanitarian disaster[2]
 **Water**	Strengthen institutional capacities to integrate adaptive management principles, strategies, and technologies into planning frameworks for data-driven governance of water resource availability in the face of water security hazards and uncertainty[10]
	Support the development, innovation, and scaling of viable drinking water service models, especially for low-income or marginalized populations[10]
	Strengthen water safety, quality, and quantity monitoring systems and increase the capacity of community service providers, local leaders, and institutions for analyzing and using climate and weather data in decision making to manage climate-related risks[10]
	Provide technical assistance to national, regional, and local governments to incorporate climate risks into water security policies and plans, including flood and drought risk assessments and maps[10]

TABLE CONTINUED

System	Illustrative actions
 **Humanitarian Response**	Support the capacities across sectors to prepare for, adapt, and respond to nutrition in emergencies for effective climate crisis action, including modifying programming to address potential interruptions in services due to extreme weather events[48]
	Promote a common climate and nutrition risk analysis through collaboration with development nutrition actors that incorporates nutrition in emergencies and the climate crisis to aid humanitarian initiatives (e.g., disaster risk management, Humanitarian Response Plans) and development initiatives (e.g., multi-sectoral nutrition plans)[48]
	Apply a climate lens throughout the Humanitarian Programme Cycle for nutrition and nutrition-related sectors/clusters[44]
	Support application and learning for available tools and initiatives to better anticipate, prepare for, and mitigate climate crisis-related risks, for example, through health system surge, Anticipatory Action, and emergency response preparedness[48]

Conclusions

Evidence on the systemic and human impacts of climate change and variability on food security, diet quality, and nutrition is mounting globally. The impacts of climate change are likely to be most severe for populations, communities, and households who are least capable of adapting to them, namely women, children, and those living in rural and developing economies.

Accurately assessing the attribution, extent, and severity of nutrition risks due to climate change remains difficult. Future research should focus on quantifying system impacts beyond the food system to understand the true effects on nutrition. In addition, future research must consider spatial and temporal patterns, including compounding extreme weather events on all population groups, especially women of reproductive age and pregnant and lactating women, to understand sub-national nuances and inform targeting of interventions. Multi-sectoral nutrition policies and programs require evidence to develop short- and long-term approaches to protecting nutrition in a changing climate.

Practitioners working on multi-sectoral nutrition policies and programs must consider the potential impacts of climate change to achieve effective results. Engaging local perspectives, particularly those of marginalized groups, is critical when planning, designing, implementing, monitoring, and evaluating nutrition interventions in a changing climate. To achieve the Sustainable Development Goals of optimal food and nutrition security, the future of climate and nutrition initiatives must be driven by collaboration and equity, ensuring that all systems, sectors, and stakeholders contribute to a shared vision of mitigation and adaptation.

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Annex 1: Definitions

Definitions sourced from the Intergovernmental Panel on Climate Change (IPCC) except where noted.

TERM	DEFINITION
Adaptation	In human systems, adaptation is the process of adjustment to actual or expected climate and its effects, in order to moderate harm or exploit beneficial opportunities. In natural systems, it is the process of adjustment to actual climate and its effects; human intervention may facilitate adjustment to expected climate and its effects.
Adaptation, incremental	Adaptation that maintains the essence and integrity of a system or process at a given scale is considered incremental adaptation.
Adaptation, transformational	Adaptation that changes the fundamental attributes of a socio-ecological system in anticipation of climate change and its impacts is considered transformational adaptation.
Adaptive capacity	Adaptive capacity is the ability of systems, institutions, humans and other organisms to adjust to potential damage, to take advantage of opportunities, or to respond to consequences.
Climate	Climate in a narrow sense is usually defined as the average weather, or more rigorously, as the statistical description in terms of the mean and variability of relevant quantities over a period of time ranging from months to thousands or millions of years. The classical period for averaging these variables is 30 years, as defined by the World Meteorological Organization. The relevant quantities are most often surface variables such as temperature, precipitation, and wind. Climate in a wider sense is the state, including a statistical description, of the climate system.
Climate change	Climate change refers to a change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forcings such as modulations of the solar cycles, volcanic eruptions, and persistent anthropogenic changes in the composition of the atmosphere or in land use. Note that the Framework Convention on Climate Change (UNFCCC), in its Article 1, defines climate change as: "a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods." The UNFCCC thus makes a distinction between climate change attributable to human activities altering the atmospheric composition and climate variability attributable to natural causes.
Climate justice	Climate justice links development and human rights to achieve a human-centred approach to addressing climate change, safeguarding the rights of the most vulnerable people, and sharing the burdens and benefits of climate change and its impacts equitably and fairly.
Climate variability	Climate variability refers to the natural variations and fluctuations in the earth's climate system over various time scales. It encompasses changes in temperature, precipitation, wind patterns, and other climate elements that can occur over short-term or long-term periods. Climate variability can be influenced by various factors, including natural processes such as volcanic eruptions, solar radiation, and ocean currents, as well as human activities like the emission of greenhouse gases.
Climate-resilient development pathways	Climate-resilient development pathways are trajectories that strengthen sustainable development and efforts to eradicate poverty and reduce inequalities while promoting fair and cross-scalar adaptation to and resilience in a changing climate. They raise the ethics, equity, and feasibility aspects of the deep societal transformation needed to drastically reduce emissions to limit global warming (e.g., to 1.5°C) and achieve desirable and liveable futures and well-being for all.
Climate sensitivity	Climate sensitivity refers to the change in the annual global mean surface temperature in response to a change in the atmospheric CO_2 concentration or other radiative forcing.

TERM	DEFINITION
Climate-smart agriculture[a]	Climate-smart agriculture (CSA) is an approach that helps to guide actions needed to transform and reorient agricultural systems to effectively support development and ensure food security in a changing climate. CSA aims to tackle three main objectives: sustainably increasing agricultural productivity and incomes, adapting and building resilience to climate change, and reducing and/or removing greenhouse gas emissions, where possible.
Co-benefits	Co-benefits are the positive effects that a policy or measure aimed at one objective might have on other objectives, thereby increasing the total benefits for society or the environment. Co-benefits are often subject to uncertainty and depend on local circumstances and implementation practices, among other factors. Co-benefits are also referred to as ancillary benefits.
Extreme event (weather or climate)	An extreme weather event is an event that is rare at a particular place and time of year. Definitions of rare vary, but an extreme weather event would normally be as rare as or rarer than the 10th or 90th percentile of a probability density function estimated from observations. By definition, the characteristics of what is called extreme weather may vary from place to place in an absolute sense. When a pattern of extreme weather persists for some time, such as a season, it may be classed as an extreme climate event, especially if it yields an average or total that is itself extreme (e.g., drought or heavy rainfall over a season).
Extreme event attribution[b]	Extreme event attribution is the science of determining what caused a given extreme weather or climate event and weighting the relative influence of global warming versus natural variability.
Global warming	Global warming is the estimated increase in global mean surface temperature (GMST) averaged over a 30-year period, or the 30-year period centered on a particular year or decade, expressed relative to pre-industrial levels unless otherwise specified. For 30-year periods that span past and future years, the current multi-decadal warming trend is assumed to continue.
Maladaptation	Maladaptations are any changes in natural or human systems that inadvertently increase vulnerability to climatic stimuli; an adaptation that does not succeed in reducing vulnerability but increases it instead.
Mitigation	A human intervention to reduce emissions or enhance the sinks of greenhouse gases is considered mitigation.
Net zero emissions	Net zero emissions are achieved when anthropogenic emissions of greenhouse gases to the atmosphere are balanced by anthropogenic removals over a specified period. Where multiple greenhouse gases are involved, the quantification of net zero emissions depends on the climate metric chosen to compare emissions of different gases (such as global warming potential, global temperature change potential, and others, as well as the chosen time horizon).
Resilience	Resilience is the capacity of social, economic, and environmental systems to cope with a hazardous event or trend or disturbance, responding or reorganizing in ways that maintain their essential function, identity, and structure while also maintaining the capacity for adaptation, learning, and transformation.
Transformation pathways	Transformational pathways are trajectories describing consistent sets of possible futures of greenhouse gas emissions, atmospheric concentrations, or global mean surface temperatures implied from mitigation and adaptation actions associated with a set of broad and irreversible economic, technological, societal, and behavioural changes. This can encompass changes in the way energy and infrastructure are used and produced, natural resources are managed, and institutions are set up, and in the pace and direction of technological change.

[a] As defined by the Food and Agriculture Organization of the United Nations.

[b] As defined by the National Aeronautics and Space Administration.

Annex 2: Further Resources on Climate and Nutrition

INITIATIVES

Initiative on Climate Action and Nutrition (I-CAN):
https://www.gainhealth.org/sites/default/files/publications/documents/Accelerating-Action-and-Opening-Opportunities-A-Closer-Integration-of-Climate-and-Nutrition.pdf

Gender, Climate Change and Nutrition Integration Initiative (GCAN):
https://gcan.ifpri.info/

DASHBOARDS AND TOOLS

Global Climate and Health Alliance. 2023 Healthy NDC Scorecard:
https://climateandhealthalliance.org/initiatives/healthy-ndcs/ndc-scorecards/

Lancet Climate and Health Dashboard:
https://lancetcountdown.org/explore-our-data/

ND GAIN Global Adaptation Initiative:
https://gain.nd.edu/our-work/country-index/

The Climate Health and Risk Tool:
https://climatesmarthealth.org/

UNICEF Children's Climate Risk Index:
https://data.unicef.org/resources/childrens-climate-risk-index-report/

GLOBAL REPORTS

FAO. 2019. The State of the World's Biodiversity for Food and Agriculture. J. Bélanger & D. Pilling (eds.). FAO Commission on Genetic Resources for Food and Agriculture Assessments. Rome.

FAO. 2021. Climate Change, Biodiversity and Nutrition Nexus – Evidence and Emerging Policy and Programming Opportunities. Rome.

International Food Policy Research Institute. 2022. 2022 Global Food Policy Report: Climate Change and Food Systems. Washington, DC: International Food Policy Research Institute. https://doi.org/10.2499/9780896294257

Romanello M, di Napoli C, Green C, Kennard H, Lampard P, Scamman D, et al. The 2023 report of the Lancet Countdown on health and climate change: the imperative for a health-centered response in a world facing irreversible harms. *The Lancet*. 2023;402(10419):2346-94.

Ruggeri Laderchi C, Lotze-Campen H, DeClerck F, Bodirsky BL, Collignon Q, Crawford MS, et al. (2024). The Economics of the Food System Transformation. Food System Economics Commission (FSEC), Global Policy Report.

Swinburn BA, Kraak VI, Allender S, Atkins VJ, Baker PI, Bogard JR, et al. The Global Syndemic of Obesity, Undernutrition, and Climate Change: The Lancet Commission Report. *The Lancet*. 2019;393(10173):791-846.

Willett W, Rockström J, Loken B, Springmann M, Lang T, Vermeulen S, et al. Food in the Anthropocene: The EAT Lancet Commission on Healthy Diets from Sustainable Food Systems. *The Lancet*. 2019;393(10170):447-92.

NUTRITION AND CLIMATE CONCEPTUAL FRAMEWORKS

IPCC Climate and Health Framework
https://www.ipcc.ch/site/assets/uploads/2018/02/WGIIAR5-Chap11_FINAL.pdf

Global Nutrition Report Climate and Malnutrition Framework
https://media.globalnutritionreport.org/documents/english_15.pdf

Climate Change Impacts on Nutrition through Food Systems
https://www.annualreviews.org/content/journals/10.1146/annurev-publhealth-031816-044356

WHO Climate and Nutrition Security Framework
https://iris.who.int/bitstream/handle/10665/325751/9789241515566-eng.pdf?sequence=1

Climate Change, Equity and Nutrition Framework
https://wires.onlinelibrary.wiley.com/doi/epdf/10.1002/wcc.696