State of evidence on link of climate–nutrition in relation to food systems

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What is the Micronutrient Forum?

The Micronutrient Forum is the central global platform for evidence, collaboration, and advocacy to improve micronutrient health.
1. The climate change and nutrition crises are intertwined with substantial consequences for future nutrition, health, development and social capital

2. Limited evidence suggests that pathways are complex, bi-directional and highly context specific

3. Solutions require holistic and context-specific approaches across agro-food, water, health and social protection systems

4. Evidence for policy is needed
   1. Lack of inclusion of nutrition objectives in climate plans or climate objectives in nutrition plans
   2. Consensus is needed on the current state of the evidence and for prioritized evidence gaps
The climate and nutrition crises are intertwined

with substantial consequences for future nutrition, health, development and human capital
Negative impacts coincide geographically

Share of population that cannot afford a healthy diet, 2021

Effects of climate change on agricultural productivity

An estimated three billion people suffer from micronutrient deficiencies

Productivity declines mean lower food availability, higher prices, lower incomes for farm families

Source: Ritchie & Roser 202.
Extreme heat and drought increase food insecurity

Compared with 1981–2010, the higher frequency of heatwave days and drought months were associated with **127 million more people** reporting experiencing moderate or severe food insecurity in 2021.

Even if temperature rise is limited to 2°C, **525 million** additional people could experience moderate or severe food insecurity linked to heatwaves by mid-century.

Source: Romanello et al. 2023
Leading to soaring hunger and malnutrition figures

122 million more people pushed into hunger since 2019 due to multiple crises, reveals UN report

Latest research shows around 735 million people currently facing hunger, compared to 613 million in 2019

Sources: FAO 2023a; WHO 2023
Increasing poverty and human capital loss

Climate change will drive an estimated 68 to 135 million additional people into poverty by 2030.

Loss of livelihoods, displacement, and reduced access to services contribute to furthering social inequalities and eroding human capital.

Sources: World Bank 2020; World Bank 2023; FAO 2024
Limited evidence suggests that pathways are complex, bi-directional and highly context specific
Climate change negatively impacts nutrition

<table>
<thead>
<tr>
<th>Impact</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>↓ nutrient content</td>
<td>Climate change—higher temperatures, atmospheric carbon dioxide, and ground-level ozone, among other factors—will reduce the nutrient value of many nutritious crops as well as staple crops and animal source foods.</td>
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<tr>
<td>↓ food availability</td>
<td>An increasing number of extreme weather events—including droughts, floods, heat waves, and storms—are reducing yields and pushing down food production.</td>
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<tr>
<td>↓ food diversity</td>
<td>Climate change is decreasing the number and diversity of pollinators, which are essential for production of nutritious foods like fruits, vegetables, nuts, and seeds.</td>
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<tr>
<td>↓ food quality</td>
<td>Rising sea levels will threaten agricultural land coastal zone and reduce rice production in the low-elevation.</td>
</tr>
<tr>
<td>↑ nutrient needs</td>
<td>Ocean and freshwater warming, ocean hypoxia, destruction of coral reefs, and loss of mangrove forests are reducing ocean and inland fisheries catch.</td>
</tr>
</tbody>
</table>

Sources: Micronutrient Forum 2022; Owino et al. 2022
Rising CO₂ levels will likely cause plants to lose nutritional value

- Under rising CO₂ levels, many food crops have iron and zinc contents that are reduced by 3-17% compared with current conditions
- Elevated CO₂ could cause an additional 175 million people to be zinc deficient
- 1.4 billion women of childbearing age and children under 5 live in countries with greater than 20% of anemia prevalence and would lose >4% of dietary iron

Source: Smith & Myers 2018
And increases the risk of infectious diseases

Climate change is altering the environmental distribution of food, water, air, and vector-borne infectious diseases – many of which threaten nutrient utilization.

In 2022, a record 10% of the global coastline showed conditions suitable for vibrio transmission (12.7% more than in 1982–2010), putting 1·4 billion people at risk, and leading to a record 610,000 estimated vibriosis cases.

Source: Romanello et al. 2023
Interactions between food, health, water and social protection systems mediate climate change and nutrition linkages

Climate
- GHG emissions
- Extreme weather events
- Change in precipitation
- Temperature increase
- Biodiversity loss
- Natural resource degradation

Agrifood systems
- Reduced agricultural production and yield
- Reduced nutrient density
- Increased food losses

Health systems
- Changes in temporal and geographic patterns of illness
- Direct damages to health facilities and infrastructure

Water systems
- Reduced availability of clean drinking water
- Increase risk of contamination and disease
- Increased risk of water-borne and vector-borne diseases

Social protection systems
- Increased demands for services from increased risk of shocks and crises
- Increased use of negative coping strategies

All forms of malnutrition
- Increased malnutrition
- Increased stunting & wasting
- Increased mortality

Nutrition
- Reduced access to safe, nutritious foods

Adapted from: FAO 2024; FAO 2023b
Our food system emits ~30% of all greenhouse gases

Greenhouse gas emissions from the global agrifood system

- Nonfood emissions: 35.9 GtCO₂eq, 69.2%
- Agrifood systems: 16 GtCO₂eq, 30.8%
- Farm gate: 45.4%
- Land use change: 20.8%
- Pre- and post-production: 33.8%

Source: Sutton et al. 2024
With impacts across multiple environmental dimensions

Source: GLOPAN 2020
Gender-related climate vulnerabilities

Women and girls require more nutrient-dense diets, which are more likely to be impacted by a changing climate.

A 1 °C increase in long-term average temperatures is associated with a 34% reduction in incomes of female-headed households.

Increased sensitivity (e.g.: higher nutrient needs), lower adaptive capacity (e.g.: lower control over assets) contribute to higher vulnerability when exposed to short- and long-term stresses.

Source: FAO 2024
Solutions will require context specific approaches across agri-food, water, health, and social protection systems
Integrated actions across systems

**CORE SYSTEMS**

**AGRIFOOD SYSTEMS**
- Diversity food production
- Shift to healthy diets
- Reduce food loss and waste

**WATER SYSTEMS**
- Improve holistic water governance
- Enhance water management
- Ensure adequate WASH

**SOCIAL PROTECTION SYSTEMS**
- Help workers engage new technologies
- Support livelihood opportunities
- Ensure gender equity in programmes

**HEALTH SYSTEMS**
- Reduce environmental impact
- Integrate essential nutrition actions
- Employ One Health approach

**INTEGRATED ACTIONS** (examples)

- Reduced risk and vulnerability for people, communities and economies, to drive sustainable development
- Healthy people, healthy planet
- Peace and stability

**CLIMATE-RELEVANT OUTCOMES**
- Greenhouse gas emissions reduced
- Biodiversity protected
- Natural resources preserved
- Negative coping reduced

**NUTRITION-RELEVANT OUTCOMES**
- Healthy diets
- Safe food
- Clean water
- Coping strategies enhanced
- Illness reduced
- Healthier people, stronger economies and greater resilience to drive inclusive, sustainable development

Notes: WASH — water, sanitation and hygiene.
Source: Author’s own elaboration.

Source: FAO 2023b
Integrated approaches to deliver nutrients sustainably

Promote healthy, sustainable diets and breastfeeding. Deliver supplementation to those in high needs.

Crop diversification, Reducing Food Loss and Waste, Biofortification and Food-fortification can deliver micronutrients in a sustainable way.

Social protection programs can ensure access to nutritious foods to those who cannot afford and ensure gender equity.

Sources: Fatemi et al. 2023; Grasso et al. 2022
Global adoption of food-based dietary guideline can:
• ↓ GHGe from food by 13%
• ↓ premature mortality by 15%

Halving food loss and waste can:
• ↑ supply of key vitamins and minerals by as much as 50%
• ↓ global food systems cropland use by 14%
• ↓ water footprint by 12-13%
• ↓ GHGe by more than 8%

Healthy and sustainable diets need integrated actions

Source: FAO 2019; Springmann et al. 2020; Springmann et al. 2023
A recent study shows that exposure to excessive heat in early pregnancy is associated with negative birth outcomes. However, these negative effects were not apparent in women exposed to heat receiving a multiple micronutrient intervention, administered from 3 months pre-conception until birth. Improving women’s nutritional status may promote resilience against the effects of heat stress on intrauterine development.

Source: Shankar et al. 2023
Women can be climate and nutrition actors

Work of GCAN shows that when women have resources and agency, they contribute to climate resilience:

- Reaching women farmers in SSA with extension reduces climate change impacts on income
- Informing women on climate-smart agriculture increases uptake
- Women’s agency diversifies farming away from rice in Bangladesh

More research is needed to assess the role of gendered responses in accelerating climate adaptation with co-benefits for nutrition

Sources: Azzarri & Nico 2022; Bryan et al. 2021; De Pinto et al. 2020
Evidence for policy is needed

Lack of inclusion of nutrition objectives in climate plans or climate objectives in nutrition plans
Consensus is needed on the current state of the evidence and for prioritized evidence gaps
Low levels of policy co-inclusion across climate and nutrition

Nutrition Considerations in Nationally Determined Contributions (NDCs) from 2016-2023 Inclusive (N=166)

Level 4: Commitment to mobilizing resources and with distinct plans to take action to connect climate and nutrition

Level 3: Intention to mobilize resources to connect climate and nutrition

Level 2: Some intention to connect climate and nutrition

Level 1: No intentional connectedness between climate and nutrition

Number of NDCs

0 20 40 60 80 100

2% 14% 25% 60%

Number of NNPs

0 10 20

28% 22% 26% 24%

Source: GAIN 2023
Climate financing for nutrition is very low

Only 1% of official development assistance funding to climate in 2019-2021 explicitly mentioned nutrition. That is 4x less than the agrifood system climate financing.

Global food and agricultural subsidies account for nearly $630 billion per year. These largely target staple foods (rice, sugar), dairy, and other animal source foods (meat), especially in HIC and UMIC.

Repurposing agricultural subsidies towards nutritious foods can increase availability and affordability of healthy and sustainable diets.

Sources: Sutton et al. 2024; GAIN 2023; FAO, IFAD, WFP, WHO 2022
Growing literature on climate change and nutrition

A ‘Climate change, Food Systems, Nutrition and Health’ meta-review of 844 synthesis reports found:

- A minority of reports assessed climate change relationships to diets and nutrition-related health
- “Within this proliferation [of research], it is unclear which evidence to prioritise for action, and which research gaps (...) would catalyse most impact”

Figure 2

Sankey diagram of the number of studies linking climate change to Food Systems, Nutrition & Nutrition-related Health (FSNH). Major categories of climate change on the left are proportionally linked to corresponding major groups of FSNH on the right.

Source: Sparling et al 2024
Nonetheless, evidence gaps remain

Both in describing and quantifying the negative impacts

• Impacts of short-term climate variability and repeated extreme weather events on diet quality, micronutrient adequacy, malnutrition, and nutrition-related health and associated economic losses.
• Impacts of diets on climate related outcomes.
• Impacts of a changing climate on the ‘middle of the food system’ (including on food environments, processing, transportation, prices, safety).
• Gender-related climate vulnerabilities and nutrition consequences.

Sources: Bush et al. 2022; Bryan et al. 2023; Headey & Venkat 2024; Sparling et al. 2024; Romanello et al. 2023
Nonetheless, evidence gaps remain (cont.)

and on interventions to prevent those negative impacts

• Quantifying benefits of interventions on both climate and nutrition, particularly for LMIC, to support for prioritization.
• Understanding complex relationships, trade-offs, enablers and pathways for action across major systems.
• Gender-responsive approaches that contribute to the effectiveness of climate change and nutrition responses.

Research gaps must be prioritized to respond to the needs of nutritionally vulnerable populations who are most affected by a changing climate

Sources: Bush et al. 2022; Bryan et al. 2023; Headey & Venkat 2024; Sparling et al. 2024; Romanello et al. 2023
Key Messages

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Thank you.

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