



Global Panel
on Agriculture
and Food Systems
for Nutrition

CLIMATE-SMART FOOD SYSTEMS FOR ENHANCED NUTRITION

This policy brief explains the challenges of meeting both agricultural and nutritional needs in the face of climate change. It identifies specific opportunities for policy change that can simultaneously enhance food and nutrition security.

POLICY BRIEF No. 2 | September 2015



ABOUT THE GLOBAL PANEL ON AGRICULTURE AND FOOD SYSTEMS FOR NUTRITION:

The Global Panel is an independent group of influential experts with a commitment to tackling global challenges in food and nutrition security. The Global Panel is working to ensure that agriculture and food systems support access to nutritious foods at every stage of life.

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RECOMMENDED CITATION: Global Panel. 2015. Climate-Smart Food Systems for Enhanced Nutrition. Policy Brief. London, UK: Global Panel on Agriculture and Food Systems for Nutrition.

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This publication is a product of the Global Panel on Agriculture and Food Systems for Nutrition, supported by the Panel Secretariat. This publication was peer-reviewed. The findings, interpretations and conclusions expressed in this work do not necessarily reflect the views of the organisations or the governments the Global Panel members represent.

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Executive Summary

The need for action

By 2100, it is anticipated that up to 40% of the world's land surface will have to adapt to novel or partially altered climates. A range of climate change impacts on crop and livestock production are projected to lead to a 2% fall in agricultural output per decade through to 2050. Over the same period, food demand will rise by 14% each decade in response to population growth, urbanisation, and increased incomes.

The regions of the world facing the prospect of the most serious impacts of climate change are Sub-Saharan Africa and South Asia which already have the highest burden of malnutrition and where the poor rely heavily on agriculture for their livelihoods.

Raising the production of staple crops will not be enough to make agriculture more resilient or to address the world's need for improved diets. Nutrient-rich foods are particularly susceptible to climate change impacts, including drought, the spread of pests and diseases, and temperature fluctuations. There is also growing evidence that higher levels of carbon dioxide in the atmosphere may reduce the nutrient content and/or quality of various staple crops, making them less inherently nutritious.

Urgent action is required by governments to link food system resilience with higher quality diets and nutrition. This brief explains the challenges of meeting both agricultural and nutritional needs in the face of climate change, and identifies specific opportunities for policy change that can simultaneously enhance food and nutrition security.

Climate-smart food systems for enhanced nutrition

Nutrition-sensitive food systems have the potential to be climate-smart. While evidence of effective climate change interventions is still limited, there is already a good understanding of how diets and the environments in which

food choices are made can be better managed in response to weather extremes and price volatility. Climate-smart actions which support nutrition entail a focus on diverse, high-quality and healthy diets. Solutions lie in the diversification of agricultural and non-farm production systems, the mitigation of climate-related stresses on crop and livestock quality, food value-chain investments to retain nutrients and reduce perishability (including greater efficiency in post-harvest storage, processing and transportation), enhancement of diet quality through more informed consumer choices, and the buffering of purchasing power in the context of supply and price shocks.

The Global Panel recommends six major policy actions to governments:

- 1. Include diet quality goals within adaptation targets proposed for climate action.**
- 2. Diversify agricultural investments, factoring in the local realities of ecological suitability and comparative advantage.**
- 3. Support greater food system efficiency so that outputs per unit of water, energy, land and other inputs are optimised and the footprint of agriculture and non-farm activities are better managed to meet both food demand and higher-quality diets.**
- 4. Integrate measures to improve climate change resilience and the nutritional value of crop and livestock products along the value chain, from production to marketing.**
- 5. Protect the diet quality of the poor in the face of supply shocks and growing food demand.**
- 6. Promote the generation and use of rigorous evidence on appropriate investments along food value-chains which are resilient to climate change and also deliver positive dietary outcomes and support improved nutrition.**

The need for action today

Climate change is already having measurable effects on food systems around the world. Impacts on agricultural productivity, post-harvest losses and value-chain efficiencies vary according to geography and each country's ability to manage risks.¹ But urgent policy action is required to link food system resilience with higher-quality diets and nutrition. Stresses that affect today's food systems, such as the increasing severity and scale of natural disasters, the spread of crop and livestock pests and diseases into new areas, and food price volatility linked to growing demand in the context of uncertainty over supply, will all be amplified by climate change. Indeed, the combined effects of short-run supply shocks and longer-term erosion of agricultural potential threaten to reverse historical trends in yield improvement and compromise the quality and diversity of foods available to consumers.

Decision makers must act now, rather than later, to achieve food system resilience, reduced emissions from agriculture, and enhanced nutrition. These are mutually-reinforcing goals that have the potential for early positive impacts in terms of an enhanced supply of nutritious foods, greater production and processing efficiencies, and reduced malnutrition. Such gains are also essential to the mitigation and adaptation agendas that lie at the heart of policies designed to prepare for, rather than react to, climate change.

Importantly, the time period over which investments will be necessary to achieve climate-resilient food systems is relatively long. Agronomic research, market development, research and development in food technology, policies that promote high-quality diets, and the implementation of protection mechanisms that buffer consumer purchasing power require investments over the medium term. This means that early steps must be taken quickly. Necessary actions include supporting the diversification of agricultural investments, increasing the efficiency of resource use along food value chains from producer to consumer, promoting food quality in terms of nutrients as well as improving resistance to pests and diseases, and protecting consumer demand and producer capabilities.

This policy brief explains the challenges to meeting both agricultural and nutritional needs in the context of climate change, and identifies specific opportunities for policy change that can simultaneously enhance food security and nutrition.

Climate change seen through a nutrition lens

By 2100, it is anticipated that up to 40% of the world's land surface will have to adapt to novel or partially altered climates.² Global agricultural production could fall by 2% per decade through to 2050 (based on projections of staple grain yields and livestock output), at a time when global food demand will be increasing by 14% each decade.³ The largest growth in demand will be occurring in low income countries, which are likely to be most negatively affected by losses in food quality and quantity through the value chain. Indeed, a growing number of projections consistently suggest that climate change will bring improved conditions for agriculture to high-latitude regions, while many parts of the tropics and sub-tropics will experience less favourable conditions and falling yields, particularly of wheat, maize and rice.⁴⁻⁷ This already appears to be happening. Maize and wheat yields would have been higher in some of the world's key production zones if climatic parameters had not shifted in the past two decades. For example in China and Brazil, maize yields would be 7% to 8% higher today had climates been stable, while wheat yields in Russia would be 14% higher.⁸

Besides affecting food supply, climate change may also affect diversity and nutritional value. Changes in temperature, rainfall and crop and animal disease environments will affect agricultural outputs in different ways.^{9,10} In general, nutrient-rich foods that are currently in short supply in many low-income settings are particularly susceptible to water constraints, pests and diseases, and temperature fluctuations.¹¹ The principal sources of essential micronutrients are animal-based foods, including milk, meat, eggs and fish, as well as vegetables, fruits and pulses.¹² Fruits and vegetables are very sensitive to damage and are more perishable than grains or tubers after harvest. Livestock productivity (the source of foods that are critical to young child growth and cognitive development) also tends to be impaired by lack of water and adequately nutritious fodder, as well as by heat and livestock diseases.

Recent research has also suggested that higher levels of carbon dioxide in the atmosphere may reduce the nutrient content and/or quality of various staple crops, making them less inherently nutritious.¹³ If this holds across a wide range of staple foods, the potential degradation of nutrient composition would have a negative impact on nutrient adequacy among the poorest consumers.¹



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How crop and livestock production adjusts to changing local patterns of rainfall, temperature and seasonality will strongly influence food systems and the food environment for consumers in the decades ahead. As a result, there is growing recognition of the need to assess impacts of climate change through a nutrition lens, which requires a global focus on healthy diets, "in particular on the quantity, quality and diversity of food".¹⁵ Healthy diets, which provide adequate, safe, diversified and nutrient rich foods, are an essential building block for physical growth and cognitive development in children.¹⁶ The nature of diets is influenced not only by policies relating to food production, but also by actions that affect market and trade systems, food transformation, and retail and consumer purchasing power. When policymakers consider how to mitigate climate change impacts on the food environment, they need to explore the potential for policy intervention across all domains of the food system.¹⁷

Climate change is expected to have particular impacts on the diets of poor populations in low and middle income countries across Sub-Saharan Africa and South Asia.¹⁸ Countries in these regions have significant numbers of people who rely on agriculture for their livelihoods, and who already carry a huge burden of malnutrition.^{15, 16, 19-22} Lower yields, combined

¹ Foods like maize, wheat and cassava are relatively low in key micronutrients. Diets dominated by nutrient-poor roots, tubers or cereals contribute to malnutrition in poor populations who cannot afford nutrient rich foods. The international research centres of the Consultative Group on International Agricultural Research (CGIAR), therefore made a commitment in 2013 to mainstream improvements in nutrition in all of its crop breeding programmes. Biofortification of cereals, by breeding crop varieties rich in micronutrients, or fortification of milled cereals with micronutrients, can also improve micronutrient intake in the diets of the poor (Global Panel 2015).

with population growth, urbanisation, poverty reduction and hence rising food demand in those regions, will likely put upward pressure on food prices and reduce the accessibility of healthy diets for the poor — including smallholder producers who are often net purchasers of food. While food is not the only determinant of poor nutrition, diet-related health and nutrition problems represent a major burden on the social and economic development of countries in these regions, with millions of children too short for their age, tens of millions of women of reproductive age suffering serious deficiencies of vitamins and minerals, and hundreds of millions of children, adolescents and adults now overweight or obese (the incidence of which is increasing rapidly in low and middle income countries).^{18, 23, 24}

It will be a challenge for countries with an existing high burden of malnutrition to improve nutrition in the context of climate change. This is because policy actions are required across the food system. They include the need to increase domestic food production efficiencies, diversify agricultural and value-chain portfolios, enhance engagement in agriculture and food trade (local, regional and global), and establish well-functioning safety nets that protect the purchasing power of the poor in both rural and urban settings. In addition, priority needs to be given to reducing greenhouse gas emissions associated with food processing technologies used in food transportation, storage, and marketing, facilitating private sector investments that will protect food supplies for all consumers, and promoting greater consumer understanding of the environmental implications of food choices (by highlighting otherwise hidden costs of production, processing and distribution).

“The already-present impacts of climate change are demanding innovation and partnership in agriculture on a scale never seen before. It is not an academic discussion about some uncertain future – it is posing challenges to farmers today.”²⁵

Rachel Kyte, Global Panel member;
Vice President and Special Envoy,
Climate Change Group, World Bank Group;
and Chair of CGIAR Fund Council

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Nutrition-sensitive agriculture must also be climate-smart

There are many public health interventions that are known to be effective in tackling various forms of malnutrition including child stunting, maternal anaemia, or iodine deficiencies among school aged children.²⁶ However, there is a growing global consensus that these interventions alone will not be enough to address current levels of global undernutrition.²⁴ Nutrition-sensitive food systems which can address underlying determinants of malnutrition along the chain from food production, through marketing and processing, to retail also need to be promoted.²⁷

However, the empirical evidence base on ‘what works’ in adapting and enhancing food systems to cope with climate change is still limited, largely because evidence of how much and how fast climates are changing is relatively recent. Governments the world over must prioritise rigorous assessment of how climatic conditions are evolving locally, and the effectiveness of policy and programmatic attempts to make various elements of the food system more resilient to actual and projected changes. A strong evidence base on innovation along the entire value chain is urgently needed.

But policymakers do not need to wait for new evidence before taking action to enhance, sustain and diversify their production systems and diets. There are already numerous examples of ways in which food systems can be made more resilient to present day threats. For example, researchers have been actively developing and promoting the use of drought tolerant strains of staple crops such as wheat and maize, salt tolerant and faster maturing variants of rice, heat tolerant strains of livestock, and pest-resistant legumes (such as peanuts).²⁸⁻³⁰ Ongoing research seeks to reduce on-field and post-harvest losses arising from moulds and diseases, while work on nutrition-sensitive value-chains seeks to promote nutrient conservation and/or nutrient fortification through processing.³¹ Other researchers seek to increase the nutrient content (vitamins and minerals) of staple and non-staple crops by making them more nutrient-dense, which often carries benefits for the vitality of the crop plant itself as well as for end consumers.^{14, 32}

Underlying all such adaptation and mitigation-focused research is an understanding that just producing more food in coming decades will not be sufficient to meet demand, protect supply, or enhance diets.³³ Greater efficiency, diversification and a focus on quality are all needed to meet the multiple goals that hinge on more nutritious and more sustainable food systems as a whole. Thus, nutrition-enhancing policy interventions need to include not only the diversification of agricultural production, but also improved

marketing and trade that supports access to nutritious foods and the commercial development of nutritious food products and their consumption (more diverse diets). Indeed, greater attention is needed for the diversification of, and enhanced resources efficiencies in, all forms of non-farm livelihood activity. In other words, rural households should have the ability to invest their time and resources in activities that reflect their competitive advantage across different income-earning opportunities.³⁴

Actions to protect consumers from food price volatility by improving marketing and storage efficiencies as well as investments in targeted safety nets that are able to smooth consumption through periods of crisis would be essential. Attention in food price policies to incentives that can encourage greater availability and accessibility of nutrient-rich foods to all consumers could also have potential value.

The Global Panel suggests six major areas of policy action which can be both climate-smart and nutrition-sensitive:

1. Diversification of agricultural investments

In the past few years, climate-smart agricultural initiatives have been promoted in Burkina Faso, Nicaragua, and Indonesia aimed at supporting food system adaptation to, and mitigation of, impacts of climate change.³⁵ So far, those actions have focused on raising agricultural productivity and incomes, adapting and building resilience to climate change, and reducing greenhouse gas emissions.³⁶ A key opportunity is to explore the potential of these and similar initiatives to improve nutrition.

Crop diversification using locally adapted varieties is widely promoted as a strategy that can support the adaptive capacity of most food systems.^{5, 37-40} Some programmes have begun to build resilience to weather variability into farm production systems. For example, the Adaptation for Smallholder Agriculture Programme in Bolivia has used indigenous knowledge related to climate change adaptation to support the introduction of varieties that can be grown at higher altitudes if necessary. That intervention has supported a transition from almost exclusive potato production to a more diversified portfolio that includes fruit tree production, which has increased market penetration for smallholders. Similarly, the promotion of agroforestry systems in the Sahel has the potential of bringing multiple benefits to smallholders, including nutritional gains achieved by growing non-traditional trees that are resilient to drought and heat, such

as *Adansonia digitata* or Baobab, whose leaves and fruit offer many high-quality nutrients, and *Vitellaria paradoxa*, which provides fruit during the lean period for consumers.⁴¹

Crop and animal diversification generally enhances dietary diversity.^{42, 43} Diet diversity represents a fundamental aspect of dietary quality since the consumption of multiple types of foods typically reflects a higher quality diet that is more likely to meet consumers' nutrient needs.²⁶ However, recent trends show global convergence towards homogenous diets. This makes the global food supply more susceptible to threats such as pests, diseases, and weather shocks which are likely to increase as a result of climate change.⁴⁴

Thus, growing a wider diversity of crops and livestock and adopting more pest, disease, drought and/or heat tolerant varieties can support climate-resilient agriculture while also facilitating consumer diversity (if those foods reach markets at prices affordable to the poor). Policymakers should promote diversification of both products and means of production (actively supporting incentives for farmer innovation and investment), rather than maintain a long-standing reliance on a narrow range of agricultural outputs that are sensitive to conditions over which smallholders have limited control.

2. Investments in efficiency across the food system to support resiliency and nutrition

Enhancing diets requires going further than producing more of the same. Even higher output of existing agricultural commodities produced in conventional ways will not suffice to enhance nutrition, nor will it be enough to achieve climate adaptation. Greater efficiencies are needed, along with greater diversity, to improve the resilience of food systems. The adoption (as locally appropriate) of no-tillage/green mulch

cropping, fine-tuned spot irrigation and enhanced water control, calibrated applications of fertiliser, rotation with nitrogen-fixing ground crops and innovations in integrated pest management can greatly improve output efficiency per unit of inputs (whether it be water, crop nutrients or energy).³⁵ These practices also contribute to reducing greenhouse gases per unit of food.

Heterogeneity in production systems needs to be taken into account when seeking efficiency gains. Staple foods must be enhanced, in terms of seed quality and how they are cultivated, to maintain yields under changing climate and to be more resilient to pests and disease. For nutrient-dense non-staples, such as animal source foods and vegetables, the promotion of enhanced varieties/species may be possible but resource efficiency along the supply chain (conservation, processing, and packaging) is where most attention is needed. Protection and enhancement of biodiversity can also promote heterogeneity in less-traditional forms of agricultural output. For example, in Ethiopia the Humbo Assisted Natural Regeneration Project has focused on restoring almost 3,000 hectares of biodiverse forest cover which, according to the World Bank, has resulted in income generation for smallholders who now sell agroforestry products, such as honey and wild fruits.⁴⁵

Livestock production presents an important opportunity to improve nutrition in low- and middle-income countries. There is strong evidence that consumption of animal source foods (meat, fish, dairy products and eggs) is associated with improved physical growth of children and cognitive development.^{46, 47} While livestock production is often resource-intensive (in its high levels of consumption of water and other natural resources), and contributes to climate change through greenhouse gas production, greater efficiency in production systems can reduce the number of animals kept, while enhancing quality and output per unit.⁴⁸⁻⁵² For example, the use of improved feed supported and implemented by the East African Dairy Development programme of Heifer International improved milk quality and supply (among 179,000 smallholder producers in Uganda, Rwanda and Kenya), as well as access to new markets through the formation of Dairy Farmer Business Associations, while reducing greenhouse gas (GHG) emissions.^{52, 53}

At the same time, reducing production and consumption of meat, particularly red meat, in high-income countries would help improve health and mitigate the global impacts of climate change.⁵⁴ The policy challenge in low-income settings is to encourage both improved livestock productivity (efficiency in the conversion of water and feed into food, as well as reduced carbon footprint) and greater consumption of animal source foods by nutritionally-vulnerable groups. The challenge is to promote these aims without establishing a trend towards consumption levels of meat and dairy that are characteristic of high-income populations who suffer significant levels of diet-related chronic diseases and obesity.^{55, 56}



Policymakers should promote resource use efficiency across the food system, including the reduction of food waste. It is estimated that one-third of food produced for global human consumption is lost or wasted. Most of the waste in low-income countries food occurs during the early and middle stages of the food supply chain⁵⁷ and is mainly caused by financial, managerial and technical limitations in harvesting techniques, storage and cooling facilities, infrastructure, packaging and marketing systems.⁵⁸ A recent review found that up to 25% of maize harvested in low-income countries is lost post-harvest. This could be decreased to about 6% with the adoption of innovations for mitigation of post-harvest losses and investments in infrastructure.⁵⁸ The losses rise for perishable crops, such as vegetables and fresh fruits, where up to 40% of crops do not reach the consumers (15% with interventions).

Other actions are needed to reduce the costs and economic viability of innovations in food storage (longer shelf-life and reduced perishability), processing (aimed at retaining nutrients and quality of products), marketing, and also lowering carbon emissions associated with value-chain activities wherever possible. In other words, decision-makers should prioritise actions that remove constraints and facilitate smoother operations for producers, processors, wholesalers, retailers and consumers across the entire food system. This includes greater attention to efficiency in resource use in non-farm rural activity.

Rural households in low-income countries are typically no longer only engaged in farming. As labour and product markets continue to link remote regions of low-income countries with economic hubs of activity in high-income nations, the share of total income deriving from agriculture is declining outside of rural areas with high productivity in high-value commodities. This means that off-farm operations, which may include working for brick kilns, mining for

“The challenges of malnutrition and climate change come together as an opportunity in agriculture. So, as we consider adopting climate-smart agricultural practices, let us also integrate nutrition. It is time for agriculture to be both climate-smart and nutrition-smart. With this approach, we have an opportunity to drive progress more sustainably and more beneficially.”⁶²

John Kufuor, co-Chair of the Global Panel;
Former President of Ghana

minerals, factory work, or charcoal production, can both contribute to climate change and to incomes used to diversify food purchase choices.

More recently, initiatives focused on renewable energy have been used to increase efficiency and reduce carbon footprints along the value chain, from irrigating fields⁵⁹ to drying and cooking food.^{60, 61} These innovations have the benefit of being responsive to the climate change agenda while simultaneously enhancing food systems in ways that support improved diets and nutrition.

3. Integrate measures to improve climate change resiliency and nutrition

Recent research suggests that climate change may affect not only people's capacity to produce crops in certain parts of the world, but also impair the nutritional content of those crops as well.¹³ Certain crops, including maize, peanuts, beans, and rice⁶³, that are less resistant to water or heat stresses are more likely to be damaged or contaminated by pests, disease and moulds, with repercussions on food quality as well as food



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safety.^{11,64} Natural toxins produced by fungi (mycotoxins) can be highly carcinogenic to consumers, and are also increasingly linked to immune suppression in infants and impaired linear growth of children, which contributes to the heavy global burden of child stunting.⁶⁵

Current international initiatives in crop breeding are already integrating properties for resilience and nutrition, for instance through new bean varieties which are climate (heat) resilient and more nutritious. Researchers have recently identified a variety of beans that show strong tolerance to temperatures 4°C higher than the range that beans can normally tolerate.²⁸ National agricultural research policies should embrace this integrated goal, pursuing their own research on local crops and animal species and adapting international seed and animal stocks to expected local conditions.

Protecting nutrients in the food supply and increasing resilience to climate change beyond productivity requires a focus on reducing post-harvest losses, enhanced storage (to protect food safety and quality of products), improved infrastructure (roads, information systems, refrigeration) that can reduce losses of high nutrient perishable goods, as well as interaction with the private sector. Engagement with the private sector is necessary to enable a successful promotion of efficient energy use in food processing and packaging, and campaigns to encourage less post-consumer food waste, which can be high in low-income settings, particularly in areas



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where processed packaged foods represent an important part of the diet. In addition, more efficient market infrastructure and stronger food safety regulations can also contribute to mitigating pest, disease and mould threats.^{66, 67}

Support for new and adaptive research is urgently needed on ways to enhance and protect the nutrient content of agricultural products in the context of climate change. This includes agronomic research to improve and retain nutrients in foods important to nutritionally-vulnerable populations, but also support for technological innovation in food processing, storage, packaging and transportation.

4. Protecting diet quality in the face of supply shocks and growing food demand

Climate and economic shocks increase the volatility of food prices. When prices are high or uncertain, consumers typically respond by protecting their intake of major staples and then substituting other foods in the diet to make the most of what their purchasing power will allow them.⁶⁸ The experience of major food price shocks of the past 15 years or so has shown that in most cases, the purchase and consumption of nutrient-rich foods, such as fruit, vegetable and meat and/or dairy products, declines in the face of a rising share in total consumption of foods that simply provide energy in the form of calories. Numerous studies have captured this standard household response to price shocks around the world, from South-East Asia in the late 1990s⁶⁹ to South America⁷⁰, Africa⁷¹ and South Asia⁷² in the context of the global food price crises of 2007/8 and 2010/11.

Improved marketing and distribution systems are critically important to help reduce supply variability, but so too are price policies and social protection systems that can buffer effective demand and smooth consumption among the poorest consumers.⁷³ Time-bound and targeted (rather than universal) food price subsidies can support consumption levels of the nutritionally vulnerable. Making rural credit more easily accessible to the poor and longer-term conditional cash transfers linked to health and education can also provide a buffer against the vagaries of prices that go hand-in-hand with climatic anomalies. That said, price and trade policies aimed at consumer protection should be informed by the potential for unintended side-effects which can distort markets and trade patterns, as well as dampen the supply response to high prices because of lower producer prices.

While it is critical to protect intakes and enhance diet diversity of the poor rural populations in time of shocks, many low-income countries are also witnessing an increasing urbanisation and a growing middle class.⁷⁴ These trends significantly increase the demand for food, particularly for meat, fish and processed foods⁵⁵, which can lead to stressed food systems, high emission of GHGs, and the potential increase of obesity and non-communicable diseases (NCDs) for consumers. These trends need to be taken into account to provide availability and accessibility of food in the near

future that is both nutrition-smart and climate-smart. As a consequence, a rebalancing of policy and investments from staples to nutrient-dense non-staples would be required.⁷⁵

Supply-side and food price shocks are likely to increase with climate change. Policymakers should support a diversification of production systems as well as products produced (incentivising innovation, including the adoption of more nutrient-dense commodities), while strengthening the resilience of food systems, from production through marketing to consumption, to withstand extreme variability of climatic conditions and an erosion of nutrient quality of foods moving up the value chain. This will need to include both public research and commercial investment in storage and transportation technologies to reduce the perishability/extend the shelf-life of nutrient-dense foods and promotion of more diverse dietary choices that incorporate nutrient-rich substitutes to common staples. Targeted protection of consumer demand through safety-nets that buffer purchasing power among poor and vulnerable populations, including public procurement of nutrient-dense foods for meals in educational and health institutions is also critical.

Greater awareness should also be promoted among consumers of the environmental, as well as economic, costs of production, processing, distribution and sale of various foods. Commercial companies are already seeking to protect consumer prices and shareholder profits from expected climate change-related impacts on natural resources (water, yields, and nutrient content) and climatic shocks that can disrupt both supply and distribution of commodities and processed food inputs. The public sector can play a role in educating and influencing consumer food choices in this wider context of system vulnerability.

5. Generate additional evidence on how agriculture can deliver positive nutrition outcomes to identify leverage points for policy

There is a growing literature on the impact of climate change on agriculture supported by better data, more advanced mathematical models, and increased computational power essential to forecast complex models. But there is a need to generate more evidence on how agriculture can deliver positive nutrition outcomes in various settings to better support decision makers. That is, research investment is needed to understand the dynamics that explicitly link investments in agriculture and desired outcomes in nutrition. There are non-linearities in such relationships, and policymakers need greater evidence-based support for policies that promote agriculture and nutrition. Such policies typically rely on a combination of innovation, technology adoption, and changes in consumers' demand. However, more attention is needed to identify the range of interventions that are possible, and their cost effectiveness, so that policy makers can focus on optimising benefits in a context of limited resources.



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A key aspect of a forward-looking climate change agenda, therefore, is the generation of novel forms of rigorous evidence on 'what works' from a policy perspective that is focused on nutrition-smart food systems. The research community must prioritise knowledge gaps in this important policy area. They include the validation of individual metrics of diet quality and climate change impacts, as well as research that enhances understanding of system-wide causal dynamics along entire value-chains from production to consumption.

This will require governments and international donors to support high quality research that a) empirically elucidates the mechanisms through which climate change will affect each link in the food value chain, separately and collectively, and b) measures the effectiveness of a range of food policy interventions for promoting agriculture, marketing and processing efficiencies, improved consumer choices, dietary quality and enhanced nutrition outcomes. Most of this research will require multidisciplinary tools and collaboration among scientists, industry specialists and government policymakers. Such a commitment to integrating different disciplinary and sectorial domains will support a novel focus on the two-way processes that link global and local food system outcomes.

National commitments to global target-setting development goals should include necessary metrics relating to food system enhancements that are amenable to policy action. The collection and sharing of data will help support of national government and global development goals.

Recommendations to policy makers

About half of the world's population is at risk of being undernourished due to rising food demand and a potentially compromised supply as a result of climate change by 2050.⁷⁶ But the worst case need not materialise.

Policymakers can make a significant difference to outcomes in the coming decades by adopting a pro-nutrition lens while protecting and promoting agriculture in the face of climate change. While evidence of effective climate change actions remains scarce there is ample evidence already of how to enhance diets and food systems in the context of weather shocks and price volatility. Effective solutions lie in the diversification of agricultural investments, the mitigation of climate-related stresses on crop and livestock quality, greater resource use efficiency along value chains, and protecting diet quality in the face of supply and food price shocks. In other words, climate-smart actions which support nutrition means focussing on diverse, high-quality, healthy diets.

The six major policy actions recommended to governments by the Global Panel are:

- 1. Include diet quality-enhancement goals within the adaptation targets that they propose for global climate action.** Upcoming global meetings will encourage governments to define nationally determined contributions to the target-setting agenda, including identifying metrics to be used to monitor progress. The more governments that include food system, diet and nutrition related issues in the climate change dialogue, the more focused policymakers will be on linking climate-smart actions with nutrition-smart metrics. The two must proceed in unison.
- 2. Diversify agricultural investments based on ecological suitability and comparative advantage,** such that a greater variety of production systems are supported, extension programmes are sufficiently varied and at scale to meet the needs of both large and small farmers, crop and livestock production is not limited to a few potentially vulnerable agricultural outputs, and required inputs of high quality are available to all.
- 3. Support greater food system efficiency,** so that agricultural outputs per unit of water, energy, land and other inputs are optimised and the carbon footprints of agriculture and non-farm activities are better managed to meet both food demand and higher-quality diets. This means rebalancing research and value-chain investments towards production and distribution systems that make more nutrient-dense foods available to all, and provide

a greater understanding of value-chain and non-farm activities as sources of income for the rural poor. Efficiency gains should span the whole value chain, focusing on post-harvest losses, and be supported by priority investments in applied research that generates evidence on the cost-effectiveness of alternative production-to-consumption scenarios. New technology transfer and open data goals framed by the post-2015 Sustainable Development Agenda should include commitments to free dissemination of public research.

- 4. Integrate measures to improve climate change resilience and nutritional value** by adapting crop and livestock sources of important nutrients, and their production systems, to the anticipated impacts of climate change in the form of pests, diseases, weather-related shocks, and price volatility. The building up of resilient and nutritious food systems which go beyond food production, to include enhanced storage and marketing, reduced food waste, and enhanced consumer choices, while seeking greater efficiencies throughout.
- 5. Protect the diet quality of the poor in the face of supply shocks and growing food demand.** This can be done by the establishment of robust, targeted social protection programmes, transitory consumption-smoothing interventions, enhanced access by the poor to credit, food market information, and enhanced nutrition knowledge on which to base appropriate choices. Improving the quality of diets is central to addressing all forms of malnutrition.
- 6. Promote the generation and use of rigorous evidence on investments along food value-chains that are resilient to climate change while also delivering positive dietary outcomes.** While evidence is accumulating on how climate change affects food production and consumption, more is needed to guide evidence-based policy making that will effectively link actions across all food system domains. Coherent research focused on policies through which different elements of climate change may have impacts on food systems, and on the cost-effectiveness of alternative actions in agriculture, marketing, processing, retail and consumer support that could offset such impacts is essential. Diet quality indices and other food system metrics should be included as part of climate-related target-setting agendas and in related surveillance systems which are established to monitor changing conditions and the effectiveness of policy responses.



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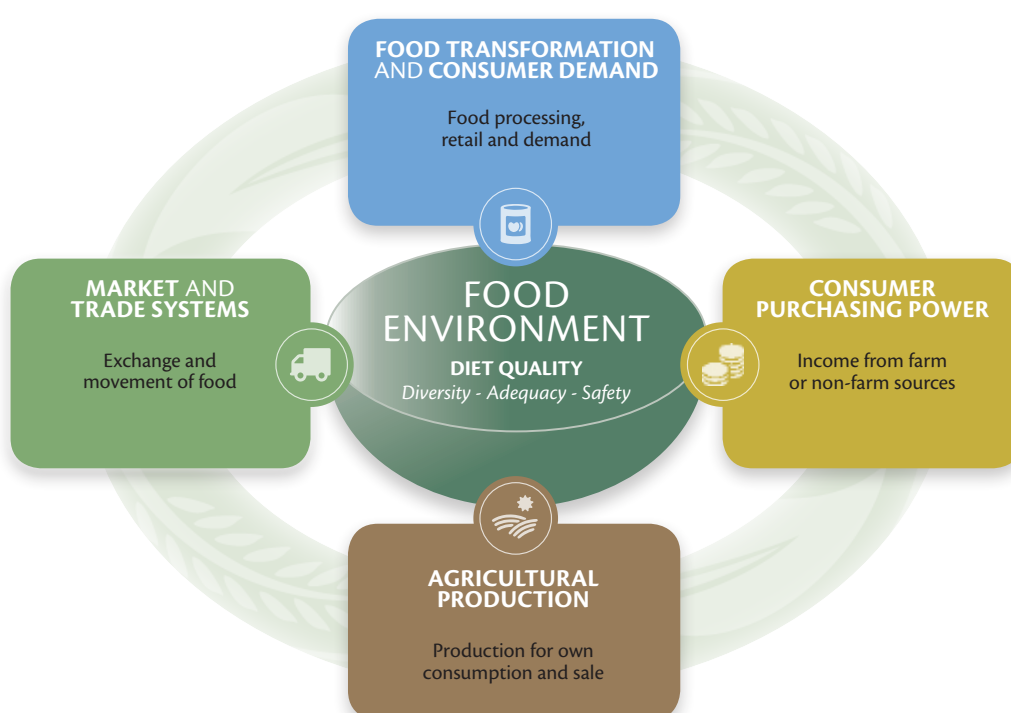
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How can Agriculture and Food System Policies improve Nutrition?

There are specific opportunities for policy change across multiple domains in the food system that can simultaneously enhance food and nutrition security in the face of climate change.

The multiple burdens on health created today for low and middle income countries by food-related nutrition problems include not only persistent undernutrition and stunting, but also widespread vitamin and mineral deficiencies and growing prevalence of overweight, obesity and non-communicable diseases. These different forms of malnutrition limit people's opportunity to live healthy and productive lives and impede the growth of economies and whole societies.

The food environment from which consumers should be able to create healthy diets is influenced by four domains of economic activity:



In each of these domains, there is a range of policies that can have enormous influence on nutritional outcomes. In the Global Panel's technical brief, we explain how these policies can influence nutrition, positively and negatively. We make an argument for an integrated approach, drawing on policies from across these domains, and the need for more empirical evidence to identify successful approaches.

Find out more here: www.glopan.org/technical-brief

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Jointly funded by



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This report is based on research funded in part by the UK Government and the Bill & Melinda Gates Foundation. The findings and conclusions contained within are those of the authors and do not necessarily reflect positions or policies of the funders.