Sharm El-Sheikh Adaptation Agenda

TECHNICAL REPORT

2030 Adaptation Outcomes for Food & Agriculture

Boston Consulting Group and UN Climate Change High-Level Champions Joint Publication

BCG

RACE TO RESILIENCE

Marrakech Partnership | Global Climate Action

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EXECUTIVE SUMMARY

The food and agriculture system today is fragile and highly vulnerable to the impacts of climate change, such as droughts and extreme weather events, with roughly 1 billion people hungry and food prices skyrocketing. As impacts from climate change continue to accelerate and the world population continues to grow, it will be essential to establish a more resilient agrifood system and protect people, the economy, and the planet. Major systemic transformations will be required along the food value chain, including shifts in the food we produce, how we produce it, and ultimately what we consume.

In the Race to Resilience, the UN Climate Change High-Level Champions are calling for action around four **Sharm el-Sheikh Adaptation Outcomes for Food & Agriculture: increasing yields through sustainable agriculture without expanding the agricultural frontier, reducing food loss and waste, shifting markets towards healthy alternative proteins, and increasing global consumption of fruits, vegetables, and other planetarily healthy options**. Achieving these outcomes will catalyse progress towards a more resilient future, with greater food security, lower disease prevalence, reduced emissions and higher carbon sequestration, and protected economies and ecosystems.

This report details essential actions for building resilience across the food value chain, deep dives into the Sharm el-Sheikh Adaptation Outcomes for Food & Agriculture, and amplifies the UN Climate Change High-Level Champions' call to action.

This report should be read in conjunction with the 2030 Adaptation Outcomes for A&R Finance, 2030 Adaptation Outcomes for A&R Planning, and 2030 Adaptation Outcomes for Human Settlements reports.

I. INTRODUCTION TO THE SHARM EL-SHEIKH ADAPTATION OUTCOMES FOR FOOD AND AGRICULTURE

The **Sharm el-Sheikh Adaptation Outcomes** are a series of bold actions that will enable 4 billion people to become more resilient to the increasingly frequent and severe impacts of climate change. Led by the UN Climate Change High-Level Champions and amplified by the Egyptian COP27 Presidency, the Adaptation Outcomes include actions across the systems that form the basis of our collective global resiliency, including food and agriculture, water, oceans, infrastructure, and human settlements. Critical enablers to build resilience across these systems are robust adaptation and resilience (A&R) planning and A&R finance.

The UN Climate Change High-Level Champions are advocating for action around four **Sharm el-Sheikh Adaptation Outcomes for Food and Agriculture** launched at COP27:

1) **Climate resilient, sustainable agriculture increases yields by 17% and reduces farm level GHG emissions by 21%, without expansion of the agricultural frontier**
2) **Halve the share of food production lost and per capita food waste (relative to 2019)**
3) **Healthy alternative proteins capture 15% of the global meat and seafood market**
4) **The global consumption of fruits, vegetables, seeds, nuts, and legumes increases 1.5x by 2030**

The Climate Champions identified these outcomes and defined the targets in consultation with non-state actors across sectors. Achieving these outcomes requires a broad set of actions in order to make food and agriculture systems resilient and unlock critical capital for adaptation and resilience (A&R) efforts. Increasing resilience will require immediate action by state and non-state actors globally, including national governments, subnational governments, funders, the private sector, and others. Collaboration will be necessary to define targets and deliver outcomes.

In this report, we provide an overview of climate impacts on food and agriculture systems, propose fundamental solutions to increase resilience, deep dive into the **Sharm el-Sheikh Adaptation Outcomes for Food and Agriculture**, and amplify the Climate Champions' call to action.

II. CLIMATE CHANGE CHALLENGES TO THE AGRIFOOD SYSTEM

Climate change is negatively affecting food systems globally

The food and agriculture (or agrifood) system is fragile and susceptible to global shocks and trends including geopolitical events, urbanisation, and a rapidly growing population (Figure 1). **Climate change in particular affects every aspect of the agrifood system.** Since food is produced across global supply chains, the system is vulnerable to heat-driven yield decreases and climate shocks like extreme weather events. This can be seen when we look at staple crop yields. Global mean yields of maize, wheat, and soybeans declined by up to 5%[1] (8% of global caloric supply) from 1981 to 2010. **Persistent yield declines are exacerbated by climate shocks** like the current droughts in Africa and Brazil or flooding in Malaysia, leading to spikes in food prices. Cereal prices in East Africa, for example, have risen by 25% to 75% in 2022 alone as the region experiences its fifth consecutive drought cycle.[2]

Climate-driven disruptions cause food insecurity through decreases across all four pillars of the Intergovernmental Panel on Climate Change's (IPCC) food security framework: availability, access, utilisation, and stability. According to the Food and Agriculture Organization of the United Nations (FAO), food insecurity increased by the equivalent of 207 million more people from just 2019 to 2021.[3] In addition to negative impacts on global nutrition and health, food insecurity affects social equity, political instability, and the economy.

Climate risks to the agrifood system are not experienced equally across the globe. These risks are **substantially more severe in the Global South** where smallholder farmers, for example, make up approximately 60% of the population of sub-Saharan Africa and will be disproportionately affected.[4] An estimated one person will die of hunger every 36 seconds between now and the end of the year in drought-ravaged East Africa.[5]

Furthermore, **agriculture, specifically livestock, is a large contributor to global warming**, responsible for a quarter of total emissions and half of anthropogenic methane emissions.[6] Methane generates approximately 84 times the warming of CO_2 per unit emitted,[7] providing a strong imperative to mitigate emissions from the agrifood sector.

Food production **challenges not only emissions, but also multiple other planetary boundaries.** Agriculture is the primary threat to 86% of the species at risk of extinction.[8] Deforestation is one of the largest drivers of biodiversity loss, and a food system that creates significant losses in biodiversity and water retention is not only detrimental to these planetary conditions but also creates negative feedback loops in production that challenge yields and therefore the resilience of the agrifood system.

The food system is vulnerable and will continue to be a large contributor to emissions. Therefore, **a systems-based transformation that builds resilience and supports the needs of a growing population is required.** A systems-based transformation can be a powerful source of sequestration and itself a nature-based solution (e.g., carbon sinks) that can support a global

[1] Iizumi et al. (2014).
[2] UN. Drought is pushing food prices up sharply in East Africa (2022).
[3] FAO. The State of Food Security and Nutrition in the World (2022).
[4] IPCC. Special Report on Climate Change and Land (2019).
[5] Oxfam International (2022).
[6] FAO. The share of agri-food systems in total greenhouse gas emissions (2021).
[7] IPCC. Special Report on Climate Change and Land (2019).
[8] UNEP (2021).

net-zero pathway. This transformation requires changes along the full value chain (Figures 1-2). We need a production system that works in greater harmony with the natural system on which it depends; food formulations that balance cost with diversity and nutrient density; logistics systems to minimise food loss; and consumption preferences that avoid diet-related diseases such as obesity, hypertension, and heart disease. The good news is that these components are self-reinforcing—we can have more diverse, sustainably grown foods that deliver better nutrition to the growing global population, but **we must act with conviction and speed.**

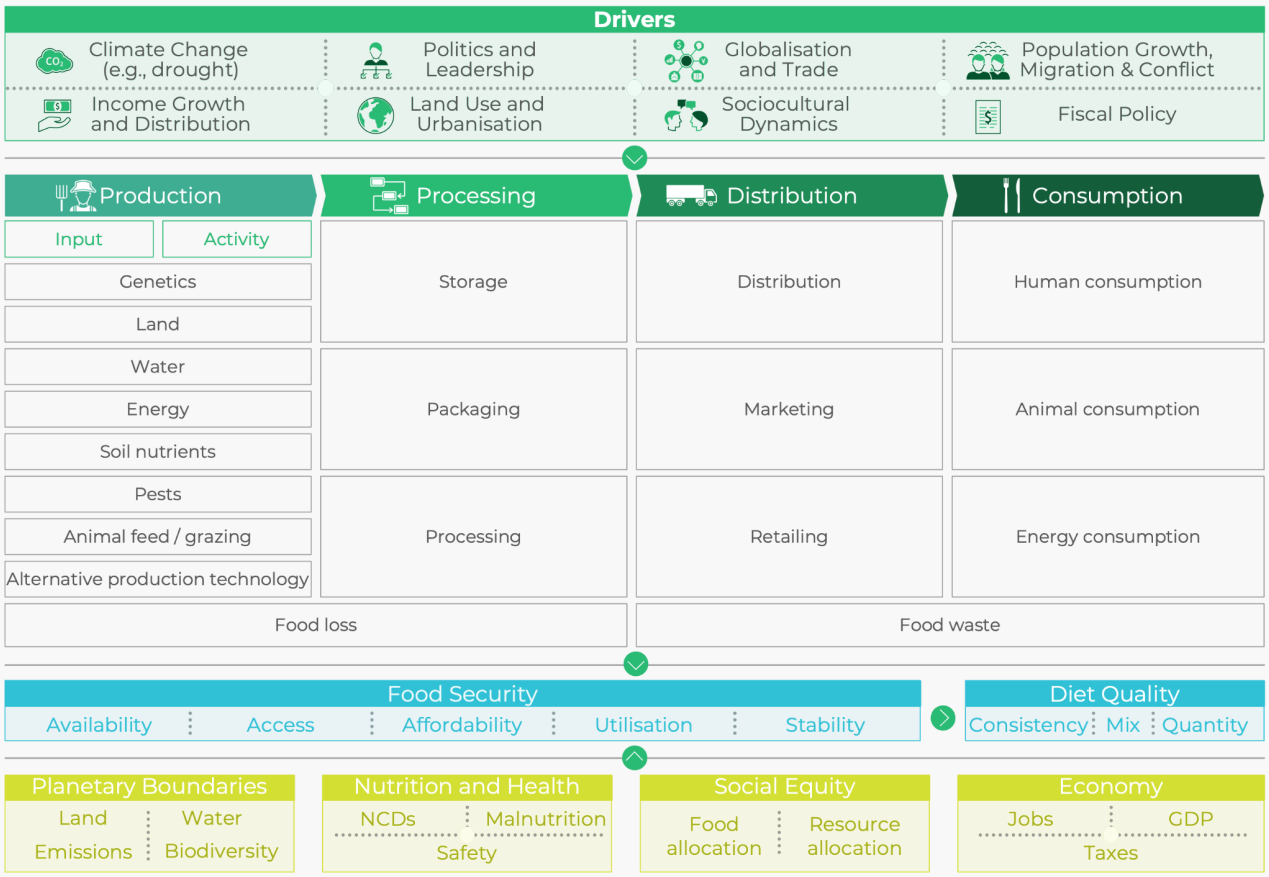

Figure 1: Food systems framework. Source: BCG analysis

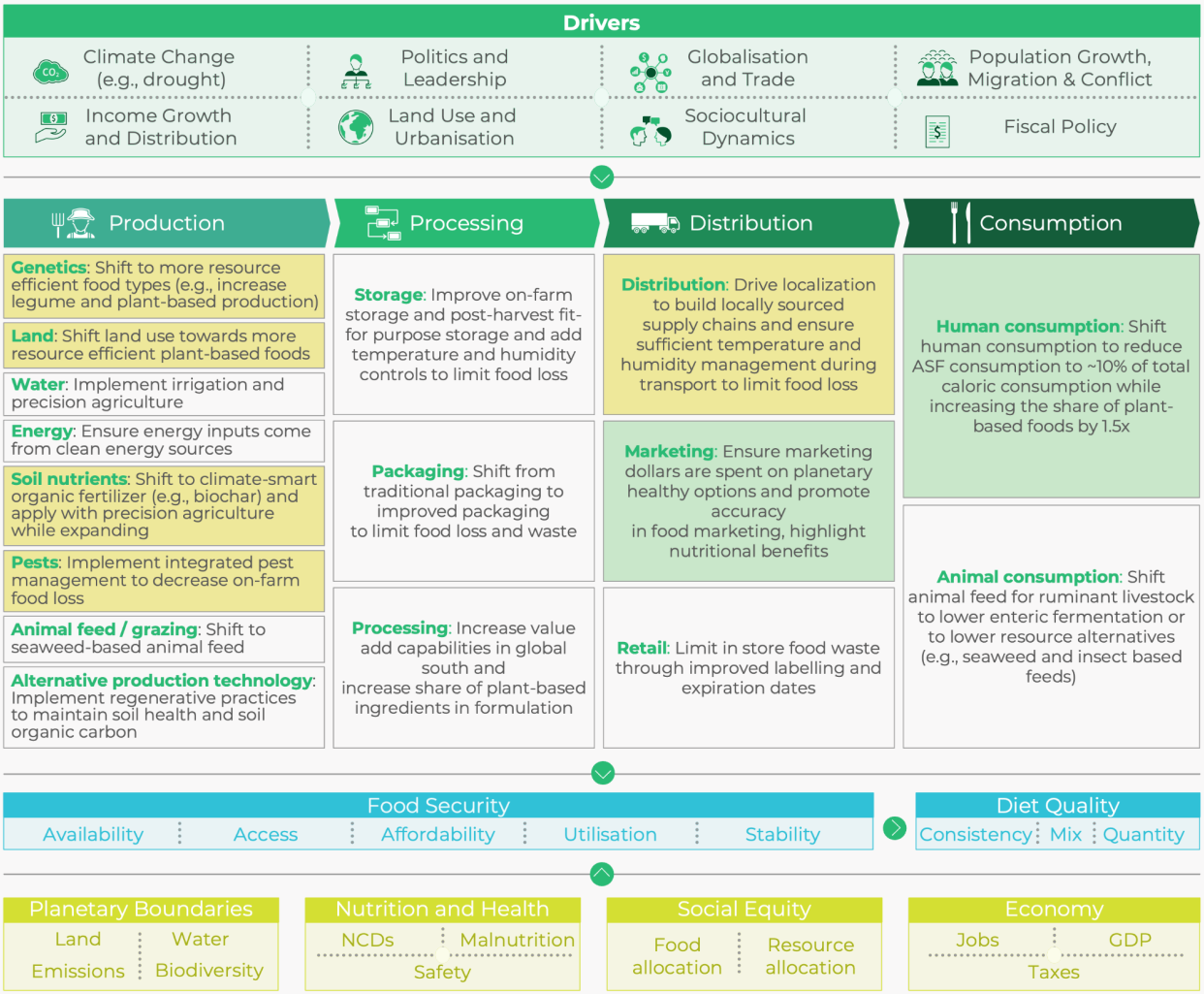

Figure 2: Shifts required to achieve the Adaptation Outcomes (green represents an action that applies to all four outcomes; yellow represents an action that applies to more than one outcome). Source: BCG analysis

III. SUSTAINABLE AGRICULTURE PRACTICES

Sharm el-Sheikh Adaptation Outcome #1: Climate resilient, sustainable agriculture increases yields by 17% and reduces farm level GHG emissions by 21%, without expansion of the agricultural frontier

As temperatures continue to rise, yields of livestock, staple crops, and agricultural commodities will decrease. Therefore, we must sustainably increase yields to feed a rapidly growing population and do so without expanding the agricultural frontier or increasing emissions due to the change from forested to agricultural land.

Target: This is based on the High-Level Climate Champions' Breakthrough Agenda State of Systems Transition Report, launched in September 2022, which estimates yield increases of 17% and emission reduction requirements of 21%. The report and figures are based on data from WRI, a leading global research nonprofit organisation, which estimates that globally we must close the "triple gap" by 2050. The triple gap consists of the **food gap**, the delta between calories produced and calories required to feed the full population; the **land gap**, maintaining and preventing expansion of total current agricultural land; and the **emissions gap**, the delta between emissions from the agrifood system today compared to the emissions required by 2050 to maintain the goals of the Paris Agreement.

Partner spotlight: FAST (Food and Agriculture for Sustainable Transformation), a COP27 Presidency Initiative, aims to implement concrete actions to improve the quantity and quality of climate finance contributions to transform the agrifood system by 2030, and to support adaptation to maintain a 1.5-degree pathway while supporting food and economic security. The initiative aims to follow a set of guiding principles: ensuring that food security and diversity of the agrifood system are reflected in activities; empowering and engaging women, youth, and Indigenous peoples; ensuring that the best science and innovation are considered; promoting a holistic vision to unlock a more sustainable agrifood system; promoting peer-to peer exchanges; ensuring wide and balanced stakeholder engagement; ensuring flexible engagement of member countries; and coordinating and collaborating with ongoing global and regional initiatives. FAST has specific deliverables focused on three pillars: Access to Finance, Knowledge and Capacity, and Policy Support and Dialogues.

Partner spotlight: The Climate Champions are working with BCG on the **Africa Food Systems Transformation Initiative (AFSTI)**. AFSTI aims to leverage scalable approaches to pivot the agriculture sector to one that is climate-resilient and sustainable, and which contributes to healthy diets and ecosystems. AFSTI works with agro-processors and aggregators to support the large-scale adoption of high-yielding, resilient, and adaptive practices (HYRAP) in their value chains, leveraging low cost of capital as an incentive. AFSTI has highlighted 12 HYRAP actions across soil systems, cropping systems, and integrated systems. These include no/low tilling, crop rotation, integrated pest management, and introduction of more nitrogen-efficient and drought-, heat-, and flood-resistant crops. Implementation of these practices will promote sustainability, increase yield and profit, encourage carbon capture, and improve diets and nutrition. The initiative is focused first on designing ecosystems at the subnational level to achieve these goals in Egypt, Kenya, Nigeria, Rwanda, and South Africa.

Building resilience through what and how we grow

Production shifts towards more resource-efficient food types are needed. Current agricultural practices are decreasing yields while depleting the soil, adversely affecting future yield potential. Increasing yields have historically correlated with increasing land use, but a requisite end to expansion of the agricultural frontier means global yields per unit of land area must increase. This necessitates different actions in the Global North and Global South, which have contributed to and experience climate change differently. The Global North currently operates at a food surplus. Food production per capita is more than 3,350 calories per day in North America and Europe.[9] Therefore, the focus in the **Global North should be on increasing yield per resource unit, lowering emissions from food production, and reducing food waste**. The Global South faces a different challenge. With malnutrition expected to increase, developing countries must increase yields to close the existing, and growing, food gap. The focus in the **Global South should be on increasing per capita yields and improving the nutritious content of food produced while reducing food loss**. The Global South must increase the amount of food produced and do so with less of the climate and environmental impact of traditional agriculture. These changes will require action across the value chain.

Shifting the production system

Resilient and sustainable yield gains can be achieved through changing food types. Within genetics and production mix, **shifting grain production is the most effective lever to build resilience.** Grains represent approximately 50% of calories consumed, and between 34% to 45%[10] of input use.[11] Rice in particular accounts for around 10% of anthropogenic methane emissions.[12] Shifting production away from the "big three" grains—maize, wheat, and rice—and towards nutritious, climate-resilient, and resource-efficient orphan grains (e.g., various millets, sorghum) contains significant resilience benefits. The big three grains are not drought- or heat-resistant, and significant yield decreases in the tropics for these grains can be expected. Maize, for example, requires approximately 15% to 20% more water per growing season than millets or sorghum.[13] Orphan grains also have higher nutrient density than the big three grains, which means the per nutrient resource usage is even lower.[14]

Another effective lever to build resilience through grains is to **shift some grain production towards more nutritious and resource-efficient non-grain alternatives** such as legumes, which are protein-dense and contain far more nutrients per kilogram produced than grains and use less water than maize.[15]

Given the need to shift to more resource-efficient alternatives to increase yield, it will be crucial to increase the demand for these products. Food marketing plays an important role in driving dietary choices. **Aligning the advertising industry with planetary health foods, which are healthy for both people and the planet, can help accelerate the difficult but necessary demand-side changes**. Increasing yields requires the above supply-side shifts as well as highly challenging consumption-level changes for humans.

Reducing resource intensity in the Global North

In the Global North, yield gains should predominantly come from reducing resource intensity. Shifting agricultural practices towards precision agriculture can increase yield without negatively affecting the land gap or the emissions gap. Traditional extractive farming practices, including heavy synthetic fertiliser usage, overtilling, and monocropping, harm soil,

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[9] FAO (2021).
[10] 36% of arable land use, 34% of freshwater withdrawals, 45% of fertiliser use, and 36% of plant-based emissions
[11] Environmental Impact on the Food System (2018).
[12] Global Methane Initiative. Global Methane Emissions and Mitigation Opportunities (2010).
[13] FAO. Water and Soil requirements
[14] Jocelyn et al. (2022).
[15] FAO. Water and soil requirements.

lowering both potential yields and carbon sequestration. Reversing this trend requires a more precise use of fertilisers, transition soils, and regenerative practices so that they can deliver similar yields with lower intensity of chemical inputs. This will create a more resilient agrifood system with soil that is richer in nutrients and higher in water and nutrient-holding capacity, therefore increasing resilience to hazards such as drought and extreme wind. Using a mixture of synthetic and organic fertilisers can also decrease costs, ensure soils are replenished with necessary nutrients, and reduce the negative impacts of fertiliser runoff. Applying fertiliser with precision agriculture techniques will reduce both the total amount of fertiliser required and the excess runoff that drives ocean acidification. Scaling regenerative practices will require large-scale buy-in from significant demand drivers in the space. For example, Walmart has committed to expanding its regenerative practices on critical commodities such as wheat, soy, corn, and rice. In 2020, it partnered with the Midwest Row Crop Collaborative (MRCC), a cross-sector initiative to help farmers in the Midwest adopt regenerative farming practices on 30,000 farm operations in the US.[16] Without large suppliers mandating more sustainably sourced inputs, farmers will not be incentivised to make the upfront investment to transition to regenerative agriculture.

Increasing access to yield-increasing inputs in the Global South

It is critical for food production and food security that Global South yields are increased through access to irrigation and a mix of synthetic and organic solutions that can improve on-farm productivity in a sustainable manner. Irrigation is among the largest drivers of lower yields in the Global South. Drip irrigation can reduce water use by approximately 50% compared with sprinkler irrigation,[17] making it a necessary technology in the increasingly arid Global South. For example, SunCulture, a precision agriculture company based in Kenya, produces solar-powered irrigation units for farmers across Africa. African yields are approximately 50% below global average, primarily due to a low irrigation rate of around 4% of total farmland in the continent. Leveraging off-grid solar power to provide irrigation to farmers not only supplies clean energy to those not connected to formal power grids but also increases yields by two to five times.[18] Additionally, fertiliser usage in the Global South remains far below levels in the Global North. Increasing the access to and prevalence of fertilisers can help close the yield gap between the Global North and Global South.

Enablers required to sustainably increase yields

Policy and finance are critical levers to achieve more sustainable agriculture. Both affect unit economics for farmers and therefore incentivise transition. **Limiting the amount of capital spent on on-farm subsidies, redirecting agriculture subsidies from staple crops to increased production of planetary health foods, and reconfiguring subsidies to prioritise planetary health foods** (e.g., by subsidising legume production) can drive the necessary supply-side behaviour change.

Providing technical assistance, equipment, and cost sharing to farmers so that they can transition to sustainable practices will be extremely effective. **Farmers require support to make a meaningful transition due to transition costs (e.g., temporary yield declines, new equipment), but that subsidy is not a long-term requirement.** Evidence shows that regenerative agriculture stabilises yields in four years while reducing input costs, ultimately improving profitability for farmers.

Additionally, investing in innovation to drive adoption of adaptive and resilient practices, such as circular packaging and organic fertilisers, and leveraging blended finance to invest in adaptation and resilience projects in the Global South are among the largest finance levers to drive the needed change. For example, One Planet Business for Biodiversity (OP2B), an

[16] Walmart (2021).
[17] Bayer. Water Management Using Drip Irrigation (2009).
[18] SunCulture. About Us (2022).

international cross-sector, action-oriented business coalition on biodiversity with a focus on agriculture, is made up of a group of influential food suppliers, including Mars, Nestlé, and Unilever, that leverage their outsize demand power to drive adoption of planetary health products.[19] OP2B creates a common framework, guidelines, and data platforms and codesigns pilots to facilitate landscape-level transition.

Importantly, the **implementation of credible carbon markets can create additional revenue streams** from the transition to regenerative practices, substantially improving the economics for farmers.

IV. REDUCING FOOD LOSS AND WASTE

Sharm el-Sheikh Adaptation Outcome #2: Halve the share of food production lost and per capita food waste (relative to 2019)

Currently, approximately one-third of food produced is either lost or wasted. The emissions generated from lost and wasted food total about 5Gt annually (equivalent to the approximate total emissions from the US).[20] While not entirely from the agrifood system, landfills and wastewater emit approximately 20% of global methane, predominantly from biodegradable waste.[21] Reduction of food loss and waste can ease the overall caloric requirement from the food system, thereby building resilience.

Target: To halve food loss and waste by 2030. This target is based on United Nations' Sustainable Development Goal 12 and Target 12.3, which states: *"By 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses."*

Food loss and waste context

Food loss is a decrease in the quantity or quality of food resulting from decisions and actions by food suppliers (excluding retailers), food service providers, and consumers. Food waste is a decrease in the quantity or quality of food resulting from decisions and actions by retailers, food service providers, and consumers. Both food loss and waste contribute to food insecurity, but **food loss and waste affect the Global North and Global South differently**. Losses at the production, handling, and storage levels comprise most food loss and waste in the Global South, while waste at the consumption level drives most food loss and waste in the Global North.

Food loss and waste use substantial resources, necessitating reduction to drive resilience across the agrifood system. Eliminating food loss and waste would **save more water than is used by India, mitigate approximately the amount of emissions produced by the US, and free up a greater land area than Canada.**[22]

Reducing food loss and waste requires changes and investment across the value chain. Without fundamental reductions in loss and waste, the agrifood system will fail to meet its mitigation targets and struggle to build sufficient resilience.

[19] WBCSD. OP2B (2022).
[20] Emission Database for Global Atmospheric Research; IEA. CO2 Emissions from Fuel Combustion; UN Population Division. World Population from Fuel Combustion (2019).
[21] Global Methane Initiative. Global Methane Emissions and Mitigation Opportunities (2010).
[22] FAO. Food wastage footprint: Impact on natural resources (2013).

Limiting soil-nutrient- and pest-driven loss

Food loss at the production level can be reduced through improvements in soil nutrient management, pest management, and alternative production technology. Organic fertilisers (e.g., biochar produced from plant matter, manure, and mulch) can improve soil nutrient quality, limiting on-farm food loss. Integrated pest management can reduce loss by decreasing root disease and weed growth. Better harvesting equipment like soil sensors and satellites can help preemptively diagnose and treat threats to crops. Better harvesting practices (e.g., consistent crop ripening times that produce food with more consistent qualities) can lower food loss from production. Applying shelf-life-extending products to produce can reduce loss and waste during storage. For example, Apeel, a US-based company, keeps produce fresh longer by using plant-based protection that slows water loss and oxidation, the primary causes of spoilage.

Reducing food loss through storage, packaging, and distribution

Food loss at the processing level occurs primarily due to poor temperature and humidity control during storage. **Poor on-farm storage drives the majority of food loss in the Global South**, where different food types require different technological solutions. The majority of losses in grains come from improper drying and humidity control during storage. Up to 50% to 60% of grains can be lost during storage due to the lack of technical efficiency. Scientific storage methods can reduce these losses to 1% to 2%.[23] Similarly, most losses in fresh produce and animal source foods (ASFs) come from improper temperature control during storage and transportation. About 25% of household food waste could be related to packaging, making improvements in packaging a large lever to reduce consumption-level food waste.[24] In *distribution*, implementing cold chains (e.g., cooler boxes) can reduce food loss of fresh produce and ASFs. For example, Victory Farms, an aquaculture company that grows tilapia in Kenya and Rwanda, reduced distribution-driven loss to less than 1% through a cost-efficient (less than 4% of revenue) **technology-enabled system to limit distribution spoilage.** In a shift from the status quo, the company uses high-quality cooler box technology to eliminate the need for refrigerated trucks to transport tilapia from its core production site to its 70 commercial branches, which lack formal cold-chain infrastructure.

The role of marketing and retail in limiting loss and waste

Consumers' actions can play an important role in reducing food waste at the last mile, particularly in the Global North. Improving consumer education on food waste handling methods, such as composting, through marketing can initiate behaviour changes needed to reduce food waste in the Global North. Retailers also play a critical role in how they engage with, market products to, and incentivise consumers. Promoting "ugly" foods to bolster demand for damaged products can materially reduce food waste from retail. New or revamped products, packaging, and promotions can also change consumer behaviour. Shifting labelling standards to remove sell-by dates and changing "Buy one, get one free" programmes to "Buy one, get one later" programmes can further drive this change. Marketing can improve consumer understanding of how to use food that would otherwise be lost or wasted. For example, Carrefour Taiwan is promoting awareness of the importance of using leftovers through its anti-waste restaurant that serves dishes made from unsold food items from distributors, wholesale partners, and its own stores.[25]

Turning food waste into productive resources

Food waste will never be fully eliminated, so scaling and implementing solutions to use it is key to reducing it. Using unconsumed food more productively can turn it into a valuable resource. **The largest potential change would be to scale and increase composting access and infrastructure.** Composting turns would-be waste into organic material that can be added to

[23] Kumar and Kalita. Reducing Postharvest Losses during Storage of Grain Crops to Strengthen Food Security in Developing Countries (2017).
[24] Williams et al. Reasons for household food waste with special attention to packaging (2012).
[25] Boston Consulting Group. Tackling the 1.6-Billion-Ton Food Loss and Waste Crisis (2018).

soil to help plants grow. Composting can be scaled by improving consumer education, expanding capacity, and building infrastructure. Additionally, scaling food-sharing systems can allow restaurants and grocers to use excess food more productively. Large food suppliers have joined the 10x20x30 initiative in which the 10 largest food retailers, including Walmart, Kroger, and Carrefour, each engage 20 of their priority suppliers to halve food loss and waste by 2030.[26]

Enablers required to reduce food loss and waste

Packaging and import policies that prioritise the reduction of food loss and waste can have significant impact at the farm level. **Financing farmer education for improved harvesting techniques** and providing subsidies to improve postharvest handling and storage in the Global South are key finance levers to reduce food loss. These investments often require both public and grant-based funding. For example, the Food and Agriculture Organization of the United Nations (FAO) has invested in building 45,000 metal storage silos, each one just big enough for use by a single farmer, in 16 different countries in the developing world.[27] These silos have cut food loss during storage to almost zero. Standardising policies for food packaging and labelling can reduce food waste at the retail level. The UK, for instance, has set a target to reduce food waste by 20% by 2025[28] by standardising labelling, investing in waste reduction marketing, and requiring grocery stores to track and report their waste. Import policy, such as the arbitrary restrictions in certain markets (e.g., the size of fruit considered appropriate for sale), contributes significantly to food waste. Standards for imported food differ significantly across countries, creating production inefficiencies and making it difficult for producers to shift their exports in response to changes in demand.[29]

V. CONSUMPTION PATTERNS AND DIETARY SHIFTS

The planetary health diet

Maintaining planetary boundaries and building the agrifood food system requires increased consumption of alternative proteins and healthy plant-based foods (e.g., fruits, nuts, vegetables, and legumes). **Current global diets are negatively affecting emissions through overconsumption of inefficient foods**. The largest driver of CO_2 emissions from food is food type, rather than handling or transportation. The farm-level emissions from beef alone are around five times the total emissions from pork.[30] The food system

Sharm el-Sheikh Adaptation Outcome #3: Healthy alternative proteins capture 15% of the global meat and seafood market

Animal source foods (ASFs) contribute 57% of emissions from the agrifood sector and require a disproportionately high amount of resources to produce.[37] Mitigating the methane emissions from ruminant livestock is the single largest lever to reduce immediate warming. Shifting to alternative proteins can yield significant nutrition and resilience benefits. Meat is an inefficient resource, supplying approximately 12% of

[26] Champions 12.3. 10x20x30 (2022).
[27] Kumar and Kalita. Reducing Postharvest Losses during Storage of Grain Crops to Strengthen Food Security in Developing Countries (2017).
[28] House of Lords Library. Food waste in the UK (2021).
[29] BCG: Tackling the 1.6-Billion-Ton Food Loss and Waste Crisis (2018).
[30] Poore and Nemecek. Reducing food's environmental impacts through producers and consumers (2018).
[37] Water Footprint Network.

must become a carbon sink by 2040.[31] However, that goal is fundamentally impossible without a large-scale shift away from red meat, specifically ruminant livestock production. Ruminant livestock require substantially more land than white protein alternatives. Approximately 63% of the land used to feed the UK is used for beef and lamb production, compared to about 5% for pork and poultry, even though the UK is a larger consumer of chicken and pork than of beef.[32]

Current food consumption is inherently non-resilient. One of the largest levers to **build resilience is to reduce the water required for food production**. Animal proteins, specifically beef, require substantially more water per kilogram than alternative protein sources, reducing resilience in increasingly arid and drought-ridden growing conditions.[33] The future food system cannot function in an increasingly hot world by continuing to rely on livestock for protein. Healthy plant-based foods have low land and water usage.

Shifting production towards planetary health foods

Alternative proteins and healthy plant-based foods can reduce emissions and improve resilience and health. At the production level, the agrifood system must increase production of alternative proteins to capture the market share from ruminant livestock. Alternative proteins fall into five distinct categories: classic plant-based, precision fermented, plant-based, insect-based, and cellular agriculture. Increasing production of plant-based alternative proteins can increase resiliency through improved resource efficiency. Legumes are high-protein-density plants that serve as nutritious alternatives to ASFs. Nuts are similarly high in protein and create negative land-use change (i.e., reduction in emissions intensity from the transition) through the introduction of carbon sinks such as nut trees onto cropland.[34] Improving global calories despite using over 70% of total agricultural land.[38] ASF production requires substantial land use, both for rearing livestock and producing crops for animal feed. Africa is the only continent where humans eat the majority of crops produced; in all other continents, the majority of crops are used for a combination of animal feed, energy, and commodity use. Additionally, livestock are inherently non-drought-resilient. As Africa faces its longest drought ever, large numbers of livestock on the continent have died, highlighting the need to shift protein production away from ASFs.

Target: This is based on thought leadership from several organisations, including Boston Consulting Group (BCG) and Ernst and Young. According to the BCG report "Food for Thought: the Protein Transformation," current forecast models indicate alternative proteins will capture 11% of all protein consumption by 2035, with an upside case of 22%.

Sharm el-Sheikh Adaptation Outcome #4: The global consumption of fruits, vegetables, seeds, nuts and legumes increases 1.5x by 2030

Increasing the share of healthy plant-based foods in global diets carries significant benefits to both resilience and health. Healthy plant-based foods often require significantly fewer resources per calorie produced, including less water and land compared to other options. The agrifood system must not expand its current frontier, and climate change will continue to constrain resources. Increasing the share of healthy plant-based foods will ensure the agrifood system stays within planetary boundaries and increases caloric output with increasingly scarce water supplies. Additionally, plant-based foods contain essential nutrients that improve

[31] EAT. Food in the Anthropocene: the EAT–Lancet Commission on healthy diets from sustainable food systems (2019).
[32] The National Food Strategy (2021).
[33] Water Footprint Network (2022).
[34] Poore and Nemecek. Reducing food's environmental impacts through producers and consumers (2018).
[38] FAOstat.

and scaling plant-based meat alternatives can drive the shift away from ASF consumption for those resistant to dietary changes while providing similar macronutrient profiles. Investing in the innovation and scaling of lab-grown meat can help transition the most unwavering consumers. Shifting to alternative proteins also carries substantial health benefits: most diet-driven deaths stem from cardiovascular diseases, which result predominantly from overconsumption of red meat.[35] Additionally, scaling alternative proteins will diversify global protein sources, which builds resilience by preventing isolated climate shocks from disrupting global protein supply chains. Increasing the share of healthy plant-based foods requires a production shift, since current land usage is skewed towards ASF production. However, transitioning land to plant-based production carries substantial resilience benefits, as plant-based foods are typically less susceptible to climate shocks than ASFs due to lower resource use.

Processing shifts to drive dietary changes

At the processing stage, increasing both the appeal of meat alternatives and the number of appealing ways to consume plant-based foods can increase adoption of planetary health diets. Consumers emphasise that **further progress in health, taste, and price is key to boosting demand.**[36]

health outcomes. Current global diets are below optimal levels of fruits, vegetables, nuts, and legumes, and increasing the share of those healthy plant-based foods can drive significant health benefits. The EAT-Lancet estimates that 19% to 24% of adult deaths every year could be avoided through universal consumption of a planetary healthy diet.[39]

Target: According to the EAT-Lancet, global consumption of healthy plant-based foods must double by 2050. Maintaining that trajectory requires increasing global consumption of fruits, vegetables, seeds, nuts, and legumes by 1.5x by 2030, necessitating the prioritisation of their consumption and access.

Partner spotlight: Egypt as COP27 Presidency, in partnership with WHO and partners, is launching I-CAN: Initiative on Climate Action and Nutrition, a multistakeholder, multisectoral global flagship initiative that will help foster collaboration, accelerating transformative action that addresses the critical nexus of health, nutrition, and climate change. I-CAN aims to achieve a 20% increase in the nutrient component of school meals by 2030 through shifting towards affordable, sustainable, and healthy diets, with a focus on Africa and developing countries.

Increasing plant-based food consumption also requires **translating agricultural inputs into dietary preferences**. In the Global North, consumption of healthy plant-based foods is driven by value-add processing (such as juices and plant-based dairy alternatives). This bolsters demand and creates additional plant-based use cases. While most agrifood value-add capabilities currently exist in the Global North, expanding processing capabilities in the Global South can both increase the demand for plant-based foods and create jobs, promoting economic growth.

Leveraging marketing to drive behaviour change

Leveraging food marketing to drive consumer acceptance and behaviour change is crucial to expanding alternative protein production and consumption, as consumer acceptance is the single largest lever to drive adoption of alternative proteins. **Improving dietary guidelines through consumer education and marketing can significantly improve health outcomes while reducing climate impacts.** More than 75% of consumers cite health criteria as the largest motivator to transition to planetary health products. Improving consumer education

[35] EAT-Lancet
[36] Boston Consulting Group. The Untapped Climate Opportunity in Alternative Proteins (2022).
[39] EAT. Food Planet Health (2019).

can therefore increase demand. Beyond health and nutrition benefits, food marketing actors must ensure that consumers have a better understanding of the environmental benefits of alternative proteins and create products and dishes that fit into established habits. For example, Beyond Meat successfully entered the mainstream through a targeted marketing approach. The company partnered with Whole Foods to ensure that its product was placed in the chain's meat section.[40] Eliminating aversion to meat alternatives is a crucial step towards consumer adoption. Lastly, as price is a significant driver of purchasing behaviour, reducing the prices of alternative proteins to reach or exceed cost parity with current ASF prices can accelerate adoption.

Building resilience through healthier diets

The shift to alternative proteins requires large-scale diet changes at the consumption level. **Human consumption must shift toward planetary health foods**. Current global consumption over-indexes on ASFs, starchy vegetables, and added sugars.[41] Feed conversion ratio—the kilograms of feed required for a 1-kilogram increase in average body mass—is a good metric to understand the throughput from animal feed to calories ready for human consumption. Cattle typically show an average feed conversion ratio of approximately 8, the highest among all food types.[42] Victory Farms has achieved a feed conversion ratio below 1.5, meaning the animal feed required to produce white protein is less than 20% of the feed required to produce beef. The lower feed requirements flow backwards, necessitating fewer resource inputs—less water, fertiliser, and land—and thereby builds resilience.

Enablers required to achieve planetary health diets

Shifting consumption requires significant policy and financial support. Policymakers should **ensure a level policy and regulatory playing field between conventional and alternative proteins**. As price is a large driver of consumer behaviour, taxes on planetary unhealthy foods (e.g., sugar, salt, ASFs) can greatly affect diets. Spain and Switzerland recently introduced taxes on ASFs, and a proposed UK tax on meat should reduce meat and dairy consumption by 20% by 2030.[43] Concerns exist about the inequity of meat taxes and the possibility that they would inadvertently hurt lower-income individuals and families, who often rely on inexpensive cuts of meat for dietary protein. Therefore, equitably implementing policy changes is crucial to prevent a decrease in food utilisation, and connecting climate policy to social justice correlates highly with public support. Other enablers include:

- Expediting regulatory reviews and approvals (where possible) in line with national principles and consumer safety to accelerate the development of alternative proteins.
- Avoiding labelling hang-ups (e.g., phrases such as "plant-based meat" or "plant-based milk").
- Requiring that sustainability metrics and measurement systems account for and highlight all environmental factors involved in food production.
- Using dietary guidelines and campaigns to educate the public about the benefits of increased consumption of plant-based proteins.

This shift also requires finance support to drive changes in fundamental unit economics for producers. Leveraging blended finance to direct capital towards transformative ventures can help catalyse the necessary dietary shifts. Innovative companies require significant capital to develop protein sources, scale up bioprocesses, and bring ingredients to market. Without the necessary policy changes and increased access to financing, producers will not be incentivised to produce planetary healthy foods.

[40] How Beyond Meat's Marketing Strategy Set It Apart
[41] EAT-Lancet
[42] Statista: Feed Conversion Ratios Worldwide
[43] House of Lords Library. Food waste in the UK (2021).

VI. CALL TO ACTION

We are on the brink of a catastrophic and multifaceted food crisis due to climate change and global supply chain shocks. But beneath this impending crisis is an already fragile food system that is neither sustainable nor resilient. As populations increase and we are constrained by land, crises will become the norm. Because the agrifood system is heavily interconnected, increasingly frequent climate shocks will have carry-over impacts on food security and resilience. The magnitude of action required is massive.

National governments, subnational governments, the private sector, funders, and civil actors to initiate overall change across the agrifood system through immediate action. Farmers should be at the centre of this transition, with support provided to them to mitigate risks and funding options provided to bolster the resiliency of their produce. Fundamental unit economic shifts at the farm level are the primary way to shift practices that in many cases have been handed down over generations.

National governments to leverage policy, taxes, and subsidies to improve the unit economics behind climate-smart agricultural practices. Subnational governments can alter local policy to drive planetary health solutions.

The private sector to invest in scalable climate solutions and drive innovation through a focus on and investment in R&D. More specifically, large commercial farmers can initiate these shifts by adopting resilience-building, climate-smart technologies and practices. Commodity traders have a role to play through demand signalling. Prioritising sustainable inputs for what commodities they buy and sell can materially affect supply-side shifts. Food processors must leverage their position to drive demand for resilient crop types through formulations and marketing decisions.

Funders to both increase funding for sustainable agrifood solutions and continue to invest in innovation and alternatives to red meat. Banks and investors must drive investments in sustainable practices to make the necessary capital available for scaling. Input manufacturers can shift supply to encourage farmers to shift to more sustainable inputs.

Civil actors include NGOs, academia, and individuals: NGOs to leverage their reach and influence to help finance adaptation and resilience projects across the developing world, and to advocate for altered dietary habits. Academia to continue to advance research and thought leadership around the effects of climate change on the agrifood system and their magnitude. Individuals to influence specific value chains via demand signalling, and small farmers to increase their yields through better practices and technology to increase the food supply.

Each actor must take a role in improving consumer education and knowledge around the intersection of climate and the agrifood system. **Successful implementation of these changes will result in a drastically more resilient food system, the mitigation of substantial emissions from the agrifood system, and the creation of additional carbon sinks to enable further carbon sequestration.**

APPENDIX: PARTNERS, ORGANISATIONS, AND INITIATIVES

Sharm el-Sheikh Adaptation Outcomes	Race to Resilience Partner / COP27 Presidency Initiative*	Other Organisations
Climate resilient, sustainable agriculture increases yields by 17% and reduces farm level GHG emissions by 21%, without expansion of the agricultural frontier	• Breakthrough Agenda • Agriculture Innovation Mission for Climate (AIM4C) • Africa Food Systems Transformation Initiative (AFSTI) • FAO • FCDO • Food and Agriculture for Sustainable Transformation Initiative (FAST)* • Agriculture 1.5 • GEGA • Efficiency for Access Coalition • RegionAdapt	• ClimEAT • World Resource Institute
Halve the share of food production lost and per capita food waste (relative to 2019)	• Africa Food Systems Transformation Initiative (AFSTI)	• Champions 12.3
Healthy alternative proteins capture 15% of the global meat and seafood market	• Good Food Institute	
The global consumption of fruits, vegetables, seeds, nuts and legumes increases 1.5x by 2030	• EAT Foundation • GAIN • I-CAN*	• Sustainable Consumption and Diets Platform • Global Alliance for Future of Food

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About UN Climate Change High Level Champions
The UN Climate Change High Level Champions engage non-State actors to support governments in delivering the goals of the Paris Agreement. Working with the Marrakech Partnership - a global alliance of more than 320 major initiatives and coalitions - the Champions enhance the ambition of cities, regions, businesses and investors and other non-State actors, to collectively race towards a fair, resilient and zero carbon world.