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IMPACTS OF FOOD

FORESEE SERIES 4C

CLIMATE | COVID-19 | CONFLICT | COST OF EXTERNALITIES

REPORT 1

Current Conditions & Policy Frameworks of Agri-Food Systems Transformation

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Contents

Preface

Why we urgently need an international policy framework to govern agri-food systems transformation

The internationally agreed sustainability goals of the 2030 Agenda, the Paris climate agreement and the goals of three **Rio Conventions** that address, respectively, climate (UNFCCC), land restoration (UNCCD) and biodiversity (CBD) **cannot be achieved without a transformation of the world's agri-food systems**.

Today's increasingly industrialized and concentrated agri-food systems are contributing to accelerated biodiversity loss, climate change and other environmental impacts, while failing to address rising food insecurity, malnutrition and food waste. They are also undermining more biologically diverse and climate-resilient food production and distribution systems that are built around smallholder production and local markets.

Transformative agricultural practices, on the other hand, **have the potential to future proof agri-food systems**. An example is when farming sequesters atmospheric carbon, effectively creating a massive carbon sink in the ground, while simultaneously improving soil health.

At the same time, the world continues to feel the impacts of multiple interlinked crises: a climate emergency; ongoing consequences of the COVID-19 pandemic; distortion of global trade in agricultural commodities by the Russian war in Ukraine and its contribution to rising energy and food insecurity; continuing conflict hotspots within countries and across national borders; and the environmental, social and health impacts and external cost of unsustainable production and consumption patterns. We refer to these crises collectively as the **"4 Cs" – Climate, Covid, Conflict and Costs**.

Beyond their immediate consequences, the 4 Cs have introduced new variables that **necessitate a rethink of how to implement existing multilateral agreements**. The 4 Cs impede progress made on internationally agreed sustainable development goals and hence appropriate strategies need to be developed in face of these new challenges to achieve inclusive and sustainable global development. A unique characteristic of today's agri-food systems is that they are simultaneously a casualty, an underlying cause, and a potential solution to these crises. Transitioning to sustainable and resilient agri-food systems has, therefore, the potential to mitigate and respond positively to these crises. However, this can succeed only if proposed transformative actions duly factor in the 4 Cs.

Achieving the right to food for all while transitioning to a more socially inclusive and environmentally sustainable future therefore calls for nothing less than the transformation of our agri-food systems. While a systemic international agreement for agri-food systems transformation has yet to be developed – which from experience could take up to a decade to negotiate and ratify – **the three Rio Conventions could offer insights on possible entry points, as well as pathways towards the required transformative actions**. Not only do they draw their legitimacy from three legally binding international treaties but with their joint focus on the environmental pillar of sustainable development, the Conventions already have a broad mandate to pursue greater synergies.

This provides a fitting starting point for jointly exploring how to address agri-food systems transformation with the existing mandate of each Convention coordinating the efforts. A possible approach is to build on the "Food Days" introduced at all three sessions of the Rio Convention Conference of the Parties in 2022, to practically demonstrate how to **move beyond consensus on the need for urgent transformation towards specific proposals** on what needs to be done, and who should take responsibility for initiating action.

Such efforts can benefit from adopting **True Cost Accounting approaches**, which undertake integrated assessments of all externalities of agri-food systems. This **can support decision makers** to quantify both the value that a transformation of agri-food systems can bring to global sustainability processes, as well as the costs of inaction.

The coordinated action of the three Rio conventions under an **international policy framework would also provide the necessary financial resources** for the required transformative measures. Under this framework, transformative actions in agri-food systems can be funded based on their contributions to fulfilling the mandate of the three Rio Conventions, using a mechanism similar to the Rio Markers mechanism of the European Commission.

Corresponding actions under an international policy framework will also be needed at the regional and national levels. **A whole-of-government approach is required** to stimulate exchanges and negotiations across sectors and make tough choices about how to balance global goals with local needs. The 'synergies agenda' can be further expanded upon by revisiting existing commitments and targets that touch on food security, social inclusion, international trade, and other relevant elements within the Rio Conventions to drive more transformative actions. This would strengthen political structures that focus on the right to food, healthy nutrition, and protecting land, biodiversity and climate.

The FORESEE (4C) Report Series: A brief outline

TMG's new report series *FORESEE (4C) – The Transformation of Agri-Food Systems in Times of Multiple Crises* informs the debate on agri-food system transformation in six ways:

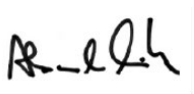
1. Identifying the key issues and hence the need for transformation of our agri-food systems,
2. Analysing the conditions that make transformation both urgent and complex,
3. Assessing the extent to which the existing policy landscape is suitable for transformative action,
4. Analysing the debate to better understand where different actors agree or disagree on transformation pathways,
5. Identifying blind spots and neglected issues in the debate,
6. Proposing recommendations on how to advance the conversation.

The first report, Current Conditions & Policy Frameworks of Agri-Food Systems Transformation takes a systems view of the aforementioned challenges. It outlines the ecological, health and social challenges of current agri-food systems and analyses how these interact with the 4 Cs (Climate, Covid-19, Conflict and Costs). Furthermore, the report reviews the existing policy frameworks at the international level that inform the direction of, and could potentially steer, the transformation of agri-food systems.

The second report, State of the Debate on Agri-Food Systems Transformation, conducts a critical discourse analysis to examine alignment, as well as divergence in current understanding of agri-food systems and potential pathways for agri-food systems transformation. The analysis further reveals important blind spots that have only been marginally addressed in the transformation debate but are essential for a holistic approach.

Current gaps in the agri-food systems transformation debate are analyzed in more detail in the third report, Blind Spots in the Debate on Agri-Food Systems Transformation, which also provides recommendations to address these gaps.

The report series was developed by TMG together with a group of experts from different disciplines and backgrounds. In an iterative process of meetings and workshops, the experts provided advice and feedback on the development of the reports and contributed as authors to the second and third reports in the series. The research was made possible thanks to funding under the Assessment and Communication of Climate Impacts of Food (CLIF) project through the International Climate Initiative of the German Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection.



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Grain storage silos, with queue of lorries and trucks waiting to deliver recently harvested maize, Eldoret, Kenya
Photo credit: Jen Watson

Two cows walking along a rural road in Kenya.
Photo credit: kovop.

Key messages

1. Agri-food systems (encompassing agriculture and the processing, distribution, and consumption of food) and food security have been heavily affected by multiple ongoing crises (especially the 4 Cs: Climate, Covid-19, Conflict and Cost of externalities).

2. This situation provides an opportunity to think about how to transform agri-food systems and rethink the existing pathways.

3. This analysis reveals that agri-food systems are simultaneously a casualty, partly a cause, and part of the solution to the 4 Cs.

4. Public policy in relation to the transformation of agri-food system must take advantage of the synergies between existing international agreements and frameworks, particularly the Rio Conventions.

5. Many of the challenges created by the 4 Cs can be traced back to the externalized costs of current agri-food systems; thus, an analysis using True Cost Accounting (TCA) is essential.

6. Using examples of successful application in different local contexts, clear alternatives to the dominant industrial agri-food system must be included in transformation frameworks.

1 A systems approach to agri-food: Towards a crises-proof pathway

1.1 Why do agri-food systems need to be transformed? An overview of the ecological, health and social challenges related to agri-food systems.

In recent years civil society, private enterprises, academia, international organizations, and policy makers alike have complained about dysfunctional agri-food systems. They argue that global agri-food systems[i] are causing a multitude of severe problems.

First, these are among the major contributors of greenhouse gas emissions, contributing one third of the total worldwide greenhouse gas emissions.[1] The resulting impacts of global climate change in the form of extreme weather events such as floods and droughts are in turn affecting food production.

Second, agri-food systems are the primary driver of biodiversity loss,[2] with agricultural activities threatening 86% of the species at risk of extinction. 50% of freshwater biodiversity loss and 70% of terrestrial biodiversity loss are related to food production. Agricultural expansion drives almost 90 % of global deforestation[3] with 50% of that loss due to crop farming and 40% due to livestock grazing. At the same time, the world loses 24 billion tons of fertile soil every year due to unsustainable farming activities.[4]

Third, food systems draw 70% of global freshwater out of natural cycles.[4] Agriculture is also the main polluter of freshwater in many developed countries, with nitrate contamination causing eutrophication of water bodies, which manifests in the form of dead zones and algal blooms. All of the above impacts degrade the environment, endanger human health, and threaten food security.

As the global population reaches the 8 billion mark, the global agri-food system is failing to properly nourish billions of people, even while producing food in sufficient quantity to feed 10 billion people[5]. Between 720 and 811 million people were threatened by hunger in 2020,[6] while 2 billion people were overweight or obese.[7] One-seventh (14%) of all food[8] produced is lost between harvest and retail every year. Current global dietary patterns contain only half the amount of fruit, vegetables and nuts required for a healthy diet, implying serious consequences for human health.

i The authors are aware that agri-food systems are extremely diverse (see Info Box 1) and therefore usually use the plural term "agri-food systems". However, it is important to note that not all food systems and agri-food systems contribute equally to the total impact.

Healthy diets were unaffordable for roughly 3 billion people in 2019.[9] On average, a healthy and varied diet that prevents deficiency symptoms and long-term nutrition-related diseases costs at least 3.75 US dollars (USD) per person per day.[9] However, wages within the food system – from agricultural labourers to workers in the processing and transportation sectors to retail and restaurant workers – are below the liveable wage in most parts of the world. On average, farmers receive 27% of the total consumer price for a food product[10] but this proportion varies widely by sector. Coffee farmers, for example, receive just 1% of the retail value of a cup of coffee.[11]

Furthermore, the agricultural sector is one of the most hazardous workplaces worldwide.[12] The incidence rate of fatal accidents in food production is double that of other industries. It is also the sector with the highest use of child labour; 108 million children, more than two-thirds of the global child workforce, are engaged in food production. The agri-food sector is marked by huge differences in power all along the value chain. In global markets and at local and regional levels alike, access to land, seeds, water, and agricultural services are very unequally distributed. Globally, between 10% and 20% of landowners are women. Yet, in half of all countries worldwide it is difficult or impossible for women to own land.[13, 14] Poor access to credit prevents small farmers, the rural poor, and other vulnerable groups from escaping poverty. Around 50% of the market for commercial seeds is controlled by just four corporations (Bayer Crop Science, Corteva Agriscience, ChemChina/Syngenta, and Vimorin & Cie/Limagrain).[15, 16, 17]

Economic power reinforces political power. As a result, policies are designed by and for people who have money and influence. For example, the four seeds giants want laws to be changed to reduce farmers' freedom to propagate, trade or exchange seeds themselves. Similarly, the food industry in Europe has spent over 500 million euros lobbying against the introduction of Nutri-Scores, a nutritional rating scheme for food packaging.[15]

Almost 90% of the USD 540 billion given each year in subsidies to farmers contribute to sustainability crises by damaging people's health, fuelling the climate crisis, destroying nature, and worsening inequality.[18] Various forms of production and export subsidies, food aid abuse and export restrictions, are still permitted by WTO rules. Government policies are generally formulated within departmental silos, resulting in a misalignment between a production-focused 'agriculture policy' and a consumption-orientated 'food policy'.

The hidden costs of global food and land use systems in terms of environmental, health and social costs are estimated at USD 19.8 trillion a year, which is twice the USD 9 trillion estimated market value of the food system's yearly global output.[19, 20] This means that we are externalizing the costs of food production and consumption, especially to the Global South and for future generations. This sustainability deficit is not an accident. It is the result of insufficient regulation, commitment, and global collaboration. It represents a glaring moral failure that requires immediate political and social action. We must rethink and fundamentally transform the way we produce, distribute, and consume food worldwide if we are to build sustainable, healthy, and just agri-food systems.

BOX 1 What are agri-food systems?

Agri-food systems include all actors and activities involved in the generation, production, aggregation, processing, distribution, consumption, and disposal of food products originating from agriculture, hunting, pastoralism, forestry, or fisheries, and the primary production of non-food agricultural products.. The broader economic, political, technological, societal (e.g., cultures and traditions) and natural environments in which they are embedded influence how agri-food systems work.[21] Food environments are the places and the contexts in which people interact with the food system to acquire, prepare, and consume food. They include physical spaces as well as social and cultural ones. [ii]

Agri-food systems can be divided into sub-systems (e.g., input supplier system, farming/fishing system, service provider system, processing system, distribution system, consumption, end-of product system) and are connected to other key systems (e.g., energy system, health system, waste system, transportation system). A change in one system or sub-system can cause changes in another; for example, greater use of biofuel in the energy system may have a significant impact on the food system.[22]

Agri-food systems vary widely across the world, but roughly speaking, we can distinguish between three types based on size, mechanization/external input intensity, length of supply chain, and the type of labour involved:

- **Industrial agri-food systems *(modern agri-food systems)*:** large-scale, highly specialized, and mechanized systems functioning on a global scale with long supply chains dominated by a few vertically integrated multinational corporations. Food is channelled through supermarket chains, restaurants, and catering companies. These systems are characterized by highly processed food, lower prices, and a wider available variety of foods in supermarkets.[23]
- **Agroecological, traditional and indigenous agri-food systems *(traditional agri-food systems)*:** These are mainly small-scale, local systems based on family farming with shorter supply chains. Food is either self-produced or channelled through small local shops and markets. Agroecological agri-food systems aim at formalizing traditional practices while as also developing innovative practices aimed at nurturing resilience, sustainability, and autonomy.[23, 24]
- **Intermediate agri-food systems *(mixed agri-food systems):*** a combination of small-scale and large-scale farming with shorter and longer supply chains, including basic products and processed food which is channelled through local shops as well as modern retail outlets. Most people participate in intermediate food systems.[25] These systems are characterized by a wide range of 'food entry points'.

BOX 2 What is an agri-food systems approach?

Typically, policies designed to improve food security have focused on one or a few elements of the food supply chain (silo approach). However, many elements and activities in agri-food systems are strongly interconnected, and a more holistic framework is needed to identify intervention points for enhancing sustainability. As a result, an agri-food systems approach is nowadays the preferred tool for analysis.[26]

An agri-food systems approach applies system thinking; it considers the agri-food system in its totality, studying relationships and interactions, including feedback loops between the different parts of the food system and the outcomes of activities and changes in terms of environmental, social, human health and economic impacts. A systems approach encourages a holistic, interdisciplinary view, sheds light on trade-offs between policy objectives, and helps identify opportunities for synergies to accomplish multiple objectives of sustainable food systems.[27]

Conceptual framing of agri-food systems

The different constituents of agri-food systems and their interactions

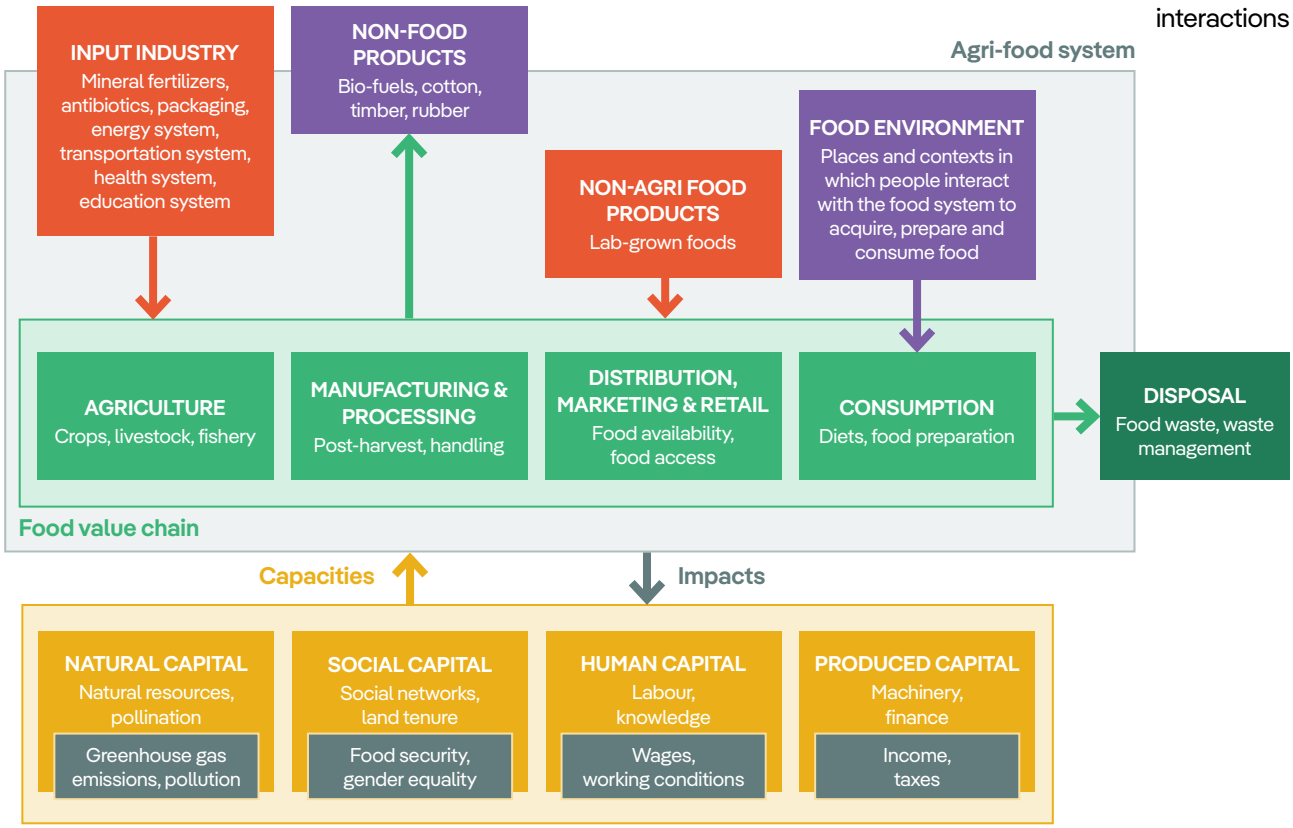

FIGURE 1 Conceptual framing of agri-food systems

1.2 What are the conditions for agri-food systems transformation during the climate, Covid-19, conflict, and cost of externalities crises?

In these times of multiple crises, the need to transform agri-food systems is more urgent than ever. Nowhere are the impacts of the four overarching global crises (the 4 Cs: Climate, Covid-19, Conflict and Cost of externalities) more severe and challenging than in agri-food systems. The accelerating climate crisis increases the uncertainty of food production, thereby threatening the livelihoods of billions of people and putting them at risk of hunger and malnutrition. The Covid-19 pandemic severely disrupted global food supply chains, revealing the vulnerability of our agri-food systems to shocks and stresses. Conflicts within countries and across national borders cause major disruptions to food production, distribution, and access. Russia's invasion of Ukraine in 2022 and the resulting interruption in trade of agricultural commodities has brought into focus the dependency of many countries on imported foodstuffs and a lack of food diversification as well as the dependency of the global agri-food systems on fossil fuel-based fertilizers. This has led to an explosion of fertilizer, fuel, and food costs in a situation where food products are already unaffordable to many, not only in the Global South. At the same time, unsustainable production and consumption patterns are degrading resources, destroying biodiversity, threatening human health, and causing high environmental, economic and health costs. Inaction and procrastination regarding the transformation of agri-food systems and with that missing progress in implementing internationally agreed goals such as the 1.5-degree goal and the UN Sustainable Development goals (SDGs) will ultimately cost trillions of dollars.[29]

A transformation to sustainable, resilient, and healthy agri-food systems offers a multitude of possible solutions to these crises as as agri-food systems can contribute to climate mitigation, offer more resilient livelihoods and healthy diets, and contribute to better access to and affordability of food for everyone.

The 4 Cs[ii] are not only in part caused by but also aggravate the challenge of transforming agri-food systems. As the crises are interrelated and converging, there is a risk that dealing with problems one at a time, without considering the system as a whole, may exacerbate the other problems. For example, the recent crises of the Covid-19 pandemic and the Russian invasion of Ukraine have shifted governments' priorities and attention towards short-term solutions and away from structural change and long-term strategies. Thus, the task of transforming agri-food systems is more challenging than ever. The 4 Cs are also entangled with other crises, such as the biodiversity crisis, creating uncertainties that will become the new and very challenging normal under the 'business as usual' scenario.

In the following section, we offer an overview of the impacts of the 4 Cs on agri-food systems and the opportunities provided by agri-food systems transformation.

The 4 Cs

How the different crises affect the functioning of agri-food systems

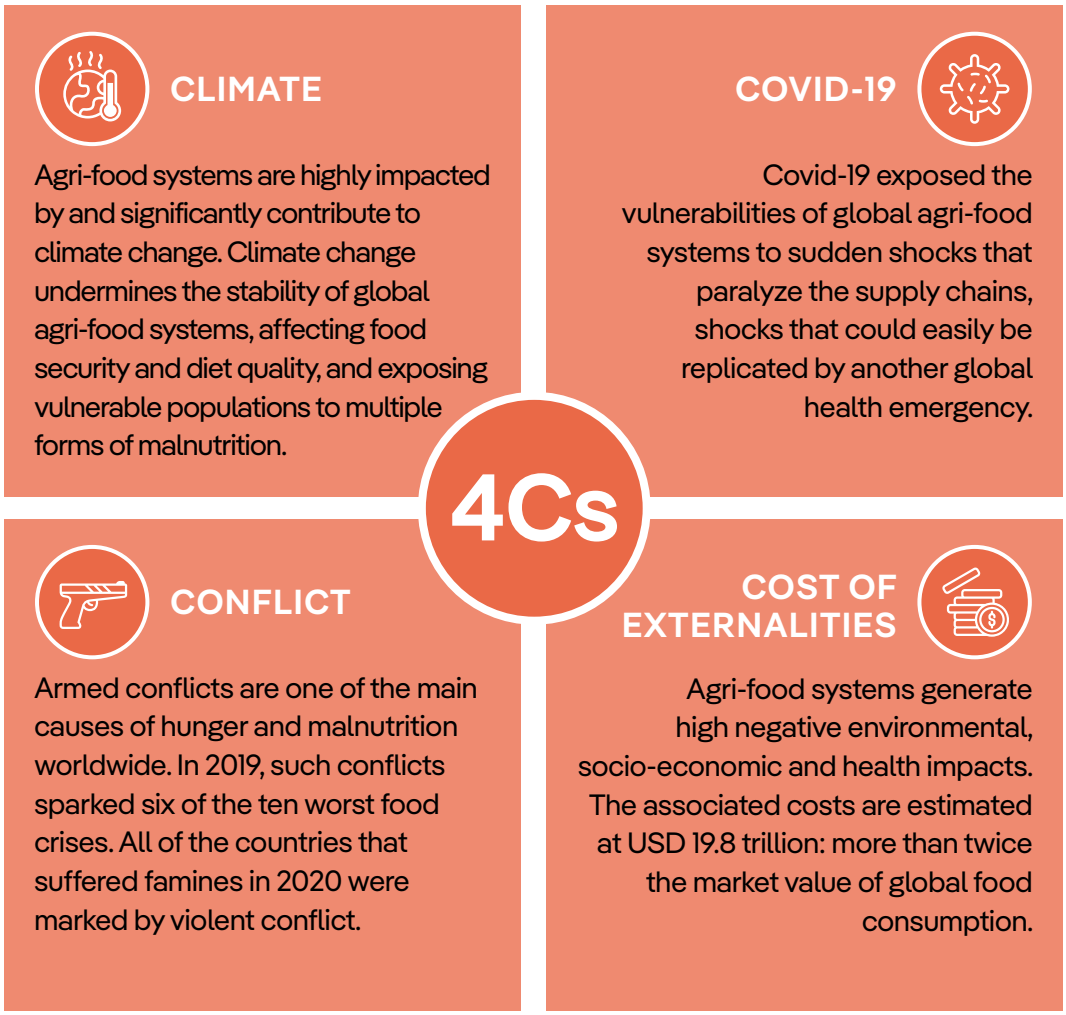

FIGURE 2 The 4 Cs in the context of agri-food systems

ii The current crises go beyond the four highlighted in this report and include for example the biodiversity crisis.

BOX 3 What is transformation?

Transformation entails more than change; it encompasses a paradigm shift. Whereas incremental change sees small improvements of the existing system over time, transformative change is grander in scope, replacing the existing system with something completely different. According to the Global Alliance for the Future of Food (GAFF)[28] transformations must be "multifaceted, multidimensional, multisectoral, multinational, and augmentative." A transformation may be triggered by new technical and economic possibilities as well as by radical shifts in social needs, for example due to new environmental risks. Every transformation encompasses a long-term process of research and learning that lasts several decades and results in winners and losers. A process of transformation is only complete when new system structures have become established and stabilized.

Climate crisis

The climate crisis is increasingly threatening our agri-food systems due to rising temperatures, changing precipitation patterns, sea level rises and extreme weather events. These effects have already reduced agricultural yields and disrupted food supply chains. According to the United Nations Intergovernmental Panel on Climate Change (IPCC)[30], between 3.3 and 3.6 billion people live in contexts and areas that "are highly vulnerable to climate change" and around one billion people live in countries, mainly in the Global South, where the official structures are unable to cope with the ecological crises that are projected for 2050. As the sixth IPCC Assessment Report (AR6) states, "Climate change will increasingly put pressure on food production and access, especially in vulnerable regions, undermining food security and nutrition … At 2°C or higher global warming level in the mid-term, food security risks due to climate change will be more severe, leading to malnutrition and micro-nutrient deficiencies, concentrated in Sub-Saharan Africa, South Asia, Central and South America and Small Islands."[31] According to the UN Environment Programme Emissions Gap Report 2019, in order to meet the 1.5°C goal of the Paris Agreement, global emissions would need to drop by 7.6% each year between 2020 and 2030.[32]

Extreme weather events have become more severe and frequent over the last 20 years driven by rising global temperatures and other climatic changes.[33] Floods, droughts, and storms account for 90% of climate-related disasters each year, affecting millions of people and jeopardizing global food production. For instance, in 2022 extreme heat led to a 10–35 % decline in crop yields in India, floods of catastrophic proportions affected 33 million people in Pakistan in 2022, leading to death of 1.2 million livestock and affecting 15 % and 40 % of the rice crop and cotton crop respectively[34], while as heatwaves and droughts drove up prices for rice and tomatoes by as much as 50% in Northern Italy,[35] and the Horn of Africa suffered its worst drought in four decades.[36]

Climate change is a threat multiplier as climate hazards happen concurrently with other crises, compounding the risk to food security and nutrition, while driving conflicts and biodiversity loss. Scientists have predicted that long-term effects of climate change will include a decrease in sea ice (resulting in sea level rises), the thawing of permafrost, an increase in heat waves and heavy precipitation, worsening droughts and decreased water resources in semi-arid regions as well as significant biodiversity loss through species extinction in many tropical areas[37]. For agricultural production, this means that higher temperatures eventually reduce yields of desirable crops while encouraging the proliferation of weeds and pests, which cause further losses[38]. Changes in precipitation patterns increase the likelihood of short-term crop failures and long-term production declines which are likely to result in higher food prices. Although some regions will see higher crop yields, the overall effects of climate change on agricultural production are expected to be negative, threatening global food security.[39] Worsening living conditions are likely to trigger displacement of people and hamper the return of those already displaced.

Food systems are an indispensable part of the solution to the climate crisis, when transformed to more sustainable ways of production and consumption they can help reduce emissions and sequester carbon. Sustainable agri-food systems thus play a decisive role in climate mitigation. At the same time, climate adaptation is of vital importance if agri-food systems are to address changes in growing conditions, build resilience and better support local livelihoods. According to the World Resource Institute (WRI) 'transformative adaptation', as opposed to incremental adaptation, promotes "long-term resilience by continually shifting the geographical locations where specific types of crops and livestock are produced, aligning agricultural production with changing landscapes and ecosystems, and/or introducing significantly new resilience-building production methods and technologies at broad scale across value chains".[40]

Covid-19 crisis

The Covid-19 pandemic severely impacted people's livelihoods, their health and agri-food systems around the world as well as causing a dramatic loss of human life. The pandemic put global agri-food systems under stress, affecting supply in complex ways and threatening the food and nutrition security of millions of people, especially the poor and marginalized. The severe disruption of agri-food systems included restrictions on labour and interruptions of transport, processing, retailing, and input distribution. According to David Beasley, Executive Director of the UN World Food Programme (WFP), the world is "not only facing a global health pandemic but also a global humanitarian catastrophe." [41] Covid-19 exposed the vulnerabilities of global agri-food systems to sudden shocks that paralyze the supply chains, shocks that could easily be replicated by another global health emergency.

The ability of supply chains to deliver food was severely affected by the introduction of trade constraints by major exporting countries, in particular export bans on rice and wheat.[42,43,44] At the national level, health, and safety measures to control Covid-19 transmission, such as lockdowns, restricted economic activity and the trade in some food products and affected the availability of farm labour and the livelihoods of seasonal farm workers.[45] At the local level, in many countries

of the global South travel restrictions impeded farmers' access to local markets, affecting their ability to purchase agricultural inputs and to sell their produce, resulting in loss of income and unemployment.[46] Many people experienced increased commodity prices and decreased access to food, for example due to lockdown-enforced closures of schools and restrictions placed on the informal markets that play a key role in ensuring food security in many countries.

The urgent need to respond to the Covid-19 pandemic led governments to lower or abandon environmental standards which risks accelerated environmental deterioration and further delays in achieving the SDGs as well as national and international climate goals.[47] Building back better in relation to agri-food systems means integrating risk prevention and management, reinforcing resilience, and improving our understanding of the system's fragility in the face of overlapping crises.[48] A transformation of agri-food systems based on a One Health approach (recognizing that the health of humans, animals, and the environment are inextricably linked) may contribute to preventing the next pandemic since wildlife spill-over associated with aggressive human interaction with ecosystems has been the likely cause of several recent pandemics, including Covid-19.[49]

Conflict crises

Armed conflicts are one of the main causes of hunger and malnutrition worldwide, due to their direct impact on agri-food system stability. In 2019, such conflicts sparked six of the ten worst food crises. All of the countries that suffered famines in 2020 were marked by violent conflict.[50] Conflicts disrupt all stages of food production, from cultivation, processing to distribution, marketing, and rural services. In conflict regions, the disruption of agri-food system stability can occur due to any of the following disruptions: crops are destroyed, livestock is stolen, people are driven off their land, livelihoods are destroyed, infrastructure and transport networks are destroyed, markets are disrupted, and food prices rise steeply while the purchasing power of households shrinks.

Conflicts not only diminish capacities to produce and distribute food in the short term, but also have long-term consequences for food security. For example, in the Central African Republic, in the two years following the outbreak of civil war in 2013, cereal production fell to just 30% of pre-conflict levels. Five years later, in 2018, production showed first signs of marginal improvement but was still just 32% of the pre-conflict level.[50]

Food shortages due to war not only affect those countries directly involved in the conflict but also other regions. For example, Russia's war in Ukraine is preventing grain from leaving one of the world's bread baskets, thus raising grain and seed oil prices across the globe, and worsening shortages, hunger, and political instability in the Middle East, North Africa, and parts of Asia. Nearly a third of the world's wheat and barley, more than 70 percent of its sunflower oil and large amounts of corn is typically exported by Russia and Ukraine, but the conflict has halted most exports. Many countries, including Somalia, Libya, Lebanon, Egypt, and Sudan, are heavily reliant on wheat, corn and sunflower oil from the two warring nations. Furthermore, Russia is the world's leading fertilizer producer. Lack of access to Russian fertilizers has caused global

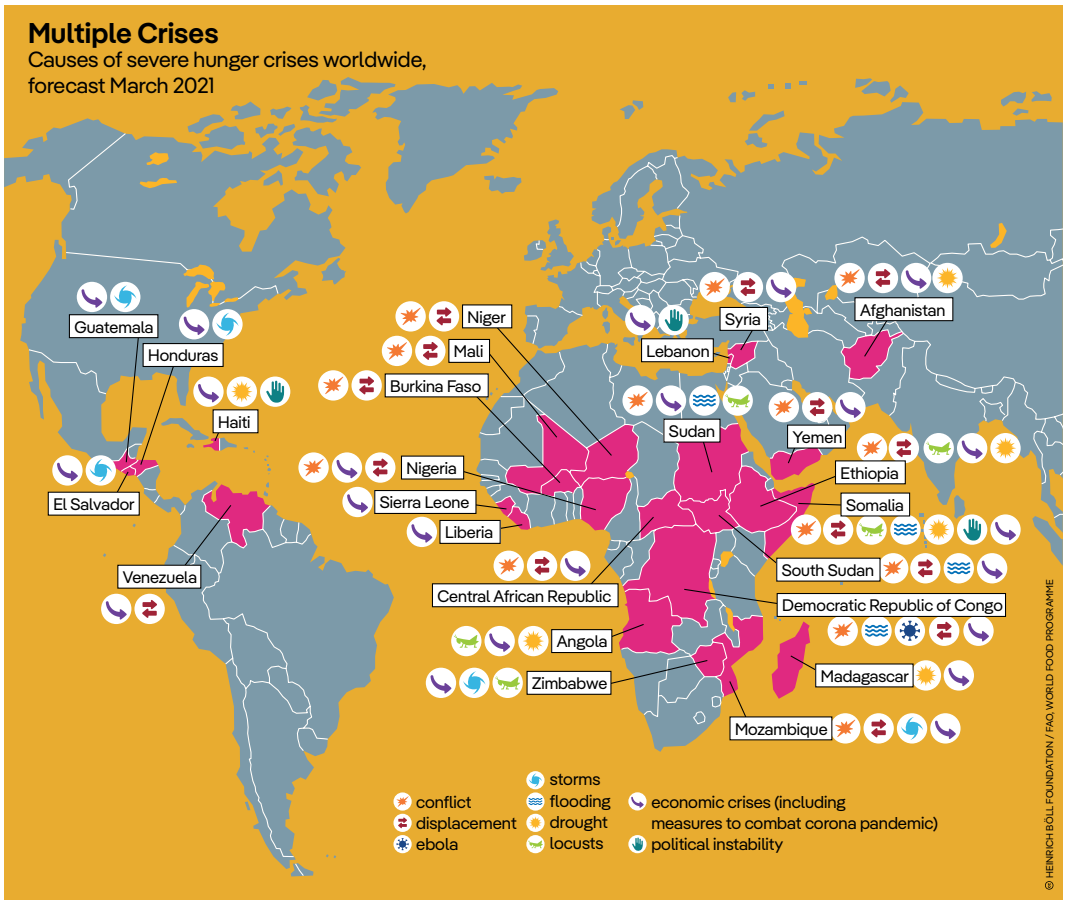

FIGURE 3 Different countries suffering from hunger due to multiple crises (Power Poverty Hunger, Heinrich Böll Foundation & TMG Research)[iv]

fertilizer prices to soar. The result is an expectation that crop yields will fall due to poor fertilizer access and that this will further exacerbate food shortages. More resilient agri-food systems of the future may include a wider range of crops grown for local consumption and will be better prepared to respond to conflict-related shocks. Furthermore, such agri-food systems will ideally be indifferent to the supply of fossil fuels and fossil-fuel dependent inputs for agricultural production.[51, 52]

In addition to international conflicts, the 2008 bread riots in Burkina Faso, Cameroon, Egypt, Haiti, and Indonesia showed that unequal access to food within a country can also cause conflict, when sufficient food is available but poorer sections of society cannot afford to buy it due to rising prices. New conflicts such as the war in Ukraine affect the food security of regions that are subject to protracted crises, for example through crisis fatigue.[53, 54, 55]

Disruption of food production, distribution and access may also form part of deliberate military strategy or tactics. This is the case in Yemen and in the Ethiopian region of Tigray and is feared to form part of Russia's strategy in the current invasion of Ukraine.

iii Power, Poverty,Hunger, A report by Heinrich Böll Stiftung and TMG Research, https://tmg-thinktank.com/event-series/power-poverty-hunger-food-system-facts/

High cost of externalities

The world is now paying for many years of inaction and procrastination on climate change, sustainable food, and public health systems. According to estimates by the International Monetary Fund (IMF), the Covid-19 pandemic will cost the global economy USD 12.5 trillion through 2024.[56] The global food system creates high environmental, economic and health costs (USD 19.8 trillion), which are currently not reflected in market prices (the current global food consumption amounts to USD 9 trillion, which means that food is roughly sold at a price that only reflects a third of the cost if externalities were included in market prices).[19, 20] At the same time, almost 90% of the USD 540 billion per year in subsidies given to farmers worldwide contributes to sustainability crises by damaging human health, fuelling the climate crisis, damaging natural ecosystems, and worsening inequality.[18, 57]

Our unsustainable food systems are wreaking havoc on the environment, destroying forests, wetlands and other ecosystems, and thereby increasing future costs of food production and consumption. In Germany, extreme weather events caused by climate change have cost the state at least 6.6 billion euro per year in damages over the past two decades.[57] The floods of 2021 alone cost the state more than 40 billion euros.

Action and investment now for human and planetary health will save billions in future costs. For instance, just 2% of the estimated financial damage (USD 11.5 trillion) caused by Covid-19 to the world economy would be needed to cover the costs of preventing future pandemics by protecting wildlife and forests.[58,59] According to a recent study comparing climate action policies to government responses to Covid-19, "acting now on climate change would mean the cost of saving a life would be 2–3 times lower than during the pandemic." [60]

Currently, a confluence of negative events, including the Covid-19 pandemic, the war in Ukraine and the ongoing climate crisis, have led to a surge in food and energy prices. Food prices have increased since mid-2020 driven by extreme weather events, trade restrictions, rising input

The hidden costs of food

The negative impacts of current agri-food systems are further driving the crises of the 4 Cs - climate, Covid-19, conflict and the cost of externalities. Responding to the 4 Cs necessitates transforming agri-food systems.

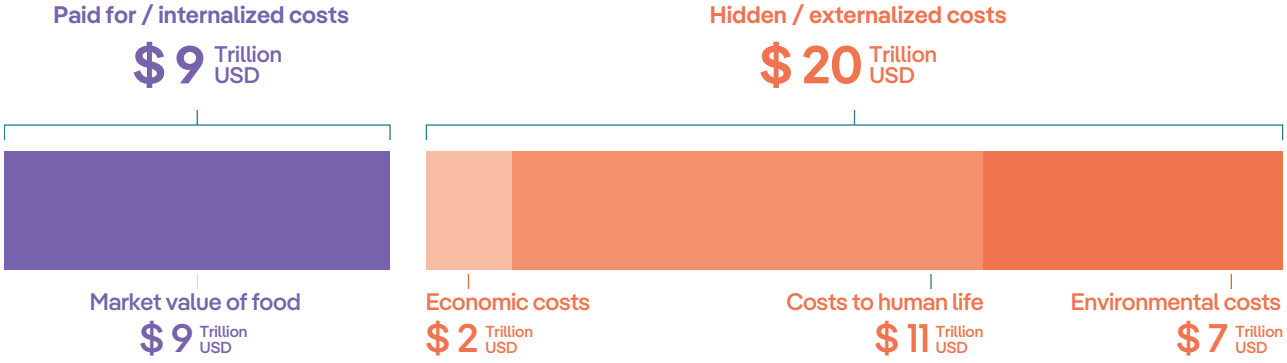

FIGURE 4 The hidden costs of food: There are many different externalized costs of food production that are not reflected in current market values.

costs and the recovery in demand following the Covid-19 crisis.[61] The FAO's Food Price Index (FFPI) – the global benchmark for food price changes – reached an all-time high in February 2022. When demand is soaring and goods and services are scarce, price hikes are the inevitable consequence. This is exacerbated by market supply constraints caused by sudden shocks such as the war in Ukraine.

Russia's war in Ukraine has exposed the strong link between food supply chains and global energy markets.[51] Rising oil and gas prices due to the war have had spill-over effects on food supply chains, for example through soaring fertilizer prices. The agri-food sector is a major consumer of energy, both directly in the form of electricity for services such as irrigation and fuel for farm machinery, food processing etc., and indirectly through the use of pesticides and mineral fertilizers. High fertilizer prices have been driven by a confluence of factors, principally Covid-19-related bottlenecks in global supply chains, the sharp increase in the price of natural gas (a core ingredient of nitrate fertilizers), and supply disruptions caused by sanctions on Russia and Belarus. Uncertainties in global food systems are reflected in grain prices; for example, the price of US soft red winter wheat increased by 52% between 21 February and 7 March this year.[62] The restricted access to fertilizer and a possible reduction in cereal exports could result in lower yields and a reduced availability of food next year, leading to higher food prices and even famine in many places.

Agri-food systems are among the drivers of 4 Cs

The negative impacts of current agri-food systems are further driving the crises of the 4 Cs - climate, Covid-19, conflict and the cost of externalities. Responding to the 4 Cs necessitates transforming agri-food systems.

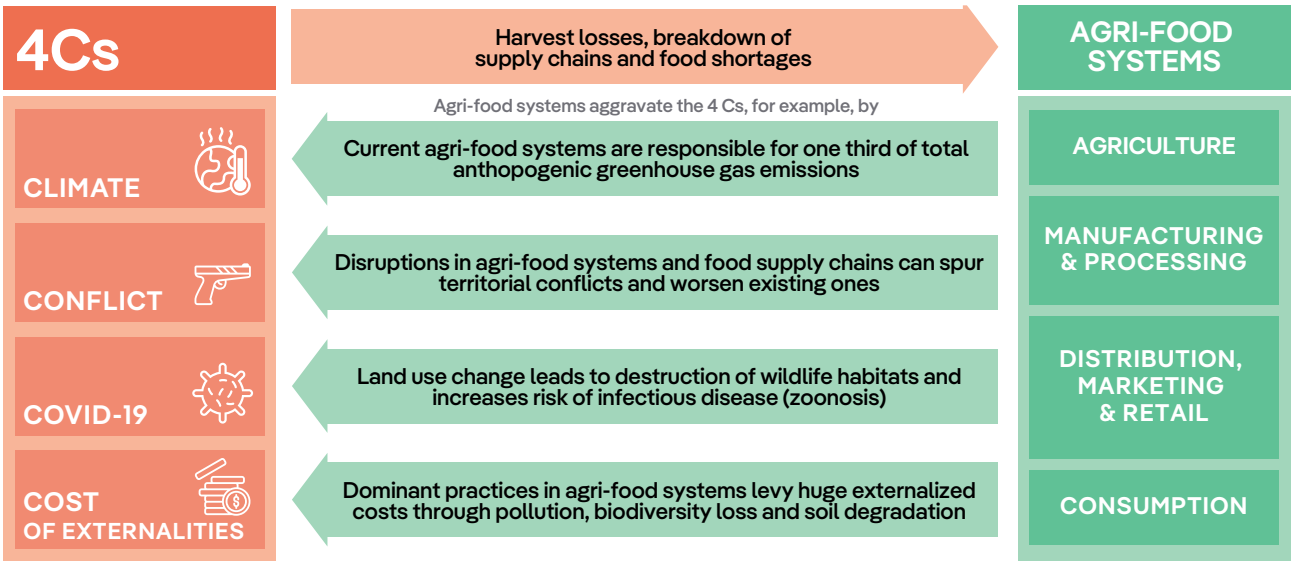

FIGURE 5 The relationship of negative impacts between agri-food systems and the 4 Cs.

Women harvesting tea leaves on a plantation in the Nandi Hills, Kenya.
Photo credit: Jen Watson.

2 Political frameworks for sustainable agri-food systems

This chapter provides an analysis of the existing policy frameworks at the international level in which the agri-food systems transformation must find a place.

Knowledge of the frameworks makes it possible to better assess the extent to which the current conditions support transformative action. In the absence of an internationally agreed framework on agri-food systems transformation, the existing frameworks provide focus and direction.

Beyond existing definitions[iv] and assessment frameworks[v] of sustainable agri-food systems, there is no international framework convention on sustainable agri-food systems.[26,63,64] However, the pathway for agri-food systems transformation can be guided by the goals and targets of the different international and UN-initiated frameworks and agreements. These include the universal declaration on fundamental human rights, the three Rio conventions – on biodiversity, climate change and desertification – and the UN 2030 Agenda with its Sustainable Development Goals. These provide orientation for the demands on sustainable agri-food systems and the direction of agri-food systems transformation. Based on these frameworks we can identify important characteristics of agri-food systems.

The United Nations Food Systems Summit (UNFSS), which took place in September 2021, was the first summit to represent the worldwide efforts towards food systems sustainability. The summit was preceded by an 18-month preparatory process during which 148 countries hosted a programme of national dialogues to develop strategies for more inclusive, resilient, and sustainable food systems. Furthermore, the United Nations proclaimed the years 2016–2025 as the Decade of Action on Nutrition, which promotes policies and programmes to eradicate malnutrition in all its forms. The recently concluded UNFCCC COP27 also took a step in this direction by agreeing to include action on agriculture and food security. It included a call for targeted action on the huge carbon emissions from industrial agriculture, although much more transformative action that was proposed by different parties did not find a place in the final agreement. The following sections review the existing frameworks and how an agri-food systems transformation can find its place within them.

iv For example, the FAO describes a sustainable food system as "a food system that delivers food security and nutrition for all in such a way that the economic, social and environmental bases to generate food security and nutrition for future generations are not compromized" (FAO 2018).

v For example, the Sustainability Assessment of Food and Agriculture Systems (SAFA) (FAO 2014).

2.1 A human-rights based approach to agri-food systems

Although many governments have not fulfilled their obligations under the Right to Food which the United Nations enshrined in 1948, the right offers guidance for the core function of sustainable agri-food systems. According to FAO's Voluntary Guidelines[64], ensuring sustainable food security requires establishing basic prerequisites (e.g., good governance, democracy, multistakeholder approaches, sufficient financial resources to fight hunger) and an enabling environment by adopting appropriate policies and strategies (e.g., developing relevant institutions). The guidelines recommend implementing a legal framework that enforces the right to food. The guidelines claim to prioritize the most vulnerable, not just their needs but also their entitlements, which should be appropriately met through the responsibility and accountability of duty-bearers. Finally, states should always guarantee the availability of safe and healthy food and hence prepare emergency strategies for man-made and natural disasters. Furthermore, the guidelines suggest that states are obliged to provide international food aid. The CFS Voluntary Guidelines on Food Systems and Nutrition present a wide range of recommendations for policy coherence between relevant sectors addressing hunger and malnutrition based on a holistic agri-food systems approach. These guidelines were endorsed at the 47th session of the Committee on World Food Security (CFS 47) in February 2021, resulting from a five-year multi-stakeholder consultation and negotiation process.

2.2 Agri-food systems transformation through the prism of the Rio Conventions

The Rio Conventions[vi] on biodiversity, climate change, and desertification have a direct bearing on how the agri-food system can be transformed.[65] Although the agri-food system is directly linked to all three areas of action of the Rio conventions, the absence of an international convention on sustainable agriculture and food production represents a serious handicap. This section looks at how much room the three Rio conventions provide for the establishment of a pathway towards a sustainable agri-food system.

The UNEP Convention on Biological Diversity (CBD) provides a broad-based plan for agri-food systems transformation from the perspective of biodiversity conservation.[66] According to the Strategic Plan for Biodiversity 2011–2020 and the "Aichi Biodiversity Targets" sustainable food systems are based on sustainably managed agricultural areas that contribute to biodiversity conservation while avoiding deforestation (Target 5) and excessive use of pesticides and fertilizers. food systems must also deliver benefits such as soil fertility, erosion control or enhanced pollination (Target 7). Only subsidies that set positive incentives for sustainable production and consumption and for biodiversity conservation (Targets 3, 4) may be included. Furthermore, sustainable food systems contribute to animal and plant health by maintaining the genetic diversity of cultivated plants and of farmed and domesticated animals and their wild relatives (Target 13) and ensure that ecosystems that provide essential services such as water are safeguarded, with secure access for local communities, especially women and indigenous people (Target 14).[67]

vi The Rio Conventions are the United Nations Convention on Biodiversity, United Nations Convention to Combat Desertification, and the United Nations Framework Convention on Climate Change. All three originated from the UN Earth Summit of 1992.

The need for a more holistic political response

The nexus relationship between UN Rio Conventions and agri-food systems transformation in view of the 4 Cs, highlighting the need to take a systems approach

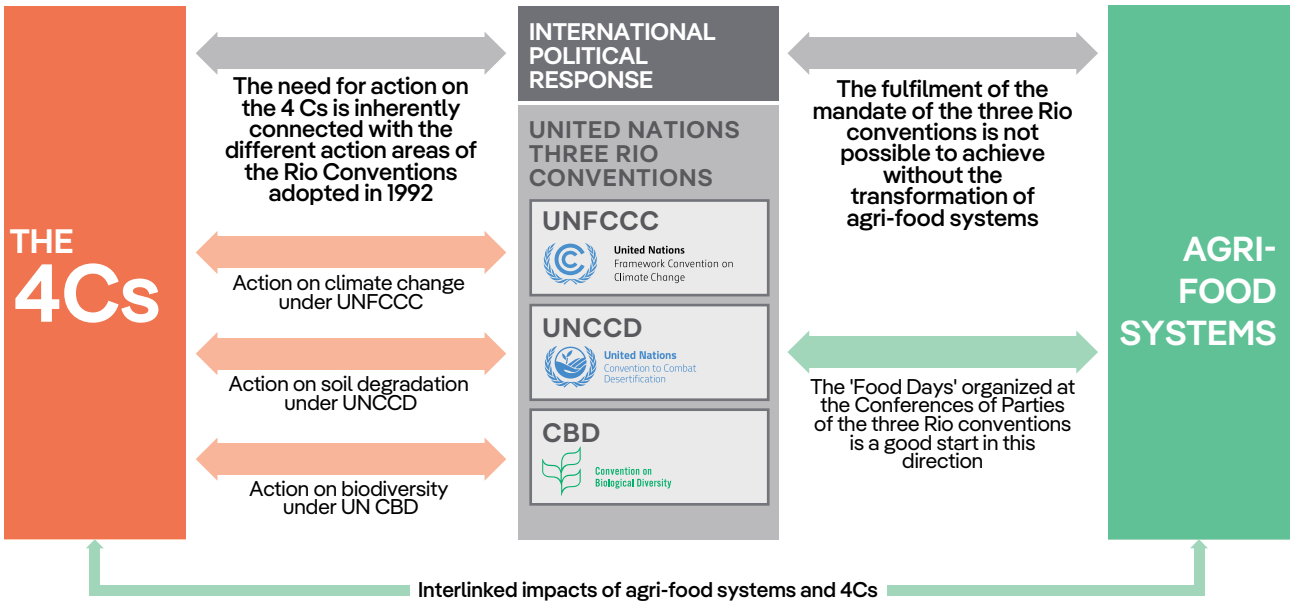

FIGURE 6 The relationships between the three Rio conventions, the 4 Cs and agri-food systems.

The UN Framework Convention on Climate Change (UNFCCC) sets out the basic legal framework for international cooperation on climate change. The Paris Agreement was adopted with the aim of limiting the temperature increase this century to 1.5 degrees Celsius above pre-industrial levels. The Paris Agreement includes the need to ensure food security on its first page.[68, 69]

At the heart of the Paris Agreement are national action plans, guided by the so called Nationally Determined Contributions (NDCs). Many countries' NDCs include agri-food systems in mitigation and adaptation plans. Considering the carbon footprint from the production, consumption, and disposal of food in current agri-food systems, sustainable agri-food systems must be less dependent on fossil fuels, reach net-zero emissions and move from being a carbon source to a sink (storing carbon in soils).[69]

While the international community has previously failed to place agri-food systems transformation at the heart of climate policy and negotiations, the latest IPCC[vii] report emphasizes the urgent need for climate adaptation and mitigation within agri-food systems. According to the report, moving towards a plant-based, meat-free diet has the potential to reduce the emissions caused by agriculture by up to 90%.[70] It highlights the role of change in production and consumption practices, with a focus on agroecological approaches, the reduction of food loss and waste and the importance of sustainable land management practices. Although the parties at COP27 agreed to include action on food security and agriculture in the outcome agreement, this did not extend to a food systems approach.[71]

vii The Intergovernmental Panel on Climate Change (IPCC) is a body of the United Nations tasked with assessing the state of scientific knowledge on climate change, its impacts and potential future risks, and possible responses.

As part of the UNFCCC, the Koronivia Joint Work on Agriculture is a landmark agreement adopted in 2017 that recognizes the unique role of agriculture in tackling climate change. It called upon the Subsidiary Body for Scientific and Technological Advice (SBSTA) and the Subsidiary Body for Implementation (SBI) to jointly address issues related to agriculture, taking into account the vulnerabilities of the sector to climate change and considering new approaches to food security.[72, 73]

The United Nations Convention to Combat Decertification (UNCCD) is another agreement under the auspices of UN that can have significant influence on the direction of the transformation of agri-food systems. The UNCCD is a legally binding framework that addresses desertification and the effects of drought. Its implementation is currently directed by the UNCCD 2018–2030 Strategic Framework which sets out the strategic objectives, roles, and responsibilities of the various parties.[74] The strategy highlights the importance of sustainable land management and transition to land degradation neutrality[viii] to combat desertification and land degradation and thereby improve the living conditions and resilience of vulnerable populations and ecosystems.

2.3 The Sustainable Development Goals SDGs and agri-food system transformation: synergies and parallels

The 2030 Agenda for Sustainable Development is a non-binding resolution of the UN general Assembly containing 17 Sustainable Development Goals (SDG) that set the policy direction for environmental, social and economic global development in all member states. According to the SDG framework, sustainable food systems need to provide "safe, nutritious and sufficient food all year round" and eliminate all forms of malnutrition (SDG 2: Zero Hunger). The targets of SDG 2 prescribe that by 2030 food systems should increase agricultural productivity and improve the incomes of smallholder farmers, particularly women farmers, indigenous peoples, family farmers, pastoralists, and fisherfolk. Furthermore, it expects food systems to achieve these targets on the back of sustainable production systems and resilient practices, while maintaining ecosystem services and strengthening climate change adaptation capacity. These targets encapsulate the essence of sustainable and resilient food system transformation. The 2030 Agenda is further supported by intersecting aims and synergies between the different goals (SDGs), which require that efforts to achieve the goals follow a systems approach rather than a silo approach. SDG 1 (No Poverty), for example, states that sustainable rural structures should improve equity of access to natural resources, while building the necessary social, financial, and ecological infrastructure to reduce poverty, vulnerability and exposure to climate-related shocks and environmental disasters.[75]

SDG 2 states that sustainable food systems require "increase[d] investment, including through enhanced international cooperation, in rural infrastructure, agricultural research and extension services, technology development and plant and livestock gene banks" in order to "maintain the genetic diversity of seeds, cultivated plants and farmed and domesticated animals and their related wild species. It also aims at promoting access to and fair and equitable sharing of benefits arising from the utilization of genetic resources and associated traditional knowledge".[75]

viii Land degradation neutrality is a state in which the amount of healthy, productive land is maintained or increased by avoiding or reversing land degradation. It is key to preserving ecosystem functions.

Regarding the market characteristics of sustainable food systems, SDG 2 mentions "the proper functioning of food commodity markets and their derivatives and ... timely access to market information, including on food reserves, in order to help limit extreme food price volatility". Furthermore, SDG 2 states that food system policy must "correct and prevent trade restrictions and distortions in world agricultural markets, including through the parallel elimination of all forms of agricultural export subsidies and all export measures with equivalent effect, in accordance with the recommendations of the Doha Development Round".[75]

Other SDG targets and stated aims that have a bearing on sustainable food systems include sustainable production by using natural resources efficiently (SDG 12), "including sustainable withdrawals and supply of freshwater to address water scarcity" to prevent people suffering from water scarcity (SDG target 6.4) and prevention of food loss along supply chains and waste at retail and household level (SDG 12). Furthermore, the SDG framework states that food production must happen without the pollution of oceans and freshwater bodies and the contamination of air and soil through hazardous chemicals, waste and nutrient runoff (SDGs 3 and 14). Agricultural activity should not lead to deforestation, but instead must promote afforestation and reforestation and the restoration of degraded land and soil. It also should not degrade natural habitats and should protect biodiversity (SDG 15). Furthermore, SDG 8 (Decent Work and Economic Growth) states that overall economic growth must be decoupled from environmental degradation.[75]

Europe has taken a lead in relation to the reform of its agri-food systems through policies and agreements designed to achieve the goals of sustainable development and agricultural sustainability. These include the European Green Deal, which considers sustainable food systems as the core of the deal, linking human, social, and planetary health. The Farm to Fork Strategy, the Biodiversity Strategy for 2030, and Soil Deal for Europe are some of the missions that contribute to the Green Deal. While the Farm to Fork Strategy aims at making food systems "fair, healthy, and environmentally-friendly", the Biodiversity Strategy for 2030 aims at reversing ecosystem degradation by putting Europe's biodiversity on the path to recovery by 2030. The Soil Deal aims at supporting the EU's ambition to lead on global commitments, in particular on achieving the Sustainable Development Goals (SDGs). Such regional frameworks help countries to achieve their NDCs targets and should be replicated in other regions of the world.[76, 77, 78, 79]

2.3.1 Trade-offs and the need for systems approach to harness the synergies

The national strategies pursued to reach the SDGs and the targets set in the three Rio Conventions (CBD, UNFCC, UNCCD) create synergies as well as trade-offs. For example, the expansion of renewable electricity generation requires additional land use (e.g., for large hydro power plants or biofuels) which competes with the use of land for food production and can lead to land evictions (in countries with low legal security), to the displacement of animal and plant species, biodiversity loss and inflation of prices for residential or commercial land.[80]

Hence, it is important to enhance coordination among the three Rio Conventions and between the Conventions and the SDGs by identifying and taking advantage of multiple synergies. Actions to address climate change, protect biodiversity and prevent land degradation are often closely linked, and can therefore be implemented in concert using a

systems approach, which considers these three conventions as applying to one system – the Earth. It is fitting then that the conference where these three conventions were first agreed upon was called the Earth Summit.

Furthermore, the strategies employed to achieve the 17 Sustainable Development Goals need to take the overarching goals of sustainability of the ecological, social, and economic systems as their guiding methodology. Sustainable land management, for example, can serve as an accelerator and integrator of the SDGs. Ecosystem and land restoration can leverage implementation synergies and support the transformation of food systems. As food systems cut across many sectors – ecological, social, and economic – and demand mutually reinforcing policies, multi-sectoral food systems are needed.

Looking at linkages between the SDGs it becomes clear that Goal 2 ('Zero Hunger') relates positively to most of the other goals but requires trade-offs with Goals 12 ('Responsible Consumption and Production') and 15 ('Life on Land').[81] Goal 13 ('Climate Action') appears to require trade-offs with most other goals. However, as pointed out by the IPCC,[82] these trade-offs may be converted into synergies based on a multitude of mitigation options that would limit global warming below 1.5°C.

While the SDGs and the Rio Conventions thus offer guidance for significant and potentially transformative global policies, national governments require support to translate those global goals into coherent national strategies.[83] What is needed are concrete suggestions for strategies, e.g., in the form of national pathways, on *how* to get there as well as governance mechanisms and resources for implementation. A whole-of-government approach is needed to stimulate exchanges and negotiations across sectors and between the different goals to align strategies and make tough choices about how to balance global goals with local needs. This would strengthen political structures that focus on the right to food, healthy nutrition, and protecting biodiversity and the climate.

2.4 An integrated policy approach to the transformation of agri-food systems

The Rio Conventions present a promising opportunity for an innovative policy framework to guide the transformation of agri-food systems as they draw their legitimacy from three legally binding international treaties.[65].It is worth mentioning that the Conferences of the Parties (COP) of these conventions have already dedicated days to looking at agriculture and food systems, the so-called Food Days.[84, 85, 86] Furthermore, the fact that seven of the 17 Sustainable Development Goals[75] can directly benefit from the transformation of agri-food systems shows that existing frameworks can be used to promote the transformation of agri-food systems, even without a dedicated international agreement. The Rio Conventions can form a basis for funding activities contributing to agri-food systems transformation. In return, transformative actions in agri-food systems can lead to a reduction in the externalities that hinder the fulfilment of the mandate of the Rio Conventions. True Cost Accounting (TCA) can be used as an assessment tool to reflect the true cost of the externalities and quantify the value that

BOX 4 Agri-food systems are a cross cutting theme of the three Rio conventions, a fact affirmed by the dedicated discussions aimed at food systems sustainability at the COPs

United Nations
Framework Convention on
Climate Change

Food Day at UNFCCC COP27 — 12 November 2022

Relevance: Greenhouse gas emissions attributed to agri-food systems and the potential of agri-food systems transformation for carbon sequestration and climate change mitigation.

The Food Systems Pavilion of COP27 states on its website, "The Food Systems Pavilion will focus on actions, strategies, and solutions across the entire food value chain that have the potential to drive the transformation towards healthier, more resilient, and more equitable food systems. The opportunity is huge. Transforming the world's food systems could generate USD 4.5 trillion annually in new economic opportunities by 2030 and help us to create a net-zero, nature positive world, while also ensuring social justice and food security."

United Nations
Convention to Combat
Desertification

Food Day at UNCCD COP15 — 12 May 2022

Relevance: Land degradation, salinization, desertification of agricultural lands and the contribution of agricultural practices to such phenomenon.

The UNCCD states on its website regarding the first ever Food Day at COP15, "We cannot achieve Land Degradation Neutrality, biodiversity or climate targets without changing the way we produce and consume food." "The advantage of the current generation", stressed the UNCCD Executive Secretary Ibrahim Thiaw, "is that we can be the leaders of this change. Agroecological approaches that emerged from the 2021 Food Systems Summit can enhance productivity and resilience, reduce emissions and chemical inputs while also meeting people's needs."

Convention on
Biological Diversity

Food Day at UN CBD COP15 — 14 December 2022

Relevance: Biodiversity loss attributed to agriculture and associated activities. The role of diversified farming systems in agri-food systems transformation.

A statement by the Executive Secretary of the CBD highlighted the role of biodiversity in transforming food systems: "As Parties to the CBD discuss the new post-2020 global biodiversity framework, to be agreed at the UN Biodiversity Conference (COP 15) in Kunming, China, a central part of the discussions will be the role of biodiversity in supporting food systems that are resilient and sustainable."

a transformation of agri-food systems can deliver. TCA[ix] assesses the true costs of a specific product or service by taking into account the effects on the natural and social environment in addition to direct costs like raw materials and labour.

An example of how this could be implemented is offered by the procedure through which the EU allocates project funding based on what it calls Rio markers (Desertification, Biodiversity, Climate Change Mitigation, Climate Change Adaptation).[87, 88] These markers are assigned to activities and projects that contribute to sustainability, resilience, and equity in line with the three Rio Conventions. The European Commission, like many other donors, uses Rio markers to measure its Rio-relevant spending and provide statistical reports to the OECD-DAC (Development Access Committee) that defined the markers. In the EU's 2019 framework guidelines related to this funding mechanism, six of the 12 activity clusters that comprize the Rio marker for biodiversity (CBD) involved agri-food systems. On the marker for desertification (UNCCD), five out of six activity clusters related to agri-food systems, while on the marker for climate change mitigation and adaptation, 13 out of 35 activity clusters involved agri-food systems. The EU allocates either 100% funding or 40% funding depending on whether a project or activity supports the Rio markers as a principal or significant objective.[87,88]

FIGURE 7 The percentage of the total budget approved for funding of an initiative considered relevant to the Rio themes based on their scores (Rio Marker Score), Directorate-General for International Partnerships.

The criteria used to decide whether particular activity contributes to meeting the targets of the Rio Conventions and thus deserves a Rio marker include the following:[87]

- **Context:** The background information discusses the theme (biodiversity, desertification, or climate) as a relevant issue for the proposed intervention or project.
- **Objectives:** There is an explicit intent to address the theme, preferably in terms of the overall objective.
- **Activities:** The proposed activities in the intervention clearly address identified issues and contribute to the stated aims.

These three criteria should be fulfilled together in order for the activity or project to qualify for a Rio marker and thus for funding. In the following sections we will see how agri-food transformation presents a strong case for fulfilling these criteria for all three Rio Conventions.

ix True Cost Accounting • True Cost – From Costs to Benefits in Food and Farming, tca2f.org
x Rio Markers Factsheet, https://europa.eu/capacity4dev/file/111486/download?token=4oDF2wCS

Rio marker on biodiversity

The OECD-DAC defines the criterion to qualify for the biodiversity marker as "promot[ing] at least one of the three objectives of the Convention (on Biological Diversity): the conservation of biodiversity, sustainable use of its components (ecosystems, species or genetic resources), or fair and equitable sharing of the benefits of the utilization of genetic resources' by contributing to activities that constitute eligibility criteria".[87]

Among the qualifying activities mentioned in the EU guidelines that relate directly to the transformation of the agri-food system are the "sustainable farming practices aimed at protecting biodiversity in agricultural ecosystems" and "promotion of agro-biodiversity and sustainable trade in valuable plant or animal species and derived products".

Rio marker on desertification

The OECD-DAC definition for the desertification marker is as follows: "an activity should be classified as desertification-related if it aims at combating desertification or mitigating the effects of drought in arid, semi-arid and dry sub-humid areas through prevention and/or reduction of land degradation, rehabilitation of partly degraded land, or reclamation of desertified land' by contributing to activities that constitute eligibility criteria."

As with the previous theme of biodiversity, the list of supported activities includes two that are vital to the transformation of agri-food systems. These are the "development and implementation of methods for conserving water, vegetation and soil in dry areas" and "sustainable irrigation for crops and livestock with a view to reducing pressure on land threatened by desertification".

Rio marker on climate change mitigation

The OECD-DAC defines an activity fulfilling the criteria for the Rio marker on mitigation as "contribut[ing] to the objective of stabilization of greenhouse gas (GHG) concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system by promoting efforts to reduce or limit GHG emissions or to enhance GHG sequestration".

Among the list of activities qualifying for a climate change mitigation marker are the following:

- Adoption of farming practices that **reduce greenhouse gas emissions** (e.g., through more rational use of fertilizers, manure management with biodigesters) or **increase carbon sequestration in agricultural systems** (e.g., agroforestry, agroecological techniques, sustainable rangeland management);
- Sustainable intensification of agriculture with a view to **reducing encroachment on forests and other natural carbon sinks** (e.g., peatlands, wetlands).

Rio marker on climate change adaptation

The OECD-DAC definition of an activity compliant with the Rio marker on adaptation is that it "intends to reduce the vulnerability of human or natural systems to the current and expected impacts of climate change, including climate variability, by maintaining or increasing resilience, through increased ability to adapt to, or absorb, climate change stresses, shocks and variability and/or by helping reduce exposure to them".

Among the activities that fulfil the criteria for this marker are the following:

- **Promotion of climate-resilient agricultural practices** (e.g., use of heat-, drought- or salt-resistant crop varieties, adaptation of the agricultural calendar, development of supplementary irrigation in rainfed farming systems, adoption of farming techniques supporting water and soil conservation, etc.);
- Crop and livelihood diversification with a view to **enhancing food and nutrition security in rural areas** affected by droughts, floods and other effects of climate change;
- Development of insurance mechanisms to **compensate farmers and other economic actors** affected by climate variability and climate change impacts;
- **Strengthening of food safety regulations, development of refrigeration and other food conservation systems** in areas affected by higher temperatures;
- Sustainable natural resource management with a view to **increasing the resilience of ecosystems and ecosystem services** in the face of climate change.

The importance of transforming agri-food systems to promote sustainability, resilience, and equity was highlighted by having dedicated food days at the COPs of all three Rio Conventions. The emerging consensus on the need for action on food and agriculture was recently reflected in the agreement at COP27 (UNFCCC) to support action on agriculture and food security. An integrated agri-food systems transformation framework policy can not only draw on the three Rio Conventions, but also actively help achieve the goals of these conventions. With proper coordination of their staff and budgets, the three conventions can provide a comprehensive framework for agri-food systems transformation. This would ideally require no new funding but develop an international mechanism to support and fund agri-food system transformation by virtue of its contribution to achieving the goals of the Rio Conventions. The Rio markers of the European Commission can offer a lead in this regard. For a more formalized framework, direction is provided by the European Green Deal, which contains initiatives and strategies for biodiversity restoration, soil regeneration, and climate change mitigation. A holistic international agreement that meets the goals of the three Rio Conventions has the potential to drive agri-food system transformation within existing policy and funding paradigms.

3 The way forward

In view of the emergent conditions created by the 4 Cs (Climate, Covid-19, Conflict, Costs of food externalities), transformation of the agri-food systems is more urgent than ever.

Current agri-food systems are at once a casualty, a cause, and a potential solution of these crises. Since one-third of global greenhouse emissions are due to agri-food systems, the transformation of the same can lead to sequestration of large amounts of carbon, potentially making agriculture a net-negative emitter. Furthermore, while the disruption and destruction of natural habitats by agriculture has been linked to the transmission of zoonotic disease such as Covid-19, transformed agri-food systems can provide nutritious food and revitalized habitats for wildlife that lead to healthier communities. Similarly, current agri-food systems incur heavy environmental costs (mostly externalized) which can be eliminated by advancing sustainable and resilient agri-food systems. Given the need to reduce the high externalized costs of food and the potential of agriculture for climate change mitigation and adaptation, agri-food systems transformation can contribute to achieving various internationally agreed goals on sustainable development and climate action.

The 4 Cs should act as a wake-up call that provokes long-term transformative strategies rather than quick fixes. It is encouraging to see that the parties at COP27 included agriculture and food security in the climate action framework. However, there is a need to work on a common understanding that goes beyond establishing definitions of the different issues in in agri-food systems, such as hunger, malnutrition, food loss and waste, natural resource degradation, socioeconomic disparities, lack of shock resilience, and rampant externalization of costs for a genuine transformation of agri-food systems to occur. This requires the application of a systems approach to agri-food and the unambiguous inclusion in policy frameworks and international agreements of indigenous, traditional, and agroecological systems, which have succeeded at the local level. This requires first an acknowledgement of successful local solutions and second applying this local experience to better global policy and governance.

At a policy level, agri-food system transformation requires action in different areas and at different levels. Existing international agreements such as the three Rio Conventions (UNFCCC, UN CBD, UNCCD) must be applied in tandem to advance the transformation of agri-food systems. The Rio Markers mechanism of the European Commission offers a good example of how such a transformation can be funded. This may take the form of a new agreement that mandates the application of a systems approach to achieve the goals and targets of the existing

agreements. For example, under such an agreement, countries would be obliged to pursue the targets of biodiversity conservation, land restoration, and climate action in a synergistic way and not as three separate aims. At a regional level, the EU European Green Deal can be a good example to follow. It is an overarching framework that covers action on sustainable agriculture, safe and fair nutrition, conservation of biodiversity, soil health management, and climate action, with a focus on synergies between the different areas of action. Such a broad-based agreement would need a discussion on the different externalized costs incurred in the agri-food system. In such a discussion, the methodology of True Cost Accounting (TCA) can provide the necessary scientific basis for policymakers to formulate policies supportive of a just, fair, and sustainable agri-food system transformation. Furthermore, the agri-food system policy can benefit immensely from the mainstreaming of more synergistic agri-food systems such as traditional and indigenous systems.

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ABOUT THE PROJECT

TMG Research gGmbH aims to help develop a more systematic understanding of how agri-food systems can be transformed as part of a project on the Assessment and Communication of Climate Impacts of Food (CLIF), funded through the International Climate Initiative (IKI) of the German Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection (BMUV) and jointly implemented with corsus and WWF Germany. This project promotes sustainable consumption patterns and helps companies, policymakers, and consumers choose more sustainable options in relation to food. The main contribution of TMG to this project is in developing a more systematic understanding of how to transform agri-food systems by publishing a series of strategic reports on the current status of agri-food systems and the likely drivers and agents of their transformation.

This report is part of the *FORESEE (4C)* series on *The Transformation of Agri-Food Systems in Times of Multiple Crises*, which explores the current agri-food system in light of challenges linked to the four crises known as the 4 Cs (Climate, Covid-19, Conflict, and Cost of externalities) and how they interact with the dynamics of the current agri-food systems. Furthermore, this report provides a general review of the international policy landscape in which the agri-food system transformation must find its place. Its main focus is on the three Rio Conventions and possible synergies between the fulfilment of the Rio mandate and a transformation of agri-food systems. The report was drafted by TMG in consultations with an extended group of experts.

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