

BURLEIGH DODDS SERIES IN AGRICULTURAL SCIENCE

Preventing food losses and waste to achieve food security and sustainability

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Foreword I

The issue of food loss and waste (FLW) has received considerable attention in recent years. With more than 820 million people estimated to be hungry in the world, growing concern about the high levels of global food insecurity and malnutrition has been one of the factors responsible for this trend. It is also being increasingly realised that food systems development is a major contributor to climate change, ecosystem degradation, biodiversity loss and unsustainable exploitation of water resources. Stemming FLW is considered by many as one of the ways through which humankind will be able to feed itself sustainably without further negative impact on the planet, in line with the 2030 Agenda for Sustainable Development.

This book therefore comes at an opportune moment. With contributions from experts working across various disciplines in different parts of the world, the document offers a comprehensive and holistic treatment of the topic of FLW. It begins by defining what is meant by FLW and then assesses current research on the economic, environmental and nutritional impact of FLW. The causes of FLW and solutions to prevent it at different stages in the supply chain from cultivation to retail and consumer use are then presented. The third part of the book looks at FLW for particular commodities, including cereals and grains, fresh fruit and vegetables, roots and tubers, oilseeds, meat and dairy products, and fish and seafood products. The final section reviews the effectiveness of campaigns to reduce FLW in regions such as North and Latin America, Asia and the Pacific, the Middle East, and sub-Saharan Africa.

As any other systems-level challenge, FLW can be best addressed through systems-based approaches that address the range of issues in a holistic and sustainable manner. On the other hand, achieving the ambitious goals under the 2030 Agenda requires concerted action, greater coordination across sectors, and collaboration by all stakeholders to achieve transformation at scale. The comprehensive and multi-dimensional approach adopted in the book will facilitate not only better understanding of the theoretical underpinnings of FLW and its inter-connections to other food security, environmental and socio-economic questions, but also the designing and implementation of practical interventions, including through lessons learned from experiences of other regions of the world. The publication will also support multi-stakeholder action as it contains information that can support the actions of different stakeholders concerned about and working on FLW reduction: academic and research institutions, private sector businesses; policy makers; civil society organisations; consumer associations; and development organisations.

It is my belief therefore that this volume will go a long way in helping us address FLW, as part of our common goal to develop sustainable food systems in line with the Sustainable Development Goals.

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Foreword II

The 2011 Food and Agriculture Organization of the United Nations (FAO) report *Global Food Losses and Food Waste* states that one-third of all food the world produces is lost or wasted every year. Food loss and waste (FLW) is devastating. FLW is perhaps the greatest impediment to adequately feeding the world's population and addressing the wide-ranging issues created by hunger. It affects an individual's health, development, productivity and overall quality of life. It influences a community's economic growth, stability and security. FLW also has a profound effect on the environment. Global food production has the largest environmental impact of any human activity. This means that food waste has a high carbon footprint, accelerating climate change which, in turn, damages food production.

In general food losses and waste happen when food is discarded or diverted at any point in the food supply chain, including during cultivation, harvesting, sorting, transportation, distribution and consumption. Food waste, specifically, results from intentional decisions made by different stakeholders in the food supply chain, including consumers. However, although consumers are a cause of food waste, they are also part of the solution. As consumers have become more aware of the economic, social and environmental damage caused by food waste, consumer demands for the problem of FLW to be tackled has also increased.

At the Global Cold Chain Alliance (GCCA), we know that building and maintaining reliable cold chains is an important mechanism for combating FLW. Cold chains ensure proper temperatures of foods –maintaining quality and ensuring safety – from the point of origin through the distribution chain to the final consumer. Optimized cold chains reduce losses and waste and extend food's shelf life, create increased food access, conserve environmental resources, reduce greenhouse gas emissions and increase economic returns.

In 2018, the GCCA partnered with the World Wildlife Fund (WWF), the University of California-Davis and Santa Clara University to release the report: *No Food Left Behind: Part 1: Underutilized Produce Ripe for Alternative Markets* (https://c402277.ssl.cf1.rackcdn.com/publications/1170/files/original/WWF_NoFoodLeftBehind820_2.pdf?1564432069). The report is the result of a US-based study to assess food loss after harvest. Given the size of the agricultural sector, US food supply chain partners have a responsibility to lead produce improvement and recovery efforts. The study clearly identified opportunities for the US food system to increase availability of fruits and vegetables without increasing negative effects on the environment. These opportunities span the entire food supply chain and, therefore, require

commitment from companies, governments, academics and individuals. Only together can we really harness the combined power of the supply chain to decrease food loss and waste, improve global access to adequate nutrition, and reduce environmental impact.

This book on *Preventing food losses and waste to achieve food security and sustainability* is a comprehensive examination of FLW that provides readers with both the foundations for understanding the global FLW crisis and strategies for reducing loss and waste in the food supply chain. The editor has brought together an esteemed group of global experts to take-up the challenge of informing and educating those who can prevent FLW and enable economic and environmental sustainability.

Part 1 details the total effect of FLW on food security, economic and environmental sustainability, human nutrition and health, and food safety. Part 2 includes research and perspectives on the causes of FLW. Authors discuss strategies to address identified issues with supply chain activities including production, storage, processing, and transportation/distribution, as well as issues at the consumer and food service levels. Part 3 explores FLW in the main food commodities, each of which presents a unique set of challenges and opportunities to address. Part 4 creates a roadmap for change. Authors explore what is needed from policymakers and regulators, the private sector, food banks, and consumers to reduce food loss and waste. In addition, this section looks at supporting strategies related to re-using, recycling and optimizing food waste. Finally, Part 5 presents regional case studies of the challenges and initiatives in reducing food losses and waste in countries and regions such as the United States, Europe, North Africa and the Middle East, Sub-Saharan Africa and Latin America.

Like the 2011 FAO *Global Food Losses and Waste* report, *Preventing food losses and waste to achieve food security and sustainability* can greatly influence the global effort to reduce FLW. In providing a comprehensive understanding of the problem and strategies required to address FLW, the editor and authors establish a basis for collaboration and a foundation upon which to build.

Corey Rosenbusch, CAE, IOM is the President and CEO of the Global Cold Chain Alliance (GCCA), which aims to forge a universally-strong cold chain where every product retains quality and safety through each link in the supply chain. Supporting this critical mission are GCCA's (www.gcca.org) three core partner trade associations, which provide relationships, resources and recognition to members:

- International Association of Refrigerated Warehouses (IARW) is the third-party logistics, temperature-controlled warehouse industry's association.
- International Refrigerated Transportation Association (IRTA) is the temperature-controlled transportation and logistics industry's association.

- Controlled Environment Building Association (CEBA) is the association for experts in the design and construction of temperature-controlled facilities.

The GCCA and its Core Partners also are supported by the World Food Logistics Organization (WFLO), a nonprofit foundation that develops education and research for the industry and provides cold chain advisory services that empower economic development and strengthen the global cold chain.

Corey Rosenbusch (CAE, IOM)
President and CEO of the Global Cold Chain Alliance

Introduction

Food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food, which meets their dietary needs and food preferences for an active and healthy life (World Food Summit, 1996).

Food insecurity is a serious global problem. Although global food production has improved significantly, especially over the last 50 years, food insecurity persists and more than 800 million people still go to bed hungry. In addition, over 2 billion people are food insecure. Food insecurity is not primarily a problem of rural poverty. About 1.2 billion people live in urban slums, of which 70% to up to 90% are food insecure. Hunger and food insecurity persist despite immense wealth, tremendous technological achievements, and a world that is more interconnected than ever with freer movement of people, capital and technology across borders. This emphasizes the economic disparity and the subsequent inequality that touches the most vulnerable.

Many and diverse factors lead to food insecurity and hunger, including armed conflicts, humanitarian crises, natural disasters like droughts such as those related to 'El Niño' weather patterns, and other severe weather events, and record food prices in some vulnerable regions. Ongoing conflicts affecting millions in different parts of the world are causing increasing rates of food insecurity. The negative impact of conflicts on food security, good nutrition and agriculture is an uncontested and globally recognized phenomenon. Conflict interrupts production of food, destroys food and agriculture assets, and can slow economic development. Conflicts also make it more difficult for governments and humanitarian organizations to deliver food assistance. Additionally, conflicts that displace large populations can stress neighbor countries or host communities, whose food systems can be insufficient to support significant influxes of people. Unfortunately, droughts and conflicts are likely to continue, which will continue to pose higher risk of food insecurity in different regions of the world.

Huge efforts and resources have been invested in achieving food security over the last several decades, through investments in intensification and expansion of agricultural production, as well as mechanisms to improve people's access to food. Millions of hectares of land, including forests and deserts, have been reclaimed as agricultural land. This has required a huge increase in the resources needed for agricultural production (water, fertilizers, chemicals, energy, labor, etc). Crop yields have been improved dramatically, and the quantities of food produced are at a historic high, with more than 5000 million metric tons of food produced annually. However, pressures such as

a rapidly growing world population and increased urbanization have led an increased demand for more and diverse food. This, and the fact that poorer, more vulnerable sections of the population are not able to access the available food, means that the numbers of hungry and food insecure people are still unacceptably high.

Several factors are exerting pressure on the global food sector, preventing the achievement of food security. Rising wealth is changing food demand towards higher-value and more perishable meats, dairy, and perishable products. Likewise, the growing influence of western diets (high in sugar, salt and fat contents) in developing countries are leading to a double- or triple-burden of malnutrition, obesity and growing rates of non-communicable diseases (so called diseases of affluence). Very significant rates of urbanization are influencing major shifts in the way cities engage with local and global food chains, in terms of marketing, diet habits, food retail and also related issues of food quality, food safety, nutrition, and how food is accessed or utilized by all different socioeconomic segments of society. The effects of climate change are already being felt, on top of growing natural resource scarcity, with greatest adverse impact for marginal and resource-poor food producers.

Yet amidst all these challenges, huge amounts of food are lost and wasted every year all over the world. The challenges to food security are complex and deserve a renewed focus on food systems and how they work, at global, regional and local levels, to sustainably deliver safe and nutritious food to all people at all times. Indeed, a major gap in the efforts to achieve food security has been the lack of attention to food systems, from preharvest to postharvest handling to their legal, economic, social frameworks and all of the actors involved in food chains. Food losses and waste (FLW) are the result of the way food systems function and, in this regard, can be in most cases as a measure of how inefficient they are.

FLW is a global problem. It has been estimated that at least one third of the food produced in the world (at least 1300 million metric tons) are lost and wasted every year. Not only do we lose and waste huge amounts of food in a world with two billion food insecure people, but FLW also lead to a tremendous loss of resources such as land, forests, water, fertilizers, chemicals, energy, labor, etc. The vast amounts of wasted food contribute to major environmental problems as they decompose in landfills and emit harmful greenhouse gases. Reducing FLW is considered as one of the key actions required to reduce accumulation of CO₂ in atmosphere.

With millions of households across the globe struggling to have enough to eat, and hundreds of millions of tons of food being tossed in the garbage every year, FLW are increasingly being seen as a serious global problem; ethically, economically, and environmentally, and intricately linked to the wider problem of world hunger. That is why global attention has started to focus more on how

to address the problem. The FAO SAVE FOOD initiative was established in 2011, followed by other global initiatives such as the high-level panel of experts of the Commission on Food Security (CFS) and the Zero Hunger Challenge. FLW now figures firmly in the UN 2030 Agenda and Sustainable Development Goals. With awareness rapidly rising, several countries and world regions have started to take action in developing policies and regulations to address this global complex challenge.

FLW reduction should not only be a goal in itself but as a key aspect of global food (in)security. FLW exacerbates the problem food insecurity: reducing food availability; wasting natural resources for which there is often already severe shortage, namely land and water; and creating major environmental problems. It is important to emphasize that most perishable foods (such as meat, dairy, fishery and horticultural products) are most vulnerable to FLW. This has direct links with malnutrition as these foods provide very important components for a healthy diet and for the prevention of disease. The underlying causes of FLW are closely related to the greatest challenges to food security: the need for sustainable production and consumption habits, the need to channel safe and nutritious food to growing, increasingly urban populations; the need for better use of natural resources such as water and land; and strategic planning and investment for sustainable food security for future generations.

FLW prevention is an opportunity to strengthen and achieve food security (directly or indirectly) in at least 3 major ways:

- 1 More efficient food systems that can sustainably deliver safe, nutritious food to the world population,
- 2 Preserving scarce natural resources, in particular water and land, but also all of the other resources (e.g. energy) used throughout the supply chains to handle, transform, and distribute food,
- 3 The opportunity for strengthened agriculture and food sectors to positively impact on rural livelihoods, by preserving the economic value of food and generating additional value through agro-processing and agribusiness activity.

As far as we know, this is the first textbook on the subject, particularly in its range, broad authorship and integrated perspective. It is meant to provide guidance to policy makers, international organizations, food producers and handlers, researchers, educators and students. Its aim is to review and suggest ideas to prevent FLW towards the goal of achieving sustainable global food security. It is also hoped it has arrived at the right time to help contribute to accomplishing the UN 2030 Agenda and Sustainable Development Goals.

The structure of the book reflects the fact that the subject is complex and multifaceted. Part 1 sets the scene by exploring the many dimensions of FLW. It reviews definitions of FLW, the links between FLW and food insecurity, the economic and environmental impacts of FLW as well as their impact on nutrition and food safety. Part 2 reviews causes of FLW at key stages in the food supply chain, from agricultural processing and harvesting, through postharvest storage, transport and processing, and on to the retail, food service and consumer stages for final consumption. Part 3 reviews FLW in major food groups with a focus on the challenges unique to each and how they can be addressed. Part 4 discusses key means to curb this global problem, including the need for i) cohesive policies and regulations, ii) investment, including that of the private sector, iii) improved ways to reuse/recycle food waste for humans, animals, plants and as energy, iv) efficient schemes of education, awareness and extension, and v) more holistic approaches of research and development. The final part of the book includes regional case studies on tackling FLW. In each part, best practices, case studies, and success stories are used to illustrate the potential options for FLW reduction. Although FLW is a global issue, there is a particular focus on developing countries (low to middle-income countries) where problems of food insecurity are particularly acute.

The effort of developing this book was only possible thanks to the great collaboration from the excellent global contributors for each chapter, and the strong support provided by the team at Burleigh Dodds Science Publishing, particularly Mr. Francis Dodds and Ms. Amanda Renwick.

I certainly hope that this book can serve as an excellent support to the efforts been invested by international organizations such as the United Nations, governments, and many experts and individuals to improve global food security.

It is certainly applicable to modify a proverb to: 'If your plan is for one year plant rice. If your plan is for ten years plant trees. If your plan is for one hundred years, do not waste food'.

Elhadi M. Yahia
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Chapter 1

Food security and food waste: key issues

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- 1 Introduction
- 2 The evolution of the concept of food security
- 3 Definitions and pillars of food security
- 4 Recent measurements and data on food security
- 5 The current food security policy framework
- 6 Food security: key dimensions
- 7 Case studies: food security in rural and urban areas
- 8 The complex relationship between food loss and waste and food security
- 9 Summary and future trends
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1 Introduction

Food security is a topic of major interest to policymakers, practitioners, international organizations and academics around the world as it affects almost every facet of society. Food security can have repercussions in areas such as:

- government policy and political stability (e.g. the food price crisis and subsequent food riots in 2007–2008 highlighted the critical role of food security in maintaining political stability).
- aid decisions (e.g. the World Bank's Global Agriculture and Food Security Program).
- the economy in general (a poorly nourished population is a less economically productive one).
- the environment (depletion of natural resources and climate change can influence food production and access to food).

Food security also matters from a moral perspective; it has been broadly agreed upon as a basic human right since 1948, under Article 25 of the Universal

Declaration of Human Rights: 'Everyone has the right to a standard of living adequate for the health and well-being of himself and of his family, including food, clothing, housing and medical care.' On one hand, food security must be considered as a requirement for guaranteeing the availability of food to the growing population, especially in developing countries, and, on the other, the absolute quality and safety of the food produced and distributed must be guaranteed.

In order to understand the complexity of food security, a multi-disciplinary approach must be used which takes into account various aspects of the concept, including: food governance, economics, environment, government policies and society. For each aspect, a number of challenges are discussed. The chapter also includes case studies on interventions in rural and urban areas to enhance food security and introduces the complex relationship between food security and food loss and waste. Finally, the authors draw on current data to predict future trends and their consequences.

2 The evolution of the concept of food security

Despite its pivotal importance and because of its multi-disciplinary nature, food security is still a concept whose definitions and operationalization vary.

Indeed, the term 'food security' has evolved in diverse ways during the last 50 years. Even two decades ago, there were about 200 reported definitions (Maxwell and Smith, 1992). According to Maxwell (1996) and Shaw (2004), the concept has gone through several paradigm shifts. These shifts in conventional wisdom reflect changes, over time, in what have been considered to be the key issues informing food security research and food policy and practice.

Food security has gone from being defined:

- 1 From the global and the national level – with a distinct focus on supply and self-sufficiency – to the household and the individual level (1975–1985). One school of thought focussed on the household as the unit of analysis for food security (Sahn, 1989; Swift, 1989; Eide, 1990; Frankenberger and Goldstein, 1990), another placed intra-household power and resource-allocation issues in the front of analysis and focussed instead on individual food security. Following this logic, most current definitions of food security being with individual entitlement, though recognizing the complex inter-linkages between the individual, the household, the community, the nation and the international economy.
- 2 From a first food perspective to a livelihood perspective (1985–1990). The most food-insecure households are characterized by high sensitivity and low resilience. Oshaug identified three kinds of households,

'enduring households', which maintain household food security on a continuous basis, 'resilient households', which suffer shocks but recover quickly and 'fragile households', which become increasingly insecure in response to shocks. Livelihood security was identified as a necessary and often sufficient condition for food security (Maxwell, 1988, 1991, p. 22): it focuses on the long-term viability of the household as a productive and reproductive unit.

- 3 From objective indicators to subjective perception. The agenda regarding the treatment of food security in the 1990s suggested that: 'Flexibility, adaptability, diversification and resilience are key words. Perceptions matter. Intra-household issues are central. Importantly, food security must be treated as a multi-objective phenomenon, where the identification and weighting of objectives can only be decided by the food insecure themselves' (Maxwell and Smith, 1992, p. 4).

In recent years, the continuous evolution of food security has led to an operational concept which reflects the wider recognition of the complexities of the technical and policy issues involved. Now the focus of food security has been further expanded to include malnutrition in all its forms and its features have prominently become a part of the second Sustainable Development Goal (SDG) of the 2030 Agenda: 'Ensuring access to safe, nutritious and sufficient food for all (Target 2.1) and eliminating all forms of malnutrition (Target 2.2)'.

This transformational vision embedded in the 2030 Agenda provides an imperative for new ways of thinking, acting and measuring. For example, the growing global epidemic of obesity, which is increasingly affecting lower-income countries and rapidly adding to the multiple burden of malnutrition and non-communicable diseases, also points to the need to re-examine how hunger and food insecurity are measured as well as their links with nutrition and health.

3 Definitions and pillars of food security

For many, the concepts of hunger, famine, undernourishment, undernutrition and food security are blurred and often used interchangeably. Hunger is usually understood as an uncomfortable or painful sensation caused by insufficient food energy consumption. Scientifically, hunger is referred to as food deprivation (FAO, 2008). A famine is a widespread scarcity of food, caused by several factors including war, inflation, crop failure, population imbalance, or government policies. This phenomenon is usually accompanied or followed by regional malnutrition, starvation, epidemic and increased mortality (Encyclopædia Britannica Online, 2017). Undernourishment is defined by the

FAO as the state 'when caloric intake is below the minimum dietary energy requirement'. Undernourishment can be mainly attributed to persistent instability in conflict-ridden regions, adverse climate events and economic slowdowns that had affected more peaceful settings and worsened the food security situation (FAO, 2008).

Malnutrition refers to deficiencies, excesses, or imbalances in a person's intake of energy and/or nutrients. The term malnutrition addresses three broad groups of conditions, namely:

- 1 undernutrition, which includes wasting (low weight-for-height), stunting (low height-for-age) and underweight (low weight-for-age);
- 2 micronutrient-related malnutrition, which includes micronutrient deficiencies (a lack of important vitamins and minerals) or micronutrient excess; and
- 3 being overweight, obesity and having diet-related non-communicable diseases (such as heart disease, stroke, diabetes and some cancers).

Malnutrition may be an outcome of food insecurity or related to non-food factors, such as inadequate care practices for children, insufficient health services and an unhealthy environment (WHO, 2016).

Multiple forms of malnutrition are evident in many countries. Poor access to food and particularly healthy food contributes to undernutrition as well as being overweight and obesity. Malnutrition increases the risk of low birthweight, childhood stunting and, in women of a reproductive age, anaemia. There is also a link between malnutrition and being overweight in school-age girls and obesity among women. This is especially evident in upper-middle and high-income countries. The link between malnutrition being overweight and obese is commonly referred to as the 'double burden' of malnutrition. Overweight and obese individuals can also be affected by micronutrient deficiencies, often called 'hidden hunger' because there may be no visible signs. Causes of malnutrition that can lead to being overweight and obese include patterns of bingeing or overeating when food is available (and continued availability uncertain), or choosing low-cost, energy-dense 'comfort foods' rich in fat, sugar and salt - which have been found to have psychological effects that reduce stress in the short term.

In this chapter, we adopt the definition of food security as provided by the World Food Summit, in 1993, which is the most useful definition today: 'Food security, at the individual, household, national, regional and global levels [is achieved] when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life.' From this definition, four essential dimensions of food security can be identified:

- **Food availability**, which refers to the need to secure and sufficient quantities of the appropriate quality food, supplied through domestic production or imports (including food aid). Food availability addresses the ‘supply side’ of food security and is determined by the level of food production, stock levels and net trade.
- **Food access** is adequate income or entitlements of individuals to enable them to access appropriate food for a nutritious diet. Entitlements are defined as the set of all commodity bundles over which a person can establish command given the legal, political, economic and social arrangements of the community in which they live (including traditional rights such as access to common resources).
- **Utilization of food** is adequate diet, clean water, sanitation and health care to reach a state of nutritional well-being where all physiological needs are met. This brings out the importance of non-food inputs in food security.
- **Stability** refers to the fact that, in order to be food secure, a population, household or individual must have access to adequate food at all times. They should not risk losing access to food as a consequence of sudden shocks (e.g. an economic or climatic crisis) or cyclical events (e.g. seasonal food insecurity).

For food security objectives to be realized, all these four dimensions must be fulfilled simultaneously. For example, even if people have financial means (access), but there’s no food available in the market (availability), people are at the risk of food insecurity. Furthermore, food security is also about quality, as bodies must be healthy to enable the nutrients to be absorbed (utilization).

It is equally important to underline that access to food may be different within households. The distribution of food and resources within households is influenced by a number of cultural and social factors. Especially under conditions of scarcity, women and children are sometimes discriminated against in the distribution of food; mothers may subsequently adjust their food intake to buffer the effect of food insecurity on their children. Gender inequalities in society and women’s roles influence decision-making power and access to food within the household, with significant consequences for women’s own food security and nutrition as well as that of their children.

4 Recent measurements and data on food security

Evidence highlights a rise in food insecurity and world hunger in the last three years (2016–2019) based on a number of indicators (FAO, 2019).

Food security measurements either focus on food availability, access, utilization, the stability of food security over time, or some combination of these

domains. Metrics are drawn from data at national, regional, household, and/or individual levels. Such tools vary from simple indicators, from which data can be quickly collected and easily analysed, to comprehensive measures that require detailed, time- and resource-intensive data collection and sophisticated analytic skills to yield results.

Food security measures rely either on data from hypothesized determinants of food security (e.g. the price of commodities) or on data from purported consequences of food security (e.g. child malnutrition). In short, the diversity of currently available food security measurement tools provides an array of options, such that it may not always be clear how the measures differ in their conceptualizations of food security and for what purpose a given tool may best be used.

The prevalence of undernourishment (PoU) is the traditional FAO indicator (FAO, 1998) used to monitor hunger at the global and regional level. It was developed at a time when very few national governments, particularly in lower-income countries, collected data regularly on food consumption. The methodology relies on aggregated country-level data, available for most countries, and occasionally data on food consumption, available for a few countries. It produces an estimate of the proportion of the population that does not have regular access to enough dietary energy for a healthy, active life.

It is based on 26 indicators which take into consideration the variations of the dietary energy supply and undernourishment measures (e.g. share of energy supply derived from cereals, roots and tubers; average supply of protein of animal origin; PoU considering energy needs for higher amounts of physical activity etc.) as well as information on food prices using data on country purchasing power parities, inflation rates and food deficits. Due to progress in the implementation of national household surveys, the number of countries able to provide information on the inequality of access to food in their population has increased. This period collection of data in many countries has been used to improve the FAO country-level PoU estimates. There are several weaknesses with this methodology associated with the fact that the frequency distribution per capita dietary energy consumption is not based on observed data but is derived using a model whose parameters are estimated on data or measures that are subject to errors of unknown magnitude and direction.

To complement the information provided by the PoU and to allow for monitoring SDG Target 2.1 globally in a more effective way, the FAO took inspiration from countries already using a different approach in measuring the food insecurity and scaled it up to the global level. The approach is based on asking people, directly in a survey, to report on the occurrence of conditions and behaviours that are known to reflect constraints on access to food. The Food Insecurity Experience Scale (FIES) survey module is composed of eight questions that have been carefully selected, tested and proven effective in

measuring the severity of the food insecurity situation of respondents in different cultural, linguistic and development contexts (see Fig. 1). Results can be disaggregated, thus helping to identify which subpopulations within a country are most affected by food insecurity. Second, it is possible to estimate the prevalence of food insecurity at different levels of severity. Someone experiencing severe food insecurity is likely to have gone entire days without eating due to lack of money or other resources.

FIE, while using a different approach and dataset, produces findings consistent with that produced the PoU. Having two alternative views of the hunger problem also provides an important opportunity to cross-check the values of the two indicators for given countries. With reference to the average over the period 2014–2017, the estimated PoU and of severe food insecurity can be compared across a number of countries (see Table 1).

According to the latest FAO estimates, in 2018, about 820 million people were exposed to severe food insecurity (FAO, 2019). At the regional level, hunger is on the rise in almost all African sub-regions, making Africa the region with the highest PoU, at almost 20%. Hunger is also slowly rising in Latin America and the Caribbean, although its prevalence is still below 7%. Western Asia shows a continuous increase since 2010, with more than 12% of its population undernourished today (FAO, 2019).

The worst food crises in 2018, in order of severity, were: Yemen, the Democratic Republic of the Congo, Afghanistan, Ethiopia, the Syrian Arab Republic, Sudan, South Sudan and north Nigeria. These eight countries accounted for two-thirds of the total number of people facing acute food insecurity amounting to nearly 72 million people (FAO, 2019). An additional 143 million people in a subset of 42 countries were found to be living in stressed conditions on the cusp of acute hunger. They risked slipping into crisis if faced with a shock or stressor. Nearly 151 million children were affected by stunting in 2017. In contrast, over 38 million children are overweight and approximately 672 million adults, one in every eight adults are obese (FAO, 2019).



Figure 1 Food insecurity based on FIES. Source: FAO Statistics Division.

Table 1 Severe food insecurity measured with the food insecurity experience scale 2014-2017

	Prevalence (percentage in total population)			
	2014	2015	2016	2017
WORLD	8.9	8.4	8.9	10.2
AFRICA	22.3	22.4	25.4	29.8
Northern Africa	11.2	10.0	11.7	12.4
Sub-Saharan Africa	25.0	25.2	28.6	33.8
Eastern Africa	25.9	25.4	29.7	32.4
Middle Africa	33.9	34.3	35.6	48.5
Southern Africa	21.3	20.4	30.8	30.9
Western Africa	20.7	21.9	23.8	29.5
ASIA	7.3	6.6	6.5	6.9
Central Asia	1.9	1.7	2.7	3.5
Eastern Asia	<0.5	<0.5	0.9	1.0
South-eastern Asia	7.3	6.6	9.3	10.1
Southern Asia	13.5	12.0	10.1	10.7
Western Asia	8.9	9.0	9.4	10.5
<i>Central Asia and Southern Asia</i>	<i>13.0</i>	<i>11.6</i>	<i>9.8</i>	<i>10.4</i>
<i>Eastern Asia and South-eastern Asia</i>	<i>2.4</i>	<i>2.2</i>	<i>3.3</i>	<i>3.6</i>
<i>Western Asia and Northern Africa</i>	<i>9.9</i>	<i>9.5</i>	<i>10.5</i>	<i>11.4</i>
LATIN AMERICA AND THE CARIBBEAN	n.a.	n.a.	n.a.	n.a.
The Caribbean	n.a.	n.a.	n.a.	n.a.
Latin America	7.6	6.3	7.6	9.8
Central America	12.7	10.2	8.3	12.5
South America	5.5	4.7	7.3	8.7
OCEANIA	n.a.	n.a.	n.a.	n.a.
NORTHERN AMERICA AND EUROPE	1.5	1.5	1.2	1.4

Source: adapted from FAO (2018a, b).

5 The current food security policy framework

The international community has repeatedly asserted its commitment to support national governments in their efforts to combat hunger. Providers of international development assistance are many and varied. They range from individual donor countries, to multilateral international agencies, international and regional financing institutions, international NGOs and private-sector foundations. Organizations and agencies in the UN system are making a major effort to streamline and coordinate their assistance through the work of the UN Country Teams by joint programming and activities.

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