Food security risks under growing water scarcity

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A. Introduction

The food and nutrition security situation in the Arab region is a concern. In 2019, nearly 13 per cent (55 million people) of the population suffered from hunger, continuing an upward trend since 2013. The relationship between food security and disasters is complex and arbitrary. Natural hazards and human-made disasters are among the main reasons for the continuing rise. In the region, water scarcity is a structural and prevailing condition, as well as a critical risk multiplier that exacerbates vulnerability and adversely impacts food security.

B. Disasters and food security

Over the past decades, the concept of food security has evolved and its scope widened. In 1996, the World Food Summit[503] provided a definition of food security that has become widely accepted. It states: "Food security exists when

503 Nguyen, 2018.

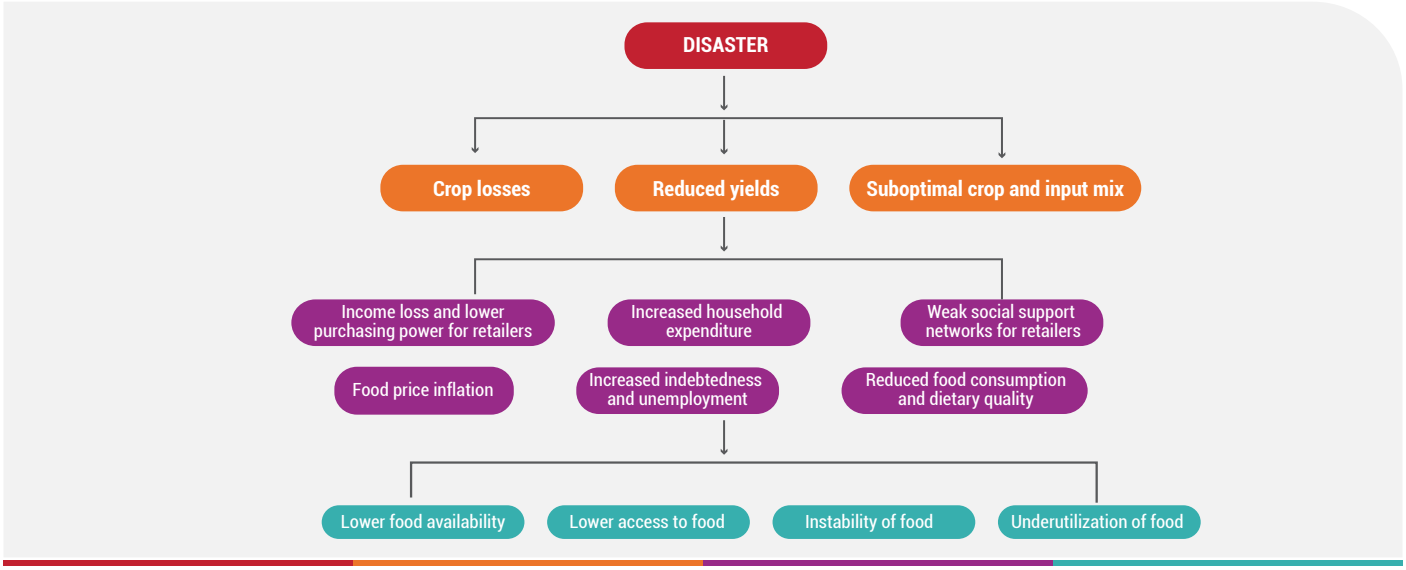
all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life." From this definition four interrelated dimensions of food security are identified:

- Availability – of sufficient quantities of food of appropriate quality, supplied through domestic production or imports, including food aid.
- Access – by individuals to adequate resources (entitlements) for acquiring appropriate foods 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 – through 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 – where 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 (for example, economic or climatic crisis) or cyclical events (for example, seasonal food insecurity). The concept of stability can refer to both the availability and access dimensions.

Food security is deeply rooted in the "food system" concept, which encompasses the whole range of actors and their interlinked value-adding activities in the production, aggregation, processing, distribution, consumption and disposal of food products that originate from agriculture, forestry and fisheries, and are part of the broader economic, societal and natural environments in which they are embedded. As such, all factors affecting these value-adding activities affect food security in one way or another.

Natural hazards and human-made disasters have a direct impact on the dimensions of food security (figure 7.1). About 23 per cent of the damage and losses from natural hazards in developing and low- and middle-income countries – of which 26 per cent are climate-related impacts – are absorbed by the agriculture sector.[504] Damages and losses caused by natural hazards and human-made disasters disrupt physical and financial access to food, especially in vulnerable households, while economic shocks and disasters cause fluctuations in food prices that significantly disturb food stability, as shown by the world food prices crisis of 2007–2008. Natural hazards and human-made disasters contribute to unbalanced diets and restrict access to clean water, sanitation and health care that are required for the appropriate utilization of food. The increasing complexity of risk, overlaying and cascading impacts of hazards, and the increasing trend of low-intensity high-frequency events have significantly and steadily undermined resilience and food security, and pushed vulnerable people into poverty.

Figure 7.1 The impact of disaster on food security



Source: Adapted from FAO, 2015, 2018b.

504 FAO, 2018b.

In 2019, there were 821 million chronically undernourished people worldwide – largely due to conflict, climate variations and extremes, and economic slowdown – up from 811 million in 2018.[505] The region suffers from a double burden of malnutrition; in several countries, hunger, anaemia and stunting coexist with worrying levels of obesity and people being overweight. The situation is particularly worrying in countries affected by conflict and violence. These include Iraq, Libya, Somalia, the Sudan, the Syrian Arab Republic and Yemen, which accounted for 24 per cent of the total food insecure people worldwide in 2019,[506] with Yemen experiencing the worst food crisis in the world, three years in a row. In addition, regional water scarcity, climate change and extremes, transboundary animal and plant pests and diseases, and economic shocks pose significant constraints to agriculture. Subsistence farmers and smallholders and women in rain-fed agriculture sectors are the most affected by these complex and overlapping constraints. The region is the largest importer of food in the world and is, therefore, highly exposed to food price fluctuation, which affects food security, especially stability.

C. Water scarcity: a critical food security risk multiplier, interacting with conflict

Water plays a vital role in ecosystems and agriculture. Water scarcity is the lack of freshwater resources to meet standard water demand. It is fundamentally dynamic and varies over time, due to natural hydrological variability but mostly as a function of prevailing policies, planning and management approaches, and the capacity of societies to anticipate changes in supply and demand. The best indicator of national water scarcity is the level of water stress (SDG indicator 6.4.2 defines this as the ratio between total freshwater withdrawals by all economic activities and total available freshwater resources, after taking into account environmental flow requirements),[507] whereby a country is generally considered water stressed if it withdraws more than 25 per cent of its renewable freshwater resources.

With a basic imbalance in water supply and demand, the region is the most water scarce in the world. On the supply side, the annual per capita water availability is less than 800 m^3, 20 per cent below the water scarcity limit of 1,000 m^3 per capita. The per capita availability has fallen by more than 66 per cent in the past 40 years, to about 10 per cent of the global average.[508] In 2014, the region's per capita renewable internal freshwater resources were estimated at 299 m^3, compared with a world average of 5,933 m^3.[509] Total renewable water resources are projected to fall by a further 20 per cent by 2050.[510] Climate change poses additional risks to water supply and exacerbates physical water scarcity through changing rainfall patterns.[511]

On the demand side, high population growth and rapid urbanization are increasing the pressure on already scarce resources, while weak institutional and governance capacities further aggravate the risk of water scarcity. The World Economic Forum's 2015 global risks report rates water crisis as the highest risk factor in the region.[512]

Water scarcity is a prevailing condition in the region, and therefore a critical risk multiplier – a factor, either linked to natural or human causes, that exacerbates existing risks – given the strong relationship between water scarcity and shocks related to climate and natural resources. Water scarcity is particularly important when discussing the impact of disasters on food security given that agriculture uses some 80 per cent of water withdrawals in the region, and more than 90 per cent in countries such as Iraq, Oman, the Syrian Arab Republic and Yemen. The multiple dimensions of water insecurity can affect agricultural production systems differently, with water stress acting as a limiting factor in irrigated agriculture and drought risk impacting rain-fed areas. Water scarcity not only adversely affects production in the region, but also contributes to other hazards, including land degradation and forest fires, and exacerbates many of the

505 FAO and others, 2019.
506 135 million people in 55 countries are living in crisis conditions or worse (IPC 3 and above). The IPC, or Integrated Food Security Phase Classification, is a multi-partner, common global system for classifying severity and magnitude of the food insecurity and malnutrition situation. For additional information, see FSIN, 2020.
507 UNWater, "Step-by-step monitoring methodology for indicator 6.4.2". Available at https://www.unwater.org/publications/step-step-methodology-monitoring-water-stress-6-4-2/.
508 Ward, 2014.
509 For additional information on renewable internal freshwater resources, see https://data.worldbank.org/indicator/ER.H2O.INTR.PC.
510 FAO, 2019d.
511 UNESCWA and others, 2017a.
512 World Economic Forum, 2015.

water-related effects of climate change, including heatwaves. Drought aggravates water scarcity, with more withdrawals needed to overcome dry spells or decreases in rainfall. The latest report of AGIR provides evidence of changes in the occurrence of climate extremes during the past 50 years. Significant warming trends were observed across the region, combined with large increases in heatwaves, which is expected to put intense pressure on current water resources with major consequences on crop yields and food security.[513]

Regionally, drought is considered the most devastating natural hazard for agriculture, given the fact that rain-fed agriculture (croplands, rangelands and forests), representing approximately 439 million hectares, contributes some 70 per cent of production.[514]

Climate change is expected to exacerbate water scarcity in the Arab region; a 2019 study suggested that with global warming of 2°C, the regions most at risk of higher water stress are the Mediterranean, Middle East and large parts of South America and North America.[515]

Box 7.1 Effective integrated water resources management

Coordinated development and management of natural resources to maximize economic and social welfare in an equitable and sustainable manner is a pressing priority in the Arab region. It requires comprehensive assessments of water supply, demand and allocations, which could be carried out using water accounting and climate-smart agriculture approaches. In view of potential outcomes, two sets of recommendations are proposed:

a. Supply management strategies that involve highly selective development, particularly of non-conventional water resources, including seawater and brackish desalination, reuse of drainage water, plus urban and treated wastewater for industries, provided specialized treatment is in place.
b. Vigorous demand management, including reforms and actions aimed at optimizing the use of existing supplies and setting sustainable limits. Effective cross-sectoral coordination and policy coherence, enhanced capacities and use of innovations are essential prerequisites. Moreover, intraregional and interregional collaboration is critical, especially for better management of transboundary and shared water resources.

D. Significant hazards to food security in the Arab region

Agriculture – crops, livestock, fisheries, aquaculture and forestry – provides livelihoods for 2.5 billion smallholders worldwide and contributes between 10 and 20 per cent of GDP in lower middle-income countries, and more than 30 per cent in low-income countries. Heavily reliant on weather, climate, land and water to thrive, agriculture is particularly vulnerable to natural hazards. One of the most direct ways these affect the sector is through reduced production, resulting in direct economic loss to farmers, which can cascade along the entire value chain, affecting agricultural growth and rural livelihoods. A review of 74 post-disaster needs assessments conducted in 53 developing countries over the decade 2006–2016 shows agriculture absorbed 23 per cent of all damage (cost of replacement and/or repair of physical assets damaged by disasters) and loss (changes in economic flows due to disasters) caused by medium- to large-scale climate-related disasters, such as floods, drought and tropical storms.[516] The main hazards affecting agriculture and food security in the Arab region are drought, floods and flash floods, land degradation, transboundary animal and plant pests and diseases, sand and dust storms and economic shocks.

513 League of Arab States, Arab Geographical Information Room, 2019.
514 Ibid.
515 Hofste, Reig and Schleifer, 2019.
516 FAO, 2018b.

1. Drought

Drought is an extended period – a season, a year or several years – of deficient precipitation, resulting in water stress.[517] It is the largest climate-related threat to agriculture, with up to 83 per cent of the damage and loss caused by drought absorbed by the sector. The livestock and rain-fed crop subsectors are the most affected by this slow-onset hazard, which accounts for 86 per cent and 15 per cent of all damage and loss to livestock and crops, respectively.[518]

Drought affects the dimensions of food security, especially availability, and poses a significant threat in the region. From 1990 to 2019, drought affected more than 44 million people,[519] while between 2000 and 2012, losses to rain-fed crops, rangeland, forest cover and land degradation were estimated at 143.17 million hectares, and approximately 32 per cent of total regional production. Assessment of economic losses in vegetation cover due to agricultural drought hazard and land degradation combined during the same period were estimated at 67.28 million hectares, with a value of $11.51 billion, leaving about 22.79 million workers jobless, and $59 billion required to create alternative job opportunities.[520] From 2006 to 2010, the region experienced one of its most severe drought cycles in the past century, leading to a loss of livelihoods, high food prices and a decrease in purchasing power for average citizens.

In the Syrian Arab Republic, the drought in the agricultural season 2007-2008 resulted in crop failure that affected 75 per cent of farmers and led to a 50 per cent reduction in livestock and a 39.8 per cent fall in wheat production in Hassaka, the largest producing governorate. Despite being drought-resistant, barley production during the period 2005–2009 also fell by 40 per cent.[521] Researchers have argued that drought contributed to the Syrian crisis.[522] Other countries in the region are also prone to drought, and have witnessed severe events in recent history. In 2011, drought led to food crises in Mauritania and Somalia, where approximately 100,000 people perished and 4 million were displaced, and in 2013 to significant agriculture losses in Algeria, Morocco and Mauritania. The Sudan has recorded 16 severe droughts since 1972, and in Somalia, between November 2016 and August 2017, close to 900,000 people were displaced due to drought.[523]

Drought has been a regular phenomenon in Tunisia, Jordan and the State of Palestine, with 1,222 events during the period 1980–2013.[524] In 2017, extreme heatwaves were recorded across the region, with Kuwait recording the hottest global temperature that year.[525]

Box 7.2 Effective drought monitoring and early warning action systems

Effective monitoring and early warning action systems are crucial to minimize the impact of droughts on agriculture. Such systems should capitalize on technologies, such as satellite-based remote sensing, linked to forecast-based finance for early action, factor relevant variables affecting agriculture production, such as sowing dates and length of crop cycle, and take into account seasonal forecasts, El Niño predictions and socioeconomic vulnerabilities. One such system is the Agricultural Stress Index System (ASIS) developed by FAO with the Flemish Institute for Technological Research (VITO) and the Joint Research Centre of the European Commission.

Countries in the region are recommended to use appropriate systems and tools that use science and technologies for monitoring, preparedness, mitigation and response, with early actions as a common dominator cutting across all stages of the risk management cycle. Recommended actions include applying water harvesting techniques and using short-cycle drought-resistant crop varieties, respectively, when El Niño is expected. Weather-based agricultural insurance systems are measures that provide effective response and transfer the risk of droughts, encouraging farmers to produce in uncertain conditions.

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517 National Drought Mitigation Centre, 2021.
518 FAO, 2018b.
519 UNESCWA, 2020b.
520 League of Arab States, Arab Geographical Information Room, 2019.
521 Saab, 2015.
522 Fountain, 2015.
523 UNOCHA, 2017.
524 UNDRR, 2017a.
525 UNDP, 2018a.

Introducing supplementary irrigation can be effective in reducing the effect of droughts and dry spells on rain-fed cereal and pulses systems. For livestock systems, securing fodder can be obtained by introducing aquaponics production systems that complete fodder requirements in case of extreme events.

The availability of open-source, open-access science-based risk information is instrumental in advancing cost-benefit analysis, transparent transactions, accountability and partnerships with stakeholders. For example, AGIR, established in 2015 by the League of Arab States and hosted by the AWC, addresses the information and analytical gaps to better inform decision-making and emphasize the interconnectedness of climate change with risk. It highlights the importance of understanding the multiple stressors of risk, creating opportunities for new insights and approaches.

2. Floods and flash floods

Floods can support the health of wetland areas, depositing nutrient-rich sediments that recharge the topsoil and make the land more fertile. Flooding can also replenish groundwater aquifers, benefit inland fisheries and create wildlife habitats. Some farming systems are highly dependent on spate, or flood-based, irrigation and recession irrigation along rivers and lake margins. In sub-Saharan Africa, an estimated 25 million hectares are irrigated with floodwater.[526] Spate irrigation is widely practised in Yemen, where in 2001 more than 217,000 hectares were cultivated using spate irrigation.[527] But floods can cause long-term economic hardship for food system actors due to lost livestock and crop production, and damaged food storage facilities, industries or commercial enterprises. After droughts, floods and flash floods are the second worst disaster, adversely impacting agriculture and food security; two thirds of all damage and loss during the period 2006–2016 was caused by floods in 53 countries, including some Arab countries.[528] With regards to subsectors, approximately 60 per cent of all damage and loss to crops was caused by floods, 8.4 per cent to livestock, 9.8 per cent to fisheries and 9 per cent to forestry. Post flooding, stagnant waters often render cropland useless and make it difficult to maintain livestock, which without proper shelter, veterinary care or adequate feed, can fall prey to disease or starvation. Floods are frequently associated with water contamination and can accelerate the process of land degradation, eroding topsoil from prime growing areas and causing irreversible habitat damage.

Despite being one of the driest regions of the world, the Arab region is frequently hit by floods and flash floods, which are increasing in intensity and frequency, while the timing of rainfall is altering due to climate change. Between 2013 and 2015, 96 flood and flash flood events occurred across the region, including 10 floods in both Somalia and the Sudan. These resulted in economic losses estimated at 0.43 per cent and 0.08 per cent of GDP, respectively.[529] In Jordan and Lebanon, flash floods are the second most serious hazard in terms of potential damage. In Lebanon, a study estimated that floods and flash floods could cause damage of up to $330 million, and 83 per cent of the floods impact the agriculture sector.[530] Jordan has registered a major flood annually since 2008,[531] and flash floods are ranked the second highest priority risk after earthquakes.[532] A number of significant events over the past 10 years reveal the extent of damage and impact on agriculture, with Jordan, Lebanon, Saudi Arabia, Somalia, the Sudan, Tunisia and Yemen the most affected countries. In March 2020, an unprecedented wave of strong rains hit the region, causing flash floods in Egypt, Iraq, Lebanon, Oman, the Syrian Arab Republic, the United Arab Emirates and Yemen.

Box 7.3 Flood management as a priority

In the region, most floods and flash floods are localized, and the damages and losses are not captured in national databases. Understanding the localized impacts, including in agriculture, is critical for early warning and context-specific preparedness and mitigation plans. On farms, raising awareness and flood preparedness measures, including storage, evacuation and elevation areas for livestock, are noticeably weak. Investment in flood management is a regional priority.

526 CGIAR, 2016.
527 FAO, 2008.
528 FAO, 2018b.
529 League of Arab States, Arab Geographical Information Room and Arab Water Council, 2019.
530 Abdallah and others, 2018.
531 Jordan, Government of Jordan, 2019.
532 Ibid.

Natural flood management measures as a tool for alleviating downstream floods risks are receiving increased attention in places such as Alexandria on the Nile Delta, where projected average annual flood losses in 2050 are expected to double compared with 2005 if current standards of defence are maintained. Interventions upstream would reduce flood inundation downstream rather than defend floodplains locally. Natural management would be one form of catchment-based management, and would consist of measures such as reducing run-off on hill slopes with soil and water conservation techniques, cascading water storage to capture high river flows, and limiting the connection between run-off sources and potential flood zones. However, when applying natural flood management, the potential for negative consequences must be considered – on the functioning of aquatic ecosystems, and the unexpected effect of water storage leading to increased demand.

Other mitigation measures include rehabilitating and expanding spate irrigation, creating temporary shelter for livestock and developing groundwater recharge ponds to use excess water to recharge aquifers.

3. Land degradation

Land degradation is a complex process in which the value of the biophysical environment is affected by a combination of inappropriate policies and unsustainable practices,[533] including overcultivation, overgrazing, land fragmentation, deforestation and inappropriate irrigation and cultivation methods. Up to 40 per cent of the world's agricultural land is seriously degraded, with devastating impacts on agriculture productivity, food security – by affecting food availability – and the environment. Wind or water erosion, organic carbon loss, nutrient depletion, salinization and sodium accumulation, soil sealing, loss of soil biodiversity and contamination, acidification, compaction and waterlogging are all increasing, and affecting the soil's productive capacity.[534] Land degradation affects the livelihoods of at least 3.2 billion people, and costs more than 10 per cent of annual global GDP in lost biodiversity and ecosystem services.[535] The United Nations Convention to Combat Desertification (UNCCD) put the loss to the global economy due to land degradation at $23 trillion by 2050, which could be saved by immediate preventative action that would cost $4.6 trillion.[536]

With deserts and unfertile land occupying about 70 per cent of its total area, the Arab region has the lowest per capita availability of arable land in the world. More than 86.7 per cent of the land is either desert or threatened by desertification.[537] Arable land constitutes less than 5 per cent of the total land in two thirds of the countries with 92 per cent of hyper-arid land and 73 per cent of arable land affected by land degradation.[538] The first report on efforts to combat desertification and achieve land degradation neutrality by the Arab Organization for Agricultural Development (AOAD) estimated that 60 per cent of the region's lands are degraded to varying degrees (26 per cent highly degraded, 43 per cent degraded, 25 per cent moderately degraded and 15 per cent lightly degraded).[539] A 2018 study by the AWC and World Food Programme showed regional variations in the coverage and severity of land degradation, the coverage ranging from 9.5 per cent in Lebanon to 83 per cent in Kuwait, and the severity from 3.6 per cent in Morocco to 69.3 per cent in Djibouti. Degradation is more problematic for rain-fed agricultural land in the region, which is estimated at 30 million hectares. The annual economic cost of land degradation is estimated at $9 billion (2.1–7.4 per cent of the region's GDP).[540] Soil salinity reduces productivity and crop yields, causing annual economic losses put at $1 billion.[541] The cost of milk and meat production due to land degradation of grazing biomass was estimated at $0.6 billion in 2007 (the global cost is estimated at almost $7 billion),[542] with grassland grazing providing only 28 per cent of the region's animal feed requirements.

The relationship between land degradation and disasters is non-linear and complicated. While land degradation contributes to some hazards directly (such as sand and dust storms), most hazards (such as drought) and disasters (such as conflicts) aggravate it. Degradation often leaves land devoid of vegetation cover, which makes the soil highly vulnerable to wind and water erosion. When rains fall on bare land upstream, water runs on the soil surface

533 Conacher and Conacher, 1995.
534 FAO and Intergovernmental Technical Panel on Soils, 2015.
535 Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, 2018.
536 https://www.unccd.int/news-events/2018-year-review.
537 Arab Center for the Studies of Arid Zones and Dry Lands (ACSAD) and UNEP, 2003, cited in Arab Organization for Agricultural Development, 2018.
538 UNESCWA, 2020b.
539 Arab Organization for Agricultural Development, 2018.
540 Hussein, 2008.
541 UNESCWA, 2020b.
542 International Food Policy Research Institute and University of Bonn, Center for Development Research, 2007.

at a higher speed and velocity, often resulting in heavy floods downstream. Forest fires as natural hazards, when occurring recurrently, lead to land degradation, as does human displacement from conflict and natural hazards. The land degradation hotspots that form around refugee camps and those for internally displaced persons are an example of the link between human-made disasters and land degradation.

Box 7.4 Sand and dust storms: a growing hazard in the region

Land degradation is a main cause of sand and dust storms, a significant hazard in the Arab region. Largely resulting from anthropogenic causes (in about 40 per cent of such storms), they generate 93.76 million tons of dust annually, 80 per cent of which is deposited within the area. The region, one of the most affected by storms, has witnessed an increase in their frequency, intensity, scale and geographical coverage in the past 15 years. The annual economic cost of storms has been estimated at $13 billion. The countries most impacted include Algeria, Bahrain, Iraq, Jordan, Kuwait, Libya, Morocco, Oman, Qatar, Saudi Arabia, the Syrian Arab Republic, Tunisia and the United Arab Emirates.

Given the transboundary nature of these storms, effective and well-coordinated regional response measures are required. UNEP, the World Meteorological Organization (WMO) and the UNCCD developed a policy framework in 2017 to establish an integrated, DRR-focused global approach to manage sand and dust storms. It is based on five strategic actions, including: i) measures to reduce anthropogenic emissions through sustainable land and landscape management and climate change mitigation and adaptation; ii) physical protection of valuable assets; iii) monitoring, prediction and early warning systems, including mapping of trends and future scenarios of anthropogenic dust sources; iv) preparedness and response, including public awareness of risks, and mainstreaming sand and dust storms into DRR and emergency response measures; and v) policies, legal frameworks and action plans to support the actions.

Box 7.5 Holistic sustainable land management

The growing challenges related to land degradation in the region urgently require the adoption of holistic sustainable land management measures within the broader restoration framework. This includes policies to reclaim degraded land and reduce degradation of currently productive land. Analyses of the return on investment for sustainable land management indicate significant economic, social and environmental benefits. For example, in Jordan, if the traditional Hema practice of managing common land was adopted within the Zarqa river basin, it could result in net benefits of $203 million to $408 million through carbon sequestration, increased water infiltration and reduced sedimentation.

Holistic sustainable land management measures would help countries fulfil voluntary pledged targets for achieving land degradation neutrality to meet SDG 15.3, which seeks to prevent, halt and reverse degradation. Maintaining healthy natural resources, including land to provide ecosystem services, offers a buffer against natural hazards such as floods and landslides, regulates the climate and maintains the productivity of agricultural systems. Applying such measures, however, requires reliable data, including early warning and detailed studies on the effect of land degradation on crop and livestock production and people's livelihoods under different farming systems and agroecological contexts.

4. Transboundary animal and plant pests and diseases

Transboundary animal and plant pests and diseases are highly contagious, and spread rapidly irrespective of political and administrative boundaries, resulting in significant damage and loss in the agriculture sector, impacting food security and the wider economy. The transboundary nature of these pests and diseases increases their geographical impact and necessitates regional collaboration in managing them.

a. Transboundary animal diseases

Transboundary animal diseases, or TADs, result in an estimated 20 per cent reduction in animal productivity and, in the worst-case scenario, the death of animals, which are essential productive assets for smallholders. Zoonotic diseases[543], or zoonoses, are diseases shared between animals – including livestock, wildlife, and pets – and people. They can pose serious risks to both animal and human health and may have far-reaching impacts on economies and livelihoods. Zoonotic diseases commonly spread at the human-animal-environment interface – where people and animals interact with each other in their shared environment. Zoonotic diseases can be foodborne, waterborne, or vector-borne, or transmitted through direct contact with animals, or indirectly by fomites or environmental contamination. TADs have a disastrous impact on trade in livestock and their products.

Droughts and floods are among the most common natural hazards, with strong and complex causal relationships with animal disease outbreaks. For example, vectors multiply faster and in higher volumes after flooding and heavy rains, leading to an increased risk of vector-borne disease outbreaks, such as Rift Valley fever, which is transmitted by mosquitoes. TADs often contribute to economic losses, especially among pastoralists, when traditional grazing areas and migratory routes become inaccessible, leading to increased density of animals and a higher risk of disease transmission. The most serious TADs in the region include the following:

- Foot and mouth disease, a viral animal disease that affects cattle, buffalo, sheep and goats. The cost burden in endemic regions such as the Arab region is estimated to be more than $6.5 billion a year. Foot and mouth causes significant reduction in production as well as economic losses due to trade restrictions.
- Peste des petits ruminants (PPR), a highly contagious viral disease of wild and domestic small ruminants, such as sheep and goats, occurs throughout the Arab region and Africa. The annual global losses due to PPR are estimated between $1.4 billion and $2.1 billion, according to FAO.
- Middle East respiratory syndrome coronavirus (MERS-CoV), an emerging threat for public health, causing severe respiratory infection in humans. Dromedary camels are thought to be a natural reservoir of MERS-CoV. Globally, as of 2020, 2,507 human cases had been confirmed in 27 countries, including 11 in the Arab region,[544] with 902 recorded fatalities.
- Rift Valley fever (RVF), transmitted through several mosquito species and by contact with infectious animal material, affects ruminants and humans, and has a high impact on livelihoods (socioeconomic) and trade (restrictions). RVF is recognized as a priority disease in the Arab region and the Horn of Africa, largely because of the huge livestock trade. A FAO study showed significant incidents in Egypt, Mauritania, Saudi Arabia, the Sudan and Yemen.[545] The highest number of human deaths (598) was recorded in Egypt in 1977–1978, the most cattle deaths in Yemen in 2000–2001.

b. Transboundary plant pests and diseases

FAO estimates that annually between 20 and 40 per cent of global crop production are lost to pests. Each year, plant diseases cost the global economy about $220 billion, and invasive insects about $70 billion.[546] The most serious transboundary pests in the region include:

- Desert locust (*Schistocerca gregaria*), the oldest and globally one of the most dangerous migratory pests. Desert locust swarms are highly mobile, covering up to 150 km a day, and ravenous eaters of food crops and forage. A square kilometre of adult swarm has the capacity to consume the same amount of food in a day as 35,000 people, posing a significant threat to food security.[547]
- Fall armyworm (FAW, *Spodoptera frugiperda*), an insect that feeds on more than 100 plant species, including maize, rice, sorghum, sugarcane and several vegetable crops, and causes yield losses of up to 100 per cent. A new pest in the region, it was first reported in the Sudan in 2016, and then in other countries, including Yemen and Egypt. It has been predicted FAW could cause up to $13 billion per year in crop losses throughout sub-Saharan Africa, threatening the livelihoods of millions of poor farmers.[548]

543 WHO, FAO and World Organisation for Animal Health, 2019.
544 Including Algeria, Bahrain, Egypt, Jordan, Kuwait, Lebanon, Oman, Qatar, Saudi Arabia, Tunisia, the United Arab Emirates and Yemen.
545 Mariner, 2018.
546 FAO, 2018c.
547 http://www.fao.org/locusts/en/.
548 Harrison and others, 2019.

- Red palm weevil (RPW, *Rhynchophorus ferrugineus*), which has caused the loss of tens of thousands of palm trees regionally, mainly in the Mediterranean basin, with a value of €483 million ($588 million, current 2021).[549]
- Fruit flies (*Bactrocera zonata*, *Bactrocera dorsalis* and *Drosophila suzukii*), which attack fruit crops, causing serious damage. For example, the cost in the region due to *Bactrocera dorsalis* alone is estimated at €320 million ($390 million, current 2021).[550]

Of the transboundary plant diseases, *Xylella fastidiosa*, a pathogenic bacterium, is one of the most dangerous plant bacteria in the region, and worldwide. Affecting more than 300 plant species, it poses remarkable risks to food security, livelihoods and economies. A 2019 assessment of the socioeconomic impact in the MENA region suggests Morocco, Lebanon, the State of Palestine and the Syrian Arab Republic are most exposed to the risk, and indicates declining yields, production, profitability, employment and exports, and increasing imports, with the highest impact on olives, then citrus and grapes.

Invasive weeds are a third category of plant transboundary pests and diseases, which cause yield losses ranging from 30 per cent to 70 per cent, reaching up to 100 per cent of some crops. They include Water hyacinth *(Eichhornia crassipes)* and Paulownia tree or Kebreet tree (*Ailanthus altissima*), which grow rapidly, outcompeting many other plant species for light and space. Toxins that inhibit the growth of other plants are also produced, seriously impacting on forest trees.

Box 7.6 The desert locust emergency

The desert locust is considered the most dangerous migratory pest in the world. Desert locust poses a serious threat to crop and livestock production in countries already highly food insecure and facing economic crises. Yemen, which is experiencing the world's worst food crisis, was forecast to face a new generation of locusts after the heavy rains in March 2020 created favourable breeding conditions. Some food insecure areas in parts of the Sudan and the Syrian Arab Republic are facing desert locust infestations, imposing additional challenges to already fragile situations in these countries.

In the event of a desert locust infestation, food security impacts are significant for vulnerable households in affected areas, especially for food insecure households (IPC 2 and above) reliant on cropping activities.[a] Pasture losses are also expected in areas where the swarms land, limiting the capacity of pastoral households to feed their grazing animals. In a worst-case scenario, where desert locusts cause below-average national harvests and major pasture losses in arid and semi-arid regions, the food security outlook is dire. Below average food stocks and pasture conditions, reduced incomes and rising food prices will likely drive widespread food insecurity for cropping, agropastoral and pastoral households.

a IPC Overview and Classification System. Available at http://www.ipcinfo.org/ipcinfo-website/ipc-overview-and-classification-system/en/.

5. The systemic risks related to pests and diseases

a. Impact of climate change on pests and diseases

Evidence suggests a correlation between climate change and the distribution, frequency and severity of plant pests and diseases.[551] Climate change directly affects the behaviour, reproduction rate, geographic distribution range, overwintering success, and pesticide resistance and dispersal ability of plant pests. It also affects host-plant physiology, plant pest interactions, plant pest enemy populations and pest management strategies. The multiplication rates of certain insects vary with temperature, while the severity of some insect increases is dependent on rainfall, such as in the case of the desert locust, where extended periods of rain and wet ground provide the most suitable environment for breeding. With regards to diseases, wheat leaf rust, for example, would develop earlier due to an increase in temperatures earlier in the season. Wheat yellow rust is now developing heat-tolerant strains that can make the disease spread more as epidemics.

549 Yaseen, 2019.
550 European and Mediterranean Plant Protection Organization, 2005.
551 FAO, n.d.

Climate change influences livestock diseases and zoonotic diseases directly and indirectly, especially vector-borne diseases. Variations in rainfall, temperature and flooding affect the distribution and abundance of disease vectors. A temperature rise increases transmission rates by increasing vectors' feeding interval and development rate, leading to an extension of vector habitats. Climate stress lowers animal immunity and alters ecosystem structure and functioning. Increased risk of infection leads to an increased risk of zoonotic diseases. Desertification intensifies the encroachment of humans and livestock into the natural habitats of wild animals, increasing contact between wildlife and livestock, and accelerating the risk of spillover and zoonotic disease outbreaks.

b. Human health and zoonotic disease

About 60 per cent of all infectious diseases in humans are zoonotic.[552] They cause approximately 60,000 deaths annually. The 2009 swine flu pandemic, which originated in Mexico, is estimated to have infected more than 100 million people, with a death toll of about 20,000.[553] Several emerging zoonotic diseases have recently caused, or threatened to cause, major pandemics. These include Ebola, highly pathogenic avian influenza (HPAI), Middle East respiratory syndrome (MERS, caused by MERS-CoV), Rift Valley fever, sudden acute respiratory syndrome (SARS), West Nile virus, and Zika virus. The pathogens causing these diseases have wildlife reservoirs acting as their long-term hosts. In the past two decades, emerging diseases losses exceeded $100 billion; if these outbreaks had become human pandemics, the losses would have amounted to several trillion dollars.[554] The World Economic Forum's 2019 global risks report notes the World Bank estimated Guinea, Liberia and Sierra Leone, the three countries most impacted by 2014-2015 Ebola outbreak, suffered combined GDP losses of $2.2 billion.[555]

Box 7.7 *Holistic risk management*

Addressing the risks posed by animal and plant pests and disease requires a holistic risk management approach that emphasizes prevention, surveillance and early warning and response. This includes understanding the relationship between animal and plant pests and diseases and other hazards; for example, plant pesticides and animal drugs can have negative consequences on food safety and human health, such as food contamination and antimicrobial resistance. Zoonotic diseases affect both animals and humans, and displacements caused by conflict necessitate certain quarantine measures to limit the transmission of animal and plant pests and disease systems. Such a holistic approach also requires: sustainability of response actions to avoid negative consequences on environment and human health; regional collaboration and joint actions to manage transboundary pests and disease, including coordinated surveillance, standards and protocols, and regional reference laboratory networks; and the use of science, technology and innovation, such as GIS in surveillance, research and preservation of genetic resources, and research to identify natural enemies of pests and diseases to limit the use of chemicals.

Recommended measures include: (i) coordination and cooperation between sectors using one-health and whole-of-society approaches; (ii) epidemiological assessments backed by reliable diagnostics (which necessitate laboratory capacities and epidemiological networks); (iii) human health and related areas, such as food safety, included when dealing with zoonotic diseases; and (iv) improved surveillance, monitoring and early warning systems for transboundary pests and diseases.

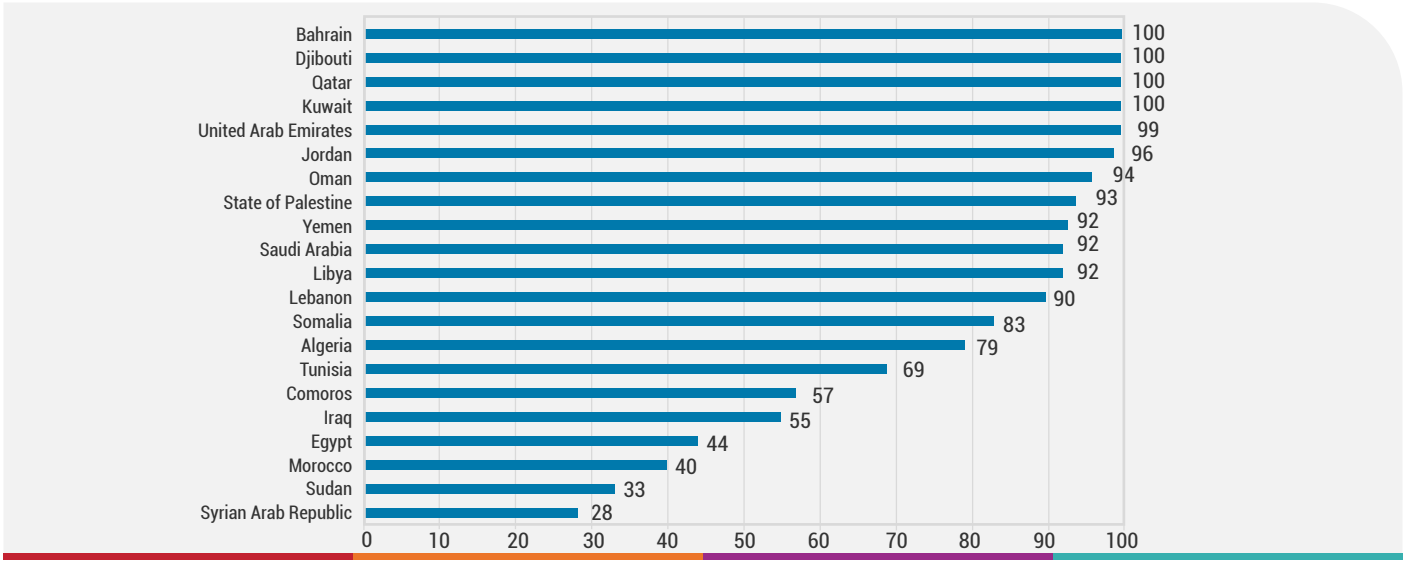
6. Economic shocks

Economic shocks have severe negative consequences for food security. They include a sudden increase or fluctuation in the price of food and productive inputs, leading to limited production capacity, limited access to financial support/credit systems and markets, in turn leading to a reduction in income across the agriculture sector, especially for vulnerable farming communities and self-employed, wage and informal workers threatened by food supply chain disruptions. Global economic shocks have a substantial impact in countries that are highly dependent on food imports due to their vulnerability to price volatility, an important indicator of the access and stability dimensions of food security. Food trade is disturbed as export countries often respond to economic shocks by restricting exports, which affects availability,

552 Woolhouse and Gowtage-Sequeria, 2005.
553 Nathason, 2016.
554 UNEP, 2016b.
555 World Economic Forum, 2019.

a third dimension of food security. The region is heavily dependent on world markets for a significant share of its food requirements, particularly cereals, with the cereal import dependency ratio ranging from 28 per cent in the Syrian Arab Republic to more than 90 per cent in the GCC countries (figure 7.2).

Figure 7.2 Cereal import dependency ratio of Arab countries, percentage



Source: World Bank, "World Development Indicators", DataBank. Available at https://databank.worldbank.org/source/world-development-indicators (accessed on 15 April 2021).

The Arab region is highly vulnerable to global economic shocks, as evidenced by the world food crisis of 2007-2008. Skyrocketing food prices made basic staples such as rice, wheat and corn unaffordable to lower-income groups, and the crisis subjected most States to considerable social and economic hardships. The GCC oil-producing countries, with their relatively small populations and ample revenue, attempted to adjust to the inflation in food prices. A significant number of people living below or just at the poverty line in the populous, non-oil-exporting countries were forced to resort to non-economic methods to protect themselves.[556]

National economic shocks also have a significant impact on the main dimensions of food security, particularly access, stability and utilization, especially among the poor. Hyperinflation, as in Lebanon, the Sudan and Yemen, reduces uninterrupted access to the adequate quantities of healthy food that ensure food utilization and stability.

Box 7.8 COVID-19: a systemic health crisis impacting food security

The outbreak of the COVID-19 pandemic and the control and mitigation measures enforced worldwide, combined with the massive economic impacts of these necessary measures, compounded by the preceding stresses of conflict, natural hazards and pests and diseases, all contribute towards a scenario of global food emergency.

Although the COVID-19 pandemic is primarily a health crisis, it has manifested in significant economic crisis, with risk implications for food trade, and consequently food security in the Arab region. Although global cereal markets are expected to remain balanced and comfortable, localized disruptions, caused largely by logistical issues, pose challenges to food supply chains in some markets, and risks to countries that are highly dependent on food imports. Some countries in the region also face specific risks related to their agrofood import-export profiles.

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556 Saif, 2008.

Food exports, which make up more than 20 per cent of total merchandise exports in six Arab countries, are facing disruption risks. In addition, while all countries are net-importers of food, they import mainly staple commodities but export varying – and for some substantial – amounts of high-value products such as fruit, vegetables, fish and meat. Usually exports are made up of a few agricultural commodities, as in Egypt, Jordan, Mauritania, Morocco and Tunisia. This implies exposure to fluctuating demand if these exports become regarded as non-essential.

Source: United Nations, The impact of COVID-19 on food security and nutrition, Policy Brief (June 2020).

Box 7.9 The need for regional collaboration

In the medium and long term, Arab governments need to adopt policies that reduce their vulnerability to global economic shocks. However, as no country is individually capable of achieving full food security, regional collaboration throughout food value chains is highly recommended, including in production, strategic reserves, processing and trade. Arab countries also need to diversify their trade partners in strategic food commodities. In parallel, they must further expand pro-poor social protection policies and programmes, including safety nets to safeguard those most vulnerable to economic shocks.

E. Conclusion

The Arab region has displayed deteriorating food security and nutrition trends since 2014. Natural hazards and human-made disasters are among the main reasons behind this worrying state. Beside conflicts, droughts and transboundary animal and plant pests and diseases have a paramount impact on food security in the region. Growing water scarcity represents a critical risk multiplier that exacerbates vulnerabilities. Studies suggest that climate change will further aggravate water stress and worsen the impact of climate-related disasters on food security.

The relationship between food security and disasters is complex. Most of the hazards affecting food security trigger systemic risks that result in significant social, economic and environmental impacts. Therefore, addressing these hazards necessitates a holistic DRM approach that fosters building resilience – across multiple sectors and systems – to multiple hazards and risks in line with the four priorities of the Sendai Framework.