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Food security and sustainable agriculture: The road to achieving Sustainable Development Goal 2 in North Africa

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[*] The thirty-eighth session of the Intergovernmental Committee of Senior Officials and Experts for North Africa is being convened in conjunction with the twenty-sixth session of the Intergovernmental Committee of Senior Officials and Experts for West Africa as their second joint session.
[**] ECA/SRO-NA/ICSOE/38/1-ECA/SRO-WA/ICSOE/26/1.

I. Executive summary

1. The various international crises, demographic pressure, rapid urbanization and water scarcity have placed agricultural sustainability and food security at the centre of the policy agendas of North African countries. This reflects the subregion's high dependence on food imports. High cereal dependency,[1] an unsustainable agricultural sector and low agricultural productivity have made the situation even more challenging since 2021.

2. Overall, against the Sustainable Development Goal targets, North Africa has the best performance among the five subregions of Africa, albeit with vast differences among the various countries of North Africa. Important challenges remain, however. Since the ongoing conflict between the Russian Federation and Ukraine is exacerbating the food-security crisis, North Africa needs to adopt new and innovative solutions to achieve food security and sustainable agriculture.

3. Analysis of the three available indicators related to food security and sustainable agriculture shows that the performance of North African countries in attaining Goal 2 remains modest. The estimated prevalence of moderate and severe food insecurity[2] in the subregion increased from 26.4 per cent of the population in 2015 to 34 per cent in 2021. The agriculture orientation index, which measures agriculture's share in government expenditure as a ratio of the sector's share in gross domestic product, stands at only 0.27,[3] well below the world average of 0.45. Most countries are still not meeting the target set in the Declaration on Agriculture and Food Security in Africa of allocating at least 10 per cent of public spending to agriculture. The Consumer Food Price Index has increased in all countries in the subregion and is high compared with the index in similar countries (in terms of development and GDP) outside North Africa. The volatility has been caused by increases in fertilizer prices and energy costs and difficult weather conditions.

4. North African countries could take several steps to ensure their food security and create a resilient agricultural sector. First, they could increase national agricultural production by boosting investment; develop an enabling environment for innovation and scientific research; and facilitate access to markets for agri-producers, fertilizers, skills and land ownership. Second, they could enhance the security and accessibility of their supply by improving the systems they use to gather information on international markets and by using digital technology to revolutionize agriculture. Third, they could adopt innovative practices to address water scarcity and land degradation, such as reusing treated wastewater for irrigation to close the gap between supply and demand.[4] Finally, they could reinforce their efforts at the subregional level to increase trade with the rest of Africa – in particular with the Sudan, which has the potential to be the next global food basket – and to share best practices and innovations.

5. Finally, North African countries need to rethink their agricultural policies and take more steps to adapt to and mitigate climate change. Several initiatives that have already been implemented could serve as examples of good practices for other countries to follow. Egypt, Libya, Morocco and Tunisia have taken steps to increase water efficiency,

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[1] With the exception of Algeria and Libya, more than 50 per cent of the wheat imported by each country in the subregion comes from the Russian Federation and Ukraine.
[2] As defined by the Food and Agriculture Organization of the United Nations: "A person is food insecure when they lack regular access to enough safe and nutritious food for normal growth and development and an active and healthy life. This may be due to unavailability of food and/or lack of resources to obtain food." See Food and Agriculture Organization of the United Nations, "Hunger and food insecurity". Accessed on 29 August 2023 (available at www.fao.org/hunger/en/).
[3] FAOSTAT, 2022.
[4] *Solutions and Investments in the Water-Food-Energy-Ecosystems Nexus: A Synthesis of Experiences in Transboundary Basins* (United Nations publication, 2021).

such as investing in desalination plants, dams, water harvesting, and advanced smart irrigation and drip irrigation technology. The Sudan has restored rangelands. Tunisia has set up effective early warning systems to monitor drought. Finally, Egypt and Morocco have adopted climate-resilient practices and technologies and digitalized their agricultural services.

II.   Aggregate performance on the Sustainable Development Goals Index

6.   North Africa remains the African subregion that is closest to achieving the Sustainable Development Goals, having posted the highest subregional score in the 2023 Sustainable Development Goals Index[5] (see figure I). The subregion's average score, however, hides differences among countries. Furthermore, the effects of the coronavirus disease (COVID-19) pandemic and the food- and energy-security crisis are major impediments that hinder progress towards achieving the Goals.

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[5] The Sustainable Development Goals Index is an assessment of each country's overall performance on the 17 Goals, with equal weight given to each Goal. A country's score indicates its position between the worst possible outcome (score of 0) and the target (score of 100).

Figure I
Average Sustainable Development Goals Index aggregate score, by African subregion, 2023
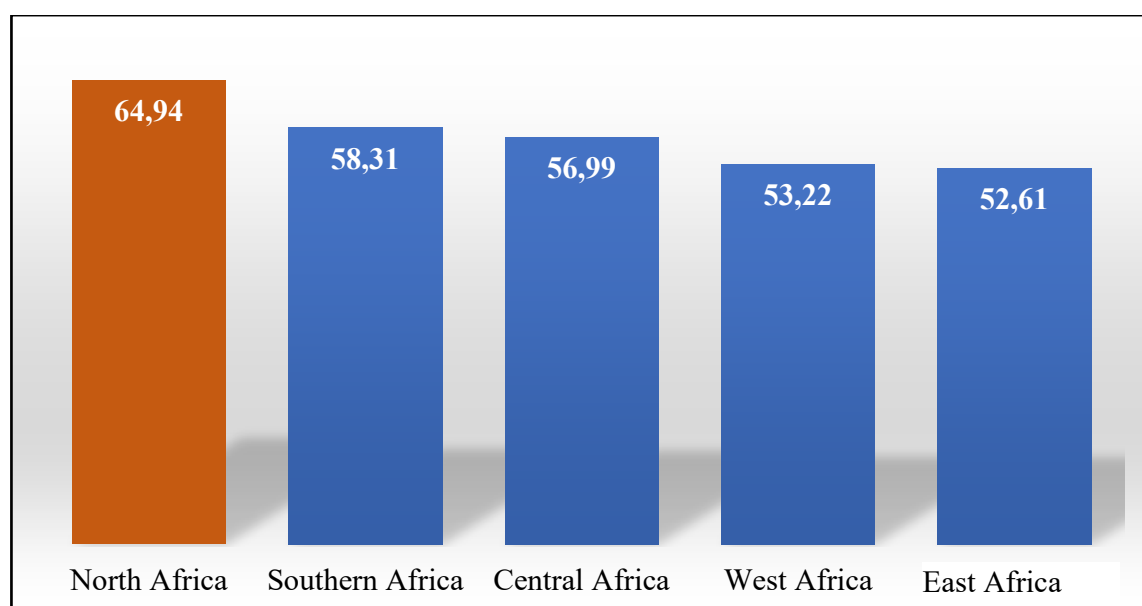
Source: Author calculations based on data from J.D. Sachs and others, *Implementing the SDG Stimulus: Sustainable Development Report 2023* (Paris and Dublin, Sustainable Development Solutions Network and Dublin University Press, 2023).

7.   Tunisia, Morocco and Algeria all scored slightly more than 70 (see table 1), making them the highest scorers in the whole of Africa. By comparison, Finland, which topped the 2023 Index, scored 86.8. The top 20 countries in the 2023 Index were all in Europe, but it is clear from the report in which the Index was published that even the countries with the highest scores face major challenges in achieving several Goals, in particular those related to climate, biodiversity and sustainable diets and food systems.

Table 1
Sustainable Development Goals Index aggregate scores and rankings, North African countries, 2023

	Aggregate score	*Ranking*
Algeria	70.8	71
Egypt	69.6	81
Libya	n/a	n/a
Morocco	70.9	70
Mauritania	57.2	133
Sudan	48.6	160
Tunisia	72.5	58

Source: J.D. Sachs and others, *Implementing the SDG Stimulus*.[6]

8.   Algeria, Egypt, Morocco and Tunisia all had an index score of at least 66.7, which indicates that they were at least two thirds (table 2) of the way to achieving the Goals. Although their overall scores were similar, there was significant variation in their scores for each individual Goal. It is therefore important for each country to look beyond its overall score and identify its gaps, challenges and strengths for each Goal. In addition, given the stagnation in their scores since 2020, as a result of numerous overlapping health crises and national and international crises, considerable efforts and greater collaboration are needed across the subregion for countries to achieve the Goals on schedule.

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[6] The 2023 Sustainable Development Goals Index covers 166 countries.

Table 2
Sustainable Development Goals Index, aggregate scores for North African countries, 2015–2022

	Algeria	Egypt	Mauritania	Morocco	Sudan	Tunisia
2010	66.8	65.1	49.6	63.7	47.1	67.4
2015	70.1	66.8	53.9	66.5	48.0	69.1
2019	70.5	67.6	55.7	68.5	49.7	70.0
2020	71.5	68.4	55.7	68.8	49.5	70.5
2021	71.5	68.5	55.7	68.9	49.5	70.6
2022	70.8	69.6	57.2	70.9	48.6	72.5

Source: J.D. Sachs and others, *Implementing the SDG Stimulus*.

9.   The present report on the Goals tracks the subregion's global performance in achieving the 2030 Agenda for Sustainable Development, with a focus on Goal 2, in particular food security and sustainable agriculture. The report contains a comprehensive overview of the progress achieved so far towards Goal 2, with a particular focus on gaps in agricultural policies and challenges in achieving food security. Measures are suggested in the report to allow countries to move towards sustainable agriculture systems, with higher productivity and less waste.

10.   The rest of the report is divided into three sections. The first is a presentation of the progress made by North African countries towards achieving Goal 2 and the effects of the various crises on food security in the subregion. The second section is an analysis of the agricultural sector and the food-security situation and includes a discussion of the challenges and opportunities associated with making the food system more resilient. The third and final section contains conclusions and policy recommendations to promote sustainable agriculture and allow countries to achieve food security.

III.   Progress of North African countries towards achieving Goal 2

11.   Goal 2 is to "end all forms of hunger and malnutrition by 2030, making sure all people – especially children – have sufficient and nutritious food all year". To achieve the Goal, countries need to promote sustainable agriculture and support small-scale farmers and equal access to land, technology and markets. [7]

12.   The number of people in the world suffering from hunger in 2020 was between 720 million and 811 million, an increase of about 161 million on the figure for 2019. Also in 2020, 2.4 billion people – about 30 per cent of the world's population – were moderately or severely food-insecure, meaning that they did not have regular access to adequate food.[8] Even though the share of the population that is undernourished in North Africa (8.0 per cent in 2019, 9.3 per cent in 2020, 9.8 per cent in 2021 and, according to projections, 7.8 per cent in 2030) is below the global average, the percentages for Mauritania and Sudan are higher than the global average. Undernourishment in North Africa is projected to rise at an alarming pace by 2030, owing to the "'triple' burden of malnutrition that is undernutrition, overweight and obesity, and micronutrient deficiencies". [9]

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[7]   United Nations Development Programme, "Goal 2: zero hunger". Available at www.undp.org/sustainable-development-goals/zero-hunger.
[8] United Nations, "Goal 2: zero hunger". Available at www.un.org/sustainabledevelopment/hunger/.
[9] Food and Agriculture Organization of the United Nations, *The Future of Food and Agriculture: Alternative Pathways to 2050* (Rome, 2018).

Table 3
Prevalence of undernourishment in North Africa

(Percentage)

	2015-2017	*2016-2018*	*2017-2019*	*2018-2020*	*2019-2021*
Algeria	2.8	2.7	2.5	2.5	2.5
Egypt	4.6	4.9	4.9	5.0	5.1
Mauritania	8.5	8.5	8.6	9.2	10.1
Morocco	3.8	3.7	3.8	4.4	5.6
Sudan	11.8	11.8	11.8	11.7	12.8
Tunisia	2.5	2.5	2.5	2.6	3.1
Average	**5.7**	**5.7**	**5.7**	**5.9**	**6.5**

Source: Food and Agriculture Organization of the United Nations (FAO), SDG Indicators Data Portal, Indicator 2.1.2. Accessed August 2023.

13.   The focus of the analysis in the present report is on the indicators related to food security and sustainable agriculture, not on malnutrition. Goal 2 is associated with eight targets and 13 indicators.

A.   Status of Sustainable Development Goal 2 in North Africa

14.   According to the 2023 Sustainable Development Goals Index,[10] North African countries are not performing well on Goal 2. Despite the slight progress that the countries had made since 2000 (see table 4), all scores stagnated in 2022 except that of Mauritania, which deteriorated. The failure of all countries to significantly improve their overall score in 2022 reflects the substantial difficulties that they faced and the fact that, although they achieved progress on some targets, they performed poorly on others. Major challenges remain for the subregion, especially for Mauritania and the Sudan.

15.   In 2022, Egypt was the country that was closest to attaining Goal 2. Its score of 65.3 indicates that the country was almost two thirds of the way to attaining Goal 2. The next best placed countries were Morocco and Tunisia. Sudan was the country that was furthest away from attaining Goal 2, with a score of 42.6.[11]

Table 4
Sustainable Development Goal 2 index by country, North Africa, 2000–2022

|	*Algeria*	*Egypt*	*Libya*	*Mauritania*	*Morocco*	*Sudan*	*Tunisia*
2000	48.7	71.5	..	31.7	51.3	16.5	60.3
2010	54.6	65.6	..	41.1	56.8	19.5	60.4
2021	57.5	65.2	..	45.5	64.6	21.8	61.5
2022	57.6	65.3	..	42.6	64.7	21.9	61.5

Source: J.D. Sachs and others, *Implementing the SDG Stimulus*.

16.   In 2022, the average Goal 2 index score for North African countries (52.3) was lower than the global average (65.0) and the averages for the other African countries (57.2) and for all upper-middle-income countries (74.1) (figure II). The situation reflects the difficulties that countries face – some more than others – in eradicating hunger, achieving food security and ensuring sustainable agriculture.

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[10] J.D. Sachs and others, *Implementing the SDG Stimulus*.
[11] The index for each Goal is a measure of how close a country is to attaining that Goal, with 0 representing the worst possible situation and 100 indicating that a country has achieved the Goal.

Figure II
Sustainable Development Goal 2 index, by country groupings
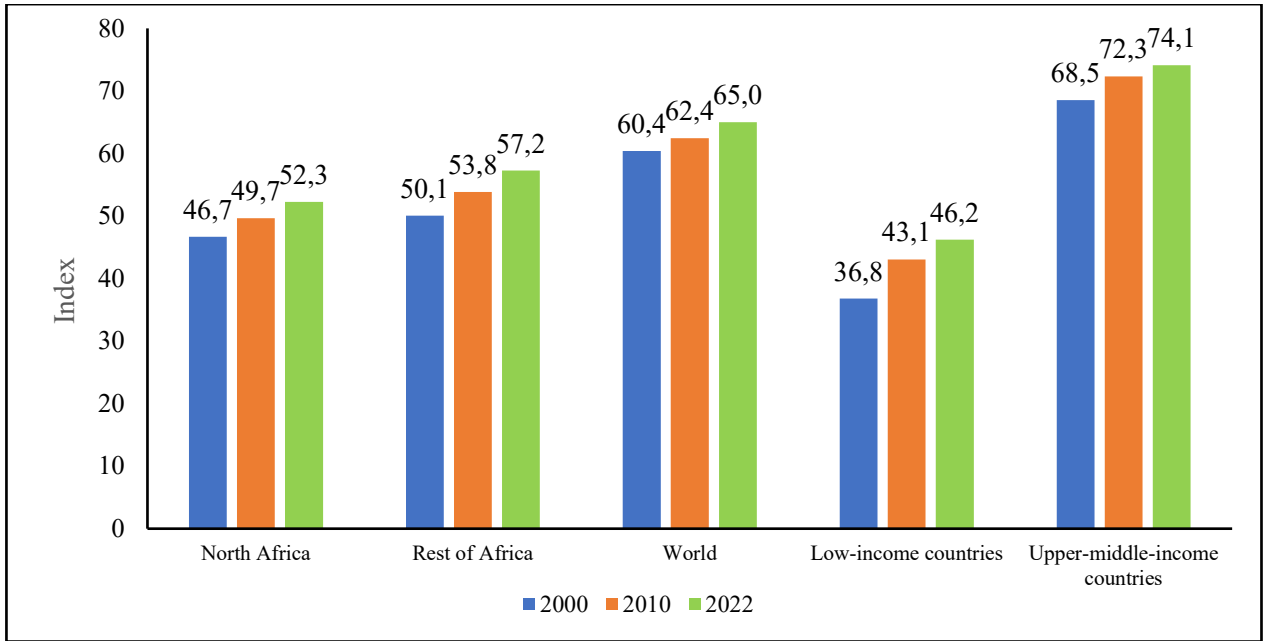
Source: J.D. Sachs and others, *Implementing the SDG Stimulus*.

B. Progress on Sustainable Development Goal 2 indicators related to food security

17. Monitoring Goal 2 and assessing the progress achieved by countries is challenging when data are missing or are not produced. The focus of the present section is on three Goal 2 indicators related to food security and sustainable agriculture.

1. Prevalence of moderate or severe food insecurity in the population[12]

18. The indicator on the prevalence of moderate or severe food insecurity in the population is defined by the Food Insecurity Experience Scale. Moderate food insecurity means that a person is unable to maintain a healthy, balanced diet, while severe food insecurity usually means there is reduced food intake and therefore more severe undernutrition, including hunger. The objective is to end moderate and severe food insecurity for all by 2030. [13]

19. As shown in table 5, the estimated prevalence of modern or severe food insecurity in North African countries increased from 26 per cent of the population in 2015 to 34 per cent in 2021, compared with 29 per cent for the world and 58 per cent for Africa. The estimated prevalence in North Africa increased by 3.8 percentage points in 2021, a sharp acceleration compared with the 1.3 percentage point increase in 2020. The increase in prevalence was nearly as much as the increases of the previous five years combined. Severe food insecurity affected 11.3 per cent of the population of North Africa in 2021, meaning that they had run out of food. This level was almost as high as the global prevalence (11.7 per cent).

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[12] As defined in the metadata glossary of the World Bank, "a household is classified as moderately or severely food insecure when at least one adult in the household has reported to have been exposed, at times during the year, to low quality diets and might have been forced to also reduce the quantity of food they would normally eat because of a lack of money or other resources". See https://databank.worldbank.org/metadataglossary/sustainable-development-goals-(sdgs)/series/SN.ITK.MSFI.ZS.
[13] Our World in Data, "End hunger, achieve food security and improved nutrition and promote sustainable agriculture", 2023.

Table 5
Prevalence of moderate and severe food insecurity
(Percentage)

		Severe food insecurity		Moderate or severe food insecurity		
	World	*Africa*	*North Africa*	*World*	*Africa*	*North Africa*
2015	7.5	17.1	9.0	21.5	45.3	26.4
2018	9.0	19.3	9.3	25.0	51.3	31.1
2020	10.9	22.4	9.5	29.5	56.0	30.2
2021	11.7	23.4	11.3	29.3	57.9	34.0

Source: FAO, SDG Indicators Data Portal, Indicator 2.1.2. Accessed August 2023.

20.   At the country level, the prevalence of moderate or severe food insecurity from 2019 to 2021 was high in all North African countries except Algeria (19 per cent) (table 6). During that period, more than 25 per cent of the population in Egypt and Tunisia suffered from moderate or severe food insecurity. The situation was even worse in Morocco (31.6 per cent), Libya (39.4 per cent), Mauritania (45.3 per cent), and the Sudan (50.7 per cent). It will be very difficult for North African countries to eliminate moderate or severe food insecurity by 2030.

21.   Algeria had the lowest prevalence, at 19.0 per cent for 2019–2021, down from 22.9 per cent for 2014–2016. This is because the country continued its policy of providing food import subsidies (which it continues to do) and because of its supplier diversification strategy, both of which are designed to protect consumers from the high cost of imports.

22.   The combined prevalence of moderate and severe food insecurity increased substantially between 2014–2016 and 2019–2021 in Libya, Mauritania, Morocco, the Sudan and Tunisia. One of the factors behind the 10 percentage point increase in Libya was that farmers had limited access to agricultural production inputs and support for animal health care due to years of conflict around main agricultural areas and disruption of agricultural extension services due to instability. A similar increase occurred in the Sudan, for similar reasons.

Table 6
Prevalence of food insecurity in the total population, by country
(Percentage)

| Severe food insecurity							
	Algeria	*Egypt*	*Libya*	*Mauritania*	*Morocco*	*Sudan*	*Tunisia*
2014–2016	13.0	8.4	11.2	4.6	6.0	13.4	9.1
2015–2017	12.7	8.7	12.4	5.0	5.1	14.4	9.3
2016–2018	11.4	8.6	14.3	5.5	5.7	15.4	9.1
2017–2019	9.3	7.4	16.7	5.9	6.0	16.4	9.7
2018–2020	6.9	6.7	18.6	6.6	7.1	16.8	10.7
2019–2021	6.2	7.1	20.7	7.2	9.7	17.4	12.6
Moderate or severe food insecurity							
	Algeria	*Egypt*	*Libya*	*Mauritania*	*Morocco*	*Sudan*	*Tunisia*
2014–2016	22.9	27.8	29.1	26.3	26.7	41.4	18.2
2015–2017	21.5	29.9	30.9	29.2	26.3	43.9	19.4
2016–2018	19.7	33.1	33.2	32.3	26.1	46.4	20.0
2017–2019	17.6	31.2	35.7	35.9	26.7	48.9	22.1
2018–2020	17.6	27.8	37.4	41.2	28.0	49.4	25.1
2019–2021	19.0	27.3	39.4	45.3	31.6	50.7	28.0

Source: FAO, SDG Indicators Data Portal, Indicator 2.1.2. Accessed August 2023.

2. Agriculture orientation index for government expenditures

23. The agriculture orientation index for government expenditures, defined as the agriculture share of government expenditures divided by the agriculture value added as a share of gross domestic product (GDP), is shown in figure III. For the purpose of this indicator, agriculture includes forestry, fishing and hunting. Changes in the agriculture orientation index of countries provide insight into the extent to which government expenditure on the agricultural sector is proportional to the sector's contribution to the economy. The objective of each country is to reach an agriculture orientation index higher than 1.

24. Public investment in agriculture in North Africa is lower than in other economic sectors. In 2021 (figure III), the subregion's agriculture orientation index was only 0.27, a little more than half the world average of 0.45. Historically, North African countries have always had an index of less than 1, which indicates that public expenditure on agriculture is lower than the sector's contribution to GDP. Since 2001, Governments in North African have been devoting fewer resources to the sector. At the continental level, Botswana (2.29 in 2021), Zambia (1.58), Seychelles (1.39) and South Sudan (1.01) invest the highest proportion of GDP in agriculture.

Figure III
Agriculture orientation index for government expenditures, 2000–2021
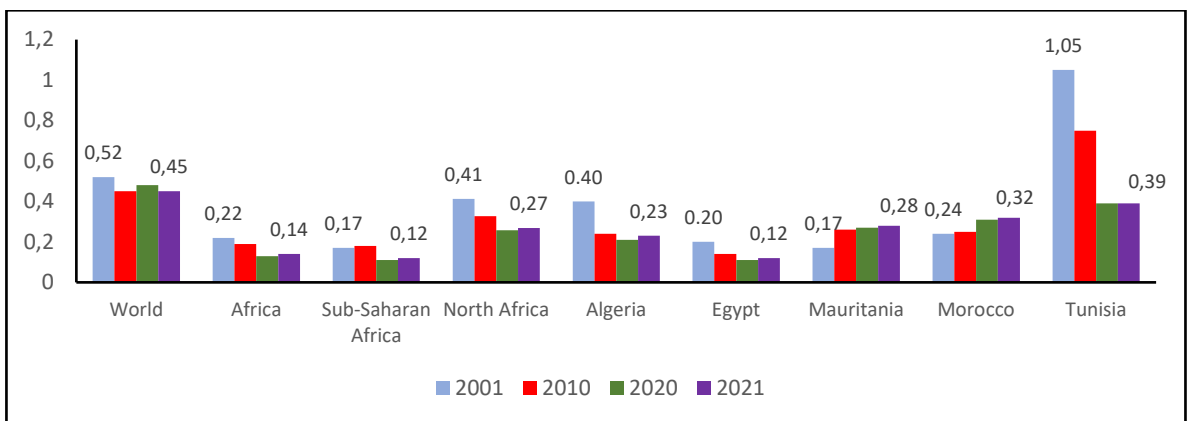
Source: FAO, SDG Indicators Data Portal, Indicator 2.a.1. Accessed August 2023.

25. Tunisia has the highest index, although its index has declined since it stood at more than 1 in 2001. The continued decline after 2010 was a result of public expenditure being redirected to finance a massive public recruitment drive and to overcome the social and economic effects of COVID-19. Algeria and Egypt also observed a decline, albeit from a lower base, which was already below 0.5. Morocco raised its index by 34 per cent between 2001 and 2021 (from 0.24 to 0.32), reflecting its strategy to boost production and productivity and support agricultural exports.[14]

26. The overall downward trend shown by the indices of countries in North Africa reflects cuts in public investment in agriculture.

3. Food price anomalies, as reflected in the Consumer Food Price Index[15]

27. As shown in figure IV, domestic food price inflation in 2022 remained above 14 per cent in Algeria, Egypt, Morocco, Mauritania and Tunisia. Egypt had the highest food inflation rate in the subregion, at 60 per cent. High fertilizer prices have also been

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[14] Government of Morocco, "Generation Green 2020–2030". Available at www.maroc.ma/en/content/generation-green-2020-2030 (accessed on 31 August 2023).
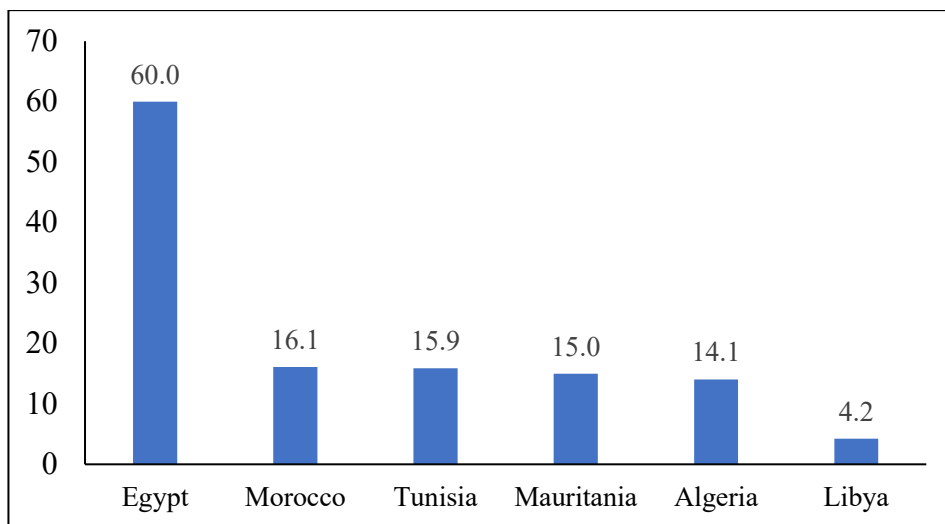[15] The Consumer Food Price Index is a measure of changes in the retail prices of food products consumed by a specific population group in a given area compared with a base year.

fuelling food price inflation. Global food prices are expected to remain high because of wars, energy costs and weather events.[16] This will place additional pressure on food security, increase social tension and put the budgets of North African countries under strain.

Figure IV
Food inflation, by country, 2022
(Percentage)

Source: FAO, SDG Indicators Data Portal, Indicator 2.c.1. Accessed August 2023.

28.   The Consumer Food Price Index is also high in Algeria, Egypt, Morocco, Mauritania, and Tunisia, again because of a significant rise in domestic food prices due to increases in fertilizer and energy costs and difficult weather conditions.

29.   During the past decade, extensive food subsidies were implemented to lower the cost of food items. In fact, the subsidies were introduced because wheat-based items constitute a relatively high share of average caloric intake in North Africa and per capita consumption of such items in the subregion is higher than the global average. In Egypt, for example, almost 40 per cent of caloric intake is met through wheat-based items, and per capita wheat consumption is almost double the world average. Moreover, food subsidies are a sensitive topic in North Africa, and there has been considerable public opposition to any attempts to reform such programmes. With wheat prices so high, maintaining food subsidy levels represents a significant drain on foreign currency reserves, reduces countries' fiscal space and increases food price inflation.

30.   The above analysis shows that all the countries in the subregion have a long way to go to achieve the indicators related to food security and sustainable agriculture. To achieve Goal 2, North African countries need to transform their food systems.

IV.   Agriculture and food security in North Africa

31.   Agriculture is one of the fundamental pillars of the economies of North Africa and plays an important role in its socioeconomic development. In addition to its contribution to GDP and external trade, agriculture provides, on average, a quarter of jobs in North African countries (see table 7) and is the main source of income and employment for almost 70 per cent of the rural population and for more than half of women in Morocco and the Sudan. Agriculture also plays an important role in land development.

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[16] International Monetary Fund, *World Economic Outlook: Countering the Cost-of-Living Crisis* (Washington, D.C., October, 2022).

Table 7
Employment in agriculture
(Percentage of total employment)

	2013	*2015*	*2017*	*2019*	*2021*
Algeria	11.0	9.6	10.2	9.9	10.3
Egypt	28.0	25.8	25.0	21.1	19.8
Libya	18.4	19.3	18.2	16.9	16.3
Mauritania	34.2	33.0	32.0	30.6	29.5
Morocco	38.0	36.6	35.3	33.9	34.6
Sudan	44.0	42.8	41.3	40.7	40.6
Tunisia	15.4	14.8	14.8	14.3	13.9

Source: World Development Indicators, 2022.

32.   Figure V shows the vital contribution that the agriculture, forestry and fishing sector makes to the economies of North Africa. In 2022, the sector contributed at least 10 per cent to the GDP of all countries except Libya (1.6 per cent) and the Sudan (5.0 per cent). The contribution in the Sudan was well below the figures recorded a few years earlier (31 per cent in 2015 and 20 per cent in 2021), mainly owing to climate change and conflict. The sector's largest relative contribution to GDP was in Mauritania (19.2 per cent).

Figure V
Contribution of agriculture, forestry and fishing to GDP in North Africa, 2022
(Percentage)
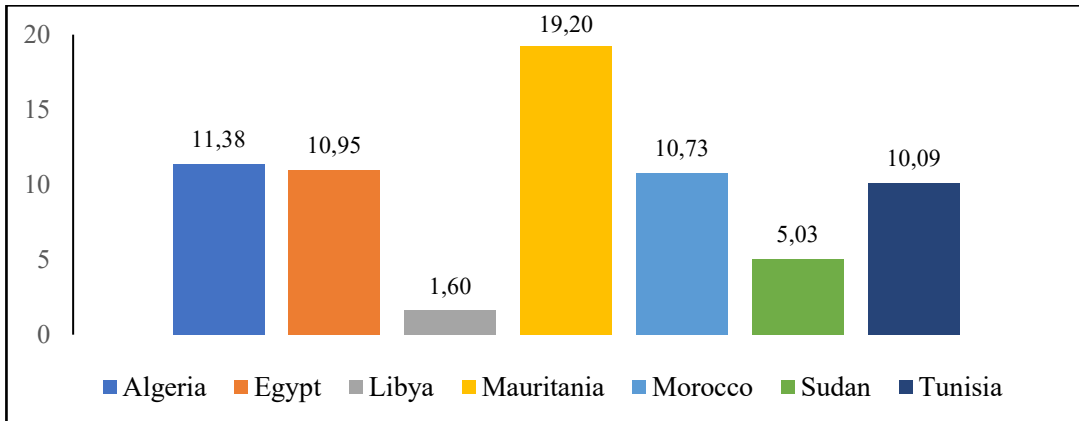
Source: World Development Indicators, 2022.

A.   Analysis of gaps in food policies

33.   North African countries are highly dependent on world markets for their food security. This was not such a big problem during the 1980s and 1990s, when world food prices were low and stable, but has become a significant challenge since 2000, when world prices became high and volatile. As shown in table 8, wheat consumption has been greater than wheat production since 2000. Based on the figures for 2018–2020, the cereal import dependency ratio is particularly high in Algeria, Libya, Mauritania, Morocco and Tunisia, all of which had ratios that were more than three times higher than the world average (16 per cent) for the same period.

Table 8
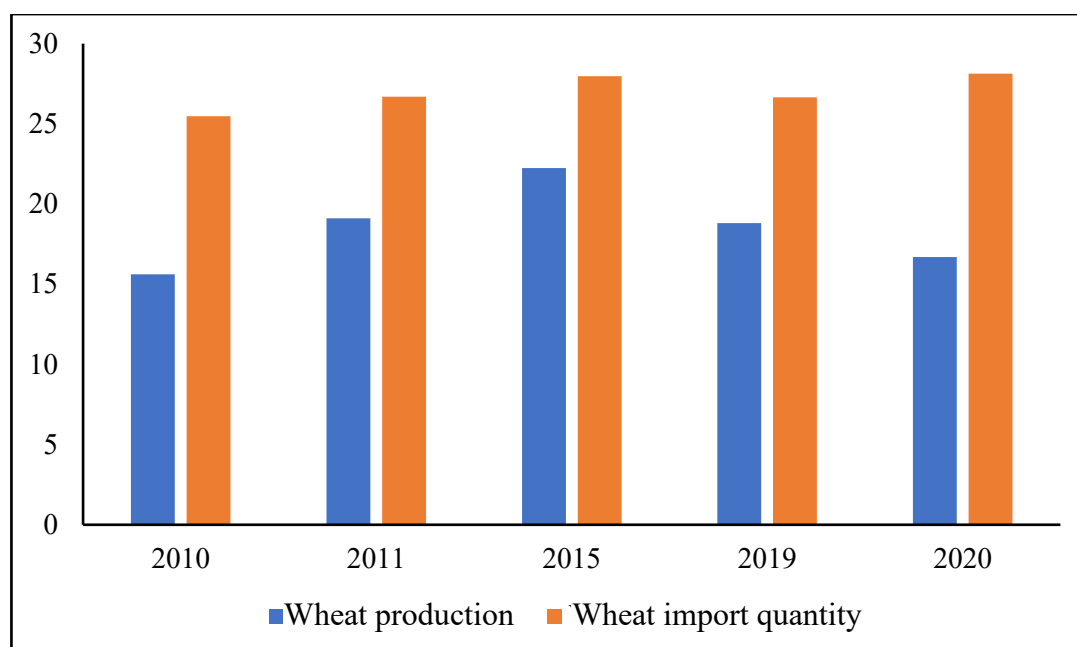**Cereal import dependency ratio, North Africa**
(Percentage)

	Algeria	*Egypt*	*Libya*	*Mauritania*	*Morocco*	*Sudan*	*Tunisia*

2000-2002	79.7	34.8	n/a	n/a	52.1	n/a	70.1
2006-2008	73.1	36.6	n/a	64.4	47.7	n/a	68.1
2010-2012	69.7	41.6	93.1	75.6	46.1	n/a	56.6
2014-2016	76.6	43.3	90.1	55.5	59.6	27.2	66.8
2016-2018	74.3	47.8	86.7	58.2	56.8	22.8	70.1
2018-2020	73.8	47.4	90.6	58.6	65.7	33.5	65.4

Source: FAO, SDG Indicators Data Portal. Accessed August 2023.

34.   In the 2010s, North Africa imported 254.6 million tons of wheat (figure VI) making the subregion the largest purchaser of foreign wheat globally, ahead of the Middle East (238.8 million tons), South-East Asia (211.1 million tons), and sub-Saharan Africa (204.5 million tons). In 2020, the subregion accounted for 13.4 per cent of all imported wheat at the global level by value ($6.59 billion), led by Egypt (5.5 per cent, $2.69 billion), Algeria (3.4 per cent, $1.65 billion) and Morocco (2.9 per cent, 1.42 billion).[17]

Figure VI
Total wheat production and imports, North Africa
(Millions of tons)

Source: FAO, SDG Indicators Data Portal. Accessed August 2023.

35.   In addition to its high dependency on agricultural imports, the North African agricultural sector is facing major pressure on its agricultural land area. Population growth has reduced the area of arable land available per person, making the subregion less self-sufficient in its agricultural production. Arable land per capita fell from 0.29 ha per person in 1991 to 0.18 ha per person in 2020. Given that the population of North Africa is expected to increase by another 25 million between 2023 and 2030, it is expected that this will further reduce the amount of agricultural land per capita and may encourage the adoption of unsustainable land-use practices.

36.   The reliance of North African countries on a small group of wheat suppliers was laid bare in 2022 and posed a severe threat to the subregion's food security. According to the United Nations Comtrade database, almost all North African countries import more than half their wheat from Ukraine and the Russian Federation (the exceptions are Algeria and Morocco). The dependency rate of Egypt is 82 per cent and that of the Sudan is 75 per cent.

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[17] BMI, "Food security in North Africa: a look at the structural factors driving wheat insecurity", FitchSolutions, 16 March 2023.

37.   Cereal production remains under serious threat, since extensive drought conditions (in Algeria, Egypt, Morocco and Tunisia) harm crop yields and reduce output. In Mauritania, high food prices, flooding in 2022 and growth in the refugee population have all exacerbated food insecurity. Aggregate cereal production was estimated at 33 million tons in 2022, 13.8 per cent below the 5-year average for 2017–2021, and aggregate wheat production at 16.6 million tons, almost 12 per cent below the 2017–2021 average. The largest drop in cereal production in North Africa was in Morocco, where widespread drought caused production to fall to 3.3 million tons, 68 per cent below the 2017–2021 average.[18]

38.   Notwithstanding the above, North African countries have recently made good progress in increasing their food production and reducing food insecurity by improving their management of chemicals and fertilizers, developing their supply chains and introducing machine technology to increase yields. In Morocco, several good practices have been introduced. For instance, a partnership was signed recently between an agri-food analysis laboratory and a university business unit to optimize the fertilization of crops by digitalizing data on soil structure. The university business unit also "uses satellite data and cutting-edge technologies to optimize fertilizer inputs, improve yields and reduce operational costs for players in the agricultural sector in Africa".[19] Another good practice being implemented in some North African countries is the use of non-traditional ingredients to make bread (in Egypt and Morocco).

39.   According to an analysis of food security in North Africa, agriculture has remained essentially rain-dependent, despite major investment in irrigation. The percentage of irrigated land compared to land farmed varies between 7 and 18 per cent, except in Egypt, where nearly 95 per cent of farmed land is irrigated by the Nile (ECA-NA/PUB/FS/13/1).

40.   Agricultural models in North African countries are based on the development of extensive agriculture without consideration for ecological and climate constraints. This has led to a decline in farm productivity, with low and limited yields. The agricultural sector remains dependent on low-yield cereal crops, with limited investment in research and innovation. For example, the production of cereals (barley, wheat and rice), which are more water-intensive than fruit and vegetables, actually increased in the subregion in the 2010s, reaching 60 per cent of the harvested land, despite the shortages of water and arable land.[20] More recently, Morocco has tried to shift the balance away from cereals and towards fruit to reduce its water requirements.

41.   Despite its potential to drive growth and jobs, agro-industry is still under-developed (ECA-NA/PUB/FS/13/1), although there have been some good initiatives in Morocco and Egypt. Agri-trade within the subregion is also poorly developed, despite its great potential and despite complementarity among countries in North Africa.

B.   Challenges and opportunities to improve food-system resilience

42.   For North African countries to improve their food-system resilience and achieve agriculture sustainability, they need to tackle four main challenges: variable rainfall and temperatures, water scarcity, high dependence on agricultural imports and low agricultural productivity.

43.   North Africa has a Mediterranean climate, with hot, dry summers, humid winters and variable rainfall and temperatures that affect yields. According to projections, North

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[18] FAO, "Crop prospects and food situation", Quarterly Global Report, No. 1 (Rome, March 2023).

[19] Bureau Veritas, "Strengthening 'rational fertilization' in Morocco – Agriedge and Labomag are mobilizing", 11 November 2022.

[20] FAO and others, *Near East and North Africa: Regional Overview of Food Security and Nutrition: Trade as an Enabler for Food Security and Nutrition* (Cairo, 2023).

African countries will become drier and hotter, which could severely reduce yields[21] and, consequently, production, especially for cereals. It will therefore be necessary to design, implement, or scale up such climate-adaptation measures as climate-smart agriculture, crop diversification, conservation agriculture, crop rotation, modification of sowing and planting times, and ecosystem-restoration activities.

44.   Innovative practices are also needed to address water scarcity and land degradation and to improve efficiency in agriculture. One solution could be to continue efforts to reuse treated wastewater for irrigation to fill the gap between the supply of and demand for conventional water resources.

45.   In the past, national grain reserve programmes have been implemented by some North African countries to overcome global price instability. Given the effects of climate change on global food production and the limited options available to water-scarce areas, potential solutions to give North Africa affordable access to grain include reviving national grain reserves and developing subregional grain reserves akin to those already developed by the Association of Southeast Asian Nations, the Economic Community of West African States and the Southern African Development Community. The Regional Food Security Reserve, a subregional initiative launched in 2013 by the Economic Community of West African States, could be used as an example.[22]

46.   In response to the global food crisis in 2007–2008, Algeria, Egypt and Morocco launched promising initiatives that could serve as good practices to be shared and duplicated. Egypt adopted a strategy for sustainable agricultural development, under which it aims to achieve food security by 2030 by modernizing Egyptian agriculture and improving rural livelihoods.[23] Morocco launched its Green Morocco Plan[24] in 2008 to "promote socio-economic development by boosting production of high-value agricultural exports".[25] The plan is focused on "modernizing production methods and introducing climate-tolerant wheat varieties". Thanks to the plan, by 2022 Morocco produced three times as much wheat as it had in 2020, when it suffered from drought.[26]

V.   Concluding remarks and policy recommendations

47.   North African countries are performing modestly in achieving Goal 2 and in achieving sustainable agriculture. The COVID-19 pandemic, the war in Ukraine and climate change have posed an unprecedented challenge to North African countries, revealing the weaknesses of their agriculture models. However, the challenge also represents an important opportunity for North African countries to rethink agriculture practices and to reshape policies to make their food systems more resilient.

48.   Boosting climate-resilient policies and innovation in the agricultural sector will help the countries to recover and become stronger than before. More specifically, important steps that Governments could take to accelerate the transition to sustainable, resilient, and controlled-climate systems include the following:

        (a)   Developing coherent and integrated policies in relation to water, energy, food and the environment. Governments should use such policies to reinforce

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[21] Davide Cammarano and others, "The impact of climate change on barley yield in the Mediterranean basin", *European Journal of Agronomy*, vol. 106 (May 2019), pp. 1–11.
[22] Maria Christoforidou and others, "Food security under water scarcity: a comparative analysis of Egypt and Jordan", *Food Security*, vol. 15 (2023), pp. 171–185.
[23] Available at www.fao.org/faolex/results/details/en/c/LEX-FAOC141040/.
[24] Available at www.agriculture.gov.ma/fr/data-agri/plan-maroc-vert.
[25] Michaël Tanchum, "The fragile state of food security in the Maghreb: implication of the 2021 cereal grains crisis in Tunisia, Algeria, and Morocco", Policy Brief, (MEI Policy Center, November 2021).
[26] Ibid.

coordination at the sectoral and national levels to ensure the sound implementation of measures to cope with the effects of climate change;

(b)   Investing in green infrastructure and upgrading ageing water management infrastructure;

(c)   Reusing treated wastewater to fill the gap between supply and demand for conventional water resources, as several countries have already done;

(d)   Developing new technologies, pursuing innovation in the agricultural sector and increasing investment in research and development;

(e)   Encouraging private-sector investment and public-private partnerships in the agribusiness sector;

(f)   Promoting integrated decision-making processes at the national and subregional levels to ensure greater synergy and address the trade-offs among agriculture, water, energy, land and climate change;

(g)   Reinforcing intra-African efforts to share best practices.

49.   Leveraging trade among North African countries could help to "reduce food scarcity during normal agricultural production cycles" and could provide "an important mechanism to address production shortfalls or supply chain disruptions".[27] Leveraging trade with the rest of the continent could produce similar results. Eliminating intra-African tariffs and trade barriers in agricultural trade is therefore essential, and the Agreement Establishing the African Continental Free Trade Area is a good framework to achieve this.

50.   Boosting North Africa integration will be a key solution, especially given the potential of the Sudan to become the next global food basket. More than ever, the Sudan holds the key to food-security problems in North Africa and the world.

51.   Finally, North African countries need to rethink their agricultural policies with a view to taking climate change into account. Several measures already adopted by North African countries offer good practices for other countries to follow. The measures include increasing water efficiency by "investing in desalination plants, dams, water harvesting, and advanced smart and drop irrigation technologies" (Egypt, Libya, Morocco and Tunisia); adopting policies to enhance the cultivation of drought-resistant crop varieties (Tunisia); restoring rangelands (Sudan); setting up effective early warning systems and monitoring drought (Tunisia); introducing climate-resilient practices; and digitalizing agricultural services (Egypt and Morocco).[28]

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[27] FAO and others, *Near East and North Africa*.
[28] Food and Agriculture Organization of the United Nations, *Food Policy Monitoring in the Near East and North Africa region*, Bulletin (Cairo, first quarter 2023).