Food and Agriculture Organization of the United Nations

INFORMATION NOTE

3 July 2023 Update

THE IMPORTANCE OF UKRAINE AND THE RUSSIAN FEDERATION FOR GLOBAL AGRICULTURAL MARKETS AND THE RISKS ASSOCIATED WITH THE WAR IN UKRAINE

EXECUTIVE SUMMARY

1. Market and trade profiles of the Russian Federation and Ukraine prior to the war in Ukraine - February 2022

1.1. Market shares

1. The Russian Federation and Ukraine are among the most important producers of agricultural commodities in the world. Both countries have been net exporters of agricultural products and leading global suppliers of foodstuffs. Between 2017/18 and 2021/22, the two countries accounted, on average, for 8.8 percent of the global output of barley, wheat and maize, with the Russian Federation accounting for 5.4 percent and Ukraine for 3.4 percent. The contribution of the two countries to global oilseed production was particularly significant for sunflower seed, with an aggregate share of more than 50 percent of world output over the same period.
2. The Russian Federation is also a top exporter of fertilizers in the world. The two countries have played an important role in global food and fertilizer markets, where exportable supplies are often concentrated in a small number of countries, rendering these markets vulnerable to shocks.

1.2. Trade profiles

3. In 2021, either the Russian Federation or Ukraine, or both, ranked among the top three global exporters of wheat, barley, maize, rapeseed, rapeseed oil, sunflower seed and sunflower oil. The Russian Federation also ranked as the world's top exporter of nitrogen fertilizers, the second leading supplier of potassic fertilizers, and the third largest exporter of phosphorous fertilizers.
4. A large number of food- and fertilizer-importing countries, many of which belong to the groups of Least Developed Countries (LDCs) and Low-Income Food-Deficit Countries (LIFDCs), have relied on Ukrainian and Russian food supplies to meet their needs. At the time of the outbreak of the war, many of these countries were already grappling with the negative effects of the COVID-19 pandemic and rising international food commodity and fertilizer prices.

2. Post-February 2022: impact of the war on production, markets and the humanitarian situation

2.1 Market and trade profiles of the Russian Federation and Ukraine after February 2022

5. In 2022/23, the two countries together accounted for 9.0 percent of the global output of barley, wheat and maize (compared to 8.8 percent on average over the period 2017/18-2021/22), with the Russian Federation accounting for 6.5 percent and Ukraine for 2.5 percent (compared to 5.4 percent and 3.4 percent, respectively). For the oilseed sector, owing mostly to a decline in the global sunflower seed production resulting from an output contraction in Ukraine in 2022, the share of the Russian Federation increased to 31 percent, while the share of Ukraine declined to 21 percent. Adjustments observed for other oilseeds were small.
6. The share of Ukraine and the Russian Federation in the global exports of wheat declined to around 17 percent in 2022, from about 26 percent in 2021. Similarly, reductions of the share of the two countries in the global exports of barley, maize, rapeseed and sunflower seed oil were observed. Nevertheless, not all the changes in the trade and market profiles are caused by the war, although it has played a role.

2.2. International prices of basic foodstuffs and agricultural inputs

7. International food commodity prices spiked in March 2022, following the war-induced suspension of maritime exports from Ukraine, which took place in a global context already marked by tight exportable availabilities. World prices overall eased since March 2022, with the FAO Food Price Index (FFPI) falling by 22 percent between March 2022 and May 2023, in part reflecting the impact of the Black Sea Grain Initiative (BSGI) and expanded non-maritime export channels from Ukraine facilitated by the European Union Solidarity Lanes, as well as seasonal factors and solid northern hemisphere harvests, in particular for wheat. However, while world prices of most food commodites encompassed by the FFPI dropped compared to one year ago, they remain relatively elevated.
8. Much of 2022 was characterized by high and volatile prices of fertilizers, with many quotations reaching all-time highs. Overall, with the decline in energy and natural gas prices, fertilizer prices have also eased significantly, declining from their peaks reached in 2022, and in some cases approaching levels of spring 2021, while prices of phosphate have remained above their levels of two years ago. In June 2023, ammonia prices averaged USD 290 per tonne, down nearly 72 percent from a year ago, and urea prices averaged USD 300 per tonne, nearly half their levels last year. However, despite these declines in prices, fertilizer affordability and accessibility continue to be a serious concern until now in many parts of the world.

2.3. Production in Ukraine and elsewhere

9. The 2022 aggregate cereal harvest in Ukraine (comprising winter and spring/summer crops in the area controlled by the government) was estimated at 54.6 million tonnes, about 23 percent below the last five-year average and 36 percent below the exceptional 2021 harvest. Oilseeds production declined markedly in 2022, primarily due to a sharp reduction in sunflower seed output, while rapeseed production increased year-on-year as planting of the winter crop was completed in late 2021, and the impact of the war on production was limited.
10. With regard to production in Ukraine in 2023, low domestic output prices have affected returns and liquidity for farmers in Ukraine and hampering agricultural activities. As such, area sown to cereals is much smaller

compared to the year before. On the other hand, higher returns and more attractive profit margins increased area planted to oilseeds.

11. While immediate losses of crop production as a direct result of flooding from the Kakhovka dam destruction on 6 June 2023 have been relatively limited, the destroyed infrastructure may carry long-term consequences for the region, especially for the irrigated production of high value commodities, potentially affecting availability in Ukraine and also impacting neighbouring countries.
12. The 2022 global wheat production was 2.9 percent higher than in 2021. In the Russian Federation, 2022 wheat production was officially estimated at an all-time high of 102.7 million tonnes, underpinned by conducive weather conditions that supported exceptionally high yields. World production of coarse grains declined by 2.8 percent in 2022, to 1 468.8 million tonnes, which was the lowest level since 2019.
13. In 2023, global wheat output is expected to fall by 3 percent compared to the all-time high reached in 2022, while world production of coarse grains is forecast to rise by 3 percent from the 2022 reduced level.
14. In the Russian Federation, in particular, total wheat production in 2023 is forecast to decline from the record high recorded in 2022, reflecting a small cutback in winter plantings, while drier-than-average weather persisted into the start of 2023 in parts of the main producing southern areas.

2.4. Trade

15. When the war broke in late February 2022, Ukraine and the Russian Federation were in the middle of the 2021/22 marketing season. As such, it had immediate impacts on the countries' capacities to execute existing export contracts and enter into new ones for crops already harvested. This was particularly the case in Ukraine, where the war caused the cessation of all commercial shipping operations, the temporary suspension of activities by private grain and crushing operators, and damages to inland transport, storage and processing facilities.
16. Global wheat and maize overall availabilities, as reflected by world imports, did not change dramatically in 2022. Some adjustments in trade reflected decreased export availabilities from Ukraine during the first months after the outbreak of the war; however, the BSGI enabled the resumption of grain exports from Ukrainian seaports from 22 July 2022.
17. Following February 2022, a large increase in wheat shipments from other countries, in particular India and Australia, was noticeable as large wheat producers increased their exports, filling part of the gap on the world markets caused by the temporary halt of Ukraine's maritime exports.
18. Immediately after the halt of exports from the Ukrainian Black Sea ports and concerns over the availability of exports from the Russian Federation, many food import-dependent countries that source a large share of their cereal purchases from the northern Black Sea region, strived to diversify their import sources. Overall, countries have managed to adjust their food import origins to satisfy domestic needs.
19. Amidst the rapid increase in interational food commodity prices and the uncertainty caused by the war, a number of countries introduced export restrictions to guarantee supplies in domestic markets and contain the price increases. Overall during 2022, 32 countries imposed 77 export restrictions in the form of export licensing requirements, export taxes or duties, outright bans, or a combination of measures. By January 2023, the share of exports affected by export restrictions dropped by over 50 percent from its May 2022 peak. Countries are strongly discouraged from using export restrictions given their harmful impacts and broad negative consequences.

2.5. Logistics

20. Constraints related to rail and road infrastructures limited Ukraine's export capacity through non-maritime routes throughout the first half of 2022. The European Union introduced the "Solidarity Lanes" in May 2022 to ensure that Ukraine can, *inter-alia*, export grains. Up to June 2023, over 35 million tonnes of grains, oilseeds and other foodstuffs were exported from Ukraine via the Solidarity Lanes. Due to transportation bottlenecks and limited grain storage capacity, resulting in depressed prices in neighboring countries to Ukraine, five European Union member states (Bulgaria, Hungary, Poland, Romania and Slovakia) introduced a temporary import ban to Ukrainian grains and oilseeds. In early June 2023, the European Commission decided to extend these preventive measures until 15 September. Movement of the concerned food products in or via these countries is not affected.
21. Similarly, benefiting from the same railroad gauge used by Ukraine and Moldova, in August 2022, a rail link between the two countries was re-established after a 23-year hiatus. The volume of exports via Danube ports

increased gradually from about 55 000 tonnes per month in January 2022 to 1.5 million tonnes in August 2022, and reached a record level of 3 million tonnes in May 2023.

22. The launch and renewal of the BSGI, together with the efforts to boost export capacity through non-maritime channels, have helped ease the severe export constraints faced by Ukraine at the start of the war. However, uncertainties continue to exist as to whether the Initiative will be extended, while issues have been raised regarding the reduced volume of food exported through the Initiative in recent months.
23. As of June 23, 2023, in total about 32.3 million tonnes of agricultural commodities were shipped from Ukraine under the BSGI. About half of the shipped volume was maize, while wheat accounted for slightly over a quarter. The total amount included over 625 000 tonnes of grain shipped on vessels chartered by the World Food Programme (WFP) in support of its humanitarian operations elsewhere.
24. Following the breach of the Kakhovka Dam on 6 June 2023, some damages on the elevators and storage capacity have been reported; however, in terms of logistics, shipping from the ports of Danube River and Greater Odessa has not been impacted. Halted navigation from the Kherson to Zaporizhia because of the breach could increase costs for operators; nevertheless, the use of the Dnipro river for commercial navigation in the past year was limited.

2.6. The spread of African swine fever (ASF)

25. The war has disrupted animal production in commercial, smallholder and backyard sectors in Ukraine. Usual supply chains of animal feed, veterinary drugs and product transportation were massively disrupted. Active and passive surveillance, laboratory diagnostics and control measures of endemic and emerging infectious diseases, notably African swine fever (ASF), are currently severely undermined due to the security situation and availability of resources and personnel.
26. Due to the destruction of farms and other war impacts, the total number of pigs in the country is currently estimated at 4.75 million, which represents about a 14-percent decrease compared to the inventories in January 2022. The interruptions of electricity, water and gas supplies in the country have affected livestock production and related value chains, as well as the services provided by veterinary clinics and laboratories. The ban on access to forests and on hunting has affected ASF surveillance in wild boars. There is also a lack of updated knowledge on ASF epidemiological situation, and reduced surveillance and control.

2.7. Humanitarian aspects

27. The war has increased humanitarian needs in Ukraine. Disruptions to provision of basic services, worsened by other events, such as the destruction of the Kakhovka dam in June 2023, have deepened the needs of millions of people who were already displaced or required assistance. By directly constraining agricultural production, limiting economic activities and raising prices, the war has further undercut the purchasing power of local populations, with consequent increases in food insecurity and malnutrition.
28. Despite some returns after the active fighting retreated to the eastern part of the country in April 2022, humanitarian needs in Ukraine's neighboring countries where displaced populations have sought refuge have also increased substantially compared to before 2022.
29. Targeted attacks have heavily damaged Ukraine's energy infrastructure, resulting in power cuts across the country and a rapid deterioration of the existing humanitarian crisis. Skyrocketing energy prices have increased the cost of living, ultimately leading to increased food insecurity.
30. Older women and single mothers comprise the majority of Ukraine's poor, and female-headed households are more food insecure than their male counterparts. The current war is deepening pre-existing gender inequalities in Ukraine, increasing unemployment among women and pushing them further into the informal economy.
31. Because men aged 18 to 60 years are not allowed to leave the country, the migration and refugee flows that the war has triggered are also largely gendered. Of the 8 million people that had fled Ukraine to neighboring countries, 90 percent were women and children. Women faced many challenges at the borders, minority groups were often unable to leave, and vulnerable groups were left behind struggling with the disruptions to services and resources, such as education, health services (including access to sexual and reproductive health), and safe and accessible shelters, with a high risk of abandonment and family separation for people with disabilities.
32. While 2.75 million refugees are of working age, the majority are employed at a lower level than their education and skill levels. A higher proportion of women are underemployed than men, at 51 percent and 39 percent of

respondents, respectively, due to language barriers, difficulties in having professional qualifications recognized in hosting countries, and inequity in domestic care work facing women and girls. There are also emerging protection concerns for women and girls, with increased safety risks, including physical and sexual violence, abductions and persecution (https://www.osce.org/secretariat/440312).

2.8. Food and agricultural input import bills

33. The global food import bill (FIB) is forecast to reach USD 1.98 trillion in 2023, representing a 1.5 percent or USD 28.9 billion increase over the record high registered in 2022, estimated at USD 1.95 trillion. While marking a new absolute high, the speed of expansion is anticipated to slow down significantly relative to 2022 and 2021, when growth rates reached 11 percent and 18 percent, respectively. From a food group perspective, the divergent trends observed in 2022 will likely persist in 2023. Overall, high-income countries (HICs) are anticipated to import a wide spectrum of food products and covering most of the increase in the import bill, whereas upper-middle income countries (UMICs), lower-middle income countries (LMICs) and low-income countries (LICs) will focus their imports on staple foods and lower the quantity and quality of what they import.
34. Soaring costs of agricultural inputs were estimated to have resulted in a near 50-percent annual leap in global expenditures on imported agricultural inputs, to USD 424 billion in 2022, with all regions and country income groups affected by this rise. However, for many low-income countries, the sharp increase in the input import bills, together with the depreciation of their currencies, have further aggravated existing balance of payments problems. The soaring costs of inputs also risk decreasing input application, and thus yields and production.

2.9. Energy

35. The Russian Federation is a key player in the global energy market. In 2021, its shipments of coal, oil and gas accounted for, respectively, 18, 12 and 20 percent of global exports. Despite registered declines in 2022, the shares remained relatively high at 15, 9 and 18 percent, respectively. Russian energy exports were particularly important for the European Union, which in 2021 sourced, respectively, 45, 25 and 46 percent of its coal, oil and gas imports from the Russian Federation. In 2022, these shares stood at 15, 15 and 25 percent.
36. World prices of fertilizers started to soar in late 2021 and reached record levels following the outbreak of the war, resulting in lower affordability for farmers, as the price increases for fertilizers exceeded those for outputs by a considerable margin. While much of 2022 was characterized by high and volatile prices of fertilizers, the drop in energy and natural gas prices in recent months resulted in significant declines in world fertilizer prices.

2.10. Macroeconomic aspects

37. The war in Ukraine has aggravated the macroeconomic challenges that the world was already facing. It has contributed to elevating the world food and energy prices and created a lot of additional uncertainty, raising the risk for further aggravating food insecurity globally, and in particularly in lower-income countries and for poorer and vulnerable populations.
38. In June 2023, the World Bank released its latest Global Economic Prospects report, highlighting that the global economy remains in a precarious state amid the protracted effects of the overlapping negative shocks of the pandemic, the war in Ukraine, and the sharp tightening of monetary policy to contain high inflation.
39. According to the report, the global economy grew by 6 percent in 2021; however, growth in 2022 was estimated at a much lower level, at 3.1 percent. Furthermore, the global economy is set to slow substantially in 2023 and grow by 2.1 percent, amid continued monetary policy tightening to rein-in high inflation, before a tepid recovery in 2024, to 2.4 percent.
40. The reduction of GDP growth in several parts of the world, combined with elevated price levels, has affected the food and agricultural input import bills and is expected to continue to affect global food and agricultural supply and demand, with negative consequences for food security and nutrition in many parts of the world. Lower GDP growth will also likely reduce the availability of funds for development, especially if military expenditures are given priority.
41. Increases in interest rates by the United States Federal Reserve Bank, aiming to control inflation, and the war in Ukraine have been important drivers behind the United States dollar appreciation against the currencies of many countries. Given the dominance of the United States dollar in international transactions, its appreciation can have significant implications for many countries, in particular net importers of food and/or agricultural inputs, and increase debt pressure on the heavily indebted poor countries.

2.11. Responses to global food insecurity

42. The global community and international organizations responded with humanitarian and emergency assistance and new initiatives to mitigate the impacts of rising food prices on food security. FAO and WFP have scaled-up and amplified their emergency livelihood assistance and the emergency humanitarian assistance programmes. Also International Financial Institutions (IFIs) are utilizing existing and new mechanisms to support countries in need and vulnerable populations.
43. FAO, together with the World Bank and the World Trade Organization (WTO), produced a report entitled *Rising Global Food Security: Assessing Policy Responses*, at the request of the G20 Leaders, through the G20 Bali Leaders' Declaration, to undertake a mapping exercise on the global responses to the rising food insecurity, with the aim to identify any major gaps in the responses.

3. Forward looking analysis of the risks related to the war

3.1. Production risks

43. Protracted active conflict in eastern Ukraine and the war's extensive economic and social consequences will continue to constrain the production potential of the country. The retreat of active fighting to the east of Ukraine in April 2022 and moderate area gains in securing control since then necessitate systematic clearance of mines, unexploded ordnance and other remnants of the war.
44. Low profitability of farming, because of both high input costs and depressed farm gate prices, will impact future land allocation to different crops and consequently production. If marketing of cereals remains a challenge due to insufficient and/or economically unappealing marketing opportunities, farmers will likely allocate area to more profitable crops, such as oilseeds.
45. The June 2023 destruction of the Kakhovka dam, although with relatively contained short-term damages, has long-term environmental and economic impacts. Contamination will affect soil fertility, availability of drinking water for people and livestock, biodiversity and overall ecosystem in the lower part of the Dnipro river. In the long term, the use of irrigation systems, unless the water in the reservoir increases to the levels that make pumping feasible, will remain constrained. It is not foreseen that the loss of previously irrigated crops in the south would have a significant impact on the world markets; however, the actual impact will largely depend on developments in other main producing countries. Nevertheless, disruption in irrigation on both sides of the Dnipro river will have a significant effect on the production of nutriotious high value foods, such as fruits and vegetables, sold mostly on the domestic markets.
46. Although the agricultural sector in the Russian Federation has not reported major challenges, difficulties with financial transactions could still result, directly or indirectly, in economic losses for the sector, and impact production decisions. Efforts aim to increase domestic seed production and decrease reliance on imported inputs.
47. Elsewhere, in parts of the world, reduced access to fertilizers have prompted some adjustments to the cropping patterns.

3.2. Trade risks

48. As of late June 2023, the prospects for extension of the BSGI remain highly uncertain. While the Initiative was extended in the past in a somewhat last minute arrangement, considering the consultation and approval process in which four parties are involved, an early agreement would be important. The expiration of the current extension of the BSGI is 17 July 2023; this coincides with the peak of the wheat harvest in Ukraine. A suspension of the Initiative would have major impacts on food importers, particularly in developing countries.
49. Trade policies – such as the European Union's extension of the duty-free import regime for Ukrainian products for another year or the extension of the import ban applied to Ukrainian wheat, maize, rapeseed and sunflower seed by five member states (Bulgaria, Hungary, Poland, Romania and Slovakia) until September 15 – can have an impact on the ability of Ukraine to export.
50. While exports of food and fertilizers from the Russian Federation are not subject to the Western sanctions imposed following the outbreak of the war in February 2022, the Russian Government has raised concerns that restrictions on payments, logistics and insurance have constrained exports. As official trade data are scarce, it is difficult to conduct an accurate assessment of the situation.

3.3. Broader economic risks

51. Slow economic growth rates in many parts of the world, combined with the elevated prices, may affect global demand for food, with negative consequences for food security and nutrition. While international food commodity prices declined over the past year, domestic retail prices in the countries remain high. Fiscal pressure and mounting debt levels limit countries' capacities to respond. The war in Ukraine and other geopolitical tensions continue, while extreme weather events are becoming more frequent. Given the dominance of the United States dollar in international trade, its strength can affect importing developing countries and have significant economic and food security consequences.
52. High energy prices can lead to lower use of inputs, lower yields and lower harvests, which also constitutes a factor that can threaten food security, in particular of the most vulnerable. Higher energy prices could also make agricultural feedstocks more attractive for the production of bioenergy, providing support for further increases in food commodity prices. On the other hand, energy production, including from renewable sources, could become more attractive and accelerate in many countries, eventually easing world fertilizer prices and consequently food prices.

3.4. Humanitarian risks

53. In Ukraine, despite the already ongoing rebuilding and reconstruction efforts, humanitarian risks remain rampant. While the current situation may persist and even become aggravated, the coping capacity of rural households is likely to remain strained. Although agricultural rural households tend not to be self-sufficient in food, those affected by the Kakhovka dam flooding and consequent lack of irrigation are likely to experience difficulties in restarting their production due to decimated resilience capacity.
54. Elsewhere in the world, conflict, economic shocks and extreme weather events are increasing humanitarian needs. While international food commodity prices have eased since their peaks in 2022, funding shortfalls and rising operational costs have reduced humanitarian assistance across many countries. Without additional funding, humanitarian assistance will likely be further reduced across the board. Therefore, securing food supplies from relatively more affordable destinations (including shipping costs) is crucial to maintain a certain degree of a fiscal balance.

4. Policy recommendations and proposals

55. Given the damage caused by the war, support to Ukraine needs to be escalated. FAO has strengthened its team on the ground to support Ukraine's people and agricultural activities. FAO has completed nationwide needs assessments in Ukraine, targeting local level administrations and commercial farmers, and has conducted rural household surveys across the country. Already in March 2022, FAO developed its Rapid Response Plan to target specific actions within Ukraine. The Plan has been regularly updated since then.
56. To minimize the war's impacts on the world agrifood markets, every effort should be made to keep international markets and trade in food and fertilizers open. Supply chains should be kept operational, including by protecting standing crops, livestock, food processing infrastructure and all logistical and marketing systems.
57. It is critical to support the provision of working capital to farmers and post-war reconstruction and recovery work in Ukraine. As of end February 2023, the total reconstruction and recovery needs in agriculture (excluding irrigation and water, forestry and fisheries) were estimated at about USD 29.7 billion over a 10-year period, including USD 600 million in 2023 for the reconstruction and replacement of damaged assets, machinery, inputs, support for immediate production recovery and other activities. FAO will continue to work with the World Bank, the European Bank for Reconstruction and Development and other development financial institutions to raise the needed funds.
58. Countries that are highly dependent on food imports should diversify their import sources and identify various export suppliers for their food purchases to absorb the impacts of shocks and remain resilient. They should also use existing food stocks and enhance the diversity of their domestic production bases.
59. Recognizing that at least two-thirds of people experiencing acute food insecurity are rural populations who rely on agriculture-based livelihoods, humanitarian responses both within Ukraine and globally must prioritize actions that boost the production of nutritious food and make agriculture more resilient. The war's impact on the food security of vulnerable population groups necessitates timely and well-targeted social protection interventions to alleviate hardship and foster a fast recovery.

60. To assist the internally displaced people, refugees and other groups directly affected by the war, Ukraine's national social protection system should be expanded to register additional population groups with the Unified Social Information System and to enhance its delivery mechanisms, particularly to reach those that do not hold bank accounts or that currently live in conflict territories. In countries hosting refugees, access to existing social protection systems and job opportunities should be eased by lifting legal access barriers and increasing the capacity of host countries' social protection systems to absorb additional caseloads.
61. Countries must carefully consider the potentially damaging effects that any trade-related measures they adopt could have on international markets and other countries. Particularly, export restrictions must be avoided and existing ones should be removed quickly because of their negative impacts. They increase uncertainty and exacerbate price volatility, limit the buffer capacity of global markets, and can have serious negative impacts over the medium to long term.
62. The most affected countries by the war must be supported to be able to face the soaring food import bills. FAO has proposed the establishment of a global Food Import Financing Facility (FIFF) to assist countries with balance-of-payment problems and address the impacts of the war on global food security. Tapping into the Facility would allow vulnerable countries to mitigate long-lasting impacts on their agrifood systems and reduce future needs for emergency assistance. FAO welcomes the adoption and the subsequent 6-month extension until end-March 2024 of the Food Shock Window (FSW), established in September 2022 by the IMF, which is in line with FAO's proposed Financing Facility. However, the country coverage of the Food Shock Window is still limited compared to the FIFF and its expansion could better address the needs of the most vulnerable countries globally.
63. Special attention should be paid to identifying and addressing the different needs and priorities of men and women, boys and girls (including those left behind and displaced people), and design gender-responsive interventions that tackle existing inequalities and the multiple forms of discrimination that women and girls face.
64. It is essential to increase efficiencies in food and agricultural production. Detailed soil nutrient maps should be developed to reduce waste in the use of fertilizers and increase efficiency, coupled with appropriate technologies. This will particularly support the most vulnerable countries in improving fertilizer use efficiency, drawing on lessons learned from other countries. FAO welcomes the support of the United States of America in funding the development of detailed soil nutrient maps in three countries. However, more resources are need to expand the number of countries with soil nutrient maps. Furthermore, FAO has developed a Fertilizer Trade Tracker, an online tool that allows countries to gauge remaining import needs and unrealized export availabilities of fertilizers for the current crop season and calendar year. FAO and WTO produced a joint report entitled *Global Fertilizer Markets and Policies* in November 2022, in conjunction with the G20 Bali Leaders' Summit.
65. Food loss and waste must be reduced. It is estimated that the current high amounts of food loss and waste, which have a huge negative impacts on the environment, could feed around 1.26 billion people per year. Estimations show that if food loss and waste were reduced by 50 percent, there would be sufficient fruits and vegetables available in food supplies to cover the recommended amount of 400 grams per person per day.
66. The spread of African swine fever and other animal diseases must be contained by improving biosecurity and husbandry practices at all production and value chain systems, taking steps to facilitate early detection, timely reporting and rapid disease containment, and implementing measures that support virus detection such as surveillance schemes and targeted sampling of animals.
67. Market transparency and policy dialogue should be strengthened, as they play a key role particularly when agricultural commodity markets are disrupted and under increased uncertainty. Transparency is essential for guiding policy decisions and ensuring that international markets continue to function properly and that trade in food and agricultural products flows smoothly. The value of timely and credible data and information cannot be overemphasized. FAO welcomes the support provided by the G20 and G7 to the Agricultural Market information System (AMIS) and will work with all AMIS participants to strengthen the role and capacities of the system and expand its work into analyzing the markets of fertilizers and vegetable oils, with the recruitment of relevant experts, as well as the improvement of its analytical capacity through the modelling work planned by FAO.

INFORMATION NOTE

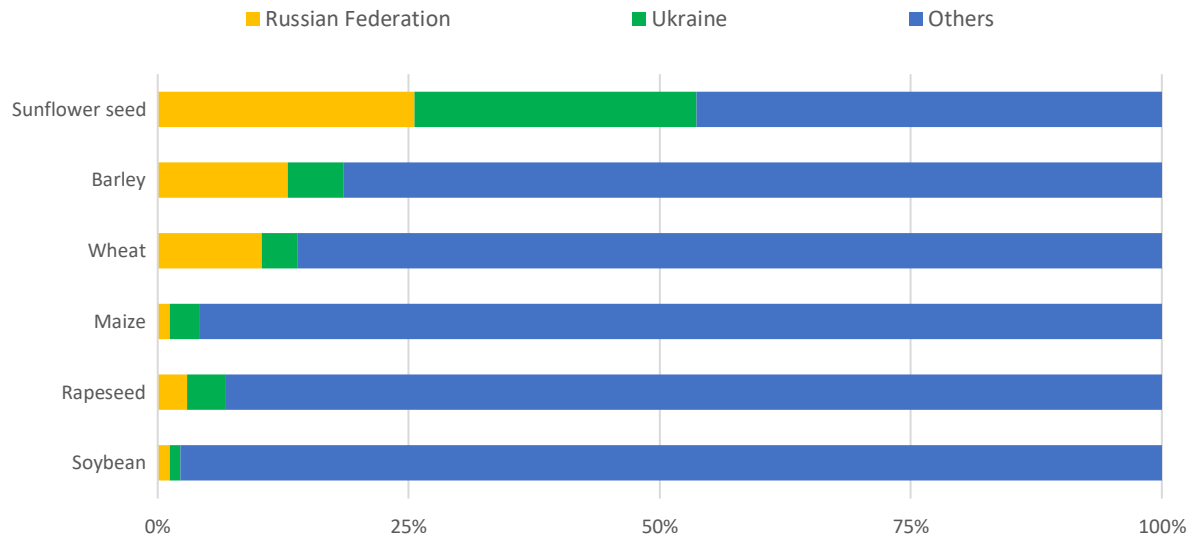
This note updates and elaborates the previous issues of the information note published by FAO in the course of 2022 following the outbreak of the war in Ukraine. The analysis is divided into three main parts in a chronological order: prior to February 2022; post February 2022 until June 2023; and outlook and risks beyond 2023. The note concludes with a summary and a set of policy recommendations as well as a section presenting FAO's policy proposals to minimize the impacts of the war.

1. Market and trade profiles of the Russian Federation and Ukraine prior to February 2022

The Russian Federation and Ukraine are among the most important producers of agricultural commodities in the world. In the cereal sector, their contributions to global production have been especially significant for barley, wheat and maize (Figure 1). Between 2017/18 and 2021/22, the two countries together accounted, on average, for 8.8 percent of global output of these crops, with the Russian Federation accounting for 5.4 percent and Ukraine for 3.4 percent.

In the oilseed complex, the contribution of the two countries to global production was particularly important for sunflower seed, accounting for more than half of world output during this period. Their shares in global rapeseed and soybean production were smaller, with the Russian Federation accounting for 4 percent of the world production and Ukraine for 5 percent.

FIGURE 1
Share in global production of selected crops (2017/18-2021/22 Avg.)



Source: FAO XCBS system.

1.1. Market shares

The critical role that the Russian Federation and Ukraine have played in global agriculture is very evident from an international trade perspective (see figures 2 to 5). Both countries have been net exporters of agricultural products, and they both have played leading roles in supplying global markets with foodstuffs. Their role is significant, especially considering that exportable supplies for global food markets are often concentrated in a handful of countries, making these markets vulnerable to shocks and volatility. For instance, in the wheat and meslin sector, where the top seven exporters accounted for 89 percent of international trade in 2021, the Russian Federation stood out as the second largest wheat exporter, shipping a total of 32.9 million tonnes of wheat and meslin (in product weight), or the equivalent of 15 percent of global shipments (see figure 6). Ukraine ranked sixth in the world in 2021, exporting 20 million tonnes of wheat and meslin and accounting for 10 percent of the global market.

The two countries have played similar prominent roles in the global markets of maize, barley and rapeseed, and even more so in the sunflower oil market, where their combined share in the world export market was close to 71 percent (figures 7 to 11). The high export concentration that characterize food commodity markets is also mirrored in the fertilizer sector, where the Russian Federation has played a leading global supplier role. In 2021, the Russian Federation was the top exporter of nitrogen (N) fertilizers, the second leading exporter of potassic (K) fertilizers in the world, and the third leading exporter of phosphorous (P) fertilizers, as shown in figures 12 to 14.

1.2. Trade profiles

The Russian Federation and Ukraine have been key suppliers to many countries that are highly dependent on imported foodstuffs and fertilizers. Many of these countries fall into the group of Least Developed Countries (LDCs), while many others belong to the group of Low-Income Food-Deficit Countries (LIFDCs).

Figure 15 also illustrates that many countries in North Africa and Western and Central Asia imported the majority of their wheat imports from the Russian Federation and Ukraine. Overall, in 2021, 40 net importers of wheat depended on the two countries for over 30 percent of their wheat import needs. For instance, Eritrea sourced the entirety of its wheat imports in 2021 from both the Russian Federation (53 percent) and Ukraine (47 percent). It should, however, be noted that the absolute volumes among the countries highly dependent on supplies from the Russian Federation and Ukraine differ significantly. For example, while Eritrea sourced wheat entirely from those two countries, total imports were only about 350 000 tonnes, making it relatively easier to replace from other sources. Egypt, on the other hand, with more diversified import base, appears to be less dependent on wheat imports from the Russian Federation and Ukraine. However, given the large volumes of wheat imports of over 11 million tonnes, any adjustment in its sourcing of wheat can have broader impacts on the global markets.

The global reliance on the Russian Federation for N, P and K fertilizers is less pronounced, with some 26 net importing countries dependent on Russian supplies for 20 percent or more of their fertilizer imports (Figure 16). Ukraine does not feature as a major fertilizer exporter, despite some sales to India. Many net importers of fertilizers in Latin America, Eastern Europe and Central Asia have an import dependency of well over 30 percent on the Russian Federation, for the three fertilizer types.

FIGURE 2
Agricultural imports of the Russian Federation in 2021

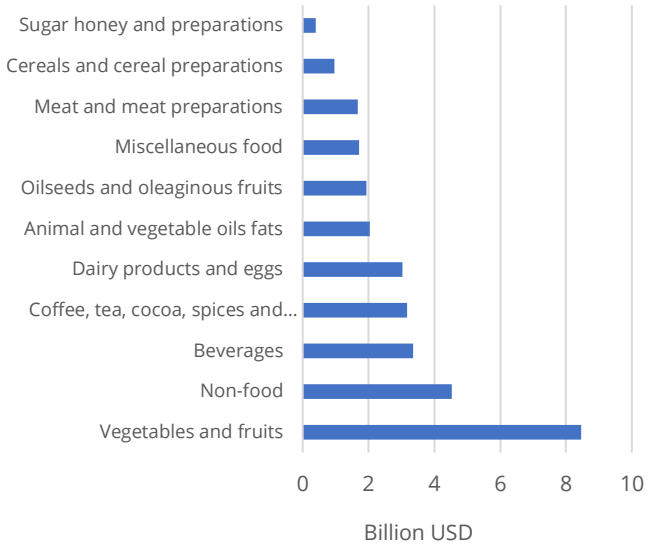


FIGURE 3
Agricultural imports of Ukraine in 2021

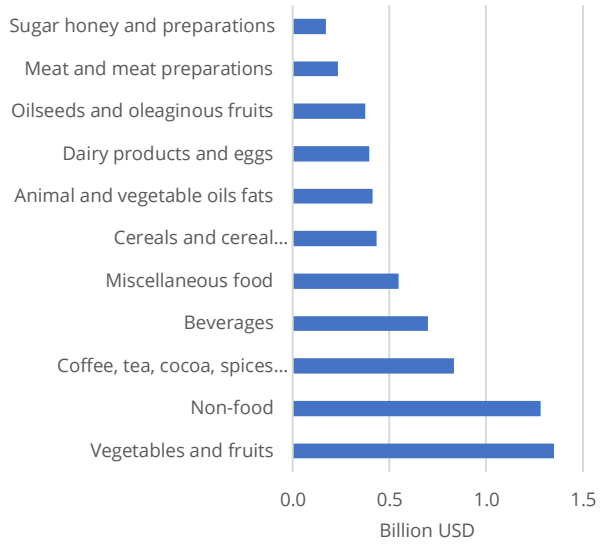


FIGURE 4
Agricultural exports of the Russian Federation in 2021

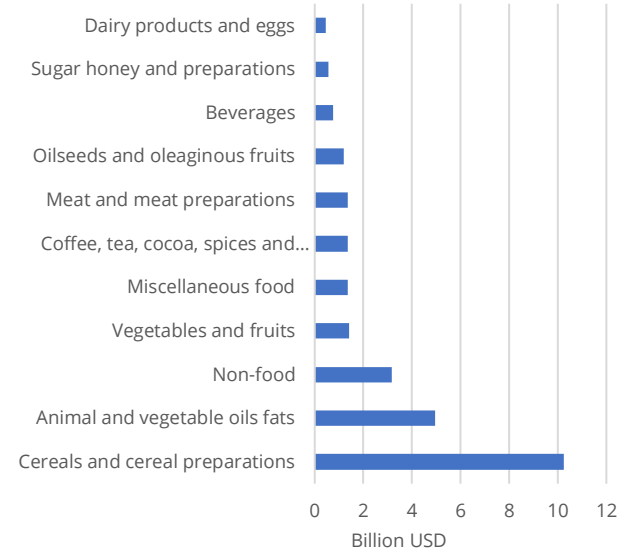
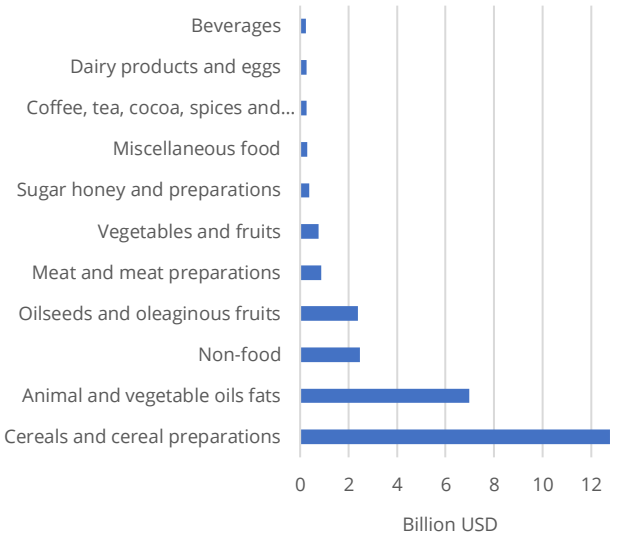
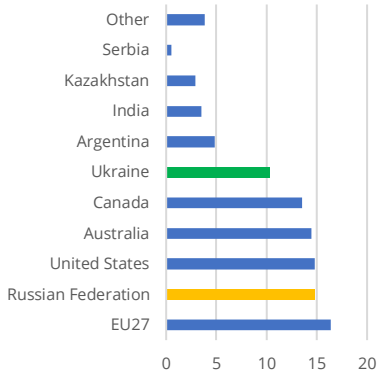


FIGURE 5
Agricultural exports of Ukraine in 2021



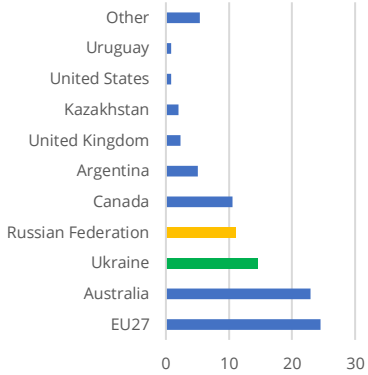
Source: Trade Data Monitor (TDM), FAO calculations.

FIGURE 6
Wheat



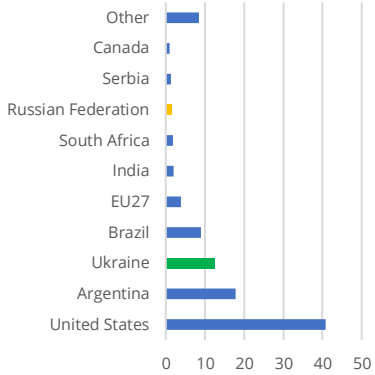
% share in global exports in 2021

FIGURE 7
Barley



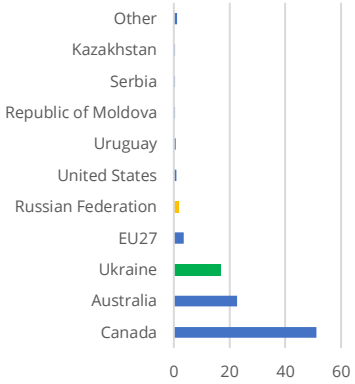
% share in global exports in 2021

FIGURE 8
Maize



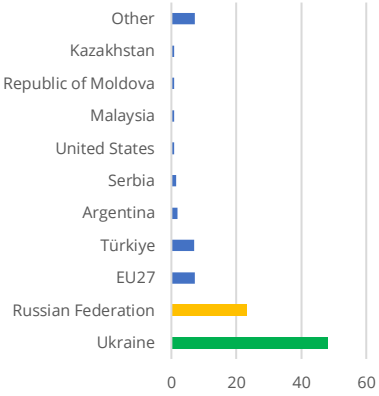
% share in global exports in 2021

FIGURE 9
Rape seed



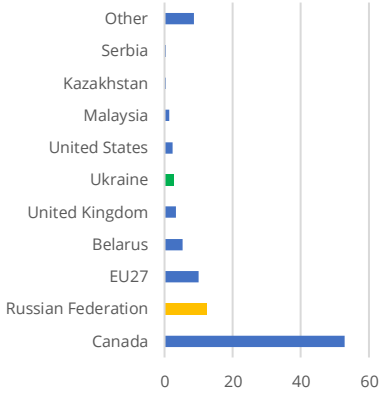
% share in global exports in 2021

FIGURE 10
Sunflower seed oil



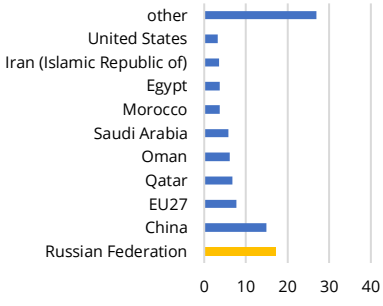
% share in global exports in 2021

FIGURE 11
Rape seed oil



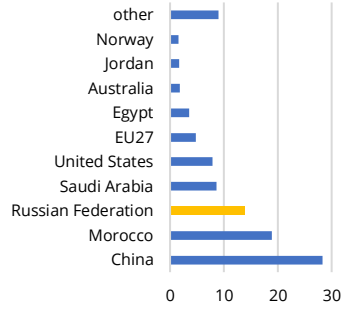
% share in global exports in 2021

FIGURE 12
N-fertilizer



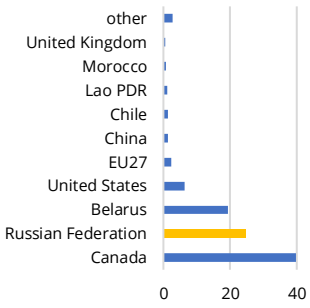
% share in global exports in 2021

FIGURE 13
P-fertilizer



% share in global exports in 2021

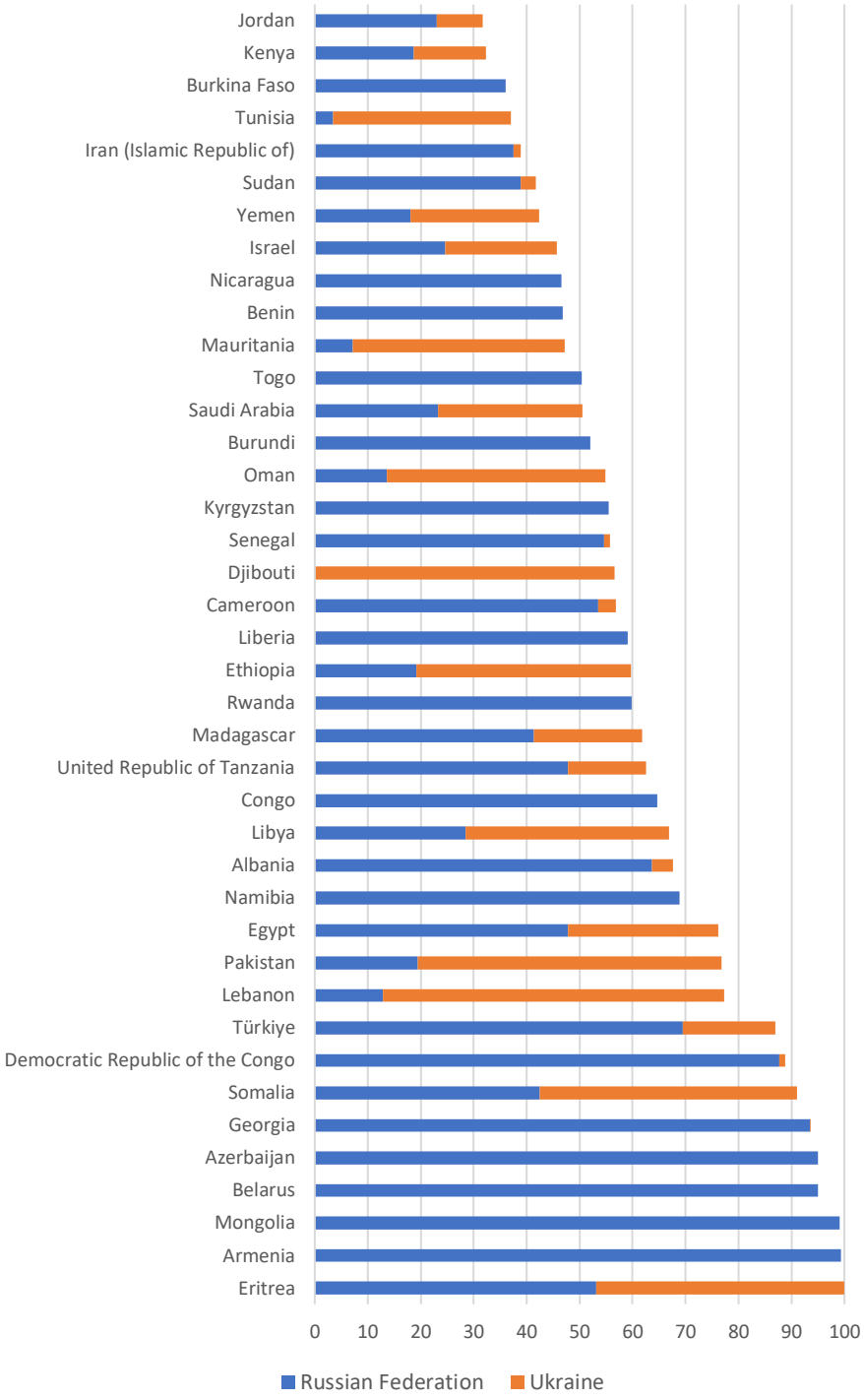
FIGURE 14
K-fertilizer



% share in global exports in 2021

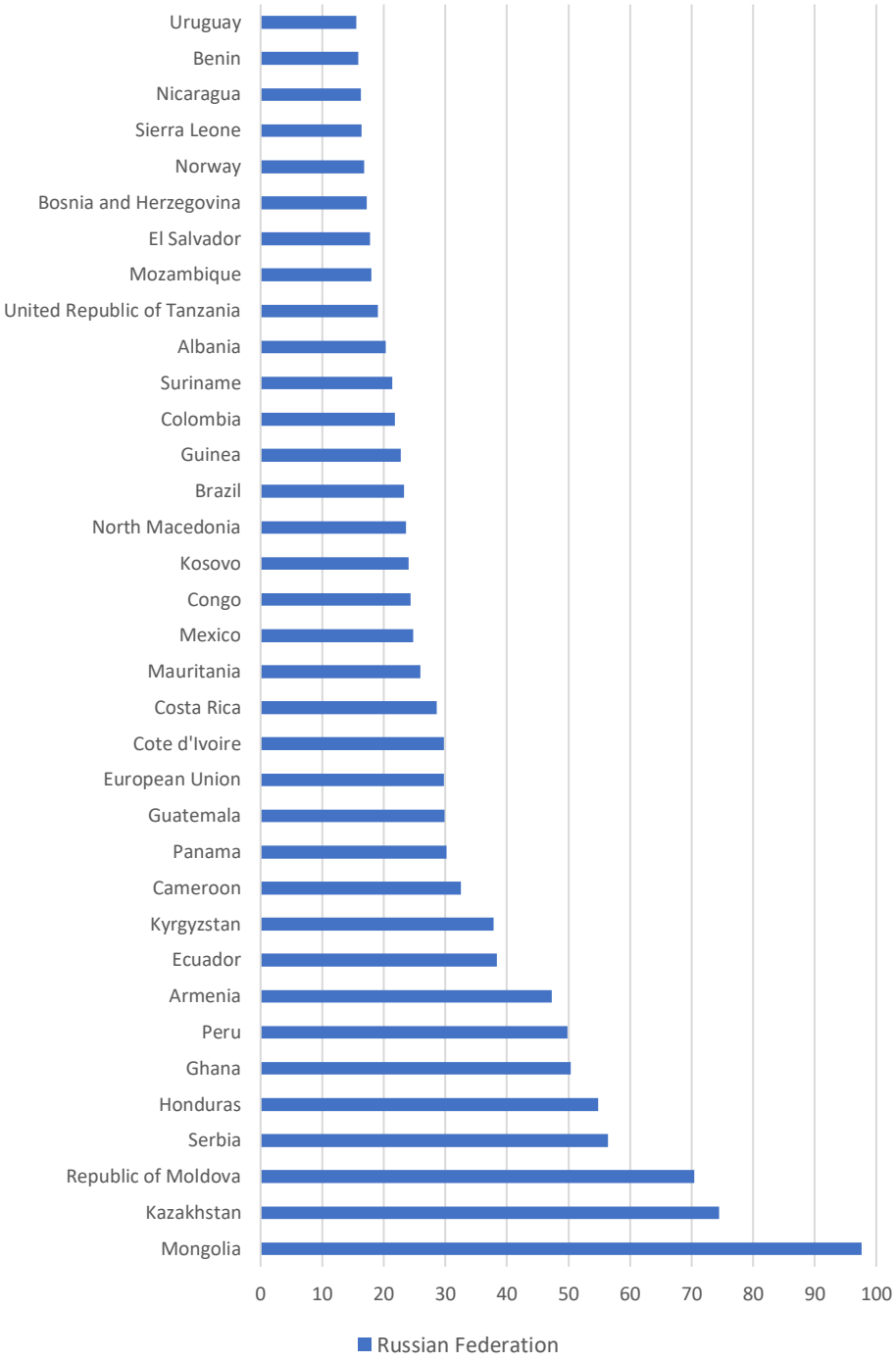
Source: Trade Data Monitor (TDM), FAO calculations
Note: Processed products are excluded from these estimates.

FIGURE 15
Wheat import dependency, net importers, 2021 (%)



Source: Trade Data Monitor (TDM), FAO calculations

FIGURE 16
Fertilizer Import Dependency, net importers, 2021 (%)



Source: Trade Data Monitor (TDM), FAO calculations

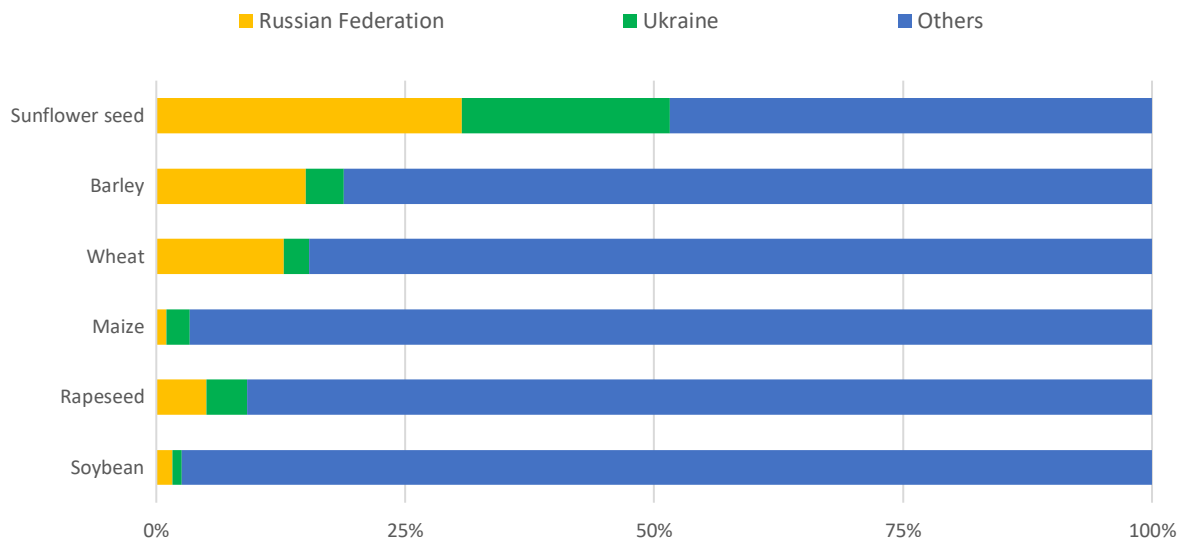
2. Post-February 2022: impact of the war on production, markets and the humanitarian situation[1]

2.1 Market shares and trade profiles of Ukraine and the Russian Federation in 2022

As illustrated in Figure 17, in 2022/23, the two countries together accounted for 9.0 percent of the global output of barley, wheat and maize (compared to 8.8 percent on average over the period 2017/18-2021/22), with the Russian Federation accounting for 6.5 percent and Ukraine for 2.5 percent (compared to 5.4 percent and 3.4 percent, respectively). The share of the Russian Federation's wheat production in global production in 2022/23 increased from 10 to 13 percent, reflecting the country's record wheat harvest, while Ukraine's share dropped from 4 to 3 percent. As regards maize, the share of Ukrainian maize production in worl production dropped to 2 percent in 2022/23, from 3 percent in 2021/22.

For the oilseed sector, owing mostly to a decline in the global sunflower seed production resulting from an output contraction in Ukraine in 2022, the share of the Russian Federation in global output increased to 31 percent in 2022/23, while that of Ukraine declined to 21 percent. Adjustments observed for the other oilseeds were small.

FIGURE 17
Share in global production of selected crops in 2022/23



Source: FAO XCBS system.

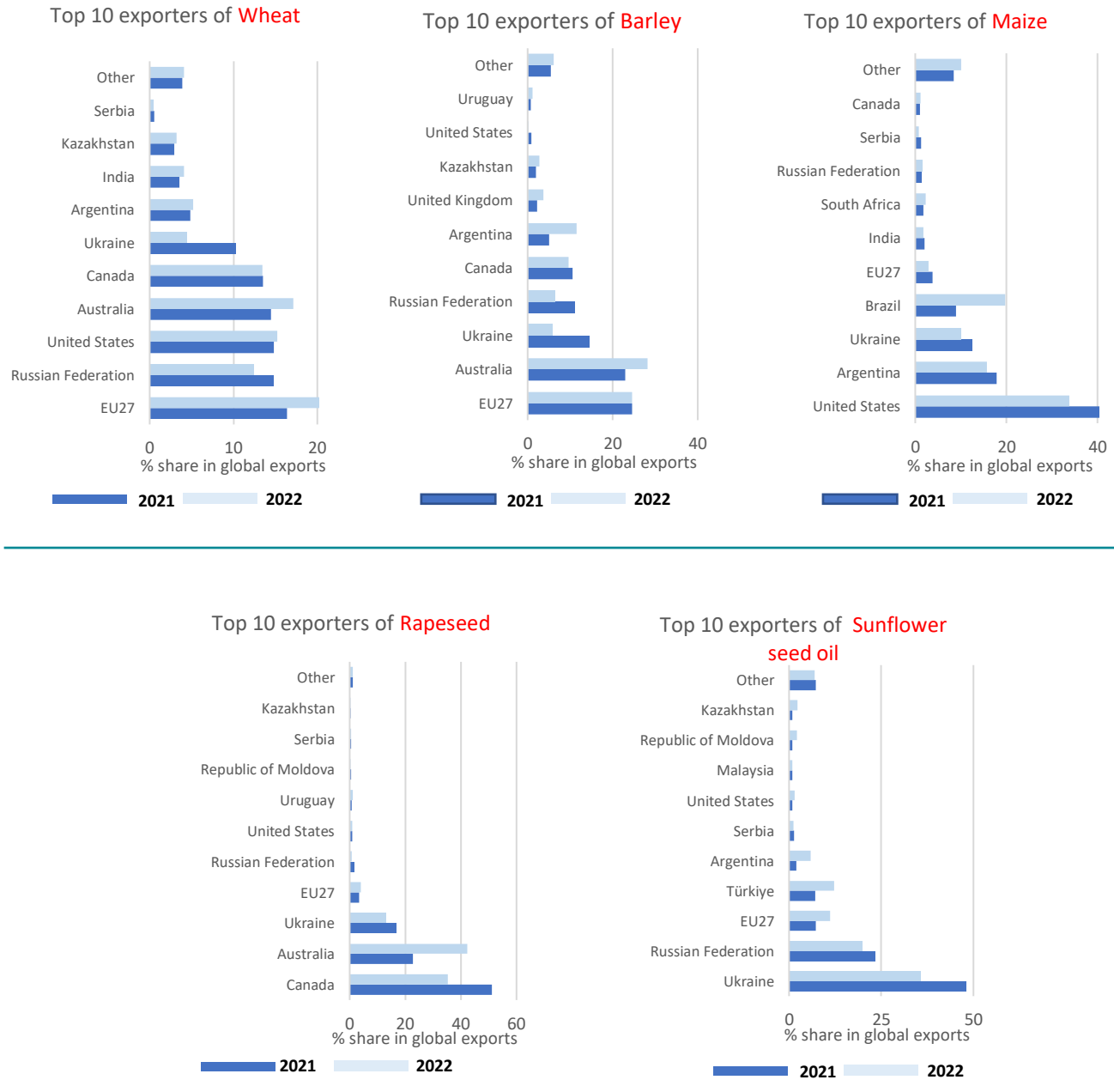
The outbreak of the war in Ukraine and the disruptions that it caused on international markets and trade, by impacting trade logistics and transport routes, has altered the market and trade profiles of the two countries in 2022, with implications for the rest of the world. It should be noted, however, that trade and market profiles adjust yearly to account for production outcomes and other policy-induced decisions (such as a decision to increase carry-over stocks or promote increased domestic utlisation in some sectors) in the major producing and exporting countries. It should also be noted that not all the changes in trade flows are caused by the war in Ukraine.

As can be seen in Figure 18 below, while the two countries remain among the most significant exporters of wheat globally, their combined share in global exports declined to about 17 percent in 2022, down from about 26 percent in

[1] This update includes information available up to June 2023.

2021. Reduced exports by Ukraine and the Russian Federation, combined with increased exports by other countries, resulted in the Russian Federation ranking fifth in the world in 2022, from second in 2021, and Ukraine ranking seventh, from sixth in 2021. Similarly, with regard to other commodities, namely barley, maize, rapeseed and sunflower oil, for which the two countries had a prominent role in the world markets, there was a general reduction in their shares in global exports in 2022 compared to 2021.

FIGURE 18
Shares of major exporters in global exports of main food commodities in 2022 compared to 2021



*Source: Trade Data Monitor (TDM), FAO calculations
Note: Processed products are excluded from these estimates.

2.2. International prices of basic foodstuffs and agricultural inputs

While the FAO Food Price Index (FFPI),[2] which tracks monthly changes in international export quotations of basic foodstuffs, saw near uninterrupted increases between mid-2020 and early 2022, it reached an all-time high in March 2022, one month after the outbreak of the war. This shows the importance of the Russian Federation and Ukraine in global agricultural markets.

Although world prices overall eased since March 2022, with the FFPI falling by 22 percent between March 2022 and May 2023, world price quotations of most of the commodity groups encompassed by the FFPI remain elevated, although the extent varies depending on the commodity.

During the course of 2021, international prices of wheat and barley rose by 31 percent over their corresponding levels in 2020, buoyed by strong global demand and tight exportable availabilities resulting from weather-induced production contractions in various major wheat- and barley-exporting countries. In the rapeseed oil and sunflower seed oil sectors, annual price increases registered in 2021 were 65 percent and 63 percent, respectively. These increases were spurred by a protracted global supply tightness and a robust global demand, with the latter coming from the biodiesel sector in the case of rapeseed oil.

The upward trend of grain and vegetable oil prices continued into early 2022. In the case of wheat, world prices surged in March 2022, following the war-induced suspension of maritime exports from Ukraine, which took place in a global context already marked by tight exportable availabilities. Export restrictions adopted by various countries exacerbated global supply concerns, causing wheat prices to rise to a 14-year peak in May 2022. Prices eased subsequently, in part reflecting the impact of the BSGI, expanded non-maritime export channels from Ukraine facilitated by the European Union Solidarity Lanes as well as seasonal factors and solid northern hemisphere harvests. In mid-June 2023, world wheat prices were down from their year-earlier levels by over 30 percent.

FIGURE 19
International grain price indices

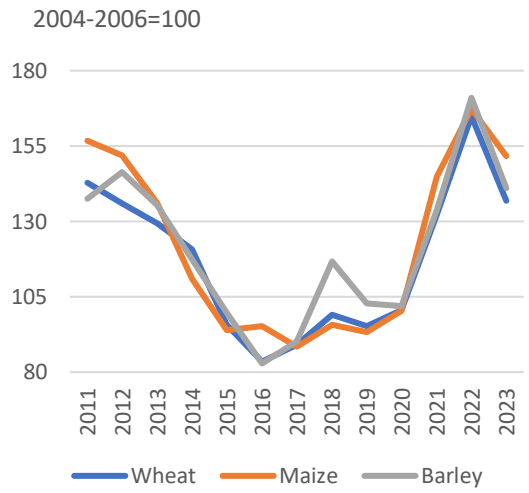
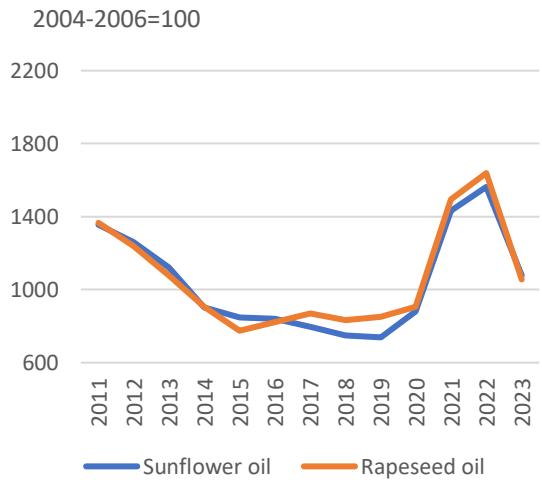


FIGURE 20
International vegetable oil prices



Source: FAO, International Grains Council (IGC) and Oil World. Averages for 2023 computed based on prices available through June.

In the case of maize, export prices rose steadily in the first two months of 2022, supported by weather related concerns over crop conditions in Argentina and Brazil, spillover effects from the wheat market, and rising energy and fertilizer costs. Similar to wheat, world maize prices rose sharply in March 2022 to reach a record high, in response to the significant reduction in maritime maize exports from Ukraine, which under normal conditions seasonally exports maize.

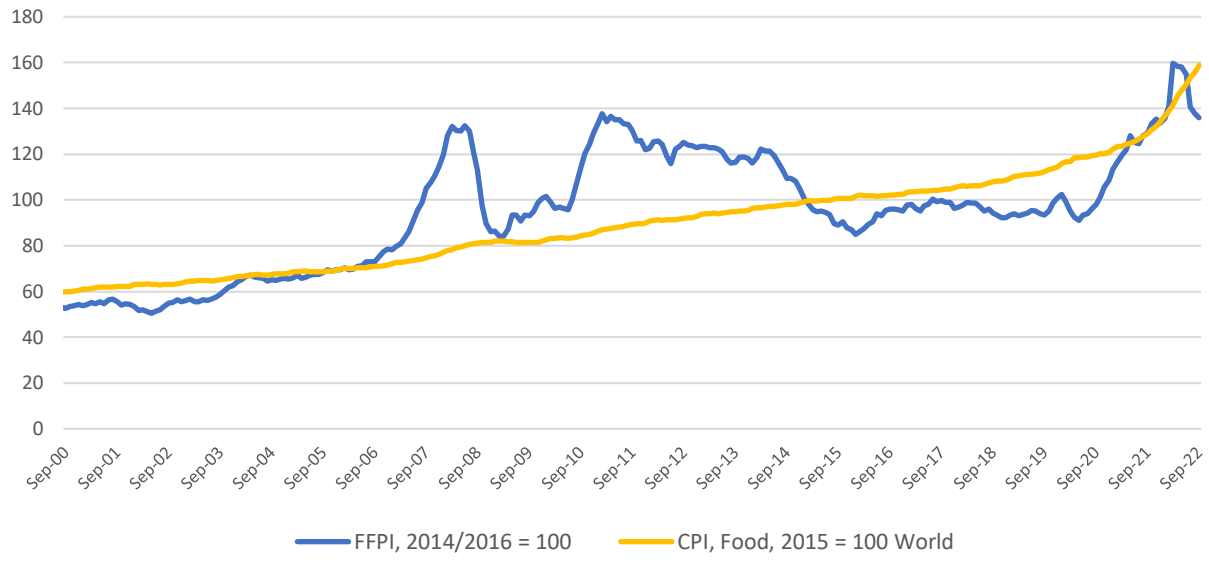
[2] The commodity groups covered by the FFPI are cereals, vegetable oils, meat, dairy products and sugar.

Even though the arrival of freshly harvested supplies from Argentina and Brazil helped to ease the pressure on prices between April 2022 and July 2022, uncertainty regarding the continuation of Ukrainian exports and tight global maize availabilities have since supported a partial price increase. Prices eased, however, following the harvest in the North Hemisphere in autumn 2022. In mid-June 2023, maize export prices were down by 20 percent from their June 2022 levels.

Export disruptions in the northern Black Sea region have also affected the sunflower and rapeseed oil markets. World prices of these oils reached record highs in March 2022, but they declined in the following months largely due to the demand rationing caused by the spike in import costs faced by buyers. International prices of palm oil, a potential substitute for these oils, also rose markedly in early 2022, buoyed by reduced export availabilities from Indonesia, which tightened export controls to contain the increases in domestic prices. Although the successive removal of these measures in Indonesia and prospects of improved supplies of palm, soy and rapeseed oils in the 2022/23 season have helped to ease the pressure on prices in recent months, in November 2022, world vegetable oil quotations remained well above their levels in recent years, even though they were down 16 percent from their November 2021 levels. International sunflower and rapeseed oil prices kept falling almost uninterruptedly since the beginning of 2023, largely underpinned by abundant global export supplies and also benefiting from the BSGI. Moreover, in the case of rapeseed oil, world prices were also pressured by subdued demand from the biodiesel sector, particularly in the European Union.

However, as Figure 21 shows, reductions in world food commodity prices have not yet tranlated into lower consumer prices, measured by the Food Consumer Price Index (CPI), as many factors, including exchange rate flunctuations, transportation cost border policies and domestic supply and demand conditions, often delay the transmission of price changes.

FIGURE 21
Prices of primary commodities vs Consumer Prices for food



Source: FAO (World Food Situation), FAOSTAT

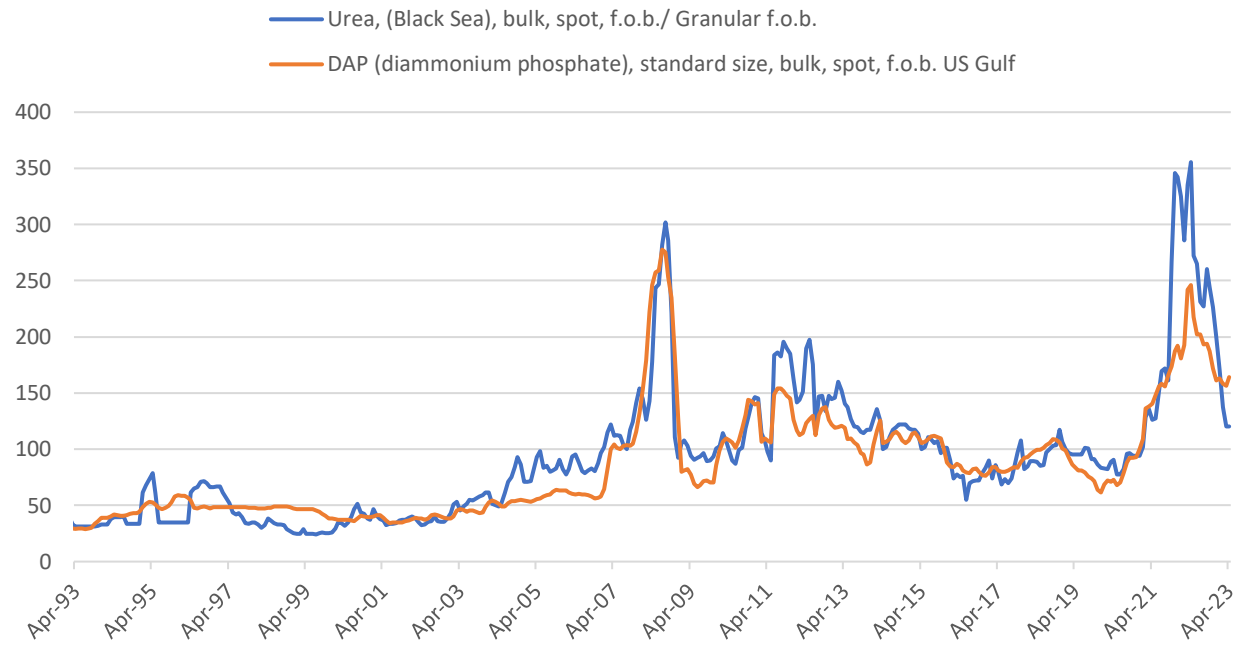
International benchmark prices of fertilizers rose throughout 2021 and into the first months of 2022, with many quotations reaching all-time highs. The most notable increases were registered for nitrogen fertilizer. Prices of urea, a key N fertilizer, peaked in April 2022, when they stood nearly four times above their level in December 2020. Prices of phosphorous fertilizer rose in tandem. While N fertilizer prices have declined somewhat since May 2022, influenced by reductions in natural gas prices, in October, prices of N fertilizers still hovered around levels that were two and a half times their longer-term average. Reflecting lower energy prices, world prices of N fertilizers decreased further. In April

2023, the price of N fertilizer approached its pre-peak levels recorded in spring 2021, of slightly over USD 300/tonne. Starting from already elevated levels, Potash (K-fertilizer) prices also registered considerable increases between February and April 2022, peaking at USD 1 202 per tonne. By May 2023, potash prices declined to levels comparable with those registered in May 2021 of about USD 380/tonne.

With the decline in natural gas prices, overall fertilizer prices have eased significantly, declining from the peaks reached in 2022, and in some cases approaching their levels in spring 2021, while prices of phosphate have remained above their levels of two years ago. Nevertheless, fertilizer affordability and accessibility continue to be a serious concern, especially in lower-income countries like Sub-Sahara Africa, reflecting also the cost of shipping and logistics.

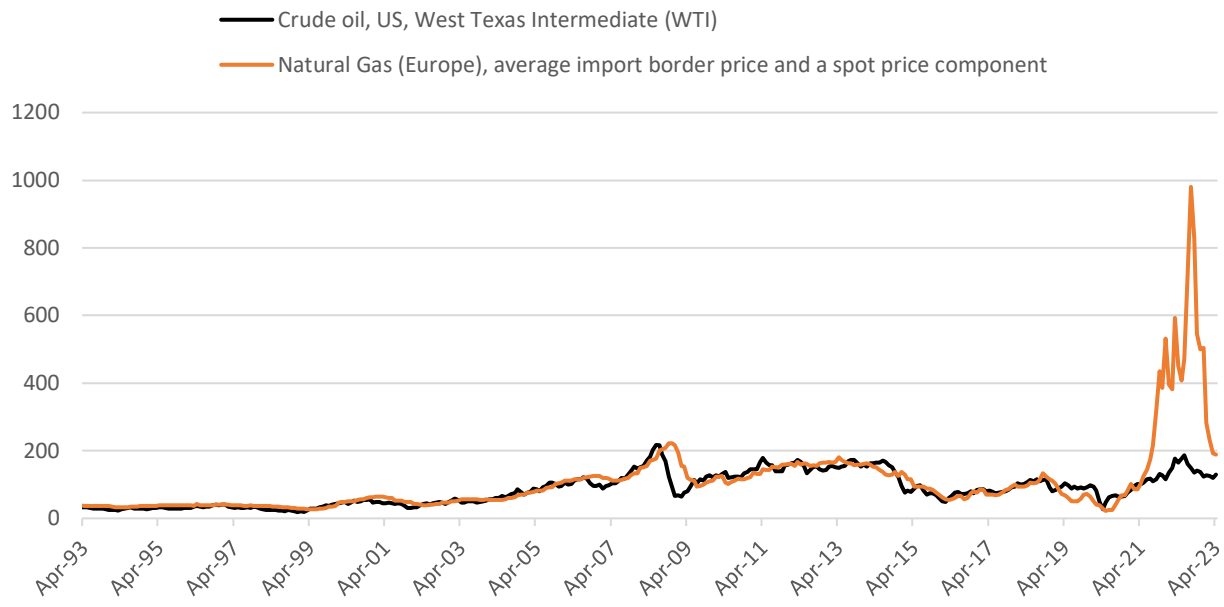
Similar to commodity prices, fertilizer price dynamics are determined by the interplay of supply and demand (also known as market fundamentals). On the demand side, the higher output (crop) prices registered in 2021 boosted affordability of fertilizers, thereby increasing demand for fertilizers and pushing prices upwards. On the supply side, energy prices were high and volatile, especially for natural gas, which is crucial for producing N fertilizer in many countries. Several other factors contributed to the sharp increases in N-fertilizer prices, including weather-induced disruptions to renewable energy. Additional upward pressure on fertilizer prices stemmed from supply disruptions and high transportation costs following the imposition of export restrictions. Sharp increases in bulk and container freight rates caused by the COVID-19 pandemic also contributed to the fertilizer price surge before the onset of the war. Trade restrictions introduced by some major producing countries to secure sufficient domestic supplies amplified the upward pressure on world fertilizer prices.

FIGURE 22
International urea and DAP prices (2014-2016 = 100)



Source: Index Mundi

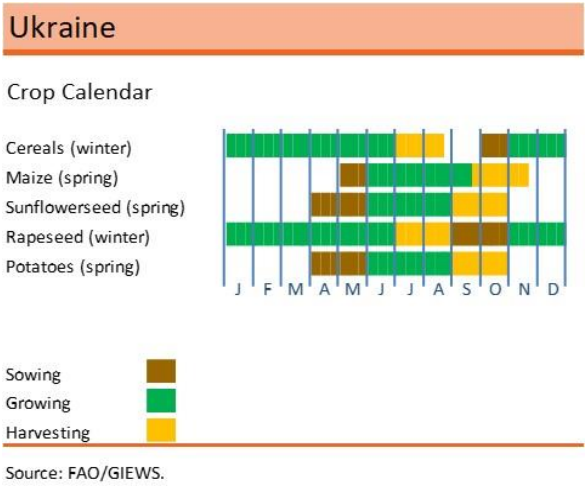
FIGURE 23
Natural gas price vs crude oil price (2014–16 = 100)



Source: Index Mundi

2.3. Production in Ukraine and elsewhere, 2022-2023

2.3.1. Production in Ukraine in 2022



Source: FAO/GIEWS.

The 2022 winter crops (wheat, barley and rapeseed), for harvest in mid-2022, were planted before the onset of the war. Active fighting across the country until April 2022 and the economic impacts of the war successively impaired the potential harvest through constrained access to fields, lack of labour, high cost of production and depressed farm gate prices. Remnants of the war such as mines and unexploded ordnances in many cases hampered the application of fertilisers and harvesting activities. Large swathes of cropped areas, particularly in the eastern part of the country, even if harvested, have not been contributing to the national production. As a result, the 2022 wheat harvest to which farmers in the areas under the control of the Government of Ukraine have access to, was estimated at 20.2 million tonnes, a decline of almost 38 percent from the bumper 2021 crop, and about 25 percent below the past five-year average (reflecting the different areas).

Remote sensing assessment studies carried out by independent consortia estimated the 2022 wheat output covering the entire country at 27.9 million tonnes, including 5.8 million tonnes in the areas outside the control of the government.[3]

[3] https://earthobservatory.nasa.gov/images/150590/larger-wheat-harvest-in-ukraine-than-expected

As for spring sown cereals (principally maize), a significant area was planted to maize following the retreat of hostilities and active fighting from the main maize producing areas in central Ukraine (with the exception of Kharkiv) towards the east. However, farmers returning to their fields were often faced with the urgent need to remove unexploded ordnance before they could prepare land for planting of the spring crops. Nevertheless, considering the impact of the ongoing hostilities at the time, larger-than-expected area was planted to maize in 2022, given that in many cases farmers had already purchased necessary inputs before the war broke.

While generally favourable weather prevailed during the crop season, wet autumn conditions challenged maize harvesting activities. High humidity also increased the energy requirements needed to reduce the moisture level before the maize grain can be stored – which, at the time of attacks on energy infrastructure and high fuel prices – led to slower pace of maize harvest. Although it is not unusual to harvest maize in winter, the harvesting of 2022 maize crop continued into January 2023, resulting in an estimated maize output of 27 million tonnes, some 20 percent below the past five-year average and less than two thirds of the 2021 record level crop.

In total, the 2022 aggregate cereal harvest (comprising winter and spring/summer crops) was estimated at 54.6 million tonnes, about 23 percent below the average and 36 percent below the exceptional 2021 harvest.

Oilseed production declined markedly in 2022/23, primarily due to a sharp reduction in sunflower seed output. Production of this crop was estimated to drop by about one-third from the previous season to 11.2 million tonnes, as the war disrupted sowing activities in some major sunflower seed growing regions, with yields also depressed by high input prices and, in some cases, shortages of inputs. On the other hand, rapeseed production increased year-on-year to 3.6 million tonnes. As the winter rapeseed plantings was completed in late 2021, the impact of the war was limited.

Livestock and poultry rearing, as well as the production of high value crops, such as fruits and vegetables, were also affected. The high cost of animal feed was cited as a recurring problem.

The retreat of fighting to the eastern part of Ukraine in early April 2022 allowed economic activities in the rest of Ukraine to restart. Markets have resumed working. While demining efforts across the country have started immediately, reduced availability of labour for agriculture, damages to civil infrastructure and opportunities to market agricultural commodities – which in turn has impacted the viability of the sector and farmers' decisions to remain in the production – have affected the sector since then and continue to do so. This has been further exacerbated by the continuing disruptions to essential public services, such as the provision of water, energy and transport. Since autumn 2022, heavy targeted shelling has decimated Ukraine's energy infrastructure, in particular significant power stations, resulting in power cuts across the country. Skyrocketing energy prices have increased the costs of industrial and agricultural activities, including irrigation, harvesting, post-harvest operations, and food processing and distribution.

Drawing from a household level analysis, FAO published in October 2022 a report on the "Impact of war on the agriculture and livelihoods of the rural population in Ukraine", indicating that at the national level, the major difficulties experienced by the rural households involved in the production and sale of crops included access to fuel or electricity to power equipment (reported by 24 percent of the respondents), access to fertilizers or pesticides (23 percent), low output prices from sales (20 percent), and access to seeds (18 percent). For regions (oblasts) along the front-line, the major difficulty faced during the upcoming crop season (2022/23) was expected to be access to seeds (22 percent). In the western and central regions, about one third of the respondents reported difficulty in accessing fertilizers/pesticides and energy (fuel and electricity) to power equipment as the main obstacle to their operations.

Consequently, the impact analysis showed that one fourth of the rural households interviewed nationally had either stopped or reduced agricultural production due to the war. Increases in production costs for both crops and livestock activities due to the war were widely felt across the country, negatively affecting income levels of rural households. To mitigate the effects of the conflict on their agricultural production, rural households incurred additional expenditures to maintain their productivity. These additional unforeseen costs have amounted to USD 234.8 million in the crop sector and USD 48.5 million in the livestock sector.

2.3.2 Production elsewhere in 2022

Farmers normally respond to market signals by adjusting their planting intentions; however, the timing of the elevated world cereal prices in the first half of 2022, immediately following the start of the war in Ukraine, did not provide

sufficient window on the northern hemisphere to adjust the choice of crops to be planted. Just like in Ukraine, winter crops were already planted towards the end of 2021, and farmers generally have purchased or contracted necessary inputs for the planting of the spring crops in the northern hemisphere and winter crops in the southern hemisphere. Responding to high prices and concerned about the global food supplies, some governments lifted certain aspects of their relevant regulations. The EU, for example, extended derogations from key environmental requirements in the EU's farming subsidy programme into 2023 to maximise the EU's cereal production capacity.[4] However, in 2022, the derogations in the EU did not have a significant impact on the cereal production, as yields were affected by significant droughts, but did increase oilseed plantings.[5]

Nevertheless, despite droughts in parts of the world and the war in Ukraine, the 2022 global wheat production was estimated at a record 800.9 million tonnes, up 2.9 percent from the previous season. Significant harvest recoveries in Canada and the Russian Federation made up the bulk of the year-on-year increase and had offset production declines experienced in several countries, including Argentina, the European Union, India, Morocco and conflict-induced production reduction in Ukraine.

In the Russian Federation, wheat production in 2022 was officially estimated at an all-time high of 102.7 million tonnes, largely underpinned by conducive weather conditions that supported exceptionally high yields. In 2022, no shortages of agricultural inputs – part of which was in the past imported – were reported.

World total production of coarse grains dropped by 2.7 percent in 2022, down to 1 468.8 million tonnes, the lowest registered output since 2019. The year-on-year fall stemmed predominantly from a decline in maize production, led by smaller harvests in the European Union, Ukraine and the United States of America.

While there is a certain degree of substitutability, particularly in the feed use, among different grains, the extent to which different vegetable oils can be substituted for each other is higher. Global oilseed production in 2022/23 rebounded from the previous season to an all-time high, primarily driven by recoveries of soybean and rapeseed output, which more than offset a drop in sunflower seed production in Ukraine. The record world soybean production was chiefly underpinned by a markedly higher output expected in Brazil while the crop in the United States of America declined slightly because of lower yields. Global rapeseed production rose sizeably, thanks to favourable weather conditions across Australia, Canada and the European Union. For palm oil, global output increased modestly, as lingering labour shortage issues in Malaysia constrained the potential for a higher growth rate.

2.3.3. Production prospects in Ukraine in 2023

Almost all wheat grown in Ukraine is of winter variety, sown by November. Areas traditionally planted with wheat and in the past significantly contributing to the national production are regions of Kharkiv, Dnipropetrov, Zaporizhzhia and Kherson, which are not entirely under control of the Government of Ukraine. Although the country regained some areas in these regions in autumn 2022, landmines and other remnants of the war for the most part prevented broader cultivation of the area. Even elsewhere in the country, though progress has been made on demining areas without active fighting, remnants of the war in many cases continue to hamper access to fields. Reports indicate some farmers have resorted to self-administered demining using a variety of innovations, although for safety reasons, self-demining is totally discouraged.

The area sown with 2023 winter cereal crops incurred an up to a 40 percent reduction compared to the average. About 4.1 million hectares were planted with winter wheat in areas under control of Ukraine. Total winter cereal plantings were estimated at about 4.8 million hectares. In 2021 – across the country – some 6.1 million hectares were planted with winter wheat for harvest in 2022.

Unlike in 2022, when farmers still had financial reserves or purchased inputs in advance, the 2023 agricultural activities are hampered by generally low liquidity of farmers. Although no major shortages of inputs are reported, low domestic output prices are constraining the capacity of many farmers to purchase adequate inputs. In mid-September 2022,

[4] https://www.euractiv.com/section/agriculture-food/news/eu-adopts-further-relaxation-of-environmental-measures-to-increase-cereal-production/
[5] https://www.euractiv.com/section/agriculture-food/news/relaxing-green-measures-falls-short-as-cereal-production-set-to-drop/

weighted average domestic prices for major export-oriented crops were about 60 percent lower than before the start of the war. General economic uncertainty has also constrained credit availability, with credit unlikely to be available to farmers with smaller holdings. Outbound population movements and military duty also continue to limit the availability of labour.

Spring cereal planting concluded in June: in total, slightly above 5.6 million hectares were planted with spring crops (both oilseeds and grains) in 2023, 5 percent below the 2022 plantings, both figures referring to the areas under government control. Economically most significant grain, maize, was planted on about 4 million hectares, compared to 4.2 million hectares planted in 2022. On the regional level, decreases in the production were distributed among different regions.

While area planted with spring grains decreased year on year, area planted with sunflower and oilseeds increased, reflecting higher returns and more attractive profit margins compared to grains. Over 5.2 million hectares were planted with sunflower, almost 9 percent more than in 2022, and over 1.7 million hectares were planted with soybeans, an increase of almost 18 percent compared to 2022. Soybeans, grown traditionally, do not require additional nitrogen fertilisation, lowering the cost of production.

As for the 2023/24 season, preliminary forecasts point to a partial recovery of oilseed production in Ukraine, mainly thanks to expectations of increasing sunflower seed production. Based on the increased plantings, for sunflower seeds, a partial production recovery to 12.9 million tonnes is forecast. Similarly, rapeseed and soybean production is anticipated to lead to a continued production growth to, respectively, 3.8 and 4.2 million tonnes.

While immediate losses of crop production as a direct result of flooding resulting from the Kakhovka dam destruction on 6 June 2023 have been relatively limited, the destroyed infrastructure carries long term consequences for the region, especially for the irrigated agricultural production, including for spring planted crops in 2023.

Following the retreat of the Russian troops towards the eastern part of the country in April 2022, the Dnipro river became de facto been the front line of the conflict. As such, active fighting and remnants of the war limited substantial agricultural production in the immediate vicinity downstream from the reservoir. Nevertheless, smaller scale – mostly backyard style – crop and livestock production has been taking place in areas along frontlines mostly in the rural households. Flooding is likely to have lasting consequences on livelihoods of small farmers and households that were still active in the area, and, given the circumstances, are unlikely to have sufficient resilience capacity to recover when the floodwaters recede.

By the time of the breach of the dam, winter wheat, barley, and rapeseed crops, particularly in the southern areas, were ripening. Under non-conflict circumstances, significant flooding at the near harvest time would have likely resulted in a complete loss, but the evidence so far is not pointing to a significant damages. Although parts of Kherson and Zaporizhzhia regions returned under the control of the Ukrainian government in autumn 2022 in time for winter crop planting, the need for demining in many cases prevented widespread cultivation. The regions of Dnipropetrovsk and Mykolaiv together accounted for up to 22 percent of the fields planted with winter grains for harvest in 2023 (Fastmarkets, 6 June 2023), although those were not directly affected by floods.

As spring planted crops (maize, soybeans, sunflower) in the south were planted in April – early May, there is a good chance that they were already established and could survive flooding if not waterlogged for a long time. However, depending on the rainfall amounts during the rest of the 2023 growing season, the lack of irrigation for spring planted crops is likely to constrain yields and reduce total production. About 300 000 hectares (out of total 4 million hectares) of maize were planted in areas dependent on water from the Kakhovka reservoir. In a worst case but unlikely scenario, assuming a total loss of production capacity in this area and, using a conservative yield estimate of 5.5 tonnes per hectare, the total maize production of the country would decrease by about 1.6 million tonnes. In a more likely scenario, lack of irrigation will constrain yields.

Although no direct information is available about plantings on the left bank of the Dnipro river, satellite images from May 2023 indicate that planting took place, and at least some fields were irrigated using pivot irrigation systems.

2.3.4. Production prospects elsewhere in 2023

Unlike in 2022, by 2023, farmers had an opportunity to reconsider their planting decisions ahead of a new crop year. In 2023, total wheat output is pegged at 777 million tonnes, representing a 3.0 percent fall from the all-time high reached in 2022. The bulk of the foreseen decline is expected to occur in the Russian Federation and Australia, following record-high outputs in both countries in 2022, while smaller declines are anticipated in several other leading producers, including Ukraine and Kazakhstan. Nevertheless, following a season of record-high world production, stocks and trade in 2022/23, global wheat markets are expected to tighten slightly in 2023/24 but should remain adequately supplied.

In the Russian Federation, total wheat production in 2023 is forecast to decline from the record high in 2022, reflecting a small cutback in winter plantings, while drier-than-average weather conditions persisted into the start of 2023 in parts of the main producing southern areas.

World production of coarse grains in 2023 is forecast to rise by 3.0 percent from the 2022 reduced level, reaching 1 513 million tonnes, with most of the increase resting on an anticipated higher production of maize and a foreseen smaller increase for sorghum. Much of the expected growth is concentrated in the United States of America, Brazil and the European Union. As maize crop in the northern hemisphere remains in early stages of development, any forecasts are very preliminary.

2.4. Trade

The war has injected added uncertainty to global food and fertiliser markets, exposing them to heightened risks of tighter availabilities from disruptions to exports from the Russian Federation and Ukraine, unmet import demand and higher international prices. While prices responded quickly, they have later eased. Concerns about significant disruptions to exports from the Russian Federation have not materialised, as international sanctions included carve outs for food and fertilisers.

The onset of the war significantly undermined Ukrainian exports, including for grains and oilseeds, as seaborne shipments were constrained by a lack of access to Black Sea ports between late February and late July 2022. Alternative modes of transportation, such as rail, river or road transport, although active, did not compensate for the decline in maritime shipments. The BSGI, agreed in on 22 July 2022 and subsequently renewed (details discussed in the part on logistics), has helped to ease these constraints, allowing grain exports to resume from three Ukrainian Black Sea ports. Efforts remain intensified and are underway to boost export capacity through non-marine channels.

Global wheat trade in 2022/23 (July/June) was estimated to have increased by 1.8 percent above the 2021/22 to a new record high of 199.6 million tonnes.

Figures 24 and 25 compare major suppliers of wheat and maize exports on monthly basis from January 2021 to March 2023. To account for seasonality, the dotted line represents the reference level of cumulative exports in the same month in the previous year. Inconsistent official reporting of country level exports challenges the analysis. The analysis therefore uses mirror data by those countries reporting origins of their imports. As such, it might be incomplete, yet provides a consoling picture of world trade in wheat and maize in 2022.

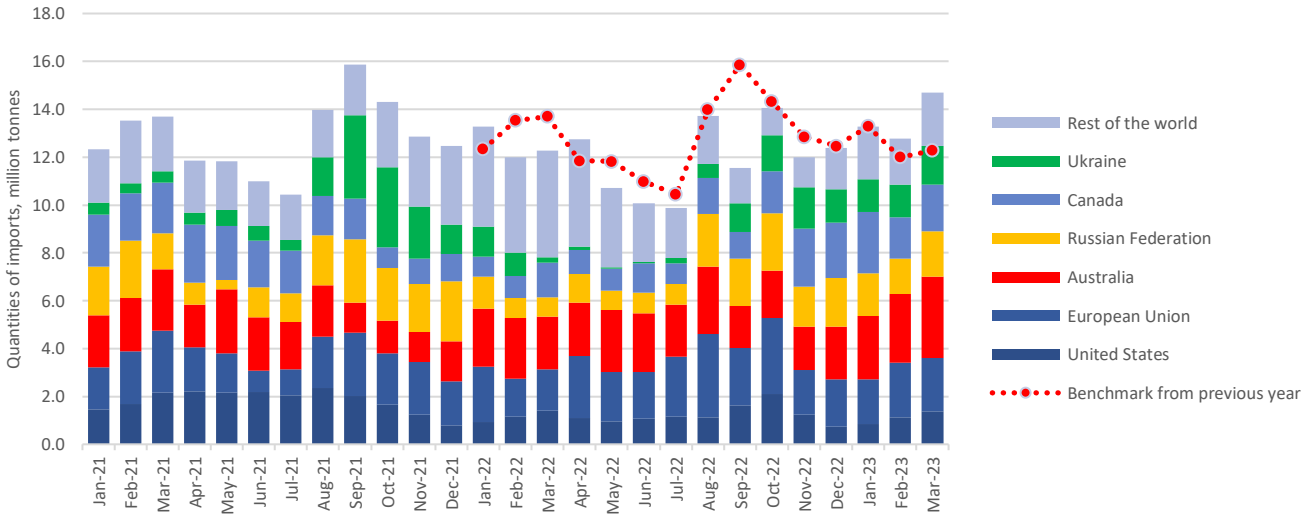
Although wheat is grown across the globe, generally a bulk of global imports originates from the northern hemisphere. Reflecting the crop calendar, wheat is usually frontloaded and, after being dried to a desirable level, exported in the first half of the marketing year, usually from August to December. Frontloading of wheat early in the marketing year also allows to free storage space for maize crop, in the northern hemisphere harvested from late September onwards.

On the aggregate level, reported wheat and maize imports did not change significantly year on year. Although adjustments between exporters reflecting availability depending on the domestic production and use happen yearly, after 2022 the adjustments reflected decreased availability from Ukraine – what at the time was perceived as a more long-lasting factor.

The wheat shipping pattern did not hold in September 2022, partially due to decimated wheat exports from Ukraine. Although by September 2022, the BSGI was getting operational, pilot export shipments consisted mostly of maize which were ready in the storage silos since February 2022 when maritime shipping from Ukraine came to a sudden halt.

The wheat supplier chart also indicates that the United States of America, following two years of below-average wheat crop in 2021 and 2022, in 2022 decreased its aggregate exports as previously accumulated stocks were diminishing. Australia, on the other hand, maintained its export pace following two years of bumper wheat crops harvested October 2021 and October 2022. Australian wheat export volumes, despite ample export availability, appear to be constrained by the overall capacity of the inland transportation. Imports from the Russian Federation appear to slightly contract in some months – however, this can be due to the nature of the data in which total exports from the Russian Federation are not captured. Finally, following February 2022, a large increase in the wheat imports from "rest of the world" is noticeable, particularly between January and May 2022, as India, a significant wheat producer but a limited exporter, amplified its exports, and later filled it part of the gap on the world markets following the temporary halt of Ukraine exports.

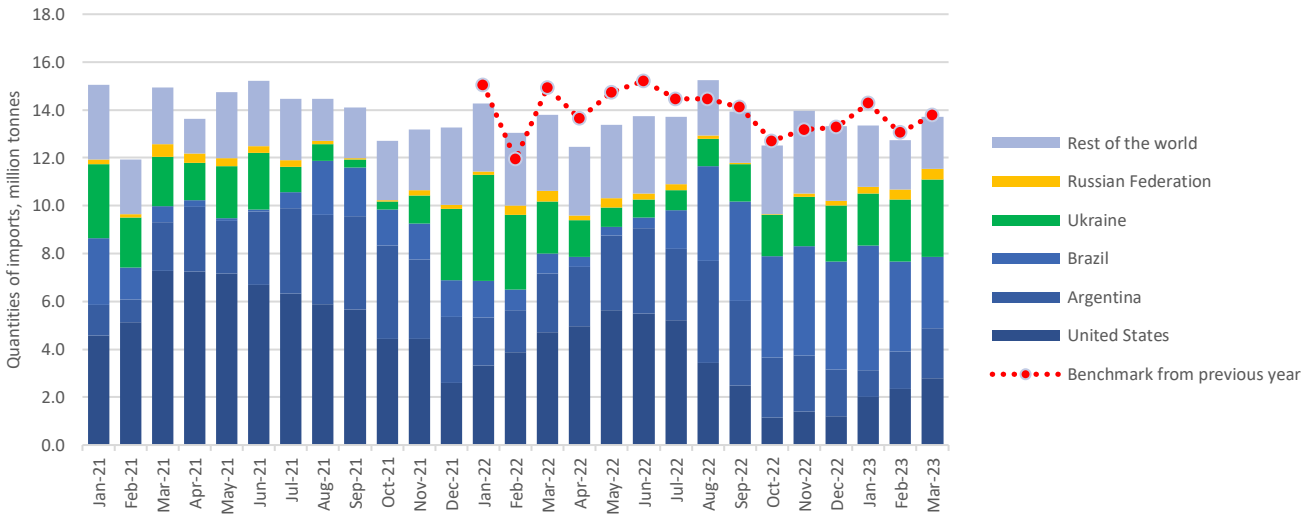
FIGURE 24
Major suppliers of global wheat imports



Source: Trade Data Monitor (TDM), FAO calculations

As maize exporters hail from both hemispheres, monthly distribution of maize exports tends to be more stable. In 2021, as Brazilian maize production suffered from drought, exports from the United States of America made up bulk of the reported imports. Recalling that the 2021 maize harvest in Ukraine was exceptional boosting export availabilities, volumes of maize shipped from Ukraine in January and February 2022 were also exceptional. These decreased from March 2022, as the capacity of alternative means of transportation was insufficient to match previously exported volumes via Black Sea. Maize exports from Brazil increased substantially from August 2022, substituting for declined availabilities form the United States of America.

FIGURE 25
Major suppliers of global maize imports



Source: Trade Data Monitor (TDM), FAO calculations

Immediately after the halt of the exports from the Ukrainian Black Sea ports and concerns about the availability of the exports from the Russian Federation, many import dependent countries sources large share of cereals from the northern Black Sea region strived to diversify their import base. Figures 26 and 27 show the shares of wheat imports from the Russian Federation and Ukraine among selected wheat importers (for which reliable data was available) in 2021 and 2022 calendar year. The importers are ranked according to the total volume of imported wheat.

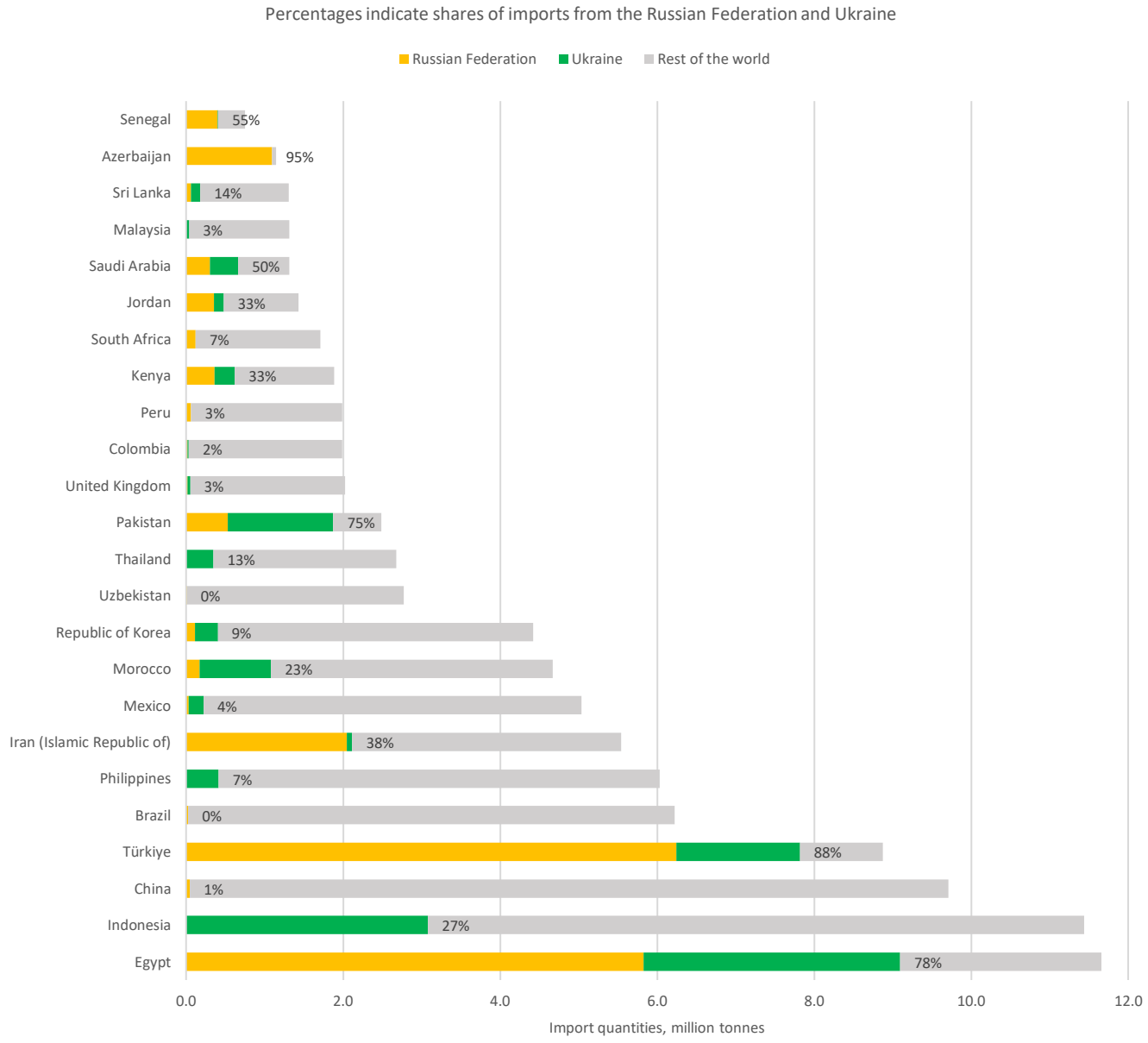
While wheat imports in some countries, such as Egypt, declined reflecting carryover stocks from the previous years as well as the ability of the country to import determined by its balance of payments situation, overall the countries managed to adjust the import origins to satisfy their domestic needs.

Türkiye, although relying on imports from the north Black Sea region, is a special case. With its efficient milling industry, the country imports large amounts of wheat under a special import processing regime, and exports wheat flour to many countries, including Yemen, Somalia, Iraq and others.

Amidst elevated interational food commodity prices, export restrictions are sometimes employed to guarantee sufficient availability on domestic markets. Overall during 2022, 32 countries imposed 77 export restrictions in the form of export licensing requirements, export taxes or duties, outright bans, or a combination of measures, according to IFPRI's Food and Fertilizer Export Restrictions Tracker.[6] By January 2023, the share of exports affected by export restrictions has fallen by over 50 percent from its May 2022 peak, while the measures themselves appear to be less consequential than many anticipated. Nevertheless, countries are discouraged from the use of export restrictions as a policy tool, as they add uncertainty to often already tight markets, increase volatility, possibly limit domestic production response by fogging the price transmission signals from the global markets to farmers, and in the extreme might result in beg thou neighbor tic for tac policies.

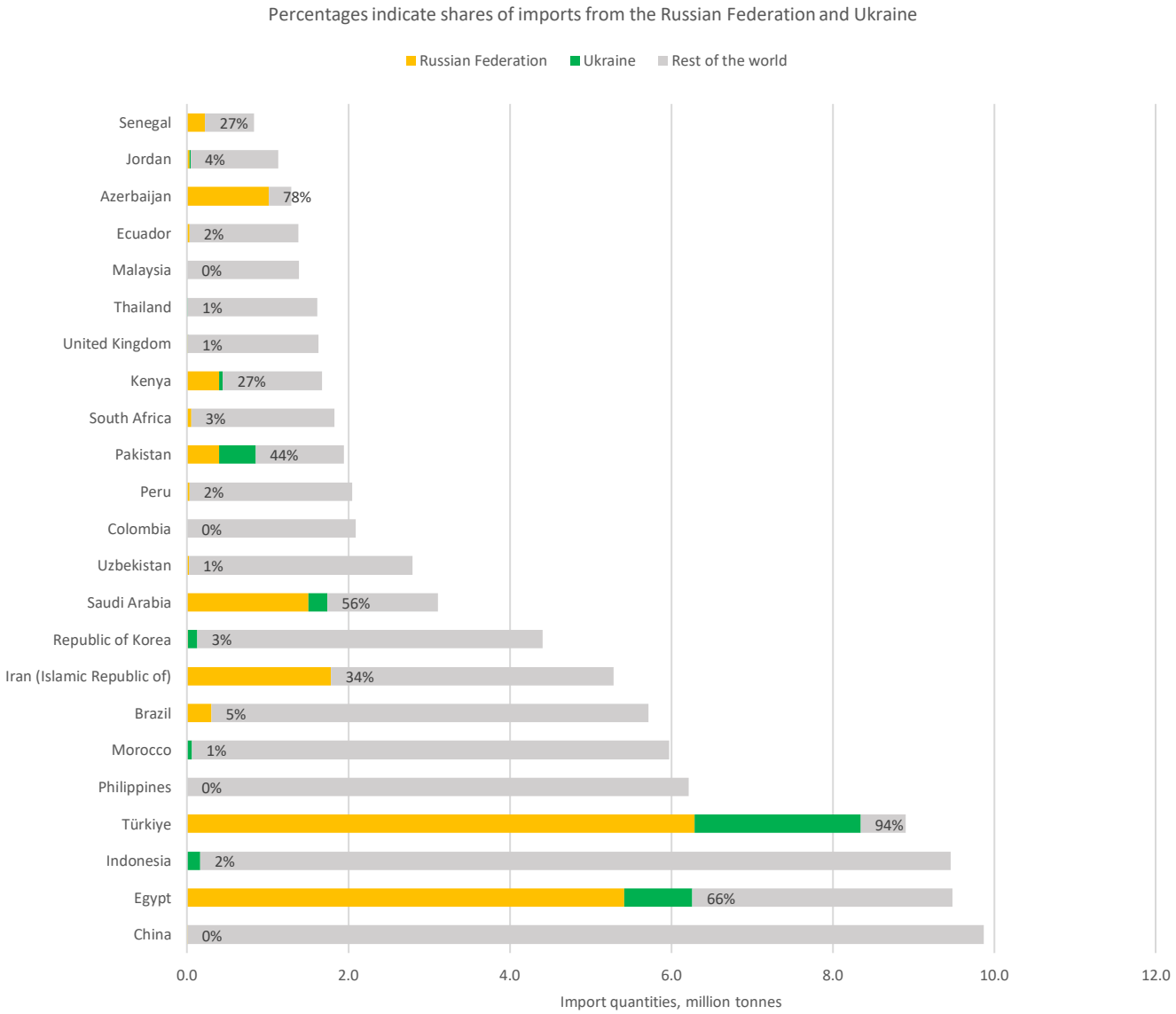
[6] https://www.ifpri.org/blog/food-export-restrictions-have-eased-russia-ukraine-war-continues-concerns-remain-key

FIGURE 26
Wheat import dependency, net importers, 2021



Source: Trade Data Monitor (TDM)

FIGURE 27
Wheat import dependency, net importers, 2022



Source: Trade Data Monitor (TDM)

Box 1: Wheat imports by Lebanon and Yemen

Yemen and Lebanon are not included in the above figures, as there is no data on reported imports for the period under examination in the Trade Data Monitor (TDM). Both countries are significant importers of wheat as domestic production is limited by landscape and natural conditions.

In Lebanon[7], wheat has traditionally been sourced mostly from the Black Sea Region to take advantage of geographical proximity and low shipping costs. Between 2017 and 2021, average wheat imports from Ukraine and the Russian Federation were about 55 and 30 percent of total imports, respectively. According to data from the Lebanese Customs Administration , in 2022 the country imported about 552 000 tonnes of wheat grain, almost 27 percent less than in 2021, but still 3 percent more than in 2019, at the start of the financial crisis. The year-on-year decline in 2022 is likely to be attributable to the challenging financial situation and the lack of foreign currency, amidst elevated global agricultural commodity prices. Despite the closure of Ukrainian Black Sea ports between March and July 2022, three-quarters of the wheat imported in 2022 were sourced from Ukraine (about 424 000 tonnes). About 52 000 tonnes originated from the Russian Federation, while 76 000 tonnes were jointly supplied from Romania, the Republic of Moldova and Bulgaria. Lack of storage capacity, following the explosion in August 2020 in Beirut that destroyed the main silo, requires more expensive small shipments.

Yemen[8] traditionally relied on imports of wheat grain from the Russian Federation and Ukraine. Since 2017, the share of wheat grain sourced from the Russian Federation gradually declined from 45 percent to 20 percent in 2021, while the share of wheat grain sourced from Ukraine increased from 5 percent in 2017 to 27 percent in 2021. In 2022, the start of the war in Ukraine raised concerns about the availability of certain food commodities, including wheat, on the global markets and the capacity of food-importing countries to secure sufficient supplies and urgently diversify their sourcing origins. According to the United Nations Verification and Inspection Mechanism for Yemen (UNVIM), 2.98 million tonnes of wheat grain were imported in 2022, about the same amount as in the previous years. About 75 percent of imported wheat entered via the ports of Al Hodeidah and As Salif (both under control of Sana'a Based Authorities (SBA)), while the rest entered via ports of Aden and Mukalla (both under control of the Government of Yemen). In 2022, import origins have been diversified, away from northern Black Sea: one-third of wheat grain was imported from Australia and over 20 percent from the United States of America, both traditional suppliers to the country, while almost 15 percent of wheat grain imports were supplied from India and 10 percent from France. The shipments under the Black Sea Grain Initiative (BSGI) from Ukrainian Black Sea ports amounted to about 304 000 tonnes, slightly over 10 percent.

In the first half of 2022, at the peak of global cereal prices, although labelled as a global food crisis, global markets remained well supplied. However, access remained a challenge for many countries, particularly those grappling with the currency depreciation and balance of payments problems. Similarly, on the country level, while most of the markets did not report shortages, elevated retail prices often constrained access.

For the upcoming marketing year 2023/24 (July/June), world trade in wheat (including wheat flour in grain equivalent) will likely fall by 3 percent to 194 million tonnes. This anticipated decline is underpinned by smaller wheat purchases by China and the European Union, where imports are boosted to high levels in 2022/23 due to large flows from Ukraine. On the export side, expected declines in sales by Australia and Ukraine are foreseen to outweigh anticipated increases in shipments from Argentina and the European Union.

2.5. Logistics

In Ukraine, active fighting and direct attacks across vast areas of the country have damaged parts of processing, storage and transport infrastructure both inland and in ports. Ongoing targeting of energy networks and other crucial infrastructure makes additional damages likely, with consequences for daily life but also the movement of goods, both internal and for export. The country experienced massive blackouts and issues with energy delivery as a result – with an estimated 43 percent of Ukraine's energy infrastructure damaged in air strikes, per the country's state-owned power distributor.[9]

[7] https://www.fao.org/giews/countrybrief/country.jsp?code=LBN&lang=en
[8] https://www.fao.org/giews/countrybrief/country.jsp?lang=en&code=YEM
[9] Ukraine races to fix power grid, fearing Russian winter attacks, minister says | Reuters

The impact of the war on transportation infrastructure, coupled by policies in place allowing or guiding exports of agricultural commodities - remain a significant source of concern. This includes inland infrastructure (mostly railways) carrying goods for export to Odesa and Mykolaiv ports, Ukraine's main ports for bulk agricultural commodities. In March 2022, Ukraine exported in total 332 000 tonnes of agricultural products, while in March 2023 – with the BSGI operational, and logistics in non-marine export channels smoothed – the exports reached almost 7.5 million tonnes.

2.5.1. Non-maritime export channels

An immediate effect of the war in February 2022 was the suspension of exports from Ukrainian Black Sea ports, which compelled Ukraine to turn to alternative export channels, including road, river barges and, especially, rail. Yet, the declining importance of railroad shipments for exports of agricultural products in the country entailed that only about 300 000 tonnes of agricultural commodity were transported trans-border through rail per month prior to the onset of the conflict.[10] In addition, in the early stages of the war, the use of locomotives and rail infrastructure was prioritised to evacuate people from the areas that were most affected by fighting, with rail shipments also constrained by a lack of rail carriages in neighbouring countries.

Internal civilian road and rail infrastructure remained operational and largely unaffected by the war, despite localized infrastructure damages and loss of life, making it a crucial component of moving goods and humanitarian aid. However, deliveries to and from Baltic ports via Ukraine's western borders with Poland (the most direct rail export route to marine access) and less frequented rail routes via landlocked Slovakia and Hungary, require that railcars' chassis be changed at the border due to the use of conflicting gauges between the countries of the former Soviet Union and the rest of Europe. Alternatively, cargo (bulk or containerized) has to be transloaded to different train cars. Road transportation of cargo also suffered from bottlenecks, particularly long waiting times at the border. During the spring of 2022, waiting times for trains and lorries often exceeded twenty days on some crossings, while some waiting times – such as those heading to the shallow ports – exceeded 30 days. These constraints limited Ukraine's export capacity through these alternative routes to 500 000 tonnes of agricultural produce per month throughout early 2022. In theory, the state carrier estimates the capacity of cross-border rail transportation at 1.5 million tonnes of grains and oilseeds per month, based on the availability of the train cars, and without considering logistical challenges of border crossing. In November 2022, slightly over 1 million tonnes of grains and oilseeds crossed the western borders, a record level. In the first quarter of 2023 (latest figures available), about 900 000 tonnes were exported via western border.

Uninterrupted access to Danube ports, in particular Reni and Ismail, allowed some quantities to be moved by river barges, but also resulted in significant bottlenecks in the Sulina channel, prompting the introduction of quotas on the number of barges allowed in those ports.

Faced with such roadblocks, various initiatives were launched to expedite and increase the capacity of Ukraine's non-marine trade. For instance, the European Union's "Solidarity Lanes", were introduced in May 2022 to ensure Ukraine can export grain, but also import the goods it needs, from humanitarian aid to animal feed and fertilizers.[11] Initiatives under the Solidarity Lanes include adding freight rolling stock, vessels, and lorries, increasing capacity of export networks and transshipment terminals, introducing certain flexibility into customs operations and other inspections, including sufficient staffing, and securing more temporary storage capacity for Ukrainian goods in the European Union. Up to June 2023, over 35 million tonnes of grain, oilseeds and other related products were exported from Ukraine via Solidarity Lanes.

Similarly, benefiting from the same railroad gauge used by Ukraine and Moldova, in August 2022, a rail link between the two countries was reestablished after a 23-year hiatus[12]. The volume of exports via Danube ports, in January 2022 limited to about 55 000 tonnes per month, gradually increased to 1.5 million tonnes in August 2022. In May 2023, a record volume of 3 million tonnes was exported via three Ukrainian Danube ports.[13] Given the bottlenecks in the railroad transport towards the river ports, replicating the record level might not be immediately attainable. Discussions are also

[10] https://www.csis.org/events/agriculture-and-food-security-casualties-war-ukraine
[11] https://transport.ec.europa.eu/news/european-commission-establish-solidarity-lanes-help-ukraine-export-agricultural-goods-2022-05-12_en
[12] https://www.reuters.com/world/europe/ukraine-restores-moldova-rail-link-could-carry-10-mln-tonnes-year-2022-08-22/ The connection could carry 10 million tonnes of freight a year.
[13] Ukraine must be ready to export mostly via Danube ports, sea ports authority says | Reuters

underway about deepening the Bystre canal to facilitate passage of larger vessels. Shipments from the shallow ports are usually transloaded to larger vessels in the Romanian port of Costanza.

While these commendable initiatives have helped Ukraine's volumes of non-marine shipments to increase, they will require additional investments to fully realize their potential.

2.5.2. Maritime transport

Prior to the onset of the war, seaborne shipments accounted for at least 90 percent of Ukraine's commodity exports. Since other means of transport were unable to fully compensate, Ukraine's loss of access to Black Sea ports between late February and late July 2022 significantly constrained its ability to ship food abroad. During this period, several vessels were reported to have been hit by shelling in the northern Black Sea region. Those civil maritime vessels (including those used for food shipments) that could still transit through the Turkish Straits (Dardanelles and the Bosporus) were also faced with increasing insurance premia or a lack of war coverage in insurance contracts for vessels sailing into the greater Black Sea region. This exacerbated the already elevated costs of marine transportation, compounding further on the final costs of internationally sourced food paid by importers.

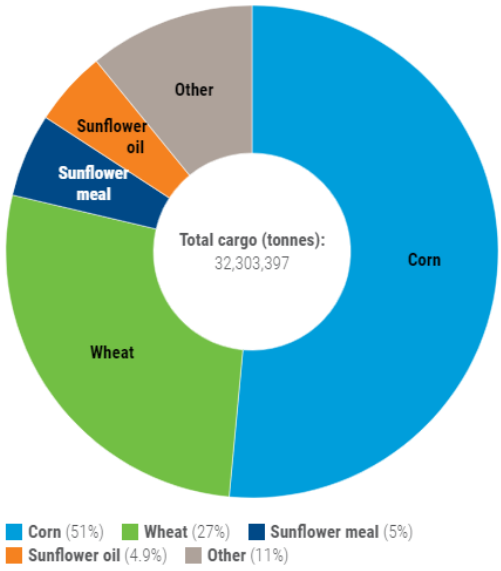
The Turkish Straits are a critical international grain trade juncture, with one fifth of world wheat exports and one sixth of global maize shipments, much of which originate from the Russian Federation, Ukraine and Kazakhstan, passing through them.[14] The impact of any shipping disruption in this area is most directly felt by importers in the Near East and North Africa region. The reliance of countries in these regions on grains originating from the Russian Federation and Ukraine is also associated with lower shipping costs facilitated by these countries' physical proximity to the Black Sea basin.

The BSGI,[15] launched by the United Nations, Türkiye, the Russian Federation and Ukraine on 22 July 2022, enabled the resumption of exports of grains, other foodstuffs and fertilizers, including ammonia, through a safe maritime humanitarian corridor from three key Ukrainian ports, Chornomorsk, Odesa and Yuzhny/Pivdennyi. The Initiative was extended by 120 days in November 2022. However, an extension of only 60 days was agreed in March 2023, and again in May 2023. The latest extension of the Initiative is set to expire on 17 July 2023, and prospects of additional renewal remain unclear despite continuing consultations and negotiations.

According to the Joint Coordination Center (JCC), as of June 23, 2023, in total over 32.3 million tonnes of agricultural commodities were shipped from Ukraine. About half of the shipped volume was maize, and slightly over a quarter wheat. The total amount included 625 169 tonnes of grain shipped on vessels chartered by the World Food Programme (WFP) in support of its humanitarian operations in Afghanistan, Ethiopia, Kenya, Somalia, Sudan and Yemen. In 2022, Ukraine supplied more than half of WFP's global wheat grain procurement, as was the case in 2021. [16]

[14] https://www.chathamhouse.org/sites/default/files/publications/research/2017-06-27-chokepoints-vulnerabilities-global-food-trade-bailey-wellesley-final.pdf
[15] https://www.un.org/en/black-sea-grain-initiative
[16] https://www.un.org/en/black-sea-grain-initiative/update-15-june-2023

FIGURE 28
Shipments of agricultural commodities from Ukraine under the BSGI, as of June 23, 2023



Source: Joint Coordination Centre for BSGI

The peak of exports under the Initiative took place in September and October 2022, when 3.9 and 4.2 million tonnes of agricultural commodities were exported. The amount declined to 1.33 million tonnes in May 2023. The number of inspections has reduced dramatically: Since 25 May, the JCC has reduced the number of inspection teams from three to two. From 1 to 4 June, the JCC conducted no inspections as the parties could not agree on the vessels to be inspected.

In mid-June, the offices of the UN Coordinator for the BSGI issued an update warning that the volume of food exported by the Initiative in May was the lowest since the start of the Initiative and well below shipping demand and Ukraine's export capacity.

The initiative also includes provisions for the exports of fertilizer, including ammonia. There have been no such exports so far under the Initiative. Exports of ammonia under the Initiative could start once an ammonia pipeline from the Russian Federation to the Ukrainian port of Yuzhny/Pivdenniy, halted by the conflict, is restarted. Damages to the pipeline were reported on 5 June.

The Initiative is important for improving global food availability and lessening the pressure on world prices. Going forward, the duration of the Initiative, the speed of vessel inspections, the safety of transport and the functioning of ancillary inland infrastructure will all play critical roles in ensuring that food and agricultural products reach the world markets.

At the time of signing the BSGI, Memorandum of Understanding between the Russian Federation and the Secretariat of the United Nations on promoting Russian food products and fertilizers to the world markets was also signed. Unlike the specific timeframe of the Initiative, the Memorandum of Understanding has an initial duration of three years.

2.5.3. Other key agricultural infrastructure and operations

In Ukraine, many international companies in the grain and oilseed export sectors reduced their operations following the start of the war to protect the safety of their employees. Even though the security situation across much of the country

improved as active fighting eased, export volumes still remain constrained by the high cost of inland transportation and active security risks. This has prevented Ukraine's agricultural sector from fully restoring its export operations.

For as long as conflict persists, additional damages to crucial infrastructure cannot be excluded. This could put in peril the country's ability to complete maize harvests and export its produce. Damages to energy infrastructure and preferential use of existing energy supplies to satisfy the heating needs of the population during the winter months are also likely to limit available energy for post-harvesting operations (such as grain drying) and processing, including oilseed crushing. This could alter export patterns going forward, shifting the balance towards less energy intensive (and less value added) products. Energy blackouts could also impact the functioning of ports. Rapidly rising fuel prices have further added to the cost of inland transportation.

Before the outbreak of the war, 1 378 grain elevators operated across Ukraine, with a total capacity of over 57 million tonnes.[17] This was sufficient to store more than 80 percent of total cereal production. Total storage capacity in the country was estimated at 75 million tonnes, of which 14 percent had been damaged or destroyed as of August 2022, while 10 percent is located in the areas outside the government control.[18] In order to ease storage constraints, the FAO Grain Storage Support Strategy, implemented with the financial support of the governments of Canada and Japan, and Australian Minderoo Foundation, in cooperation with the Ministry of Agriculture, distributed 30 000 polyethylene grain sleeves (so called silo bags), enough to temporarily store 6 million tonnes of grain on farms.

Although grain elevators and oilseeds crushing facilities are spread across the country, their concentration and carrying capacity are closer to important transportation points and ports, thus increasing their risk of being damaged in war. Smaller regional processing facilities, which do not usually operate for the whole season due to lack of raw materials, are needed for crushing oilseeds.[19] If modern oil crushing facilities are damaged, the excess capacity of smaller regional processing facilities could balance losses. However, many of the smaller facilities lack the technology to switch between oilseeds varieties. In addition, high energy prices prompted increased exports of oilseeds instead of usually more lucrative value added oil and meal.

Following the breach of the Kakhovka Dam on 6 June 2023 (the event is discussed in the Annex), some damages on the elevators and storage capacity have been reported. Although total storage capacities of more than 100 000 tonnes were situated close to the Dnipro River, (Fastmarkets, 6 June), in terms of logistics, shipping from the ports of Danube river and Greater Odessa has not been impacted. Halted navigation from the Kherson to Zaporizhia as a result of the breach is likely to increase costs of operators who relied on the water transport in the past. However, considering the river have effectively acted as a contact line, in the past year its use for navigation was limited.

In the Russian Federation, a number of multinational agribusiness companies have withdrawn from their export-oriented operations. However, some remain active in the domestic market, such as in feed production or oil crushing. In both countries, any delay in exports would require a greater reliance on storage facilities, especially silos. Under favourable conditions, grains can be stored for multiple seasons, but the duration that raw oilseeds can be stored is usually shorter. Moreover, to achieve the highest possible oil yields, oilseeds must be crushed shortly after harvest.

2.6. The spread of African swine fever: A heightened risk for Ukraine and all neighbouring countries

The war in Ukraine has disrupted the agricultural sector of the country, including animal production in commercial, smallholder and backyard sectors. Usual supply chains of feeds, veterinary drugs and product transportation were massively disrupted. This is likely to be a long-term problem due to ruining of transport infrastructure. Active and passive surveillance, laboratory diagnostics and control measures of endemic and emerging infectious diseases, notably African swine fever (ASF), are severely undermined currently due to security situation and availability of resources and personnel. The interruptions of electricity, water and gas supplies have affected livestock production and related value chains as well as veterinary clinics and laboratories.

[17] https://elevatorist.com/karta-elevatorov-ukrainy
[18] https://www.fao.org/newsroom/detail/ukraine-fao-canada-join-forces-to-address-grain-storage-deficit/en
[19] https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Oilseeds%20and%20Products%20Annual_Kyiv_Ukraine_04-15-2021)

According to FAO's assessment the preliminary damages and losses in livestock sector is estimated at USD 1 billion. According to FAO's survey, around 25 percent of the rural population involved in agricultural production stopped/reduced its production due to the war (over 40 percent in war-affected regions). In the liberated and contact line regions (oblasts), the major challenges are access to young animals for restocking purposes and animal feeds (including access to pastures). Approximately 80 percent of commercial livestock producers, located in the territories controlled by Ukraine, continue to operate steadily.

There are risk and implications for high impact animal diseases:

1. Possible upsurge in rabies incidence due to transmission of fox rabies to abandoned cats and dogs in the areas affected by military activities implying significantly increased risk for humans
2. Spread and upsurge in the incidence of the ASF disease due to increased slaughter and uncontrolled trade in pork in the whole country, particularly in the areas on the left bank of Dnipro river
3. Unrecognized introduction and spread of Avian Influenza in backyard sector from natural reservoirs in the rural areas throughout the country, but especially in its southern regions
4. Massive mortalities or escapes of farmed animals (livestock and poultry) and problems with their keeping, maintaining proper health status or incineration of dead animals.
5. Problems with maintaining sufficient biosecurity levels at commercial poultry and livestock farms
6. Challenges for the implementation of the surveillance and laboratory diagnostic activities due to frequent and prolonged interruptions of electricity, gas, water supply.

Large numbers of abandoned livestock and pet animals, might contribute to the transmission of the diseases. Uncontrolled movement of animals, or undisposed carcasses of animals left after bombardments, and encroachment and destruction of wildlife habitats can lead to spillover of pathogens to wildlife and from wild to domestic animals.

Due to the destruction of farms and other war impacts, according to the Association of Pig Breeders of Ukraine, the total number of pigs in the country is currently estimated at 4.75 million, which is about a 14-percent decrease compared to inventories in January 2022. A ban on access to forests and on hunting has impacted ASF surveillance in wild boars. There is also a lack of updated knowledge on ASF and other infectious animal diseases, epidemiological situation, and reduced surveillance and control.

2.7. Humanitarian aspects

2.7.1. Assessing the possible effects of the war in Ukraine on domestic food security in Ukraine

The war in Ukraine has created several challenges for food and agricultural markets and trade, described in the earlier sections. Active fighting in some regions along with labor shortages, high production costs, and low farm-gate prices, have led to a decrease in cereal production. Furthermore, mines and other remnants of the war in fields have hindered farming activities. Despite this, Ukraine's agricultural production in 2022 was sufficient to meet domestic requirements.

Since the peak in October 2022, the level of domestic food price inflation is decreasing, but remains significantly elevated. According to the State Statistics Service of Ukraine, food prices in May 2023 had increased by over 20 percent compared to the same month in the previous year, but overall declined from 22 percent in April.

Ukraine's energy and general infrastructure has also been heavily damaged. This damage and high energy prices will maintain upward pressure on food prices and lower the purchasing power of local populations, with consequent risks of food insecurity. Additionally, the recent breach of the Kakhovka reservoir has removed the primary water source for irrigation systems in the southern part of the country, with possible impacts on agricultural livelihoods.

Already, prior to 24 February 2022, about 1.5 million people had been displaced as a result of the near eight-year conflict in eastern Ukraine, some 1.1 million were in need of food and livelihood assistance, and about 400 000 of them had needs related to food insecurity. The war has increased humanitarian needs within Ukraine and in neighboring countries where displaced populations have sought refuge. Areas exposed to ongoing hostilities have reported shortages of food and medicine, as humanitarian corridors have faced difficulties in reaching those in need.

According to the August 2022 update of the Ukraine Flash Appeal 2022[20] issued by the United Nations, ongoing hostilities have left 17.7 million people in Ukraine in urgent need of humanitarian assistance and protection. As of 23 January 2023, the estimated number of internally displaced people (IDPs) in Ukraine decreased to 5.4 million down from over 5.9 million in the beginning of December 2022. Many have returned to their homes in the newly accessible areas, mainly in Kyiv, eastern and in northern parts of the country. These populations require particular attention, as IDP income sources have been severely impacted by the war. According to the twelfth round of the Ukrainian Internal Displacement Report, around one in four IDP respondents stated that monthly livelihood cash assistance for IDPs was their primary source of household income (24%). The vast majority (72%) of IDPs who rely on social assistance reported a total household income which – when divided by the number of people in the household – was equal to or less than UAH 2 500 (i.e. the subsistence minimum poverty line as of January 2023).

FAO assessment on the impact of the war on the rural population found a concerning situation for households dependent on agriculture for their livelihoods compared with the same period last year.[21] While decreases in income were reported across the country, this trend was more accentuated in frontline oblasts, such as Sumska, Mykolaivska, Donetska and Zaporizka.

More than half of the rural households surveyed reported to have spent over 50 percent of their total expenditure on food in the last three months. Moreover, in the frontline oblasts, almost 1 in 5 respondents reported to have spent over 75 percent of their total expenditure on food. The distressed situation of rural populations is even more evident when looking at the adoption of negative coping mechanisms. Around 40 percent of the rural households surveyed have started to adopt negative coping mechanisms to meet essential needs. Oblasts such as Zaporizka, Chernihivska, Sumska and Dnipropetrovska revealed higher shares.

A more recent FAO assessment on the impact of the war on agricultural enterprises shows how high prices and lack of access to key agricultural inputs, rising production costs, and economic disruption have a significant impact on farmers' production and incomes.[22] Agricultural producers reported operational stop or delivery failure from input providers, coupled with the collapse of crops inputs provision and the disruptions in the output markets, which are resulting in a contraction of the agricultural production, Combined with the loss of households' incomes, these disruptions in the agri-food value chain significantly impact domestic food security.

While the effects of the war are experienced in the whole country, these are more prominent in the oblasts along the frontline. [23] Preliminary findings of the ongoing FAO assessment on the impact of the war on agricultural livelihoods along the frontline areas confirm a concerning situation. According to the analysis, around one in three heads of villages interviewed in Khersonska and Zaporizka oblasts reported difficulties in meeting the needs of their residents, mainly due to lack of affordability of food and/or no access to markets.

FAO is responding to emergency and humanitarian needs in Ukraine through its Response Programme for 2023, described in Section 5.

2.7.2. Assessing the gender-related impacts of the crises

Prior to the current conflict, Ukraine had made modest gains on reducing gender inequalities, ranking 74th out of 156 countries according to the Gender Gap Index. This limited progress was already under threat by eight years of previous conflict in the east of the country, and after the outbreak of the COVID-19 pandemic. Recent data show that the current humanitarian crisis following the outbreak of the war in February 2022 has further exacerbated the complex situation and compromised the achievements made towards gender equality and women's empowerment.

According to UNHCR, since March 2022, an estimated 13 million people have been forced to leave their homes in Ukraine, with over 5 million becoming internally displaced and over 8 million becoming refugees outside of Ukraine. Ninety percent of all refugees are women and children, while most men aged 18–60 are required to stay behind under the

[20] https://ukraine.un.org/uk/node/193988
[21] https://www.fao.org/3/cc3311en/cc3311en.pdf
[22] https://www.fao.org/3/cc5755en/cc5755en.pdf
[23] The assessed territories in the "grey zone" correspond to an area of approximately 1 200 kilometres at the border with the Russian Federation and Belarus, and comprises villages and settlements located up to 50 kilometres from the frontline.

martial law.[24] The International Organization for Migration reports that women represent 60 percent of the adult internally displaced population, while men are only 40 percent. Over 4.7 million people who have been forced to leave their homes have returned to Ukraine amid the conflict, including over a million from abroad.[25] Similarly, more than 7.8 million Ukrainians have fled to European countries, including 4.8 million registered for temporary protection or similar national mechanisms.

Available statistics show that women who are migrating face many challenges at the borders, and some minority groups are unable to leave. Many vulnerable groups are left behind and cannot access essential services and resources, such as safe and accessible shelters, with a high risk of abandonment and family separation for people with disabilities. Female-headed households have a higher prevalence of food insecurity than male-headed households (23 versus 13 percent). FAO's Food Insecurity Experience Scale (FIES) data show that the prevalence of moderate or severe food insecurity (SDG indicator 2.1.2) among women has increased from 17.3 percent in 2019 to 28.9 percent in 2021 and among men from 13.3 to 24 percent in the last two years. While the differences between women and men are not statistically significant, the trend over time is consistent and suggest that women have been more food insecure than men over the past eight years.[26]

UN Women and CARE International conducted a Rapid Gender Analysis (RGA) in May 2022[27] showing an increase of existing gender and social inequalities, and older women and single mothers represent the majority of Ukraine's poor. In a joint assessment conducted by UN Women, FAO, ILO, and CARE International in May 2023, data showed that while 2.75 million refugees are of working age, the majority are employed at a lower level than their level of education and skill sets, with a higher portion of women being underemployed than men at 51 and 39 percent of respondents, respectively. Reasons are attributed to language barriers, difficulties in having professional qualifications recognized in hosting countries, and inequity in domestic care work facing women and girls.[28] In fact, even prior to the full-scale war on Ukraine, women performed twice or almost three times as much unpaid care and domestic work, with women spending 24.6 hours per week on such work compared to men's 14.5 hours according to a UN Women and CARE RGA. According to national statistics, the war is expected to increase the unemployment rate and further push women into unprotected informal sectors of the economy.[29]

Lack of access to employment and livelihoods opportunities, childcare support, and civil documentation in addition to language barriers increases the vulnerabilities of refugees, particularly women, to various forms of harm and abuse such as trafficking, labor exploitation, and gender-based violence including sexual exploitation. Some groups are more vulnerable to these risks than others, including but not limited to refugees from Ukraine without civil documentation, Roma communities, LGBTQIA+ individuals, single women and women-headed households, people with disabilities, and those living in rural areas.[30] Moreover, inside Ukraine, disruptions to health services, including access to sexual and reproductive health, are affecting thousands of pregnant Ukrainian women and increasing safety risks for people left inside the country with little or no access to adequate protection services. The disruption of infrastructure and the lack of mobility have posed a significant risk to women and girls, who constitute more than 72 percent of social protection recipients, reducing their access to healthcare, social services, and social assistance, such as cash and asset transfers.[31]

Amid conflicts, entrenched gender inequalities often lead to women and girls eating less and last, as a negative coping mechanism.[32] At the global level, disruptions to food supply, soaring food prices and limited access to fertilizers are having a cascading effect on women's and girls' food security and nutrition, as well as on women's farmers productivity.[33]

[24] https://eca.unwomen.org/sites/default/files/2023-06/Final%20English%20livelihoods%20brief%202%20June.pdf
[25] https://dtm.iom.int/reports/ukraine-snapshot-report-population-figures-and-geographic-distribution-general-population?close=true
[26] https://www.fao.org/3/cc3318en/cc3318en.pdf
[27] https://www.unwomen.org/en/digital-library/publications/2022/05/rapid-gender-analysis-of-ukraine
[28] https://eca.unwomen.org/sites/default/files/2023-06/Final%20English%20livelihoods%20brief%202%20June.pdf
[29] https://www.fao.org/3/cc3318en/cc3318en.pdf
[30] https://eca.unwomen.org/sites/default/files/2023-06/Final%20English%20livelihoods%20brief%202%20June.pdf
[31] UN Women. 2022. Women flee and show solidarity as a war ravages Ukraine.
[32] https://www.unwomen.org/sites/default/files/2022-09/Policy-paper-Global-gendered-impacts-of-the-Ukraine-crisis-en.pdf
[33] https://www.unwomen.org/sites/default/files/2022-09/Policy-paper-Global-gendered-impacts-of-the-Ukraine-crisis-en.pdf

2.7.3. Assessing the possible effects on world food security

The 2022 edition of the report on *The State of Food Security and Nutrition in the World* (SOFI), released in July 2022, estimated that the number of people affected by chronic hunger globally rose to as many as 828 million in 2021, an increase of about 46 million since 2020 and 150 million since the outbreak of COVID-19. After remaining relatively unchanged since 2015, the prevalence of undernourishment (PoU) jumped in 2020 and continued to rise in 2021, to 9.8 percent of the world population. This compares with 8 percent in 2019 and 9.3 percent in 2020. In addition, around 2.3 billion people in the world (29.3 percent) were moderately or severely food insecure in 2021 – 350 million more than before the COVID-19 pandemic. Nearly 924 million people (11.7 percent of global population) faced food insecurity at severe levels, representing an increase of 207 million in two years. The next edition of SOFI, to be published on 12 July 2023, will provide the updated figures for world food insecurity.

According to the 2023 Global Report on Food Crisis (GRFC),[34] published in May 2023, around 258 million people across 58 countries and territories faced acute food insecurity at crisis or worse levels (IPC/CH Phase 3-5) in 2022, up from 193 million people in 53 countries and territories in 2021. This is equivalent to an increase in the prevalence of the population in IPC/CH Phase 3-5 from 21.3 to 22.7 percent between these two years. The increase is mostly explained by the increased number of countries and size the population covered. When comparing the same 48 countries/territories analyzed in 2021 and 2022, the population facing IPC/CH Phase 3-5 increased from 191.4 million people to 228.6 million and the share of people in these phases from 21.8 to 22.5 percent. However, even in these countries, there were also differences in coverage within countries resulting in a 15.5 percent increase in the analyzed population.

To assess the possible impacts of the war in Ukraine and other global developments on global food security in 2022, an initial analysis was conducted using the Aglink-Cosimo modeling system. Prior to the outbreak of the war in Ukraine, SOFI 2022 projected the number of undernourished in 2022 at 733.9 million people. Using the new baseline projections generated under the OECD-FAO Agricultural Outlook, and based on the projected global food consumption patterns, the number of chronically hungry people in 2022 is projected at 744.6 million, representing an increase of 10.7 million people from the pre-war baseline. This estimate was very close to the projected number under the severe shock scenario published in the 10th of June update of this Information Note. The final result depends on many factors, including measures taken by governments to lessen the impact of the war.

It should be explained that the expected increase in undernourishment in 2022 results from the incorporation of revised yield expectations, a more rapid rise in energy prices and a broad range of other emerging economic trends. However, it must be noted that these estimations are preliminary and only serve to provide an initial assessment of the possible impact on global hunger, considering that the effect is different depending on the country.

2.8. The world food and agricultural input import bills

The world food import bill (FIB)

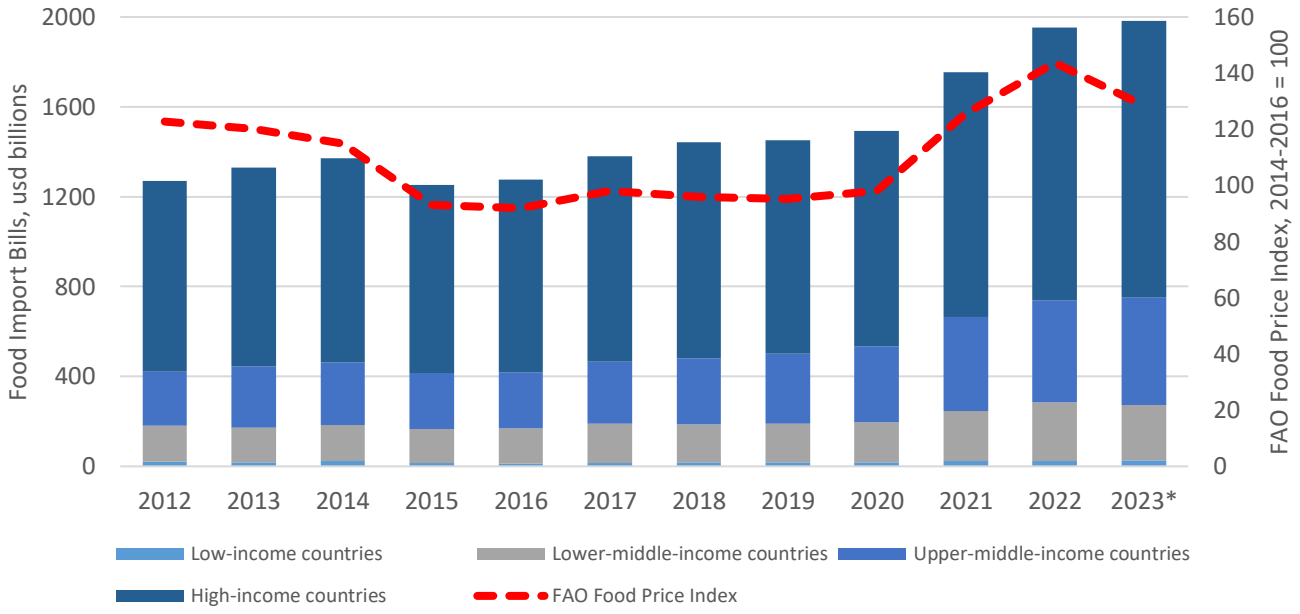
The FIB is forecast to reach USD 1.98 trillion in 2023, representing a 1.5 percent or USD 28.9 billion increase over the USD 1.95 trillion previous record attained in 2022. While marking a new absolute high, the speed of expansion is anticipated to slow down significantly relative to 2022 and 2021, when growth rates reached 11 percent and 18 percent, respectively. From a food group perspective, the divergent trends observed in 2022 are expected to persist in 2023. Overall, high-income countries (HICs) are anticipated to import a wide spectrum of food products, whereas upper-middle income countries (UMICs), lower-middle income countries (LMICs) and low-income countries (LICs) will focus their imports on staple foods.

A combination of price and volume effects is expected to drive the FIBs in 2023. Disaggregating FIBs to ascertain the price and volume effects of changes in expenditures at the global level and across all products, the anticipated increase in the 2023 bills reflects a combination of both, with an additional USD 18.4 billion stemming from higher international prices and USD 12.9 billion from higher volumes. For fruits and vegetables, cereals, sugar and dairy products, the increase will primarily be price-driven, while growth in oilseeds is expected to be mostly volume-driven. For vegetable oils, higher volumes are more than offset by a negative price effect, resulting in an overall decline in their global FIB.

[34] https://www.fsinplatform.org/sites/default/files/resources/files/GRFC%202022%20MYU%20Final.pdf

Vulnerable countries are likely to see contractions in their food imports. Disaggregating the global FIB by country groups suggests that the more vulnerable groups, notably the least developed countries (LDCs) and the net food-importing developing countries (NFIDCs), will see their food import bills contract by 1.5 percent and 4.9 percent, respectively. The decline in food import volumes is a concerning development in both groups, suggesting a decline in purchasing capacity. These concerns are amplified by the fact that lower international prices for a number of primary food items have not, or at least not fully, translated into lower prices at the domestic retail level, suggesting that cost-of-living pressures could persist in 2023. The evolution of the FIB by country income group is provided in Figure 29.

FIGURE 29
Global Food Import Bills by income groups, USD billions (current prices)



Source: Trade Data Monitor (TDM), FAO calculations

Global agricultural input import bill

Similar to the food import bills, the bills for imported agricultural inputs have surged, adding to the pressure exerted by the rising costs of food imports and, together with the stronger United States dollar, have further aggravated existing balance-of-payments problems of many lower-income countries.

FAO's agricultural input import bill (IIB) includes four major rubrics of inputs, namely fertilizer, seeds, pesticides and energy, used in agriculture.[35] The global IIB was estimated to have reached USD 424 billion in 2022, representing a leap of 48 percent or USD 138 billion over the total reached in 2021. Relative to 2020, the 2022 IIB soared by as much as 112 percent, albeit from a depressed level of USD 200 billion owing to lower overall imports during the near ubiquitous trade contractions caused by the COVID-19 pandemic. Higher bills for imported agricultural inputs add to rising food import bills for many low-income countries and, together with a stronger United States dollar, have further aggravated existing balance-of-payments problems.

[35] Feeds are excluded from the bill for methodological reasons. Available import statistics do not distinguish between different forms of utilization for commodities that can be used as food, feed or otherwise, e.g. as feedstocks for biofuels.

Higher costs for imported energy and fertilizer were the main drivers behind the soaring global IIB in 2022. These two inputs accounted for well over 75 percent of the overall world bill in the past, and were estimated to have accounted for 86 percent of the bill in 2022. Fertilizer and energy are particularly important items in the import bills of LICs and LMIC, accounting for 92 percent and 91 percent of total imported inputs, respectively.[36] Saddled with higher costs of fertilizer and energy imports, these countries may have been forced to cut down on the use of imported inputs, and, where domestic substitutes were not available, input applications were overall reduced. Decreased use of inputs would almost inevitably result in lower agricultural productivity, potentially resulting in lower domestic food availability.

Higher import bills do not necessarily mean higher product inflows. The decomposition of changes in the IIB between 2022 and 2021 shows that price effects dominated volume effects at the global level, meaning that countries around the world were encumbered with higher costs for imported inputs without necessarily purchasing higher quantities – they paid more for imported inputs in 2022 while receiving lower volumes than in 2021. While this is a near ubiquitous development, the price effect was less pronounced for LICs, where higher prices account for "only" 67 percent of the respective overall increase in their IIB. This could signal the beginning of a more general slowdown in the demand for imported agricultural inputs.

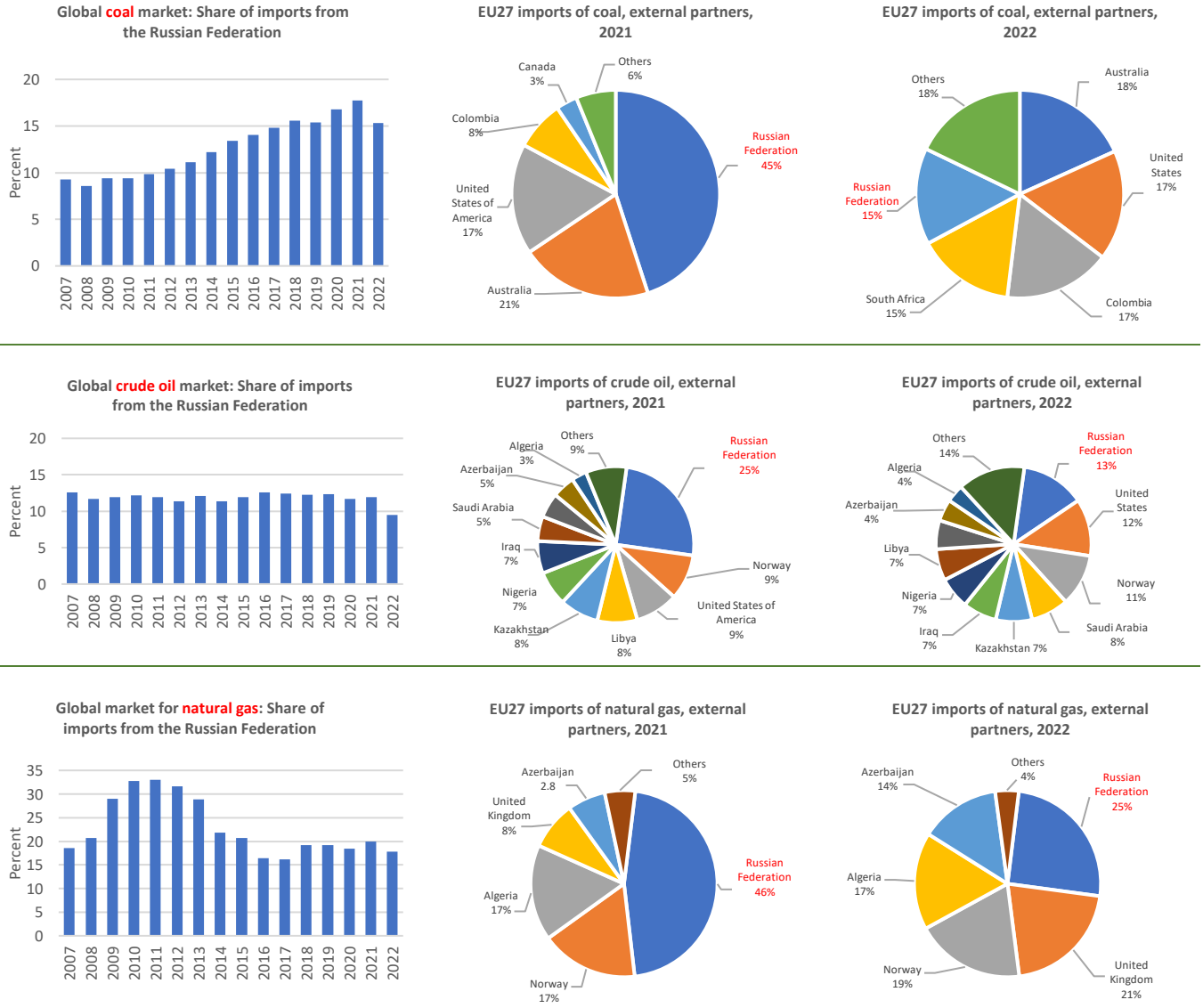
Pesticides are an exception, especially in sub-Saharan Africa (SSA), where volume effects invariably outweighed price effects, indicating that countries received more of the input at the same price. For sub-Saharan Africa, a plausible explanation for the buck in trend is the upsurge of desert locusts, resulting in international purchases of subsidized pesticides. No discernible global trend emerged for seeds, which constitute a minor cost in the import schedule of many countries.

2.9. Energy

The Russian Federation is a key player in the global energy market. In 2021, its shipments of coal, oil and gas accounted for, respectively, 18, 12 and 20 percent of global exports. Despite a decline in 2022, the shares remained relatively high and reached 15, 9 and 18 percent respectively. Russian energy exports were particularly important for the European Union, which in 2021 sourced, respectively, 45, 25 and 46 percent of its coal, oil and gas imports from the Russian Federation. The dependency of the European Union on energy imports from the Russian Federation decreased significantly in 2022 to 15, 15 and 25 percent respectively (Figure 30 A, B and C).

[36] For high and upper-middle-income countries, almost 55 percent of the increased IIB stems from higher fertilizer imports. This compares to 26 and 10 percent for lower-middle and low-income countries, where the increased IIB is dominated by energy imports.

FIGURE 30
Coal, crude oil and natural gas market



Source: Trade Data Monitor (TDM), FAO calculations

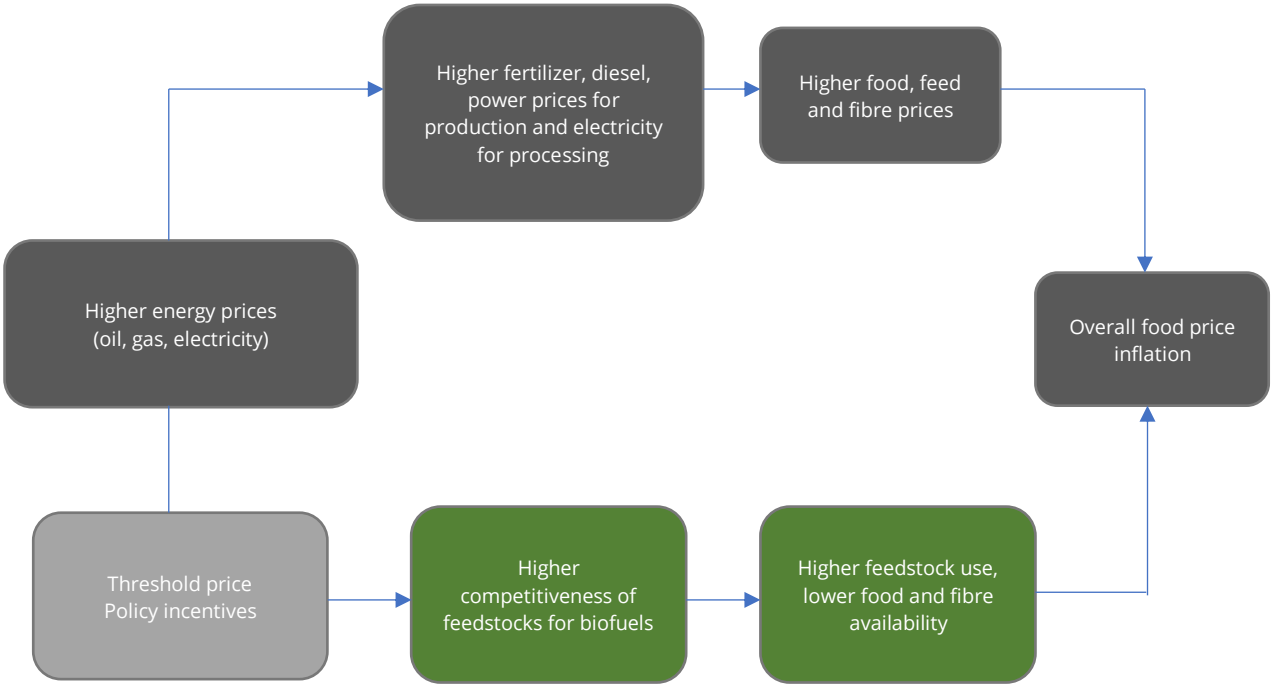
Two main links between energy and food markets can be identified. Either through input or output markets, as can be seen in Figure 31. With regard to the former, agriculture absorbs high amounts of energy either directly through fuel, gas and electricity use or, indirectly, using agri-chemicals such as fertilizers, pesticides and lubricants, all of which have large, embodied shares of energy.[37] Energy is also required to manufacture feed ingredients, such as the crushing of oilseeds to

[37] N-fertilizer, for instance, is the product of an energy-intensive process, known as Haber-Bosch synthesis, in which nitrogen and hydrogen are synthesized into ammonia. Ammonia, in turn, is processed into a variety of products, notably fertilizers such as urea and ammonium nitrate, which are then blended with other plant nutrients into compound fertilizers such as diammonium phosphate (DAP), monoammonium phosphate (MAP) or a variety of N-P-K fertilizers. The main energy feedstock for N-synthesis is natural gas, notably in Europe and North America. That said,

produce oil meals and the milling of grains to manufacture feedstuffs (pellets, flours, and compound materials). When it comes to food processing, the price of energy features heavily in the cost schedule. Globally, estimates of direct and indirect energy consumption vary widely across countries. In highly developed agricultural economies, they can exceed 30 percent for direct use and 15 percent for indirect consumption. These high shares mean that higher prices of these inputs will inevitably translate into increased production costs and eventually into higher food prices.

The second channel of transmission involves price linkages through the output side. In fact, the experience of the global food price crisis in 2007/08 shows that under scarcity, the diversion of food crops to non-food uses can also drive up food prices markedly. When energy prices rise, there is a threshold at which the production of biofuels from food crops, especially maize, sugar and oilseeds (vegetable oils) becomes competitive. Higher energy prices can make more and larger quantities of agricultural feedstocks competitive for conversion into energy and, given the large size of the energy market relative to the food market, can pull food prices up to their energy parity equivalents. The food price rise is capped again where agricultural feedstocks become so expensive that they can no longer compete in the energy market.

FIGURE 31
Energy and food markets tightly linked through input and output markets



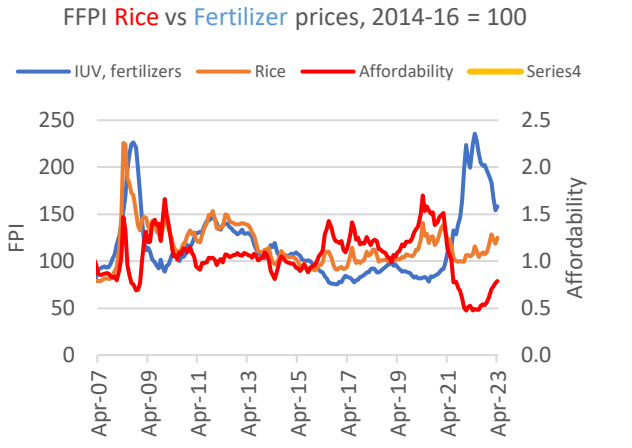
there is a wide variety of feedstocks used for the Haber-Bosch process ranging from coal to renewable energy sources. Ammonia is also used in numerous other industrial processes, all of which compete with the production of fertilizers. For instance, industrial grade ammonia is used as a liquid to reduce the amount of air pollution created by a diesel engine, which plays a pivotal role for the operation of cars, trucks, and tractors.

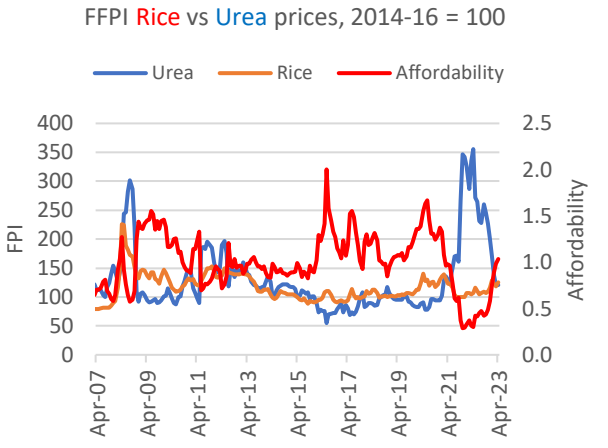
Price transmission through the input side

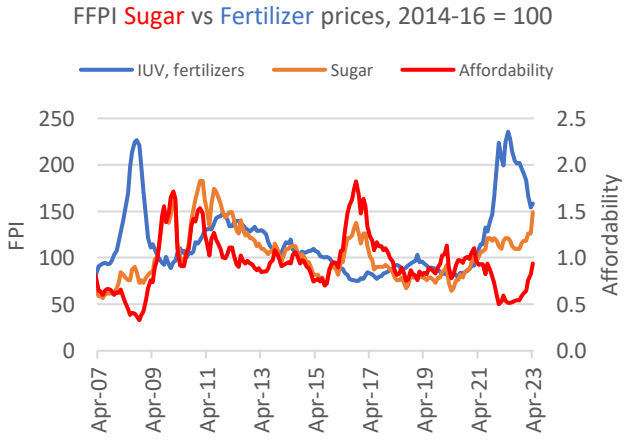
Prices of fertilizers started soaring in late 2021 and reached record levels after the outbreak of the war, resulting in lower affordability for farmers as they exceeded the price increases for outputs by a considerable margin. As can be seen, in Figures 32-35 this was the case both for agricultural products that were initially spared by the otherwise widespread price increases, such as rice and sugar, and for products for which an initial increase of prices was observed, such as maize and wheat.

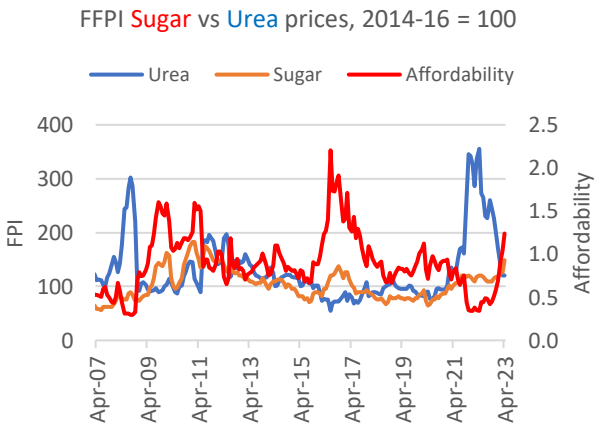
Lower levels of affordability could in turn result in lower input use, lower yields and compromised quality of crops in the following cropping season. That said, while much of 2022 was characterized by high and volatile prices of fertilizers, the decline of energy prices in the recent months resulted in significant reductions in fertilizer prices, in some cases more than 40 percent from the record highs reached in spring 2022, therefore resulting in increased affordability. However, fertilizer prices have remained almost twice their levels of two years ago and thus affordability and accessibility continue to be a serious concern. Global food markets are always subject to uncertainties and volatility, which relate to future developments in the energy market and fertilizer prices, weather conditions, geopolitical conflicts, macroeconomic prospects, and to changes in trade policies especially by the major exporting countries (e.g. use of export restrictions).

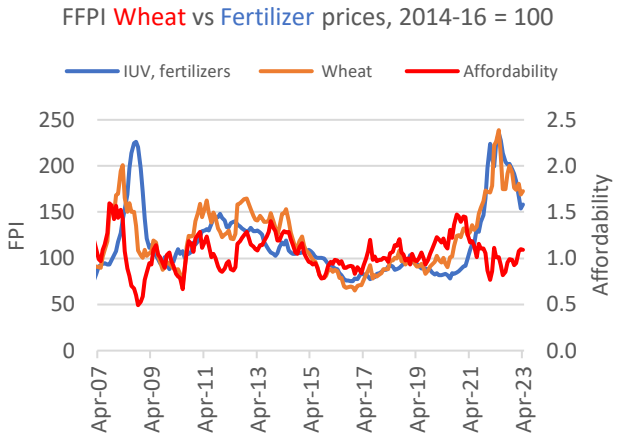
FIGURES 32-35
Relationship between agricultural commodities and fertilizer prices

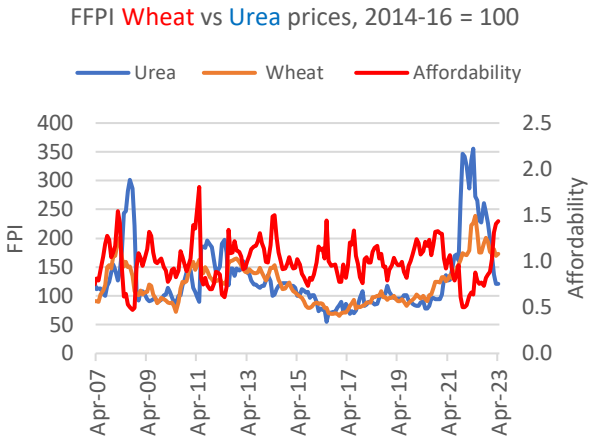


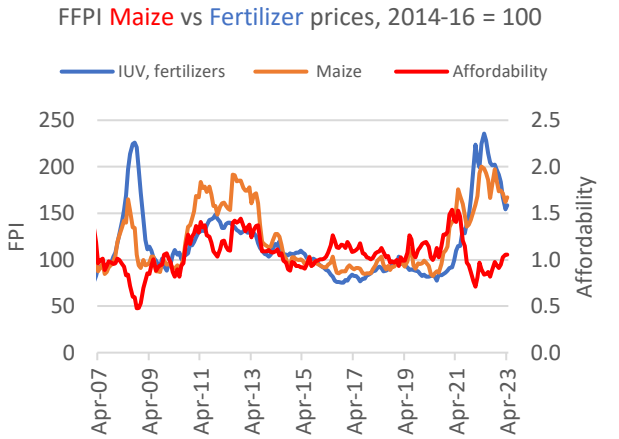


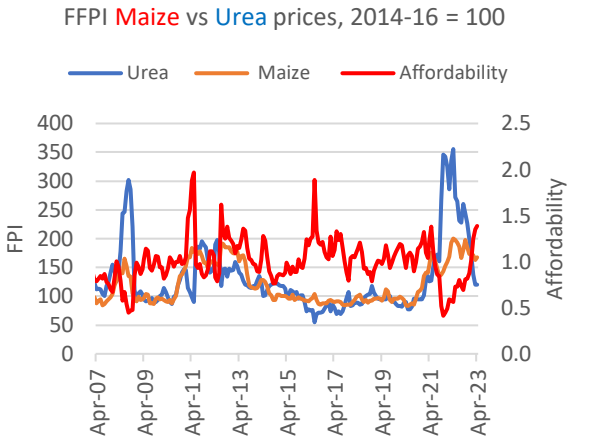












Source: Trade Data Monitor (TDM), FAO calculations

2.10. Macroeconomic aspects

The war in Ukraine has aggravated the macroeconomic challenges the world is facing. It triggered a shock, in particular to global food and energy markets, contributing to elevated food and energy prices and creating a lot of additional uncertainty, further aggravating food insecurity in many places in the world.

In June 2023, the World Bank released its latest Global Economic Prospects report[38], highlighting that the global economy remains in a precarious state amid the protracted effects of the overlapping negative shocks of the pandemic, the war in Ukraine, and the sharp tightening of monetary policy to contain high inflation.

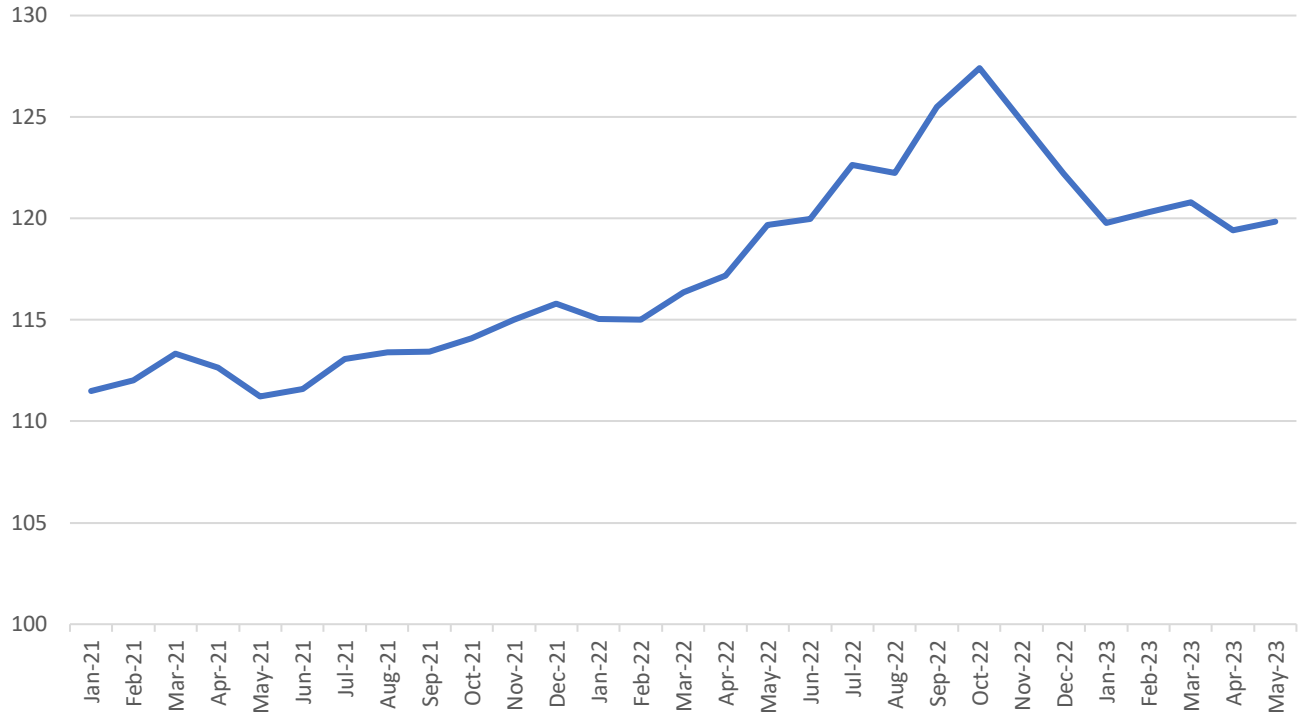
According to the report, global economy grew by 6 percent in 2021, however the estimated growth in 2022 is much lower, reaching 3.1 percent. Furthermore, the global economy is set to slow substantially in 2023, to 2.1 percent, amid continued monetary policy tightening to rein in high inflation, before a tepid recovery in 2024, to 2.4 percent. The aforementioned development of global growth are following that of the advanced economies. More specifically, the growth rate of the latter for 2022 is estimated to 2.6 percent, down from 5.4 in 2021. The forecasted growth for 2023 and 2024 is much lower, (0.7 and 1.2 respectively). In emerging markets and developing economies, the growth rate is estimated at 3.7 percent both in 2022 and forecasted to reach 4 percent in 2023 and 3.9 percent in 2024. For the Russian Federation, the report estimates negative growth rate of -2.1 percent in 2022 and forecasts growth rate of 1.2 percent in 2024.

[38] https://openknowledge.worldbank.org/server/api/core/bitstreams/6e892b75-2594-4901-a036-46d0dec1e753/content

Inflation remains a huge challenge globally, in particular for the most vulnerable. While food price inflation constitutes an important component of the soaring overall inflation rates, some signs of easing food inflation are being observed nevertheless not across all countries in the same way. For example, according to national sources, year-on year food price increases in the United States of America were 10.9 percent in October 2022 and 6.7 percent in May 2023. The respective rates were 15.5 percent and 13.7 percent in the Euro zone, 7.0 percent and 1.0 percent in China, 7.0 percent and 2.9 percent in India, and 6.76 percent and 4.27 percent in Indonesia.

As Figure 36 shows, the United States dollar has sharply strengthened since May 2021. The Nominal Broad Dollar[39] Index reached in October 2022 its highest level since 2006. Despite some decrease since then, it has remained significantly higher than its historic levels. This has added to the financial burden of many countries.

FIGURE 36
National Broad Dollar Index (January 2006=100)



Source: US Federal Reserve (https://www.federalreserve.gov/releases/h10/summary/jrxwtfb_nm.htm)

Increases in interest rates by the United States Federal Reserve Bank, aiming to control inflation, and the war in Ukraine have been important drivers behind the United States dollar appreciation. In particular, the surge of gas prices during the first months after the outbreak of the war significantly lowered the terms-of-trade of advanced economies, mainly the European Union, resulting in an appreciation of the United States dollar against their currencies. At the same time, many emerging economies were ahead in the global monetary tightening cycle, as such exchange-rate pressures for the average emerging market economy have been less severe.

Given the dominance of the United States dollar in international trade, its appreciation can have significant implications for many countries, in particular net importers of food and/or agricultural inputs. As reported earlier in this note, the global food import bill is forecast to increase further in 2023, though at a slower rate than in 2022 and 2021, and reach USD 1.98 trillion.

[39] The Nominal Broad Dollar Index is being calculated by the US Federal Reserve Bank and it measures changes in the value of the US Dollar against the currencies most used for US imports and exports, rather than rather than against all currencies.

Analysis done and presented in the latest edition of the Food Outlook[40] showed that with regard to the group of NFIDCs, for example, the real appreciation of the United States dollar meant that the increase in international cereal prices was generally much higher when prices were expressed in local currency terms. Over the period from June 2020 to May 2022, world wheat prices in real local currency terms rose, on average, by as much as 6 percentage points more than the increase in world wheat prices expressed in United States dollars. However, the sustained fall in world cereal prices, after reaching a peak in mid-2022, was not fully transmitted to NFIDCs in real domestic prices. Changes in real exchange rates are only one component of food import costs, which also include elements such as transportation, insurance, financing and other retailing fees. Increases in these costs constitute a burden, particularly on the poorest and most vulnerable people, with serious implications for their food security.

Agriculture is the backbone of the economy in many developing countries, the majority of which rely on the United States dollar for their borrowing needs. As the world experienced a second wave of the COVID-19 pandemic in 2021, the World Bank preliminary estimates included in the second edition of the 2022 Debt Report[41] indicate that the economic and social impacts of the pandemic added around USD 550 billion to the external debt obligations of low- and middle-income countries in 2021. As a consequence, the external debt stock of low- and middle-income countries rose by 6.9 percent in 2021 to USD 9.3 trillion.

The deployment of funds by multilateral creditors, such as the World Bank and the International Monetary Fund (IMF) can play an important role in offsetting the impact of the triple burden of high food prices, high agricultural inputs prices, and increased debt on the agricultural sector of developing countries. For example, countries benefiting from the "Food Shock Window" of the International Monetary Fund (IMF), a programme that was inspired by FAO's proposal for a Food Import Financing Facility (FIFF) in April 2022, include, *inter alia*, Haiti (USD 105 million), Guinea (USD 71 million), South Sudan (USD 113 million) and Malawi (USD 88 million).

2.11. Responses to global food insecurity since the start of the war

Emergency Food Assistance (WFP): The World Food Programme (WFP) reached a record 140 million people in 2022, a significant increase from the already record-high 128 million people reached in 2021. In 2022, contributions to WFP also reached a record USD 14 billion. WFP's efforts to respond to the increasing demand for food and nutrition assistance was complicated by the outbreak of the war in Ukraine, which resulted in a surge in emergency food assistance needs for Ukraine, higher operational costs from rising food and fuel prices, and reduced access to critical food supplies from Ukraine and the Russian Federation.

The overall financial resources allocated to humanitarian assistance increased over the years, but their growth rate did not keep pace with the growing needs. In 2021, the humanitarian assistance requested for the food sectors through the United Nations Appeals and Response Plans reached a record high of USD 16.8 billion. However, available humanitarian resources per person facing high levels of acute food insecurity decreased from USD 85 in 2018 to USD 51 in 2021. In 2021, only 47 percent of the financial resources needed to meet food security and nutrition needs were mobilized, compared to 70 percent in 2019. As the levels of acute food insecurity continue to climb due to compounded crises, a commensurate growth in funding will be needed to meet the additional need for food assistance.

Emergency Livelihood Assistance (FAO): In 2022, FAO assisted over 35 million people through emergency and resilience programming. FAO's largest ongoing humanitarian and resilience programmes are in Afghanistan, Somalia, Yemen, South Sudan, Sudan, Syria and the Democratic Republic of the Congo, countries that are also home to some of the largest populations in IPC AFI Phases 3 and above acute food insecurity.

In 2022, FAO received 54 percent of the USD 1.9 billion requested under the Humanitarian Response Plans. Yet, this share conceals an enormous imbalance of funds, with appeals for Afghanistan fully funded while those for Nigeria were only funded at 25 percent and those for the Syrian Arab Republic were barely over 10 percent of requirements. FAO has also been active in Ukraine in the context of the war, providing policy support and emergency assistance to maintain the productive capacity of the Ukrainian agricultural sector.

[40] https://www.fao.org/3/cc3020en/cc3020en.pdf
[41] https://thedocs.worldbank.org/en/doc/6e72b0ded996306fa01f5db7a0c38b19-0050052021/related/2022-Debt-Report-Edition-II.pdf

Measures taken by International Financial Institutions (IFIs)

World Bank: As part of a comprehensive, global response to the food security crisis, in May 2022 the World Bank announced that it is making available up to USD 30 billion over a period of 15 months, including USD 12 billion in new projects. World Bank support is expected to benefit 296 million people, targeting at least 50 percent women. From April through February 2023, the Bank has committed USD 16 billion, with over USD 12 billion from International Bank for Reconstruction and Development (IBRD) and the International Development Association (IDA), split between the crisis response at USD 6.1 billion and slightly more long-term resilience at USD 6.3 billion in order to address both the outcomes and the structural causes of the global food crisis. Since April 2022, disbursements from the World Bank's existing food security and nutrition portfolio have totaled USD 5.3 billion. Most of this support is in Africa, which is one of the regions hardest hit by food crises. The World Bank Group has active food security and nutrition interventions in 90 countries, including 22 of the 24 hunger hotspot countries identified in the September 2022 edition of the FAO-WFP Hunger Hotspots Report.

GAFSP: The Global Agriculture and Food Security Program (GAFSP) hosted by the World Bank launched its Seventh Call for Proposals as part of the global response to growing food insecurity. In March 2023, the Program allocated USD 220 million in new investment grants for 15 countries, which are expected to support countries overcome the food security crises and enable the long-term transformation of agrifood systems towards more resilience and sustainability. GAFSP will also allocate at least USD 45 million for the producer organization-led financing modality, for which the Call is ongoing and will close in July 2023.

IFAD: The International Fund for Agricultural Development (IFAD) is building on its experience in responding to the COVID-19 pandemic to design its response to the global impacts of the war in Ukraine. IFAD aims at protecting the development gains and livelihoods of poor rural households and producers within its projects, while reinforcing their resilience to this new shock, focusing on the poorest and most affected countries. IFAD is repurposing existing resources to the extent possible and is also launching a new Crisis Response Initiative (CRI). The CRI targets those most affected by the impacts of war in Ukraine, while already dealing with other shocks (e.g. COVID-19), weather extremities (e.g. droughts, floods, cyclones) and/or conflict. The CRI leverages IFAD's ability to respond to the crisis with speed by channeling additional grant resources through existing projects to countries where the impact of the crisis is most acutely felt by poor rural people and small-scale farmers, and where alternative funding sources are limited. By March 2023, IFAD raised about USD 52 million for interventions in 15 countries. The CRI was conceived as a time-bound response and is now being internalized within IFAD's portfolio.

AfDB: In May 2022, the African Development Bank (AfDB) launched a USD 1.5 billion Emergency Food Production Facility to help African countries avert a looming food crisis. The facility is designed to help African smallholder farmers' access high-quality seeds and fertilizers to boost production and fill the shortfall in Africa's food imports that was induced by the war in Ukraine. The initiative aims to reach 20 million farmers over four farming seasons. The Facility will also create a platform to advocate for critical policy reforms to solve the structural issues that impede farmers from receiving modern inputs. This includes strengthening national institutions overseeing input markets.

IDB: The Inter-American Development Bank (IDB) is supporting countries requesting assistance to broaden and deepen social programmes that target the food insecure, including through conditional and unconditional cash transfers, food vouchers, school meals, and other. Where relevant, the IDB will work to target support to women, minorities, migrants, and hard to reach populations in rural and urban areas. The IDB is engaged in dialogue with most countries in the region and is responding to specific requests as they arise. It is also providing policy assistance on markets and trade, financing to support food production, technical assistance on fertilizer use, and supporting projects to reduce dependency on chemical fertilizers.

ADB: The Asian Development Bank (ADB) is supporting social safety net programmes throughout the region, in cases partnering with WFP and FAO. Where possible, ADB is using trade finance guarantees to support imports of essential foods. It is also providing financial support to agribusinesses and agricultural value chains. ADB is working with countries to promote the efficient use of fertilizer. Climate-smart agriculture is being promoted as a key priority in the ADB climate action plan. In September 2022, the Asian Development Bank announced plans to provide at least USD 14 billion over 2022–2025 in a comprehensive programme of support to ease a worsening food crisis in Asia and the Pacific and improve long-term food security by strengthening food systems against the impacts of climate change and biodiversity loss. ADB's

assistance will seek to leverage an additional USD 5 billion in private sector co-financing for food security. The assistance expands ADB's already significant support for food security and nutrition in the region, where nearly 1.1 billion people lack healthy diets due to poverty and record-high food prices. The funding will be channeled through existing and new projects in sectors including farm inputs, food production and distribution, social protection, irrigation, and water resources management, as well as projects leveraging nature-based solutions.

EBRD: The European Bank for Reconstruction and Development (EBRD) is increasing the volume of trade finance commitments for Ukraine and neighboring countries, which includes agricultural inputs, agricultural commodities, and foodstuffs. It is also making infrastructure investments in grain storage and logistics, both in Ukraine and as part of the post-war reconstruction, and in importing countries of North Africa and the Middle East. EBRD is providing a loan to pioneer a green ammonia manufacturing facility in Egypt. When fully developed, the facility will use renewable energy to deliver up to 15,000 tonnes of green hydrogen annually. This, in turn, will be used as an input for the production of green ammonia to be sold on the Egyptian and international markets.

3. Forward-looking analysis of the risks related to the war

Recognising that a broad set of risks pertains to global agri-food production and trade, this section attends only to risks directly related or traceable to the ongoing war in Ukraine. Those are identified as production risks, trade and logistical risks, broader economic risks to world economy, and humanitarian risks. It does not discuss weather related risks, including the emerging El Niño phenomenon, which following three years of La Niña, needs careful monitoring as it can lead to significant impacts on the production of food commodities.[42]

3.1. Production risks in Ukraine and elsewhere, including Russian Federation

Since the start of the war, farmers in Ukraine have demonstrated remarkable resilience in maintaining production despite war-induced damages challenging the sector, although protracted active conflict on the east, and extensive economic and social impacts of the war, coupled with traditional weather related uncertainties, will continue to constrain the production potential, and impact farmers' production decisions in the future seasons.

Access to fields amidst ongoing demining across the country has complicated agricultural operations. The retreat of the active fighting to the eastern part of the country in April 2022 and moderate area gains in securing control since then necessitates systematic clearance of mines, unexploded ordnance and other remnants of the war. Although efforts are ongoing to demine areas and make them safe for cultivation, the area of the country exposed to the conflict and thus potential contamination is estimated to reach 25 million hectares. The government aims to return 470 000 hectares of land to productive use within 10 years. Additional mines might have been moved by the flood waters of Kakhovka dam destruction.

In late June 2023, FAO and the WFP launched a joint programme in collaboration with mine action partner Fondation Suisse de Déminage (FSD) to support smallholder farmers and rural families most affected by the war.[43] The programme has already started in Kharkivska oblast, and will later expand to Mykolaivska and Khersonska oblasts, focusing on farmers with land plots smaller than 300 hectares as well as rural families growing food for their own consumption. The programme is designed to safely release land back to productive use, including by clearing it from mines and other explosive remnants of the war, to help restore agricultural livelihoods, contribute to Ukraine's economic recovery, and phase out the need for humanitarian assistance for thousands of rural families.

Low profitability of farming, both as a result of high input costs and depressed farm gate prices, are influencing farmers' cropping decisions, and will impact future land allocation to different crops and consequently production. Despite below average domestic production in both 2022 and 2023 which could lend some support to farm gate prices, to remain competitive on the world markets, farmers are compensating for increased transportation and logistical costs from their

[42] Analysis of the El Niño can be found at https://www.fao.org/3/cc5749en/cc5749en.pdf
[43] https://www.fao.org/newsroom/detail/ukraine--fao-and-wfp-join-forces-to-clear-agricultural-land-from-remnants-of-the-war-and-help-farmers-resume-production/en

margins. Elevated inland road transportation costs, resulting from infrastructure damages, as well as increased train freight amidst higher demand for rail transportation, are borne by producers. Although inputs across most of Ukraine (in areas under government control) are available, low profitability of farming often deems them non accessible. The cost of harvesting and post-harvesting operations will also continue to impact production decisions, as already observed in autumn 2022 when farmers refrained from harvesting maize amidst energy blackouts and high energy prices necessary for drying the grain. If marketing of cereals a remains a challenge due to insufficient or economically uninteresting marketing opportunities, farmers are likely to allocate area to more profitable oilseeds. Further shifts to less costly crops, such as soybeans which do not require nitrogen fertiliser, are likely, as already observed in the planting of the 2023 crops. Eventually, should the related logistical challenges intensify, farmers might shift to even higher value products, such as spices, as observed in other conflict situations elsewhere in the world in the past.

The June 2023 destruction of the Kakhovka dam (described in the Annex), although with relatively contained short term impacts, has long term environmental and economic impacts. In terms of longer term environmental impacts, flood waters washed away topsoil, moved sediments from the reservoir and other water bodies, altering soil composition. Although the scale of the contamination is yet to be assessed, 150 tonnes of machine oil was washed into the Dnipro river from the Kakhovka Hydroelectric Power Plant itself, and there was a risk of further leakage of more than 300 tonnes. Contamination is likely to have longer term impacts on the soil fertility, availability of drinking water for people and livestock, biodiversity, and overall ecosystem in the lower part of the Dnipro river.

While immediate damages for landowners and workers have significant impacts on livelihoods further eroding resilience of the agricultural sector and rural households, long term damages stemming from the disruption in the irrigation system raise concerns about the viability of the agricultural sector in the affected area. As a result of the dam destruction, the ability of farmers to irrigate crops in the southern part of the country has been seriously curtailed. Damages to state property of reclamation systems and canals as a result of the destruction of the Kakhovka HPP are estimated at UAH 150-160 billion (corresponding to USD 4 to 4.3 billion).

In the long term, the use of irrigation systems will remain constrained, unless the water in the reservoir increases to levels which make pumping feasible. The breach of the dam left 94 percent of irrigation systems in Kherson, 74 percent in Zaporizhzhia and 30 percent in Dnipropetrovsk regions without a water source, affecting future agricultural activities in the region. Analysis of satellite images indicate that most irrigation canals are disconnected from the reservoir (or what remained from it), and it is likely that the pumping equipment was damaged by flood waters. Making the reservoir functional again will require at least temporary repairs to the structure in order to lift the water level.

Rainfall is unlikely to provide sufficient and timely distributed amounts for reliable agricultural production and lack of irrigation carries risks of increased production volatility in the region. Failed reservoir also increases risks of seasonal floods, particularly in the spring period following the snow melt. Should the disruption in the irrigation last several seasons, immediate restart of the production following the repairs of the irrigation system is unlikely, as soil salinity might have increased in the meantime.

Lack of irrigation, prompting changes in the cropping patterns or even causing land abandonment in some areas, could increase soil erosion with cascading environmental and social effects. Significant changes in production will have impacts on rural livelihoods, infrastructure, market access, and overall fabric of rural areas which in the past relied on the reservoir.

Restricted livelihood opportunities could contribute to increased migration. Directly, food security outcomes of rural population which heavily relies on backyard gardening and small scale food production for dietary diversity, calorie intake, and income generation, is likely to be affected.

Although it is not foreseen that the loss of previously irrigated crops in the southern part of Ukraine would have a significant impact on the world markets, the actual impact will depend on developments in other main producing countries.

Elsewhere in the world, concerns about access to fertilisers have prompted some adjustments to the cropping patterns. Although anecdotal, there is evidence that farmers across the world (including in less traditional producers, such as South Africa) are switching to less fertiliser intensive crops such as soybeans with potential longer term implications for availability of cereal and other crops.

Although the agricultural sector in the Russian Federation has not reported major challenges, difficulties with financial transactions still could directly or indirectly result in economic losses for the agricultural sector, and impact production decision. Loss of markets has not proved to be significant but constrained access to financial services needed to complete international transactions and secure not yet substitutable inputs could have consequences. Russian agriculture includes a large number of input-intensive, large-scale farms, specialized in supplying international markets with basic food commodities such as wheat and maize. The production of these crops is characterized by high application levels of domestically supplied fertilizers, as well as of imported seeds and pesticides.

The sector is trying to increase domestic seed production, and decrease reliance of imported inputs, setting up longer term strategies. Lack of formally reported trade data challenges the analysis to what degree this process has already happened. However, it is likely that the importers of agricultural inputs have switched origins as older stocks have run out, and are now importing larger amounts of generically equivalent products from countries not subscribing to the economic sanctions. One of the conditions voiced in March 2023 by the Russian Federation as a prerequisite for the renewal of the BSGI was resumption of supplies to the Russian Federation, including agricultural machinery and spare parts, indicating a potential susceptibility in the supply chain.

3.2. Trade risks related to logistical concerns impacting exports from both Ukraine and Russian Federation

Considering the significant role Ukraine still plays on the global commodity markets despite impact of the war, lack of economically interesting marketing channels in the near future could have implications on the supply availability on international markets, as well as on the earlier mentioned profitability of farmers.

As of late June 2023, the prospects for extension of the BSGI remain highly uncertain. Despite different expiration dates of the "Black Sea Grain Initiative" (120 days) and the "Memorandum of Understanding between the Russian Federation and the Secretariat of the United Nations on promoting Russian food products and fertilizers to the world markets" (in effect for a period of three years), the demands during the renewal process of an earlier extension highlighted the need to treat both Istanbul agreements as a bundle. In March 2023, the Russian Federation communicated a list of demands for the extension of the BSGI. These included connecting the Russian Agricultural Bank (*Rosselkhozbank*) to the SWIFT payment system from which Russian banks were disconnected in June 2022; resumption of ammonia exports from Togliatti in the Russian Federation to Pivdenniy (Yuzhnij) port in Ukraine, capable of transporting 2.5 million of tonnes of ammonia annually in the world's longest ammonia pipeline; resumption of supplies to the Russian Federation of agricultural machinery and spare parts; lifting restrictions on insurance and access to ports for Russian ships and cargo; and unblocking accounts and financial activities of Russian fertilizer companies.[44]

Various proposals have been made to satisfy the demands, including processing payments for grain exports via a commercial bank (JPMorgan Chase) with reassurances from the United States government, and a collaboration with African Export-Import Bank to create a platform to process transactions for exports of grain and fertilisers from the Russian Federation to Africa.

Until early June 2023, the ammonia pipeline was not operational, but not damaged. Reports indicate that in early June, the pipeline was damaged in the Kharkiv region, although the extent of damages remains unclear. Out of three Ukrainian ports included in the initiative, effectively only 2 have been used, as the Russian Federation blocked vessels from entering the Yuzhnyj/Pivdenniy port until the resumption of the ammonia exports. In May 2023, only 3 vessels were allowed to load in the Yuzhnyj/Pivdenniy port, and none in June 2023. At the height, in October 2022, 51 vessels were loaded there. In addition, Togliattiazot revealed plans to open Russia's first ammonia export terminal on the Kerch Strait in Taman, Krasnodar Region, by the end of 2023 to compensate for the decline in pumping volume through the Togliatti-Odessa pipeline.[45]

While the BSGI was extended in a last minute arrangement in the past, considering the approval and inspection process in which four parties are involved, smooth implementation is no guarantee as indicated by the decreasing number of vessel inspections per day since May 2023.

[44] https://www.reuters.com/world/europe/what-is-russias-problem-with-black-sea-grain-deal-2023-06-16/
[45] https://tass.com/economy/1634835

The current expiration of the BSGI on 17 July 2023 coincides with the peak of the wheat harvest in Ukraine. New wheat crop is normally shipped from September onwards. While the volumes shipped through the Black Sea corridor declined recently, 1.8 million tonnes shipped in June (until June 27) 2023 does improve the overall capacity.

Should the BSGI not be extended beyond July 2023, despite damages on the storage infrastructure, there should be enough storage for the new crop of winter wheat and rapeseed in Ukraine. Sufficient availability of storage for spring planted crops (maize and sunflower) depends on the export volumes using non-maritime channels – and policies which guide them.

In June 2023, the European Council approved an extension of the duty-free import regime for Ukrainian products for another year, while the import ban of Ukrainian wheat, maize, rapeseed, and sunflower seed by five member states (Poland, Slovakia, Hungary, Romania and Bulgaria) was extended until 15 September. Transit of agricultural products via five EU Member states remains allowed. However, administrative and logistical hurdles to ensure transport to the rest of the EU and further might discourage broader utilisation of the initiative. More transparency and predictability are desired, keeping in mind interest of both farmers' and consumers' groups.

In the past, navigation along the recently destroyed Kakhovka reservoir played a significant role in transporting agricultural products. The proximity of active frontline constrained its use recently, leading to further increases in inland shipping costs.

Ukraine policies: Although at the moment only a few policies restricting exports from Ukraine remain in place, depending on the available supplies on the domestic market, additional policies could be introduced to ensure sufficient supplies. On 5 March 2022, the Government of Ukraine introduced zero quotas for exports subject to licensing of maize, oats, buckwheat, millet, sugar, and salt suitable for human consumption. With the exception of buckwheat and salt, zero quotas were lifted by September 2022, while export licensing remains in place for meat, eggs, millet, sugar, oats and rye. In the near future, introduction of trade restrictive policies in order to protect sufficient supplies on the domestic markets is unlikely – but cannot be ruled out in a more distant future should domestic production decrease significantly and there are no sufficient supplies covering domestic needs.

While exports of food and fertilizer from Russian Federation are not subject to Western sanctions imposed after the outbreak of the war in Ukraine in February 2022, the exporting party has raised concerns that restrictions on payments, logistics and insurance have constrained shipments. As official trade data are scarce, and analysis of mirror trade does not capture all trading parties, an accurate assessment of the claim cannot be made. However, anecdotal evidence indicate that aggregate exports from the Russian Federation have not decreased.

3.3. Broader impact on the world economy

The slow growth rate in several parts of the world, combined with the elevated prices, may affect global demand for agrifood products, with negative consequences for food security and nutrition in many parts of the world. Lower economic growth will likely also reduce the availability of funds for development. At the same time, although inflation has declined as central banks have raised interest rates and food, and energy prices have come down, underlying price pressures remain in many countries. Debt levels remain high, limiting countries' capacities to respond, the war in Ukraine continues and also do other geopolitical tensions and extreme weather events are becoming more frequent.

Given the dominance of the United States dollar in international trade, its appreciation may have implications for many countries and negatively affect in particular developing countries that rely on their agrifood sectors. Furthermore, in addition to increasing food import bills, high international food commodity prices make sourcing of food assistance to those most in need across the globe more expensive. Therefore, securing food supplies from relatively more affordable destinations (including shipping costs) is crucial to maintain a certain degree of fiscal balance.

At the same time, despite the recent declines in prices of fertilizers and energy-intensive products, they remain well above their historical levels. Higher input prices could translate into higher production costs and thus to pressures for higher food prices. They can also lead to lower use of inputs, lower yields and finally lower harvests, which also constitutes a factor that can threaten food security, in particular of the most vulnerable. Higher energy prices could also make agricultural feedstocks more attractive for the production of bioenergy, something that could also raise food prices up.

On the other hand, energy production, including from renewable sources, could become more attractive and accelerate in many countries, eventually easing international fertilizer prices and consequently food prices.

Beyond the fiscal pressure on countries, high food prices negatively impact populations with low incomes (including pensioners) in both developed and developing countries, as these groups spend a larger share of their incomes on food. To cope with high food prices, these groups may be compelled to cut other essential expenses, such as schooling, energy, heating or medicines, or to engage in negative coping strategies including skipping meals, and/or purchasing cheaper but less nutritious alternatives. In extreme cases, decreasing purchasing power of population might enhance social frustration, which is likely to result in unrest.

3.4. Humanitarian risks (related to broader impact on the world economy)

In Ukraine, despite the already ongoing rebuilding and reconstruction efforts, as a result of the war and decreased economic opportunities, humanitarian risks remain rampant. While the current situation may persist and even become aggravated, the coping capacity of rural households is likely to remain strained. With damages to the energy infrastructure across the country and water infrastructure in the southern part of the country as a result of the Kakhovka dam destruction, humanitarian needs are increasing. Needs are usually compounded in the winter season, which – depending on the state of energy infrastructure – could further displace a large segment of the population toward the rural areas as energy shortages affect mostly urban centres.

Although agricultural rural households tend not to be self-sufficient in food, those affected by the Kakhovka dam flooding and consequent lack of irrigation, are likely to experience difficulties in restarting their production due to decimated resilience capacity.

Elsewhere in the world, conflict, economic shocks, and extreme weather events are increasing humanitarian needs. While global food commodity prices have eased since their peaks, funding shortfalls and rising operational costs have reduced humanitarian assistance across many countries. Without additional funding, humanitarian assistance is likely to be further reduced across the board.

4. Summary and policy recommendations

The war in Ukraine has fully engulfed two of the most important agricultural commodity producing and exporting countries at a time of already high and volatile international food and agricultural input prices. This has raised significant concerns over its potential adverse impacts on food security, both domestically and internationally. With the outbreak of the conflict, it was anticipated that the war would directly affect agricultural production in both countries, which coupled with the impact on economic activity and rising prices, could undercut the purchasing power of local populations. Globally, because of the impacts on food exports by these two countries, the war exerted additional upward pressure on international food commodity prices to the detriment of LIFDCs, in particular. From the beginning of the war, and with the objective to minimize the negative impacts on world markets and global food security, FAO has put forward a set of policy recommendations.

1. **Keep trade in food and fertilizers open**

   Open markets and trade helps prevent the war from negatively affecting productive and marketing activities in both countries in order to enable them to meet domestic production and consumption needs, while also satisfying global demands. To ensure that supply chains continue to function properly or resume operations swiftly, such efforts should include steps to protect productive assets, including standing crops, livestock, inputs and machinery, from damages or any war-induced disruption. This must also extend to food processing infrastructure, such as grain mills and oilseed crushing facilities, as well as ancillary storage, transportation and distribution systems.

2. **Find new and more diverse food supplies**

   Countries that rely heavily on world markets and food imports to meet their consumption needs should diversify their food import sources and identify various exporters for their purchases to absorb shocks and remain resilient. By resorting to various sources of supply, countries become less vulnerable to place-specific shocks.

Greater resilience can also be achieved by relying on existing food stocks and by enhancing the diversity of domestic production to ensure the supply of food that is nutritious and necessary for healthy diets.

3. Avoid ad hoc policy reactions

Measures put place in countries affected by potential disruptions ensuing from the war must be carefully weighed against their potentially damaging effects on international markets in both the short and long term. For instance, while reductions in import tariffs and/or the use of export restrictions could help improve availability in domestic markets in the short term, they would inevitably add to the upward price pressure on international markets and exacerbate the situation globally. Ad hoc policy measures and trade policies must always be avoided.

4. Strengthen market transparency and dialogue

Global market transparency plays a key role when agricultural commodity markets are under uncertainty and need to adjust to shocks affecting supply and demand. Initiatives like the Agricultural Market Information System (AMIS) strive to increase such transparency through the provision of objective, timely and up-to-date market assessments that enable informed policy decisions. Through its Rapid Response Forum, AMIS also provides a unique platform for policy dialogue and coordination among members, which include the Russian Federation and Ukraine. Policy dialogue and coordination are necessary to minimize disruptions and ensure that international markets continue to function properly and that trade flows efficiently to meet global demand and safeguard food security.

5. Support internally displaced people, refugees and those directly affected by the war in Ukraine

Until the start of the war, Ukraine's social protection system was covering 73 percent of the population with at least one benefit.[46] After the escalation of the conflict in February 2022, the social protection system has remained largely functioning. The government of Ukraine has continued to make payments to beneficiaries' bank accounts[47]regardless of their ability to actually claim the benefit, by setting up a system of centralised accrual for those living in Russian-controlled territories[48]. The population in need of social protection support remains large and reaching them is difficult due to security risks and mobility – within and beyond national borders. To maintain and further strengthen the delivery of assistance through the national social protection system in Ukraine and in neighboring countries, the following steps should be taken: i) maintain efforts by external development and humanitarian actors to piggyback on social registries including Ukraine's Unified Social Information System to route humanitarian aid to vulnerable population groups; ii) ensure access to payments for people without bank accounts and for citizens living in Russian-controlled territories; iii) continue to ensure access to social protection systems and decent jobs within host countries for refugees; iv) assess how existing social protection programmes or new ones are actually reaching the poor and most vulnerable women and men, girls and boys, taking into account their specificities; v) build policy links between the social protection system and local agricultural sector in the countries receiving refuges and with relevant sectors mandated to work with socio-economic integration; and vi) in Ukraine, align social protection programmes with short-term jobs and skills development programmes to help develop and rehabilitate destroyed production assets.

6. Support the most vulnerable population groups

It is critical to provide the necessary support to the most vulnerable population groups through various actions: i) identifying and addressing the specific needs of women, men, girls and boys in vulnerable situations and from different marginalized and vulnerable groups; ii) setting up advisory and financial services targeted to women and youth to support their business opportunities in value chains that are still operational, and increase their resilience capacities; iii) monitoring prices and food security outcomes of groups that were already vulnerable before the war, as well as groups pushed into hunger and poverty by deteriorating economic conditions resulting from the war and the respective increase in prices, in both urban and rural areas; iii) linking monitoring and early

[46] ILO. 2022. Social Protection Platform. In: *World Social Protection Database, based on SSI; ISSA/SSA, Social Security Programs Throughout the World; ILOSTAT, ECLAC, IMF, WHO, WB, UNDP, UNICEF, completed with national data sources.* Cited 26 September 2022. https://www.social-protection.org/gimi/gess/ShowCountryProfile.action?iso=UA

[47] https://www.msp.gov.ua/news/21511.html

[48] Ministry of Social Policy of Ukraine. (msp.gov.ua)

warning to anticipatory action to avert forecast deteriorations and mitigate the impacts of the war and other shocks on vulnerable people; and iv) providing timely, gender-responsive and well-targeted social protection interventions to alleviate the hardship caused by the war on affected local populations and to foster a recovery from it, taking into account the specific needs of men and women belonging to different age, socio-economic and ethnic groups.

7. **Ensure prevention and control of animal diseases in line with One Health approach**

   The FAO Emergency Management Centre (EMC) is committed to facilitate the coordination of emergencies affecting animal health with severe impacts on food security and livelihoods, in line with the One Health approach and in accordance with existing global mechanisms, such as the FAO-WOAH Global Framework for the Progressive Control of Transboundary Animal Diseases (GF-TADs). Due to the critical and volatile situation in Ukraine, which is highly unpredictable and most likely to endure for a long time, an incident coordination group (ICG) was established. The overall objective of the ICG is to coordinate and harmonize the activities of the various stakeholders and partners to identify and address critical needs, while considering the national and regional impacts of animal health threats, as well as their impact on food security, livelihoods and trade. Up to 25 November 2022, four ICG meetings were held with the participation of FAO Emergency Centre for Transboundary Animal Diseases (ECTAD), Emergency Prevention System for Transboundary Animal and Plant Pests and Diseases (EMPRES), Office of Emergencies and Resilience Global Programme Support Team (OER), FAO regional and national offices, WOAH global and regional Preparedness and Resilience Department, Regional Activities Department and Regional and Sub-Regional representatives and GF-TADs Europe, National authorities (acting CVO Ukraine), EU, USAID, WHO, IAEA, EFSA, FVE and other partners.

5. FAO Policy proposals

Further to the policy recommendations, FAO has developed a number of concrete and implementable policy proposals to address the global food security challenges and the risks associated with the war.

1. **Ukraine Response Programme (January-December 2023).** FAO's overarching priority is to protect the food security and livelihoods of rural households while also sustaining Ukraine's food system. Within the framework of the Rapid Response Programme 2023, FAO aims to provide 500 000 rural households with critical agricultural inputs to boost household level food production, generate household income and revive local economies to protect the food security and livelihoods of conflict-affected rural communities. Strengthening the resilience of rural households will also support their contribution to the country's broader food systems. In addition, FAO will assist small and medium sized agricultural producers in priority conflict-affected areas, particularly newly accessible areas. Producers will receive seeds and other essential agricultural inputs and temporary energy solutions to enable them to sustain production and facilitate a ripple effect along value chains, both within and between local communities and regions. Support to small and medium-sized producers across the agriculture sector will prevent the further deterioration of national agrifood systems until the cessation of hostilities. Finally, FAO is also supporting the restoration of critical agrifood systems services, such as improving and sustaining grain quality, addressing technical challenges related to overland transportation, facilitating the export of grain for distribution and marketing in highly food insecure countries, as well as the relocation of the National Gene Bank of Plants of Ukraine from its vulnerable location in Kharkiv to safer sites in Lviv, to protect this critical repository of plant genetic materials.[49]

2. Inspired by FAO's **Food Import Financing Facility (FIFF)** proposal, the IMF Executive Board approved on 30 September 2022 a new, temporary **Food Shock Window (FSW)** under its emergency financing instruments (Rapid Credit Facility-RCF and Rapid Financing Instrument-RFI). The Food Shock Window will provide, for a period of 12 months, a new channel for emergency financing to member countries that have urgent balance-of-payment needs associated with acute food insecurity and experience a sharp increase in their import bill due to rising costs of cereal and fertilizer imports, or a shock to their cereal exports. This new channel for emergency financing is specifically targeted at the food crisis and safeguards the financial space available for emergency financing under other windows. The IMF's preliminary assessment is that around 50 countries would meet the

[49] https://www.fao.org/documents/card/en/c/cc4655en

qualification criterion of either acute food insecurity, a negative import price shock of at least 0.3 percent of GDP, or a qualifying export shock, though not all of these would ultimately draw on this emergency credit window. By March 2023, six countries have accessed additional financial resources through this emergency financing window.

3. **Strengthening social protection for food security and nutrition** across all countries affected by the ripple effects. Humanitarian responses should, where possible, be channelled through social protection systems to better reach the most vulnerable. These interventions are needed to cushion the negative impact of these developments on the food security and nutritional status of Ukrainians affected by the war, particularly ahead of the winter season, as well as of nutritionally vulnerable groups in food-importing countries, particularly in North, East and West Africa, as well as countries in West and Central Asia traditionally dependent on remittances from Russia. Given the multiple ramifications of the war, FAO has identified three main ways in which social protection can help address the current crisis and its aftermath. They consist of measures geared toward: i) Enhancing the capacity of Ukraine's social protection system to respond to the crisis and help rebuild rural/agricultural livelihoods after the war; ii) Strengthening social protection systems in neighbouring host countries to cater to the needs of refugees from Ukraine and support the socio-economic integration in the host communities, in coordination with agricultural sector actors; and iii) Responding to increases in food and fertilizer prices in net food-importing countries and the reduction of remittances in Central Asia. All these interventions must be gender-responsive and ensure that older people and people living with disabilities have access to appropriate assistance.

4. **Assessing investment needs in Ukraine's agricultural reconstruction and recovery** and work with International Financial Institutions. While the war in Ukraine is ongoing and its outcome remains unclear, the damage to the country's agrifood sector is already of an unprecedented scale. With the war-induced damage to the agriculture sector in Ukraine estimated at USD 8.72 billion (excluding irrigation and water, forestry and fisheries) and the aggregate losses totalling USD 40.2 billion (as of 24 February 2023[50]), the total reconstruction and recovery needs were estimated at USD 29.7 billion over a ten-year period, including USD 10.2 billion in the short-term (2023-2026) and USD 19.5 billion in the medium term (2027-2033). The most pressing investments include rebuilding the damaged assets, helping agriculture recover by addressing liquidity (especially for smaller farms), investing in resilience to climate change and in integrated food-energy systems, and strengthening the agricultural public institutions to effectively support recovery and reconstruction. While it is early to consider developing investment plans, considering the extent of the war and its impact on a complex food system such as the one in Ukraine, a post-war recovery plan for Ukrainian agriculture will also need to account for future domestic demand, export market access and food processing, storage and logistics.

5. **Addressing animal health.** The war has caused disruptions to the normal animal health services, surveillance and control, resulting in delayed recognition of, and response to, important animal diseases. Large numbers of abandoned animals might contribute to transmission and spread of the disease. The most significant disease risks pertain to African swine fever (ASF), highly pathogenic avian influenza (HPAI), rabies and leptospirosis as well as food borne zoonotic diseases (i.e. brucellosis, salmonellosis). The initiative aims to address the risk of disease spread in Ukraine and neighbouring countries, which needs to be re-evaluated to apply coordinated and targeted, risk based control measures. Recommended actions include the establishment of a multi-disciplinary panel of experts to work on risk evaluation and monitoring of the situation jointly with the Government of Ukraine, setting up a system of collection information on the problems and issues related to animal production and health, enhancing disease reporting and detection through appropriate surveillance methods, evaluating the risk of transmission and spread of diseases into neighbouring countries, activating early warning systems applying the One health approach, provision of vaccine against rabies and related equipment, and a risk communication campaign to all stakeholders and the general public on risk of emergence and spread of transboundary diseases including zoonosis.

6. Promoting efficient use of fertilizers. Farmers can use fertilizers more efficiently to deal with the rapid increases in fertilizer prices. **FAO proposes the use of soil nutrient maps** to achieve this end. Ethiopian producers have successfully used soil maps to identify the best blending of N, P and K fertilizers for their plots, cutting the use of

[50] https://documents1.worldbank.org/curated/en/099184503212328877/pdf/P1801740d1177f03c0ab180057556615497.pdf

fertilizers while optimizing yields. This approach should be adopted by all countries. Detailed information on the soil profile and its spatial distribution is essential for promoting sustainable agriculture, with precise inputs in quantity, space and time. In particular, accurate and updated soil attributes allow for better and more efficient fertility management, benefiting crop productivity and sustainability and at the same time reduce the quantity of fertilizers being used. The proposed initiative looks to establish a self-sustaining, government-managed national soil database to become a public good to be used by public policies, private sector and farmers. The goal is to publish the country's total land mass for which soil information is available. It also aimed to provide accurate soil management information system and advice to smallholder farmers to enhance efficiency and crop productivity and yields. FAO has also developed a **Fertilizer Trade Tracker**, an online tool which allows countries to gauge remaining import needs and/or unrealized export availabilities for the current crop and calendar year. The estimates distinguish between the main nutrients (N, P and K), and the results are updated on a monthly basis. In response to rising import prices and growing difficulties in accessing international fertilizer markets, FAO has developed a methodology to prioritize the allocation of international fertilizer supplies to African countries.

7. **Reducing Food Loss and Waste (FLW).** We must reduce food loss and waste. Currently the high amounts of food loss and waste could feed around 1.26 billion people per year, and results in a huge negative impact on the environment. If we reduce food loss and waste by 50%, there would be sufficient fruits and vegetables available in the food supply to cover the recommended amount of 400 grams per person per day and as a result increase the resilience of our agrifood systems. This proposal has therefore the overarching objective to create the evidence base using the methodology developed by the FAO for measuring and monitoring progress against SDG target 12.3 and formulate recommendations for policy- and decision-making in line with the 2019 edition of FAO's flagship report *The State of Food and Agriculture* (SOFA) guiding principle to find solutions for reducing food loss and waste. The expected impact is that countries take informed decisions on loss and waste reduction interventions to structurally reduce the level of food losses and waste of key commodities and ultimately improve the efficiency of their main supply chains as well as the food security of selected population groups, and to create new jobs opportunities while tackling this issues.

Annex

THE KAKHOVKA RESERVOIR: AN IMPORTANT SOURCE OF WATER FOR ARID REGIONS

The Kakhovka Hydroelectric Power Plant (HPP), located near the city of Nova Kakhovka in the Kherson region in the southern part of Ukraine, was the last one in the series of six dams in the cascade of Dnipro HPPs, including also Kyiv, Kaniv, Kremenchuk, Kamianske, and Dnipro. The construction of the cascade bridged over half a century, forming an important nexus for ecological and economic systems in the region.

Source: Planet and NASA Harvest, May 2023.

The Kakhovka dam, stretching 3.2 kilometres, ensured annual regulation of the flow of the Dnipro river for power generation, irrigation and water supply to Kherson, Mykolaiv, Zaporizhzhia, and Dnipropetrovsk, four southern arid regions. It also facilitated navigation between Kherson to Zaporizhzhia. The reservoir held an estimated 18 cubic kilometres of water. The HPP supplied 0.7 percent of Ukraine's overall energy balance in 2021.[51] While its overall contribution to energy generation was small, the HPP acted as a regional stabiliser during the peak load regulation. The reservoir provided water for the essential cooling of the six reactors at Zaporizhzhia nuclear power plant as well as of spent fuel and emergency diesel generators that have had to be used repeatedly when external power fails. Since the start of the war in February 2022, the control of the plant was not with the Ukrainian government, and since October, the HPP was not producing electricity for the United Energy System of Ukraine.

Following the completion of the Kakhovka reservoir in 1956, and its network of the irrigation canals later, creating the largest irrigation system in Europe, drought-prone southern steppes , became an important and reliable producing region. Kakhovka and North Crimea canals are the most significant ones, with Kakhovka (sometimes referred to as South Ukrainian) Canal irrigating 326 000 hectares in Kherson and parts of Zaporizhzhia. The North Crimean Canal irrigated 39 700 hectares of agricultural land. Dnipro-Kryvyi Rih Canal supplied the Dnipropetrovsk region, while the Verkhnio-Hachynsky Canal supplied the northern Zaporizhzhia region.

The reservoir provided water supply to 31 irrigation systems consisting in total of over 12 000 km of canals in Dnipropetrovsk, Kherson and Zaporizhzhia regions. In 2021 – prior to the start of the war in February 2022 – the reservoir provided irrigation for 584 000 hectares on both sides of the Dnipro river from which about 4 million tonnes of grain and oilseeds were harvested. Irrigation tends to be used more on spring and summer crops, utilising water accumulated in the reservoir from melted snow. Although crops in the Mykolajev region were not directly irrigated from the Kakhovka reservoir, they take advantage of good soil humidity benefits due to the close proximity of the reservoir. In 2023, 13 irrigation systems were operational on the right bank of the Dnipro river, area under control of Ukraine.

Although not all cereal and oilseed crops were irrigated, the regions of Kherson, Zaporizhzhia and Mykolajev were significant producers of wheat, barley, millet (relatively small quantities), rapeseeds and sunflower. Before the start of the war, Kherson, Zaporizhzhia and Dnipropetrovsk region accounted for about 20 percent of the country's wheat and barley production, and about 18 percent of rapeseed production. Maize and soybeans crops, planted in spring, are normally irrigated, while sunflower – also planted in spring – is usually grown as rainfed. Southern regions also produced a significant share of fruits and vegetables, including grapes, eggplants, onions, peppers and cucumbers, all entirely irrigated.

[51] The average output of the Kakhovka HPP before the start of the war reached 1.5 - 2 billion kWh per year. The energy generating capacity of 334.8 MW, corresponded to about 5.7 percent of the total hydroelectric power generating capacity of Ukraine (6.23 GW in 2019). Hydroelectric power general supplies about 10 percent of the total energy needs of Ukraine.

THE BREACH OF THE DAM: ITS HUMANITARIAN, ENVIRONMENTAL AND ECONOMIC CONSEQUENCES

On 6 June 2023, a breach of the Kakhovka dam caused widespread flooding, immediately endangering human settlements, economic activities, and the supply of drinking water in the region. The consequences of the dam's destruction carry immediate and long term humanitarian, environmental and economic impacts, including on agricultural production.

In areas under Ukrainian control, flood waters receded from 5.6 meters peak on 8 June to 1.6 meters on 15 June, and further since then. Humanitarian efforts, including evaluation of damages and distribution of humanitarian aid, were hampered by heavy rains in the area. Over 3 600 people were evacuated from the flood zone by Ukrainian authorities. The number of human casualties remains unknown. Despite the lowering water levels, as of 14 June, 46 towns and villages remained flooded in Khersons region, including 32 in the Ukraine-controlled right bank of the Dnipro River, 14 in the areas under Russian control, and 31 in the Mykolajev region. By 15 June, 13 towns and villages were still flooded in the Ukraine-controlled parts of the Kherson region.

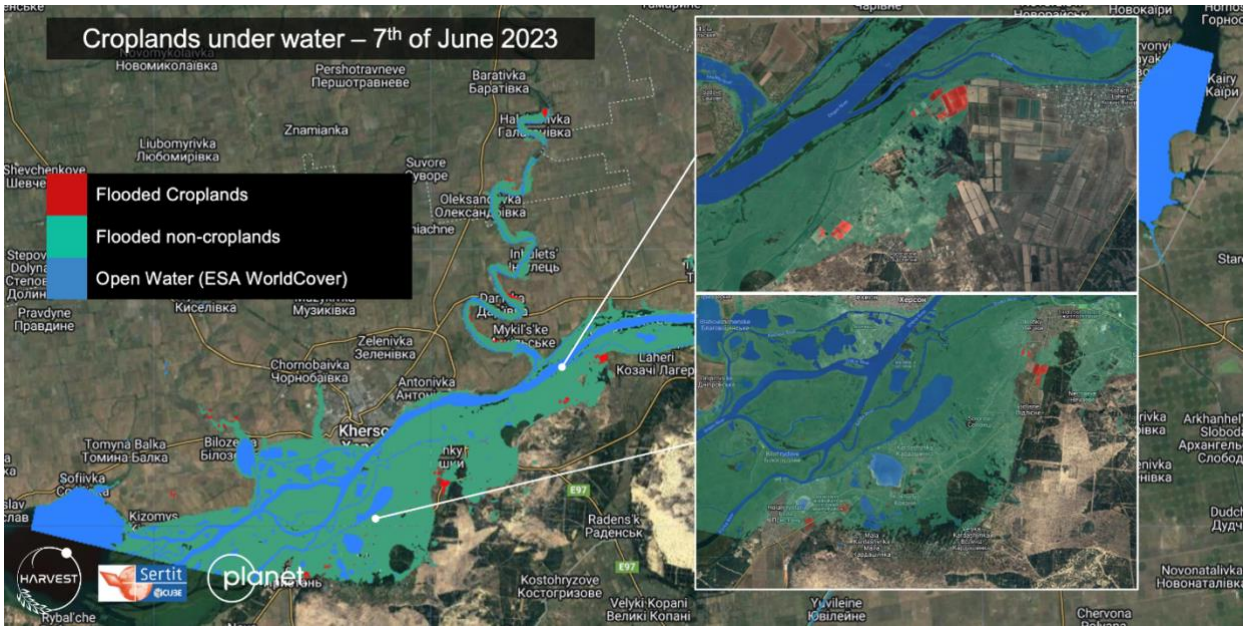
The reservoir provided drinking water supplies for about 700 000 people in the southern part of the country. As water levels in the reservoir dropped by 70 percent by 15 June, drinking water shortages were already reported in the area. Following the breach, the width of the reservoir decreased from 3 to 1 kilometre, and the water level (as of 15 June) was at 7 metres, well below the threshold of 12 metres necessary for pumping. The extent of structural damages and water contamination will have long term consequences on the provision of drinking water in the region. Shortages of the piped drinking water amplify other humanitarian needs that were already present in the area.

While the energy system of the country has been reported to be stable, shortly following the breach, upstream hydroelectric plants are operating at reduced capacity to limit risks of further flooding, and could have an impact on the electricity generation. Water was also being accumulated in the upper reservoirs to reduce the scale of the damages downstream.

Floods, in addition to washing away fertile upper soils, moved sediments from the reservoir and other water bodies, altering soil composition. Contamination is likely: 150 tonnes of machine oil were washed into the Dnipro river from the HPP itself, and there was a risk of further leakage of more than 300 tonnes of oil. Although no major chemical factories were located along the flooded area, runoff from storage of lubricants, fertilisers and other contaminants of both industrial and small scale levels is likely, including from storage facilities close to ports. Floodwaters also washed away mines. While eventual sea mines previously anchored in the reservoir along the frontline are unlikely to accidentally detonate, displaced landmines (both anti-tank and anti-personnel) pose a serious risk for the local population, and are likely to further thwart rescue and clearing efforts.

The reservoir, its water discharge canals, and the accumulating ponds were used for fish farming. Losses for the fishing industry due to the death of only adult fish were estimated at 95 000 tonnes, or about UAH 4 billion (approximately USD 108 million). Beyond immediate death of fish in the reservoir as well as wildlife, long term implications on biodiversity are likely due to changing ecosystems. The area around the Dnipro river hosted rich ecosystems, including also rare species. As flood water receded, fresh floodwaters contaminated with debris, chemical and biological material including pathogens has made its way to the Dnipro-Buza estuary system and the Black Sea, with broad implications for ecosystems.

First reports from the Ministry of Agrarian Policy and Food of Ukraine indicated that approximately 10 000 hectares of agricultural land on the right bank of the Kherson region (under the control of Ukrainian government) were flooded. However, owing to topography, as seen from earth observation images, the extent of flooding on the left bank, was larger, although more precise information is scarce. Based on high definition remote sensing images, NASA Harvest estimated that, as of June 7, 2023, the total flooded area was around 410-420 square kilometres (41 000 – 42 000 hectares) including about 3.5 - 5 square kilometres (or 350 – 500 hectares) of croplands.



Source: Planet and NASA Harvest.

INFORMATION NOTE

THE IMPORTANCE OF UKRAINE AND THE RUSSIAN FEDERATION FOR GLOBAL AGRICULTURAL MARKETS AND THE RISKS ASSOCIATED WITH THE WAR IN UKRAINE

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