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Agricultural War Damages, Losses, and Needs Review

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1 *Global Facility for Disaster Reduction and Recovery (GFDRR), www.gfdrr.org*

Executive Summary

This Report presents the details of the Rapid Damage and Needs Assessment (RDNA) that was carried out for Agriculture Sector of Ukraine as part of the third RDNA report prepared by the Government of Ukraine, World Bank, United Nations, and the European Union[2]. While the overall RDNA report makes a brief presentation of the sectoral results, this Report presents the results in detail and explains the methodology used for estimates. This Report does not cover the damages and losses in irrigation, food industry, agricultural logistics, and demining which are closely linked to agriculture, as they are covered by other work as part of the RDNA.

$80 billion in damages and losses to the agriculture sector

The report furnishes comprehensive details on the damages and losses endured by the agricultural sector in Ukraine. It emphasizes the immediate needs for 2024, as well as the medium and long-term requirements for the reconstruction and revitalization of the sector. The estimates presented in this issue are as of December 31, 2023 (unless specified otherwise), nearly two years after the commencement of the full-scale invasion.

The impact of RF invasion of Ukraine on the agricultural sector is immense. T**he damages** – the combined value of the destroyed assets **totals at $10.3 billion,** marking 18% increase over the previous issue of the review[3]. The relatively moderate increase in damages is attributed to a substantial share of the assets located in areas of active hostilities already being damaged in the previous version of the estimates. The largest category of damages is the damaged and destroyed agricultural machinery, accounting for $5.8 billion or 56.7% of all damages.

The losses, including foregone revenue of agricultural producers and increased production costs, have more than doubled compared to the previous review, amounting to **$69.8 billion**. These losses encompass the decrease in crops and livestock production, losses due to lower domestic prices for key agricultural commodities, increased production costs, and recultivation costs. This increase in losses is explained by the fact that, in the previous review, most loss categories were estimated for the 2022 calendar year alone, assuming a quick resumption of most sector operations. In this review, however, we include lower production in 2023 and 2024 as well. Additionally, we assume that the 2023 harvest will be fully

2 Ukraine - Third Rapid Damage and Needs Assessment (RDNA3) February 2022 – December 2023 (English). Washington, D.C. : World Bank Group. http://documents.worldbank.org/curated/en/099021324115085807/P1801741bea12c012189ca16d95d8c2556a

3 *KSE Agrocenter, Agricultural War Damages, Losses, and Needs Review, Issue 3, https://kse.ua/wp-content/uploads/2023/05/RDNA2.pdf*

affected by lower domestic prices, and increased production costs have impacted the 2023 production as well. The total losses due to lower crop production account for $35.1 billion, additional losses due to lower livestock production amount to $5.6 billion, losses caused by lower domestic prices are estimated at $24.1 billion, and losses due to higher production costs are estimated at $4.4 billion.

Total reconstruction and recovery needs over the next 10 years amount to $56.0 billion, with 2024 priority needs being $435 million, most of which is already covered by donor funding.

The needs include support for reconstruction, specifically the replacement of damaged assets ($9.4 billion), support for immediate production recovery ($6.1 billion) aiming to restore production, support for longer-term production recovery ($35.5 billion) aiming to deepen value chains and increase value-added in the sector, along with improved sustainability of production, and support for public institutions ($5 billion), including initiatives aimed at accelerating EU accession.

Overall Approach

Damages

The monetary value of war-related damages is determined by assessing the quantity of physical assets destroyed, stolen, or partially damaged due to military actions and occupation. This involves a two-step procedure. In the first step, the baseline quantity of each asset category is estimated using data from the State Statistics Service of Ukraine, surveys by the Ministry of Agrarian Policy and Food (MAPF), and other sources. The second step involves deriving coefficients representing the shares of damaged assets for each category at the regional level. For deoccupied territories, damage coefficients are derived from the results of the IPSOS survey, while for regions still affected by active fighting, coefficients are assumed based on the duration and intensity of military actions, incorporating insights from the IPSOS survey conducted in the Kharkiv region.

Losses

In addition to damages resulting from the destruction of physical assets, Ukrainian agricultural producers face significant challenges, including a sharp decline in revenues and increased production costs, all encapsulated as losses. These losses encompass the impact of reduced production in crop and livestock sectors, lower domestic prices triggered by export disruptions, and heightened production costs. Losses from decreased production are calculated as the monetary difference between baseline production and production projections post the RF invasion. Losses stemming from lower domestic prices involve the price difference before and after the invasion multiplied by the total affected production. Losses due to increased production costs are estimated based on projected demand for key inputs and the associated price hike for these inputs. Additionally, losses attributed to recultivation needs are assessed using satellite imagery to identify damaged farmlands[4] and a governmental decree to determine recultivation prices.

4 *The authors are deeply thankful to the team of the Department of Mathematical Modeling and Data Analysis of Igor Sikorsky Kyiv Polytechnic Institute and Space Research Institute NASU-SSAU led by Prof. Dr. N. Kussul, who generously provided their estimates of damaged farmland for this study.*

Needs

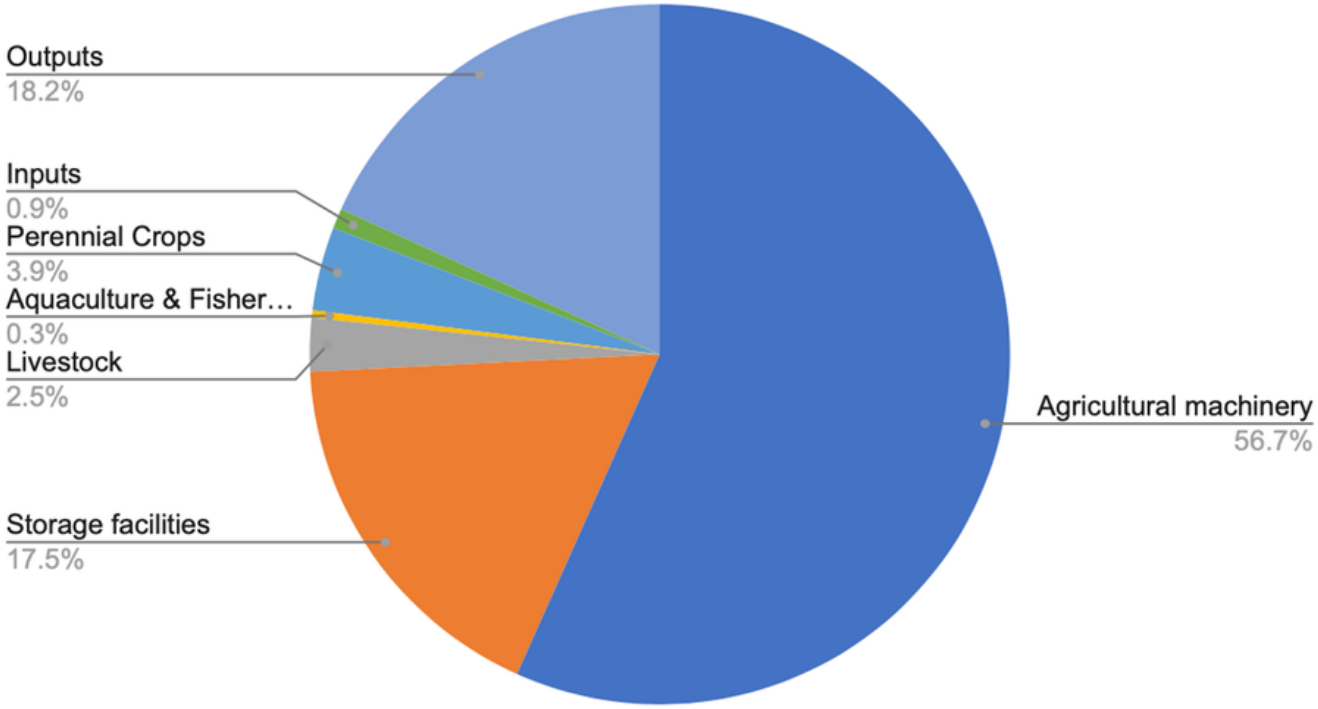
For the Needs assessment, the methodology was used from the Post-Disaster Needs Assessment Guidelines developed by the GFDRR, World Bank Group, European Union, and United Nations,[5] as well as discussions with MAPF, other ministries, development partners, and other stakeholders.

5 *GFDRR, World Bank Group, European Union, United Nations. 2017. Agriculture, Livestock, Fisheries & Forestry. PDNA Guidelines Volume B 49 pp. https://www.gfdrr.org/en/publication/post-disaster-needs-assessments-guidelines-volume-b-2017*

Agricultural Damages: $10.3 billion

The damages represent the monetary value of physical assets damaged or destroyed during the RF invasion. Two years into the invasion, the total damages amount to $10.3 billion, indicating an 18% increase from the previous year. The relatively moderate pace of this increase can be attributed to a significant portion of assets in regions with ongoing ground battles already being destroyed in the initial year of the invasion. The top three regions that incurred the most substantial damages are Zaporizhya, Kherson, and Luhansk, collectively representing 65% of the total damages.

Figure 1 Breakdown of damages by category



Agricultural machinery: $5.8 billion in damages

Damaged and destroyed agricultural machinery constitute the single largest category of damages, totaling $5.8 billion. This figure is attributed in part to a significant quantity of assets in this category being damaged or destroyed, with an average of 18.6% of available machinery sustaining at least partial damage due to RF aggression, depending on the specific type of agricultural machinery and equipment. Another factor contributing to the prominence of this category in damages is that the assessment is based on the replacement value rather than the balance value of the damaged equipment. Consequently, the assumption is made that all damaged

machinery and equipment would be replaced with new units, significantly boosting the damage value for this category.

In total, an estimated 181 thousand units of agricultural machinery and equipment were partially or fully damaged due to the invasion. The largest source of damages within this category is tractors, with approximately 18.2 thousand units destroyed and 6.8 thousand partially damaged (but still suitable for repair). The replacement value for damaged tractors amounts to $1.6 billion.

Damaged/Stolen inputs and outputs: $1.97 billion

Inputs and outputs are the only category that has remained unchanged compared to RDNA2. The reason is that in our previous estimates, we assumed all outputs stored in the occupied territories would have already been lost. Unfortunately, due to the limitations of our methodology, we couldn't account for additional damages resulting from missile attacks targeting grain infrastructure, leading to the destruction of already-produced goods. This oversight means that the presented estimates for this category should be viewed as minimal damages rather than the actual figures.

Consequently, similar to RDNA, the estimated 2.8 million tons of grain and 1.2 million tons of oilseeds located in the occupied territories are considered damaged or stolen, resulting in $1.87 billion in damages. Additionally, an estimated 124 thousand tons of fertilizers, 587 tons of crop protection measures, and 11.6 million liters of fuel contribute another $95 million in damages to this category.

Damages to storage facilities: $1.8 billion

Storage facilities are a category that sustains damages even when relatively distant from the frontline. Despite only 37.5% of farmland in the Kharkiv region being under occupation at the peak of the invasion, a significant 61% of storage facilities in the region were fully or partially damaged, as indicated by the IPSOS survey. As discussed earlier, we are unable to account for storage facilities destroyed by missile strikes due to methodological limitations. Still, an estimated 3.3 million tons of storage capacity are partially damaged, while 11.3 million tons of storage capacity are fully destroyed due to the invasion, resulting in total damages of $1.8 billion. This translates to a 19.5% reduction in Ukraine's storage capacity, without considering storage facilities that remain structurally intact but are inaccessible due to occupation.

Damages to perennial crop plantations: $398 million

In comparison to RDNA2, we recalculated the damage to perennial crop plantations using data from the State Statistics Service of Ukraine (SSSU), which published cultivated areas under perennial crops as of the beginning of 2023. This update replaces the previous estimate with actual figures instead of projections. As the area of cultivated perennial crop plantations typically does not decrease over time, any reduction is attributed to the effects of war. According to our estimates, the war has led to a loss of 16.3 thousand hectares of perennial plantations, with an estimated replacement value of $398 million.

Damages to livestock: $254 million

Similar to the estimates for perennial crops, the damage assessment for livestock herds was re-evaluated based on the number of heads reported by the State Statistics Service of Ukraine (SSSU). The re-evaluation resulted in a 4.4% reduction in damages for this category compared to RDNA2. The damages arising from the decrease in herds are categorized into deaths of animals due to active hostilities (estimated at full replacement value) and deaths due to forced slaughter (estimated at half of the full replacement value). In total, the war has led to the loss of 238 thousand heads of cattle, 544 thousand heads of pigs, 131 thousand heads of sheep and goats, along with almost 13 million heads of poultry. The combined damages resulting from the decrease in herds are estimated at $254 million, without considering losses from the lower livestock production caused by the decrease in herds.

Damages to aquaculture and fishery: $35 million

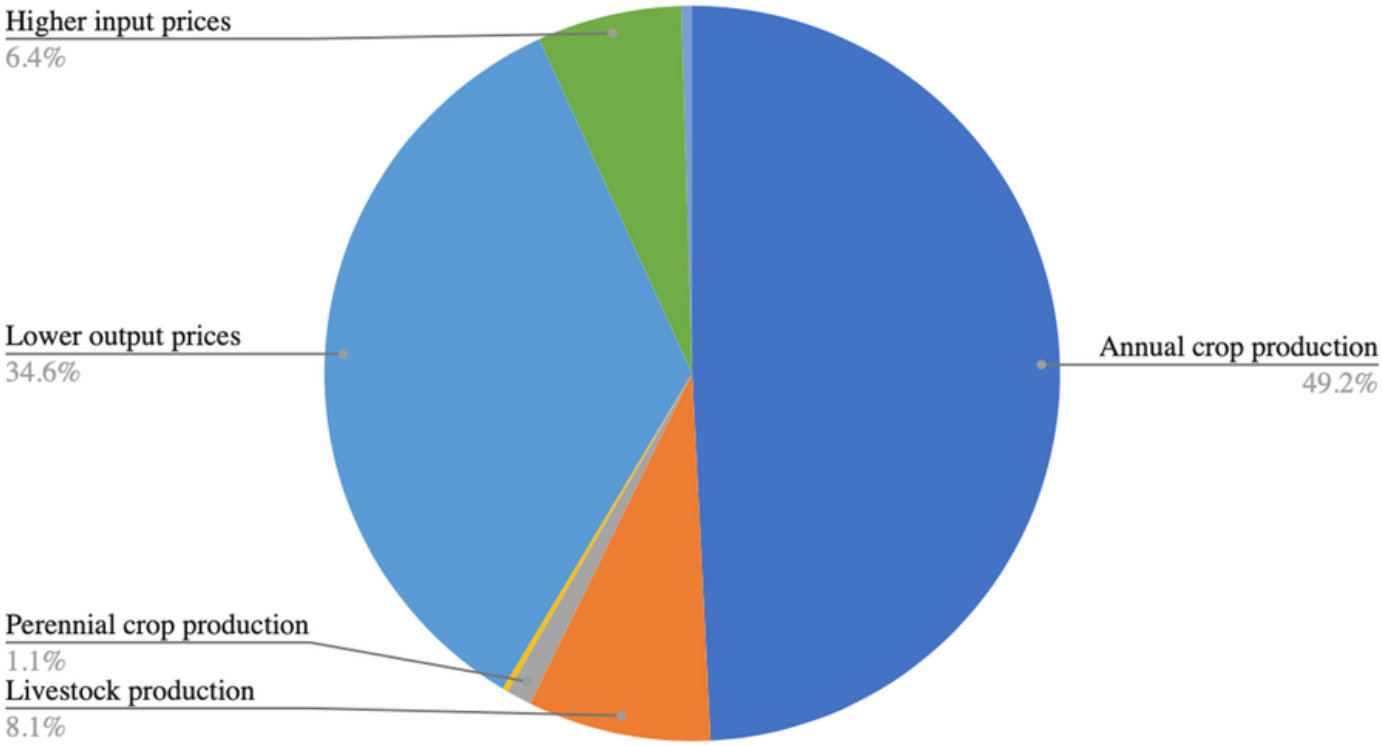
Compared to RDNA2, damages for this category nearly tripled, increasing from the estimated $12 million in RDNA2 to $35 million in this assessment. The significant factor contributing to this rise is the destruction of the Kakhovka dam, which has caused notable damage to this industry.[6]

6 *The Post Disaster Needs Assessment report of the Kakhovka Dam Disaster, https://ukraine.un.org/en/248860-post-disaster-needs-assessment-report-kakhovka-dam-disaster*

Agricultural Losses: $69.8 billion

In addition to damages, which involve the destruction of physical assets, Ukrainian agricultural producers are confronted with losses—foregone revenues due to lower production, reduced prices, and increased production costs. Unlike damages, which are localized in the areas affected by the ground battles – losses affect agribusinesses all over Ukraine. The total estimated losses amount to $69.8 billion, reflecting a 122% increase over the losses estimated in RDNA2. The primary reason for this substantial increase is that, in the previous version of estimates, we primarily (with a few exceptions) included losses covering the 2022 year. In this version of the estimates, we not only encompass losses occurring in the 2022 and 2023 calendar years but also include forward-looking losses for a few major categories that extend into the 2024 calendar year. The detailed breakdown of the losses by category and years covered is presented in **Table 4.**

Figure 2



Losses due to lower production, annual crops: $34.3 billion

The most significant category of losses is caused by lower annual crops production, which forms the backbone of the Ukrainian agricultural sector. Lower production of annual crops constitutes 49.2% of all sector losses, amounting to $34.3 billion. This category has seen one of the most substantial increases over RDNA2 in monetary terms. In RDNA2, losses in this category were only $13.8 billion. The primary reason for the three-fold increase is that in RDNA2, this category covered only the 2022 calendar year production decrease, along with the decrease in winter crops production in the 2023 calendar year. In the current version of the estimates, we include three years of lower agricultural production—2022, 2023, and 2024. In 2022-2023 alone, we attribute a 48.6 million ton reduction in grain production and an 8.7 million ton reduction in sunflower production to losses. It's worth noting that not all decreases in production are attributed to losses. We attribute 100% of the decrease in production due to lower cultivating areas to losses, while 70% of the decrease in production due to lower yields is attributed to the losses due to war-induced changes in production technologies.

Losses due to lower production, livestock: $5.6 billion

Losses in livestock production arise from both a decrease in production due to the reduction in herd size ($2.6 billion in losses) and a decrease in productivity reported in survey results according to the FAO study ($3 billion), resulting in a total of $5.6 billion in losses. These losses are estimated for the 2022 calendar year and projected for three years of reduced production covering 2022-2024. The primary and largest source of livestock losses stems from the decrease in milk production, resulting in $2.9 billion in losses over three years. The annual milk production is projected to decrease by 1.3 million tons due to the reduction in herd size, and the additional decrease in productivity is expected to further lower annual milk production by 1.4 million tons. The assessment of the consequences of war-induced productivity change in the livestock sector is subject to further revisions in the next version of the estimates, contingent upon the availability of reliable data.

Losses due to lower production, perennial crops: $769 million

Losses attributed to perennial crops are calculated as a reduction in production resulting from a decrease in the plantation area. We assume that even in the unlikely scenario of fully replanting the destroyed plantations, it will take some time for newly

established plantations to bear fruits. Therefore, we estimate losses for three years of reduced harvests for berries and five years of reduced harvests for pome and stone fruits. The combined value of losses for these categories is $769 million, with an annual reduction in harvest for perennial crops estimated at 458 thousand tons.

Losses resulting from lower domestic prices due to export disruptions: $24.1 billion

The second-largest category of losses results from a decrease in domestic prices, totaling $24.1 billion or nearly 35% of all losses. Export disruptions due to the naval blockade imposed by the RF significantly complicated logistics routes for Ukrainian agricultural exports, reducing demand for agricultural commodities in the domestic market and increasing logistics costs, leading to a sharp decline in domestic prices. This category also demonstrates a substantial increase in the current version of the estimates compared to RDNA2. In RDNA2, we assumed that the situation with lowered domestic prices would be resolved in the near future, affecting only the remaining stock of the 2021 harvest and the 2022 harvest. As of the preparation of this report, the maritime corridor opened by Ukraine has increased Ukrainian export capacity, but the basis between domestic and world prices remains well above the pre-invasion level, indicating that the invasion's effect on domestic prices persists. In the current edition of the estimates, we assume that the 2023 harvest will still be affected by lower domestic prices, while the situation will improve in the 2024 calendar year, and the 2024 harvest will not be affected.

Losses due to the increase in production costs: $4.4 billion

One consequence of the RF invasion of Ukraine for agricultural producers is the rise in input prices. We assessed the implications of this price increase for two key inputs: fuel and fertilizers. During the preparation of RDNA2, reliable data on changes in fertilizer prices was unavailable, so approximations were utilized. In this version of the estimates, we utilize data from the Ministry of Agrarian Policy and Food (MAPF)[7] to reevaluate the losses incurred due to higher production costs in 2022. While in RDNA, we estimated losses for this category at $844 million for the 2022 calendar year, using the updated data, we now estimate 2022 losses at $3.2 billion. As input prices plummeted in 2023 but remained elevated compared to pre-invasion levels,

7 *Ministry of Agrarian Policy and Food of Ukraine, Effect of war on the profitability of agribusiness, https://minagro.gov.ua/storage/app/sites/1/uploaded-files/viyni-na-pributkovist-silskogospodarskogo-virobnitstvavipusk-2.pdf*

we also estimated losses due to higher input costs for 2023, resulting in an additional $1.2 billion in losses. This brings the total to $4.4 billion in losses due to higher production costs over the last two years.

Losses due to recultivation costs: $329 million

While the demining of agricultural lands is not considered in this analysis, the recultivation of damaged lands is included. After the first year of the invasion, an estimated 836 thousand hectares of farmlands were damaged, resulting in a $184 million loss due to the need for recultivation. As of October 2023, this number increased to 1.5 million hectares of farmlands, equating to 3.6% of all farmlands in Ukraine being damaged. The estimated cost of recultivation thus increased to $329 million.

Fishery and aquaculture production losses: $170 million

There are two components contributing to the increase in fishery and aquaculture losses compared to RDNA2. The first component involves extending the estimation beyond the 2022 calendar year; in this edition of the estimates, we include projections for the years 2023 and 2024 based on the 2022 figures. The second source of change results from the Kakhovka dam disaster, which added an additional $9 million in losses to these sectors, bringing the total losses to $170 million.

Reconstruction and Recovery Needs: $56.1 billion

Given the extent of damages and losses suffered by agricultural producers in Ukraine, the full restoration of the sector's potential requires substantial resources. We estimate two broad categories of needs – Reconstruction and Recovery Needs. Reconstruction Needs aim to replace the damaged assets, while Recovery Needs provide resources for the sector's recovery by addressing the challenges it faces, along with enhancing sustainability, value-added production, and facilitating the process of EU accession. The needs are estimated over a 10-year period, with special attention given to the priority needs for 2024. These priorities are derived from consultations with the Ministry of Agrarian Policy and Food (MAPF), other ministries, and the statistics of donor support earmarked for Ukrainian agriculture for the 2024 calendar year. The overall Reconstruction and Recovery Needs are estimated at $56.1 billion. The detailed breakdown of Needs is presented in **Table 5**, while the actual donor support is presented in **Table 6**.

Reconstruction Needs: $9.4 billion

The Reconstruction Needs delineate the resources required to replace the damaged assets crucial for the revival of agricultural production. In comparison to RDNA2, we have excluded compensation for destroyed and stolen inputs and outputs from the Reconstruction Needs, resulting in a total of $9.4 billion for Reconstruction Needs, only a $100 million increase over the Reconstruction Needs in RDNA2. Due to the distribution of donor and state financing among projects (which lacks resources for the replacement of damaged assets), we have not allocated any Reconstruction Needs to immediate needs in 2024, distributing them over a medium and long-term perspective.

The distribution of Reconstruction Needs among asset categories follows the pattern of damages distribution among the categories. A 20% premium over damages, following the "build back better" principle, was assumed for all damage categories, except for machinery and equipment, where the premium was set at 10%. The lower premium for damaged machinery and equipment, compared to other damage categories, is due to estimating damages not at the balance value but at the replacement value with new assets.

Recovery Needs: $46.7 billion

Recovery Needs encompass three categories: support for immediate production recovery ($6.1 billion), support for longer-term recovery ($35.5 billion), and support for agricultural public institutions ($5.0 billion), totaling $46.7 billion over the next 10 years.

Support for immediate production recovery: $6.1 billion

In 2024, the absolute priority is assigned to supporting immediate production recovery, with $402 million out of the $435 million allocated to this category. Most of the support, constituting 55% of all Needs in the support for immediate production recovery category goes to the interest rate compensation program aimed at addressing liquidity constraints among agricultural producers. The total need for this program is estimated at $3.4 billion, with $320 million allocated in 2024, and the majority of the 2024 financing ($250 million) is already provided by donors. Another program targeting liquidity constraints is the funding of a partial credit guarantee fund and providing partial guarantees for agricultural sector financing, with a total estimated need of $631 million, with $11 million being the immediate priority for 2024.

The second-largest category in support for immediate production recovery is grants and inputs for small producers, with a total need over the next 10 years at $1.07 billion. The financing for 2024 ($71 million) is already reserved by donors for this category.

The Need for the recultivation of damaged farmlands is estimated at $1.05 billion over the next 10 years, substantially outweighing the losses in this category. Several primary reasons contribute to this. Firstly, the volume of damaged farmlands is likely to increase until the end of the war. Since the price of recultivation is estimated based on governmental regulations, the actual recultivation costs could be higher as well.

The program for storage bags and other on-farm storage infrastructure was present in RDNA2 but was removed from the current version of estimates since Ukrainian agricultural producers no longer maintain high ending stocks, which would have exerted additional pressure on the storage infrastructure in 2022.

Support for longer-term recovery: $35.5 billion

This category of Needs aims to enhance productivity in the agrisector, foster resilience to climate change, develop value chains, and increase value-added in the sector. It includes investment grants programs, with a significant portion allocated to promoting climate-smart technologies for arable crops ($15.0 billion) and livestock ($9.0 billion).

The second-largest program in this category involves investment grants for integrated food-energy systems, including biogas production, with estimated Needs of $8.0 billion and no financing reserved for 2024.

Two other programs in this category encompass investment grants for horticulture ($2.5 billion, with $27 million for 2024) and for fishery and aquaculture ($1.0 billion).

Support to agricultural public institutions: $5.02 billion

The invasion has heightened the workload for key agricultural public institutions. Challenges linked to European integration also necessitate additional resources and increased capacity at public institutions. These include the Ministry of Agrarian Policy and Food of Ukraine, the Food Safety Agency, support to laboratories, research and educational institutions, as well as initiatives aimed at supporting policy dialogue and fortifying Ukrainian public institutions. The overall Need for this category is $5.02 billion, with $20 million earmarked for 2024 and $18.25 million already reserved by donors.

Annex 1. Methodology

Damages methodology

War damages are calculated as the monetary value of physical assets that are destroyed, stolen, or partially damaged (but still suitable for repairing and recovery) due to military actions and occupation. The assessment is indirect, which is based on the baseline of assets in the form of machinery and equipment, storage elevators, perennial plantations, livestock, and stored inputs and outputs. We also differentiate territories by the supposed severity of the damages. In the regions with little military activities and no prior occupation, the damages were assumed to be zero (except for the fisheries and aquaculture damages, the estimates for which are provided by the FAO team).

We use information from the survey conducted for the World Bank's Ukraine Rapid Damage and Needs Assessment by IPSOS. This survey covers four regions - Kyiv, Sumy, Chernihiv & Kharkiv regions. Based on the similarities in terms of the share of the region affected by the active hostilities and the duration of the hostilities, we are using the estimates for the Kharkiv region as a proxy for the Donetsk region and estimates from the Kyiv region - as a proxy for the Mykolaiv region. At the same time, in the Donetsk region, we expect that all assets that were partially damaged in second rapid damage and needs assessment (RDNA2)[8] are now entirely destroyed.

For all other regions affected by war (Zaporizhzhya, Kherson, and Luhansk regions), we are using the same approach as in the RDNA2.[9] We assume that active hostilities in the region will lead to damage/destruction of all productive assets in a year for the Luhansk region and in two years for the Kherson and Zaporizhya regions. In the Luhansk region, which has been under an almost complete occupation since the beginning of the invasion, we assume that all assets that were partially damaged in RDNA2 are fully damaged in this assessment. Thus, in the current assessment, we assume that all assets in the Kherson and Zaporizhzhya regions are either partially or fully damaged. The only exception is damage coefficients to the agricultural machinery. We expect 10% of the machinery to be evacuated from each of these three regions.

8 *Agricultural War Damages, Losses, and Needs Review, https://kse.ua/wp-content/uploads/2023/05/RDNA2.pdf*
9 See Annex 1 in *https://kse.ua/wp-content/uploads/2023/05/RDNA2.pdf*

Compared to the RDNA2, no changes were made regarding the share of damaged inputs (fuel, fertilizers, pesticides) and outputs. In RDNA2, the damage coefficients for these categories were estimated as the share of these assets damaged in the Kharkiv region, adjusted for the differences in the share in areas under the occupation.

In this assessment, we also changed the approach to estimating the livestock damages and perennial crops damages. The base for livestock damages in this assessment - is the decrease in the number of animals based on the information from the State Statistics Service of Ukraine (between January 1, 2022, and January 1, 2023). We estimated the decrease in the number of heads for all regions that suffered from active hostilities and occupation. To distinguish the decrease in the number of heads due to the damages and the decrease due to the forced slaughter, we use the results of the FAO survey for each type of livestock asset. Similarly, for the perennial crops we estimated damages as difference in planted areas between 2021 and 2022.

Table 1 Sources of information used for the damages estimates (baseline and unit prices)

Indicator	Source for the baseline	Source for the unit price
Agricultural machinery	SSSU, 2019	SSSU, 2020 - average price of the machinery purchased by agricultural companies
Сільськогосподарська техніка домогосподарств	SSSU, 2019	For tractors - the average price of imported tractor from Belarus in 2021, for combine harvesters - the average price of imported from China combine harvester in 2021
Storage facilities	SSSU, 2021	Interview with industry experts
Livestock	SSSU, 2021	Own estimations using the b2b listings, May 2022
Livestock - bees	Registry of beekeepers, 2021	NGO "Brotherhood of Ukrainian Beekeepers", the cost of beekeeping equipment, 2021

Fisheries and Aquaculture	SSSU, 2021, State Agency of Fisheries	
Perennial crops	SSSU, 2021	Interview with industry experts
Inputs - fertilizers	Average fertilizers consumptions (SSSU, 2018-2020), Ministry's survey on the purchased inputs (Feb. 2022 - Mar. 2022).	Customs data for 2021 + estimated price increase via the Fertilizers Price Index (World Bank)
Inputs - fuel	Fuel consumption, SSSU, 2020, Ministry's survey on the purchased inputs (Feb. 2022 - Mar. 2022).	SSSU, May 2022
Inputs - CPMs	Crop protection measures consumption, SSSU, 2020, Ministry's survey on the purchased inputs (Feb. 2022 - Mar. 2022).	SSSU, 2020
Outputs	SSSU, Jan 2022, discounted on the volumes of exports in January & February 2022	Ukragroconsult, world prices, May 2022

Losses methodology

Losses due to lower production - annual crops

As a baseline for annual crop production, we use the data on the sowing areas published by the State Statistics Service of Ukraine (SSSU) for 2021 and the average yields for the years 2020-2021 to smooth out yield fluctuations due to the weather effects.

In this section we attribute to losses 100% of production loss caused by the decrease in the sowing areas and attribute 70% of yield decrease to war-induced factors (thus counting this decrease in yield as losses), accounting for changes in production technologies.

Since the production figures for the 2022 calendar year are available from the SSSU- we used this data to estimate the production losses for the annual crops in the calendar year 2022.

For the 2023 annual crop losses, we estimated the change in the sowing area, compared to the 2021 calendar year, using the official information on the sowing areas for winter crops sown in the 2022 calendar year and spring crops sown in the 2023 calendar year. We compared these sowing areas to the corresponding MAPF statistics for the 2020-2021 calendar years to derive the percentage change in the sowing areas, which we applied to the baseline 2021 harvesting areas.

We then used the MAPF data on the harvesting campaign 2023 to estimate the average productivity on the region level for each of the cultures. The productivity for the "other crops" category for the year 2023 was estimated as the average change in productivity for four major crops - wheat, barley, corn, and sunflower.

Unlike RDNA2 - in the current assessment, since the war will likely affect the 2024 production, we elected to include the forward-looking losses - the losses from lower annual crop production in 2024. We estimated the 2024 annual crop production losses as the average losses for the given crop in a given region between the years 2022 and 2023.

Losses due to lower production - livestock

We replaced the post-disaster number of heads for the livestock assets with the official data from the SSSU. Similarly to the RDNA2, we also assume that the livestock's productivity decreased due to the war. The exact decrease in productivity is the same as in RDNA2 and is estimated based on the FAO survey.[10] We attribute to losses all decrease in post-invasion production. In this assessment, we also include forward-looking losses for livestock production. Thus - in this assessment, we estimated the production losses for three years of lower production (extrapolating the results of the 2022 calendar year for all three years of lower production).

Losses due to lower prices for export-oriented commodities

In RDNA2, we assumed that lower prices for export-oriented commodities would only apply to the 2022 harvest and ending stocks of the 2021 harvest. Since logistics from Ukraine remain cumbersome and expensive - Ukrainian farmers are continuing

10 *FAO, Ukraine: Impact of the war on agriculture and rural livelihoods in Ukraine, https://www.fao.org/3/cc3311en/cc3311en.pdf*

to take losses due to logistical hurdles. In this assessment, we assume that lower prices for export-oriented commodities will also affect the 2023 harvest. We estimate the difference in prices for the 2023 harvest using the MAPF[11] data on prices for main commodities for 2021 and 2023.

Losses due to the increased production costs

We re-estimated the 2022 losses due to higher production costs using the MAPF6 prices for the key inputs. The price difference for fertilizers was estimated as the difference between 2021 and 2022 average prices for the five most common fertilizers in Ukraine (ammonium nitrate, urea, potassium chloride, ammonium phosphate, and NPK 10:26:26). On top of that, although prices for key inputs (fuel and fertilizers) decreased, compared to the 2022 - the 2023 prices remain substantially higher than pre-invasion prices. Thus, in the current assessment, we estimate the losses due to higher production prices (due to the increase in fuel and fertilizer prices) for the 2023 calendar year as well.

Losses – fishery and aquaculture

Similarly to other sectors, in RDNA3, we include forward-looking losses for fishery and aquaculture industries. In doing so, we extrapolate the RDNA2 estimates, which were estimated for the year 2022 to 2023 and 2024. We also add losses caused by the Kakhovka dam disaster.

Losses – recultivation of damaged farmlands

To estimate the losses due to the damage to the soil layer, we rely on the estimations from the Department of mathematical modeling and data analysis of Igor Sikorsky Kyiv Polytechnic Institute, Space Research Institute NASU-SSAU. The team used the satellite data to classify fields as damaged and provided the RDNA team with the estimates of damaged farmlands. To estimate the unit price for the recultivation – we relied on the Government's decree that regulates the formula for recultivating the damaged farmlands.[12]

11 *Ministry of Agrarian Policy and Food of Ukraine, Effect of war on the profitability of agribusiness, https://minagro.gov.ua/storage/app/sites/1/uploaded-files/viyni-na-pributkovist-silskogospodarskogo-virobnitstvavipusk-2.pdf*

12 *See https://zakon.rada.gov.ua/laws/show/z0406-22#Text, and https://zakon.rada.gov.ua/laws/show/z0285-98#n97*

Annex 2. Data

Table 2 Regional breakdown of damages and losses

Region	Damage	Loss	Total	% of National
Vinnytska	-	4,768	4,768	5.96%
Volynska	-	1,013	1,013	1.26%
Dnipropetrovska	1	3,720	3,721	4.65%
Donetska	912	3,700	4,612	5.76%
Zhytomyrska	0	2,003	2,003	2.50%
Zakarpatska	-	316	316	0.39%
Zaporizka	2,929	4,656	7,585	9.47%
Ivano-Frankivska	-	667	667	0.83%
Kyivska	456	3,206	3,662	4.57%
Kirovohradska	1	2,900	2,901	3.62%
Luhanska	1,747	2,799	4,546	5.68%
Lvivska	-	1,072	1,072	1.34%
Mykolaivska	476	3,385	3,861	4.82%
Odeska	1	2,534	2,535	3.17%
Poltavska	0	3,818	3,819	4.77%

Rivnenska		1,008	1,008	1.26%
Sumska	119	3,402	3,521	4.40%
Ternopilska	-	1,782	1,782	2.23%
Kharkivska	1,360	6,000	7,359	9.19%
Khersonska	2,050	5,660	7,710	9.63%
Khmelnytska	-	4,063	4,063	5.07%
Cherkaska	1	3,131	3,132	3.91%
Chernivetska	0	377	377	0.47%
Chernihivska	234	3,785	4,019	5.02%
Total	10,288	69,763	80,052	

Table 3 Agricultural war damages by type

	Totally damaged, #	Partially damaged, #	Damage, m. USD
Agricultural machinery			**5831.9**
Tractors	130,529	18,184	1611.3
Trucks and lorries	78,678	9,899	511.0
Combine harvesters	31,588	4,663	978.7
Machine harvester for vegetables and melons	447	118	9.8
Agricultural trailers. semitrailers	64,800	8,474	185.3
Ploughs	51,447	6,612	146.3
Cultivators	71,633	11,590	282.6

Harrows	160,004	19,496	403.9
Seeders (excluding fertilizer seeders)	66,511	10,917	882.6
Mowing-machines	10,196	1,356	8.2
Ripper-binders	16,862	2,385	69.9
Press-packers. including pickup presses	8,226	1,039	40.1
Spreaders of manure and fertilizers (including fertilizer seeders)	23,878	2,683	52.9
Grain cleaners	21,591	3,016	63.9
Milking and dairy machines	4,334	400	7.1
Milk cleaners. milk coolers	2,555	209	3.6
Machinery for fodder's cooking	4,046	420	7.4
Feed distributors	5,040	472	13.3
Manure conveyers	11,958	1,094	3.3
Tractors (Households)	180,078	25,407	453.1
Combine harvesters (Households)	14,586	2,168	97.6
Storage facilities			**1802.9**
Storage facilities (t. tons)	11,351	3,341	1802.9
Livestock			**253.9**
Cattle (t. heads)	2,704	100	147.8
Pigs (t. heads)	5,559	122	53.0
Sheeps&goats (t. heads)	1,089	46	7.4
Poultry (t. heads)	193,940	1,632	13.9
Bees (bee colony)	86,902	192,526	31.9

Fisheries and aquaculture			**34.7**
Aquaculture facilities	177		27.1
Aquaculture facilities - broadstock	29		0.6
Fisheries - number of producers	23		7.0
Perrenial crops			**397.6**
Berries, hectares	2,307		46.1
Stone fruits, hectares	9,200		230.0
Pome Fruits, hectares	4,857		121.4
Stolen/Lost Inputs & Outputs			**1967.4**
Fertilizers (tons)	123,825		67.4
Crop protection measures (tons)	587		6.7
Fuel (thsd. liters)	11,582		21.2
Grain (t. tons)	2811		983.7
Sunflower seeds (t. tons)	1227		888.4
Total			**10,288.4**

Table 4 Breakdown o losses by category and comparison with RDNA2

RDNA2, m. USD			Current assessment, m. USD		
Losses due to lower production	Annual crops - 2022	**$10,511**	**Losses due to lower production**	Annual crops - 2022	**$10,638**
	Annual crops - 2023 (winter crops only)	**$3,294**		Annual crops - 2023	**$12,245**
				Annual crops - 2024	**$11,441**
	Perennial crops	**$450**		Perennial crops	**$769**
	Livestock - 2022	**$1,670**		Livestock - 2022, 2023, 2024	**$5,624**
Losses due to lower prices	2021&2022 harvest	**$14,480**	**Losses due to lower prices**	2021&2022 harvest	**$14,281**
				2023 harvest	**$9,828**
Losses due to higher production costs	2022 production	**$844**	**Losses due to higher production costs**	2022 production	**$3,217**
				2023 production	**$1,219**
Land recultivation		**$184**	**Land recultivation**		**$329**
Fisheries&Aquaculture losses		**$54**	**Fisheries&Aquaculture losses**	2022, 2023, 2024	**$170**
Total		**$31,488**	**Total**		**$69,763**

Table 5 Agricultural reconstruction and recovery needs

Category	Component	2023 [for information only]	2024	2025-2027	2028-2033	**Total (2024-2034**
Reconstruction Needs	**(a) Support for reconstruction:**			3,134	6,268	9,402
	Storage facilities			721	1,442	2,163
	Farm equipment and machinery			2,138	4,277	6,415
	Perennial crops			159	318	477
	Livestock, fisheries, and acquaculture			115	231	346

	(b) Support for immediate agriculture production recovery:	590	402	2,054	3,667	6,122
	Interest rate compensation (BDF, credit program 5-7-9)	300	320	1,050	2,000	3,370
	Partial credit guarantees for agriculture	20	11	287	333	631
	Grants and inputs for ag production by small farms (per hectare, per livestock unit, and others)	120	71	333	667	1,071
	Storage bags and other support on on-farm storage	50				
	Full and matching grants for alternative energy generation of farms, elevators and other agribusinesses	50				
	Recultivation of damaged farmlands	50		383	667	1,050
Recovery Needs	**(c) Support for longer-term recovery of the agriculture:**	30	13	11,833	23,667	35,513
	Investment grants for promoting climate-smart technologies for arable crops (inc. mechanization)			5,000	10,000	15,000
	Investment grants for investing in horticulture orchards and greenhouses)	30	13	833	1,667	2,513
	Investment grants for climate smart livestock development			3,000	6,000	9,000
	Investment grants for integrated food-energy systems, inc. biogas			2,667	5,333	8,000
	Investment grants for fisheries and acquaculture			333	667	1,000
	(d) Support for agricultural public institutions and programs, including for the EU accession	10	20	1,667	3,333	5,020
	Total	**630**	**435**	**18,688**	**36,935**	**56,057**

Table 6 Actual donor support

Types of activities/investments	2023	2024	2025	Total
Support for immediate agriculture production recovery	**273,8**	**448,2**	**134,9**	**856,9**
Interest rate compensation (5-7-9 credit program)	180,0	250,0	70,0	500,0
Partial credit guarantee for agriculture	21,8	6,8	0,8	29,4
Additional liquidity for agricultural financing	3,5	3,5	3,5	10,5
Grants for production by small farms		173,2	50,0	223,2
Inputs and cash transfers for small farms	51,6	11,2	8,3	71,1
Storage bags and other storage equipment distributed to farms	2,3	2,3	2,3	7,0
Procurement of equipment	14,5	1,2		15,7
Support for longer-term recovery of the agriculture sector	**46,7**	**21,9**	**15,8**	**76,0**
Development of storage infrastructure	4,7	4,7	14,7	44,0
Investment grants for value chains	3,2	6,4	6,0	15,6
Investment grants for horticulture	30,0	2,0	2,0	34,0
Support for water use associations and restoration of irrigation systems	10,7	10,7	5,0	26,4
Financing of medium to long-term investments	2,8	2,8	2,8	8,4
Support for agricultural public institutions, including for accelerating the EU accession	**22,1**	**18,3**	**14,2**	**39,5**
Support for MAPF (including State Agrarian Registry maintenance)	3,2	4,3	3,3	10,8
Support for food safety	2,1	1,2	1,2	4,5
Support for agricultural research and education institutions	5,2	5,2	4,7	15,1
Support for policy dialogue and strengthening of the technical capacity of Ukrainian institutions	11,6	7,6	5,1	24,2
Tota	**342,6**	**488,3**	**164,9**	**972,4**

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