



Photo by manhai on Flickr.

## The war in Ukraine: assessing the human and environmental costs

In February, 2022, Vladimir Putin ordered Russian forces to invade Ukraine. **Stuart Parkinson**, SGR, assesses the data on the impacts of the war during the course of the year – both on the battlefield and beyond it – and considers what the future might hold.

While video footage of the war in Ukraine has filled our TV screens, social media feeds and newspapers over the past year, hard data about the major impacts has been in rather shorter supply, with much of it contested. Rigorous assessment of the effects of any war has always been a difficult task – not least because of the accuracy of the old saying, “The first casualty of war is truth”. Nevertheless, by picking through a wide range of data, it is possible to start to piece together a picture of the main impacts – on civilians (both on and off the battlefield), soldiers, infrastructure, and the natural environment. Here, I provide a summary of key data available for the year 2022 – with the caveat that many large uncertainties remain. Then I discuss implications for the future.

### Direct human casualties

Firstly, what are the casualty levels due to the Ukraine war? The UN Office of the High Commissioner on Human Rights (OHCHR) publishes weekly updates on verified civilian casualties due to weapons use – and its estimate for the whole of 2022 recorded approximately 7,000 deaths and 11,000 injured.<sup>1</sup> The OHCHR “believes that the actual figures are considerably higher” due to the obvious reporting difficulties. A widely quoted alternative estimate comes from General Mark Milley, head of the US military, who gave a figure of 40,000 casualties (i.e. including both deaths and injuries) – around double the UN level – in November.<sup>2</sup> Ukrainian sources have argued the death toll alone for civilians could be over 33,000 due to a large number of as yet uncounted deaths during intense fighting in the city of Mariupol.<sup>3</sup> The growing evidence of war crimes and other human rights violations, the vast majority committed by Russian forces<sup>4</sup> – together with efforts to hide them – increases the problems of estimating the casualty levels.

Regarding military casualties, these are even more difficult to estimate – not least because the militaries involved in this war

are reluctant to publicly admit their own losses, while freely exaggerating those of the opposing side. Nevertheless, minimum figures from government sources indicate at least 10,000 dead on each side.<sup>5</sup> General Milley put the total casualties on each side at over 100,000<sup>6</sup> while other international military sources claimed even higher figures. Given that the recorded numbers of injured have mostly been two to three times the numbers of dead during the war,<sup>7</sup> these estimates would mean a death toll on each side of at least 25,000 and possibly higher than 40,000.

In summary, in 2022, the total casualty level from weapons use seems to be around 100,000 dead and around 250,000 injured – but the uncertainty remains high. The weapons most responsible for the casualty level tend to be explosive weapons ‘with wide area effects’ including shelling from heavy artillery, multiple launch rocket systems, missiles and air strikes.<sup>8</sup> Indeed, although the figures above point to most casualties being soldiers, data from the Explosive Weapons Monitor show that, when explosive weapons are used in populated areas, it is actually civilians that make up the vast majority of deaths and injuries.<sup>9</sup>

### Damage to infrastructure and the local environment

But, of course, the war does not only kill people directly, it damages essential infrastructure including homes, water and energy supplies, and health care services – leading to indirect civilian deaths – as well as causing huge impacts to the surrounding environment, including farmland and forests.

Indication of the scale of this damage is given in a report published by Climate Focus which assessed some of the environmental impacts of the first seven months of the war.<sup>10</sup> Using data from European and US satellite images, the researchers estimated that the conflict had caused over 6,000 fires damaging nearly 5,000 square kilometres of land – mostly

cropland, but also large areas of forests and obviously urban areas as well. The report also highlighted that over 70,000 homes had been destroyed and over 60,000 more had been damaged. The Conflict and Environment Observatory (CEOBS) has documented how numerous industrial sites – including fossil fuel, chemical and nuclear facilities – have also been attacked, releasing large amounts of pollutants.<sup>11</sup>

At the time of writing, Russian missile attacks on civilian infrastructure had been stepped up – including against energy facilities – often cutting off supplies during the harsh Ukrainian winter – but, as yet, there had been no major attack on a nuclear power reactor or its spent fuel stores.<sup>12</sup>

Estimates of the number of indirect deaths due to this range of impacts are especially hard to compile. However, broad assessments of war-related casualties in conflict zones conclude that indirect deaths tend to be at a level comparable to direct deaths.<sup>13</sup> Hence, in 2022 in the conflict-affected areas of Ukraine (and Russia's border), we can make an initial estimate that perhaps another 100,000 people died indirectly due to the war.

### Wider impacts

The war in Ukraine is also causing considerable problems beyond the conflict zones. One of the most obvious is the huge increase in migration, as civilians flee the fighting. Data from the UN High Commission on Refugees (UNHCR) shows that, in late 2022, nearly 7.9 million Ukrainian refugees had been recorded across Europe,<sup>14</sup> with a further 6.5 million 'internally displaced persons' within the country<sup>15</sup> – making a total of nearly 14.5 million refugees.

And, of course, the war has fuelled inflation across the world's economies. In the latest report<sup>16</sup> on progress towards meeting the 17 Sustainable Development Goals (SDGs), the UN states that the war "has caused food, fuel and fertilizer prices to skyrocket, disrupted supply chains and global trade... fuelling the threat of a global food crisis." The report points out how this is undermining progress on eradicating poverty and hunger (SDGs 1 and 2) – which have already been badly hit by the COVID-19 pandemic. It estimated that the war pushed an extra 20 million people into extreme poverty in 2022. Part of this was as a result of a sudden 30% increase in global food prices in March (although prices have fallen back somewhat in the months since) – not least because Ukraine and Russia are major international suppliers of wheat, maize, sunflower seed products, and fertilizers. A subsequent report by the World Food Programme (WFP) estimated that the war had forced an extra 47 million into 'acute food insecurity'.<sup>17</sup>

Of course, a key aspect of this impact stems from Russia's role as a leading supplier of fossil oil and gas – and the Western sanctions imposed on these. The consequent jump in fuel prices has pushed large numbers into fuel poverty across the world. For example, in the UK an extra three million households were expected to be in fuel poverty this winter<sup>18</sup> – which translates into about seven million more individuals – despite the government's energy price cap.

Then there is the impact on climate change. The Climate Focus report mentioned earlier is the first to try to estimate the war's effect on greenhouse gas emissions.<sup>19</sup> It calculates that military fuel use, fires and explosions, refugee movements, and leakages of methane due to sabotage of the Nord Stream fossil gas pipelines have together led to emissions of approximately 50 million tonnes of CO<sub>2</sub> equivalent (MtCO<sub>2</sub>e) during the first seven months of the war. It further estimates that post-conflict

reconstruction will result in a further 50MtCO<sub>2</sub>e being released. The total of 100MtCO<sub>2</sub>e is similar to the national emissions of the Netherlands over seven months.

Arguably, however, the largest climate-related impacts of the war are likely to come from factors beyond the battlefield. In particular, there has been a massive international expansion of fossil gas capacity as nations seek to reduce their dependence on Russian supplies – in particular, for liquified natural gas (LNG), which is a higher carbon type of the fuel. This factor – coupled with an uptick in oil and gas exploration – may well have pushed the Paris Agreement target of 1.5°C out of reach.<sup>20</sup> Indeed, the huge increases in military spending that have followed the invasion are also highly likely to raise carbon emissions significantly.

### Comparisons

Can we make comparisons with other wars or humanitarian disasters at this stage? To do this, let's start by looking at the most robust figures from the preceding discussion – the verified civilian death toll due to weapons use – which, for the war in Ukraine, was about 7,000 for 2022. Similar data have been compiled for the wars in Iraq – which averaged more than 13,000 a year over a 15 year-period from 2003.<sup>21</sup> Given the figures for Ukraine are likely to be revised upwards as more data becomes available, it seems that the impacts of weapons use on civilians in these wars are – on an annual rate – comparable. However, the death rate of combatants does seem to be significantly higher in Ukraine.<sup>22</sup>

Another comparison which can start to be made concerns the excess death rate. From the preceding discussion, excess deaths in 2022 among the Ukrainian population due to the war could be around 150,000. This compares with approximately 100,000 a year in 2020 and 2021 related to the COVID-19 pandemic<sup>23</sup> – although the age profile is likely to be markedly different. Russia's excess death rate due to the COVID-19 pandemic was about 550,000 a year – perhaps 10 times war-related deaths.

A further comparison could be made with the number of deaths caused by the Türkiye-Syria earthquakes in February 2023. The official (direct) death toll has passed 40,000.<sup>24</sup> This is higher than the upper estimate for the direct civilian death toll in Ukraine in 2022 – which shows just how destructive those earthquakes were, and how important it is not to neglect efforts to protect populations against such disasters.

Finally, it's worth making comparisons with projected death tolls related to the use of a nuclear weapon. For example, a single 100 kilotonne (kt) warhead exploded on a medium-sized city would kill around 80,000 people immediately<sup>25</sup> – with many thousands more dying of injuries in the following few months and years. This shows how much more destructive a single nuclear weapon is compared to a conventional missile or bomb. Indeed, due to the catastrophic climate impacts, the consequences of a nuclear war would endanger human civilisation itself. Hence, it is absolutely critical that this conflict isn't allowed to escalate to nuclear use.

### Looking to the future

There are a number of conclusions that can be drawn from the data summarised in this article:

- Although there is much talk about new, more accurate weapons being deployed on the battlefield, modern warfare remains highly destructive and the war in Ukraine – in common with other recent wars such as in Iraq, Syria, Yemen, Afghanistan and Libya – has caused and continues to cause considerable suffering.



» **Table 1. The war in Ukraine: comparing casualty statistics**

Cause of casualties	No. of people	Notes
Verified civilian death toll from weapons use in Ukraine war (2022)	7,000	Robust estimate of minimum level, but likely to be large underestimate of total
Verified annual civilian death toll from weapons use in Iraq wars (mean over 15y from 2003)	13,000	Robust estimate of minimum level, but likely to be underestimate of total
Verified death toll due to Turkiye-Syria earthquakes (February 2023)	44,000	Robust estimate of minimum level, but likely to be underestimate of total
Estimated immediate death toll from one 100kt nuclear weapon used on medium-sized city (theoretical)	80,000	Estimated based on environmental modelling; uncertainty – medium
Estimated total death toll from weapons use in Ukraine war (2022)	100,000	Compiled from various sources; uncertainty – high
Estimated total death toll in conflict-affected areas due to Ukraine war (2022)	200,000	Initial estimate; uncertainty – very high
Additional people forced into ‘acute food insecurity’ due to Ukraine war (world total, 2022)	47 million	Estimate based on UN modelling; uncertainty – medium

NB: All figures rounded; references and further discussion provided in the main text.

- The interconnectedness of the global economy means that a major war can cause as much suffering in countries with no involvement in the conflict, as those that are. In the case of the war in Ukraine, the impact on global food and energy prices has threatened the lives of tens of millions of people.
- Any escalation to nuclear weapons use would multiply considerably the devastation caused, with human civilisation itself being threatened. Politicians and commentators who belittle such concerns endanger us all.
- The war in Ukraine is not the only crisis the world faces, and policy-makers should not use it as an excuse to reduce action to tackle global poverty, the climate crisis, or meet any of the other Sustainable Development Goals.

Such conclusions emphasise the importance of rapidly finding a peaceful resolution to the war. Unfortunately, at the time of writing, such prospects look remote. Russian, Ukrainian and NATO leaders talk up the prospect of a rapid victory based on new military offensives. Putin is deploying ever-greater numbers of Russian troops while Ukraine is deploying more powerful weapons supplied by NATO. Further prolonged bloodshed seems the most likely path – perhaps lasting years<sup>26</sup> – accompanied by the ever-present risk of escalation to nuclear war, and the continued failure to direct sufficient resources into tackling other global crises.

This is why calls for a peaceful settlement from civil society must be louder. The world cannot wait.

*Dr Stuart Parkinson is Executive Director of Scientists for Global Responsibility, and has written on science and security issues for over 20 years.*

## References

- 1 UN OHCHR (2023) <https://ukraine.un.org/en/215396-ukraine-civilian-casualties-15-january-2023>
- 2 Associated Press (2022) <https://apnews.com/article/russia-ukraine-zelenskyy-europe-army-joint-chiefs-of-staff-688e99d37f25ac8340b6a96a79a89abf> The figure of 40,000 has been misquoted in some media reports as only referring to deaths – and, indeed, it is common for politicians, journalists and others to mix up these two statistics.
- 3 Wikipedia (2022) [https://en.wikipedia.org/wiki/Casualties\\_of\\_the\\_Russo-Ukrainian\\_War](https://en.wikipedia.org/wiki/Casualties_of_the_Russo-Ukrainian_War) (accessed: 29 December)
- 4 UN OHCHR (2022) <https://www.ohchr.org/en/press-releases/2022/10/un-commission-has-found-array-war-crimes-violations-human-rights-and>
- 5 Wikipedia (2022) – as note 3.
- 6 Associated Press (2022) – as note 2.
- 7 This range is based on civilian data from April to December from: UN OHCHR (2023) – as note 1. Data from the earliest months of the war have been excluded as there was a higher likelihood of under-reporting of injuries due to the practical difficulties in setting up casualty monitoring.
- 8 OHCHR (2022) – as note 1.
- 9 Explosive Weapons Monitor (2022) <https://www.explosiveweaponsmonitor.org/>
- 10 Climate Focus et al. (2022) <https://climatefocus.com/publications/climate-damage-caused-by-russias-war-in-ukraine/>
- 11 CEOBS (2022) <https://ceobs.org/category/publications/country-publications/ukraine-country-publications/>
- 12 For a discussion of the potential impacts of an attack on a Ukrainian nuclear reactor, see: Webber, P. (2022) <https://www.sgr.org.uk/resources/nuclear-power-ukraine-what-would-happen-if-zaporizhzhia-was-hit>
- 13 Geneva Declaration (2008) <http://www.genevadeclaration.org/measurability/global-burden-of-armed-violence/global-burden-of-armed-violence-2008.html>
- 14 UNHCR (2022) <https://data.unhcr.org/en/situations/ukraine> (27 December update)
- 15 International Organization for Migration (2022) <https://displacement.iom.int/reports/ukraine-internal-displacement-report-general-population-survey-round-10-17-27-october-2022> (27 October update)
- 16 UN (2022) <https://unstats.un.org/sdgs/report/2022/> (7 July)
- 17 WFP (2022) <https://www.wfp.org/publications/update-global-food-crisis-2022> (25 July update)
- 18 The Conversation (2022). <https://theconversation.com/energy-crisis-the-uk-is-still-heading-for-widespread-fuel-poverty-despite-the-governments-price-cap-190290>
- 19 Climate Focus et al. (2022) – as note 10.
- 20 Climate Action Tracker (2022) <https://climateactiontracker.org/publications/massive-gas-expansion-risks-overtaking-positive-climate-policies/>
- 21 Iraq Body Count (2023) <https://www.iraqbodycount.org/database/>
- 22 See, for example: Costs of War (2021) <https://watson.brown.edu/costsofwar/figures/2021/WarDeathToll>
- 23 Our World in Data (2023) <https://ourworldindata.org/excess-mortality-covid>
- 24 BBC (2023) <https://www.bbc.co.uk/news/topics/cq0zxdd0y39t>
- 25 SGR (2015) <https://www.sgr.org.uk/publications/uk-nuclear-weapons-catastrophe-making>
- 26 See, for example: Rogers P (2023) <https://www.opendemocracy.net/en/ukraine-war-putin-us-nato-weapons-victory-stalemate-long-game/>