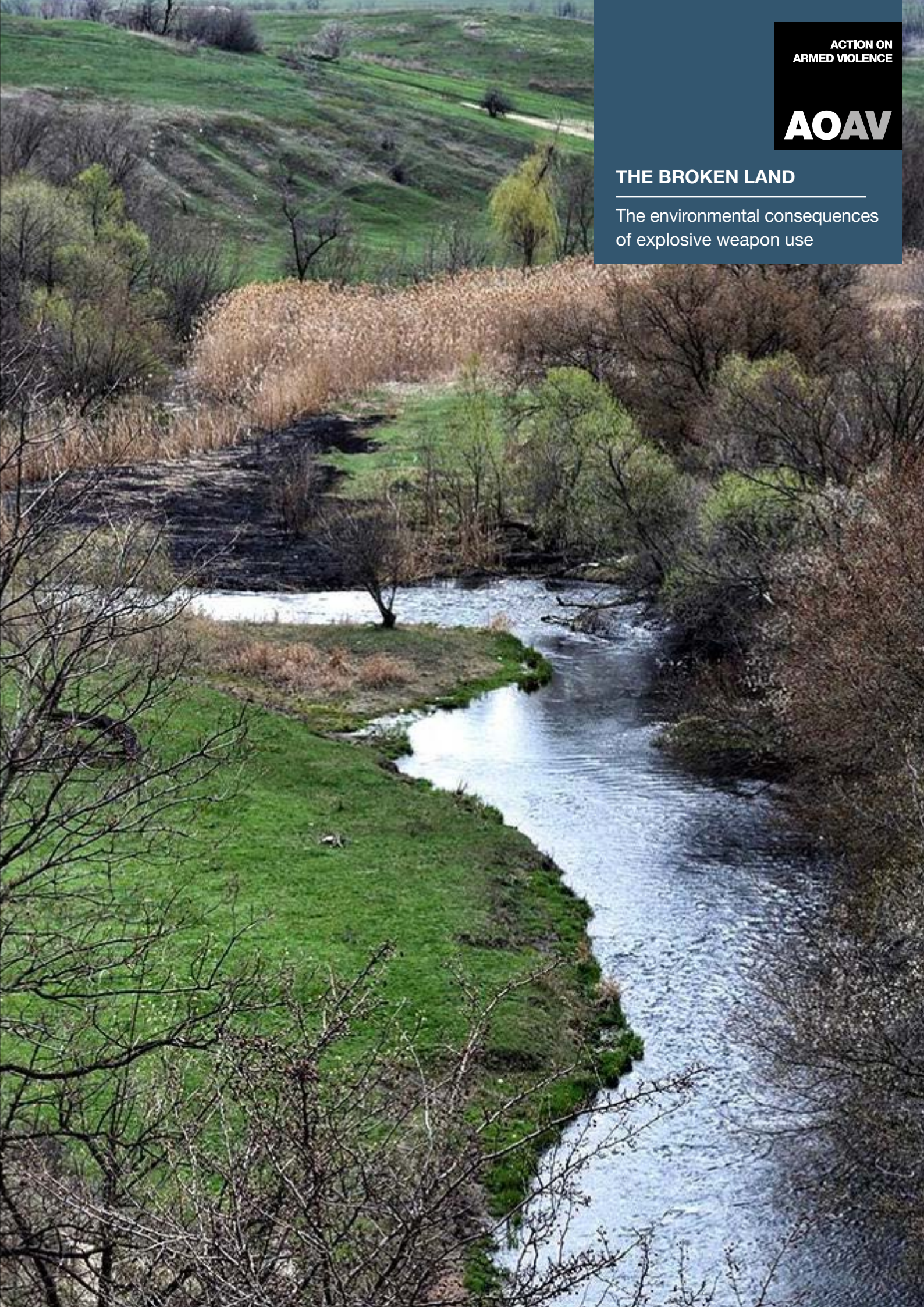

ACTION ON ARMED VIOLENCE

AOAV

THE BROKEN LAND

The environmental consequences of explosive weapon use

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National park in eastern Ukraine

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INTRODUCTION

Explosive weapons can devastate a landscape. They can reduce buildings to toxic rubble and destroy long-cherished trees; they can contaminate the soil for decades and cause poisons to leach into once healthy rivers; they can decimate ecosystems and disturb the harmony of nature. They kill humans and animals without reflection and tip the world out of balance.

Such truths are revealed, time and time again, in Action on Armed Violence's (AOAV) data on global explosive harm; a data set born from nine years of monitoring casualties from explosive weapons around the world. Over that time, AOAV has recorded more than 338,000 casualties from this violence. Of these, just under 251,000 have been civilians or 74% of all those killed or injured. And the impact of such explosive weapons stretches far beyond the immediate blast, as research by Action on Armed Violence (AOAV) and colleagues,[1] such as Save the Children,[2] Article 36,[3] and Humanity and Inclusion,[4] has repeatedly shown; none more so than in any examination of explosive weapons' impact on our environment.

National park in eastern Ukraine.

While the links between conflict and the environment have been investigated by some organisations such as The Conflict and Environment Observatory, relatively little research, however, has been carried out into the environmental impacts of explosive weapons. This lack of research needs to be addressed. Not only do explosive weapons result in lasting environmental damage, but this harm has considerable health and livelihood consequences for civilian populations.

In an attempt to address this lack of research, this report set out to focus on four key areas of environmental concern, to gain some understanding of the environmental consequences from the use of explosive weapons. These areas are unexploded ordnance (UXO), agriculture, infrastructural damage, and flora and fauna. To provide tangible case studies, we focused on two on-going conflicts: Syria's nine-year-long conflict which began in 2011, and the conflict in Eastern Ukraine which began in 2014.

Destroyed building in eastern Ukraine.

In Ukraine, the conflict is located in the eastern part of the country, involves few actors and sees predominantly shelling, landmines and victim-activated IEDs being used. In Syria, the conflict has spread across the country at various times and, due to the huge numbers of both state and non-state actors involved, the variety of weapon types being used has been considerable, including cluster munitions and improvised air-dropped bombs such as barrel bomb use by regime forces and improvised air-dropped munitions by ISIS. Both conflicts have caused significant environmental harm.

It is hoped that this report highlights key areas of concern in relation to the environmental impact of explosive weapon harm, and provides compelling evidence to encourage states to listen to the call for immediate action to prevent human suffering from the use of explosive weapons in populated areas.

METHODOLOGY

As part of AOAV's research into both the lasting health and environmental consequences from the use of explosive weapons, AOAV carried out desk-based research, as well as interviews and on the ground investigations in Ukraine and at the Syrian border in Lebanon. Interviews were conducted with academics, NGO personnel, farmers, civilians, demining organisations, and other experts. The data on explosive weapons comes from the Explosive Weapons Monitor Project. For this methodology please see our latest Explosive Violence report.[5]

INFRASTRUCTURAL DAMAGE

- The destruction of buildings will likely release hazardous material into the air and on the ground, such as toxic smokes and heavy metals.
- Estimates suggest that the conflict in Syria has generated 15 million tonnes of rubble in Aleppo and 5.3 million in Homs.
- UXO contamination in Ukraine and Syria prevents civilians from returning or reconstruction taking place.
- Exposure to the dust and debris when buildings and industrial facilities are destroyed by explosive weapons is linked to cancers and other health consequences.

DESTRUCTION OF TOWNS AND CITIES

When used in urban areas, explosive weapons with wide-area effects inevitably lead to the damage of infrastructure. This devastation hinders access to vital services and makes areas uninhabitable, causing long-term displacement.

The destruction of buildings themselves will also likely release hazardous material into the air and on the ground, such as toxic smokes and heavy metals.[6] As the NGO Conflict and Environment Observatory notes: “When buildings are directly impacted by munitions or damaged through pressure waves generated by explosions, building materials are pulverised, generating large volumes of dust. Pulverised building material dusts are typically a heterogeneous mixture of materials, such as cement, metals, PCBs, silica, asbestos and other synthetic fibres. Exposure to these dusts can have both physical and chemical impacts on health.”

While there is little research on the long-term health impacts from the damage in the post-conflict setting, some insight can be gained from some defining events of this century. American scientists found that the release of toxic dusts following the attack at the World Trade Centre in 2001 resulted in a significant increase of cancer risk amongst the exposed.[7] More recently, there has been concern over potential lead poisoning of Parisians living nearby Notre-Dame Cathedral, after the devastating fire of April 2019.[8]

One can expect similar issues of cancer and toxic poisoning in conflict-affected countries, particularly places like Syria where a third of homes are estimated destroyed alongside countless hospitals, schools, factories and more.[9] Moreover, the destruction of the health infrastructure in places like Syria means that the monitoring of the health impacts from toxic dust and rubble is all too often frustrated.

What is known is the scale of the problem. One year after the battle of Mosul and the retaking of the city from the Islamic State by the US-led coalition, the United Nations’ Environment Programme estimated the city bore some eight million tons of war debris, rubble highly contaminated with UXO and Improvised Explosive Devices (IEDs).[10]

With conflict comes the challenge, too, of ineffective waste disposal, and such lingering detritus poses further problems. In Lebanon, the debris from the destruction of downtown Beirut was said to have contributed to the nation’s lasting garbage problem,[11] which has led to pollution in the Mediterranean Sea[12] and significant air pollution across the country.[13]

A similar issue arose in post-WWII Germany. In the old town of Nuremberg, some ten million tonnes of rubble from the ferocious fighting there was deposited in a huge pit after the war ended. In the ensuing years, other waste of many kinds continued to be dumped there.[14] Few safety measures were carried out to ensure such pollutants were contained and, over time, this waste leached beyond its earth confines, severely pol- luting the nearby Silbersee, or Silver Lake. There, lethal concentrations of hydrogen sulphide were found and while the landfill has since been landscaped, forested and incorporated into the Volkspark Dutzendteich, the Silver Lake remains heavily polluted to this day. Some fifty people have reportedly lost their lives after bathing there, after ignoring rules warning not to do so.[15]

Any failure to impose effective procedures governing the removal and disposal of conflict rubble will not only lead to pollution from waste dumps but will also decrease the levels of materials recycled; increasing the demand for raw materials. Where debris has been managed poorly in the past, these failures – and the subsequent environmental harm – is rarely addressed, owing to the prohibitive costs.

These numerous challenges pose not just immediate environmental health concerns to civilians in impacted areas and those displaced, but also raise lasting consequences that can be felt decades later, and both Ukraine and Syria show evidence of such direct and long-term harm.

Ukraine

Ukraine’s census data shows significant recent population decline in both Luhansk and Donetsk, the two oblasts most impacted by the conflict. According to the State Statistics Service of Ukraine, the population in these oblasts decreased by over 37,000 and 65,000 respectively between 2016 and 2018, constituting the two highest population decreases across the country over these two years.[16]

As of February 2019, over 50,000 homes were reported destroyed in Ukraine’s war.[17] About one in every ten families were also reported as being unable to access shelter assistance due to the absence of formal documentation confirming tenure rights or their rights of ownership.[18] This process to receive documentation can take a year and can cost up to $400. As in so many post-conflict countries, the bureaucratic process is often an insult to the injury of explosive violence. Moreover, there is no quick or easy fix to the damage caused across large parts of eastern Ukraine. One village, Shyrokyne, that sits in the Volnovakha Raion of Donetsk Oblast, was ‘retaken’ by the Ukrainian army in 2016. Today, however, it still sits in ruin, uninhabitable.[19] The lasting damage of the fighting and permanent threat of explosives hidden in the rubble make it a ghost town.

The Norwegian Refugee Council (NRC), in response to such realities, conducted an assessment of housing and shelter in Luhansk oblast, publishing their results in July 2019.[20] They visited some 3,100 addresses and found that 1,289 needed urgent repairs.

It is not just housing. Waste and water pipes in eastern Ukraine were also impacted by shelling, leaving water supplies contaminated and, in some cases, leading to community illness and individuals requiring hospitalisation.[21] Damage to water drainage, removal systems, water supply infrastructure and treatment facilities, forces residents to use unprotected shaft wells, boreholes and springs.[22] Such improvised responses, and the threat itself, has led UNICEF to estimate that at least 750,000 children in the region are at risk of contracting water-borne diseases like diarrhoea.[23]

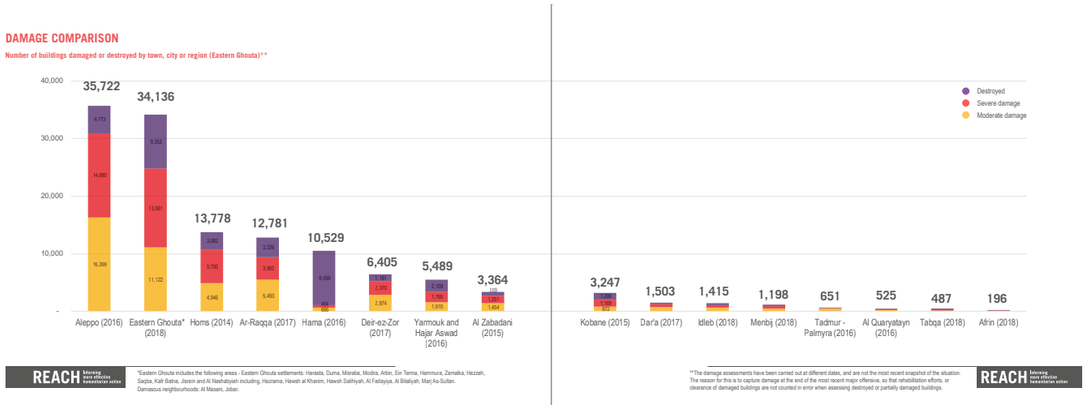
Disturbingly, these children are almost three times more likely to die from disease due, in part, to a lack of safe drinking water and the capacity to keep clean and hygienic. In short, the damage to water systems by explosive violence lingers and can threaten lives long after the bombing has stopped.[24]

Syria

In Syria, the reality is even starker. The levels of destruction seen there is on the scale of European cities destroyed in World War II Germany, such as Dresden. In Aleppo alone, at least 15 million tonnes of rubble were estimated to have been created in bombing attacks by 2017, while 5.3 million were reported in Homs, according to the World Bank’s Toll of War report.[25]

Such vast quantities of rubble, and the ensuing clearance needed, raises a host of environmental concerns many of which could have a significant impact on human health. And it is not just Aleppo and Homs - Raqqa, Douma and many other urban areas also witnessed major attacks. Indeed, AOAV’s data on explosive violence in Syria shows that three-quarters of all harm from explosive violence happened in populated areas. Few places were safe.

By 2017, it was reported that 50% of Syria’s basic social infrastructure lay damaged or broken.[26] During 2018, heavy bombardment continued to rain down on towns and cities; 34,136 buildings were damaged or destroyed in Eastern Ghouta; a further 1,415 were impacted in Idlib; some 1,198 in Manbij; and yet more in Taqba and Afrin.[27] Such damage continued across the country in 2019, and such damage will continue until the conflict comes to its much-welcomed end.



REACH, 'Syrian Cities Damage Atlas', 2019. https://reliefweb.int/sites/reliefweb.int/files/resources/reach_thematic_assessment_syrian_cities_damage_atlas_march_2019_reduced_file_size_1.pdf

A thematic assessment of satellite identified damage by the research organisation REACH, published in 2019, gives a snapshot understanding on just how high the levels of rubble rise across Syria.[28] In Aleppo, some 35,722 buildings were damaged or destroyed. In Eastern Ghouta this figure was similar, with 34,136 buildings estimated impacted. In Homs, 13,778 buildings were seen lying in ruin, and in Raqqa a similar number of 12,781 buildings lay damaged or destroyed. A look at the entire graph created by REACH shows just how high the levels of rubble across many areas of Syria remains. In short, Syria has become an enormous site of destruction and devastation, with about a third of homes across Syria thought damaged or destroyed by 2017.[29]

In 2018, the UN estimated the cost of the damage of Syria's cities lay at some $120 billion.[30] By 2019, 12 million people – half of Syria's pre-war population – had been displaced.[31] Some 5.6 million people – women, girls, boys and men – had fled the country entirely. A further 6.6 million had been internally displaced. And, given the extent of the damage, it is likely such displacement may last years, if not decades.

Despite all of this, some people remained, living in areas unfit for habitation. Others even began to return. What greets them is a hard future. To clear the debris in Aleppo alone would take six years of continuous work and 26 million 'truck-kilometres'.[32] There is not the equipment, the funds, or the capacity to carry out most of the clearance work needed; the enormity of the task ahead is hard even to articulate. And, given the current crisis of COVID 19 and other pressures on the international community, finding funding to clear the streets of debris will be harder still.

In the meantime, informal waste dumping, already a pre-conflict issue in Syria, will increase. The burning of waste, said to be on the rise, will further contribute to the pall of pollution that lingers over the beleaguered cities. And so it goes. In the end, the memory of this terrible conflict will be one of dust, as much it will be one of violence.

Industrial facilities

In times of conflict, industrial plants and factories may be deliberately or accidentally impacted by explosive violence. This destruction may lead to leaks or spillages of hazardous materials into the environment or cause persistent fires that belch toxic fumes into the air. There are many historical cases of such environmental catastrophes. During the Kosovo conflict, in 1999, airstrikes led by the NATO coalition damaged oil refineries and depots in Pančevo, resulting in widespread environmental damage.[33] There have been reports of "Pančevo cancer" among people from the affected area who breathed in those poisonous clouds.[34] Burning oil often contains soot particles made of carbon, along with sand, dust and dirt, and plumes of gases, including carbon dioxide, carbon monoxide, sulfur oxide, nitrogen oxides, volatile organic hydrocarbons (e.g. benzene) and hydrogen sulphide, quickly contaminate and radiate. This can cause asthma and other long-term health complications.[35] Some work has already been done on the impact of damage to industrial facilities from recent harm caused explosive violence, particularly by PAX.[36]

Ukraine

The shelling of industrial facilities in Ukraine has caused significant environmental damage, with chemicals contaminating large surrounding areas. One 2018 FAO report described how some of the industrial enterprises damaged as a result of the fighting included coke processing plants, steelworks, oil refineries, chemical plants, thermal power stations and two of the largest chemical enterprises in the region, all highly environmentally hazardous industries.[37] So, whilst a lack of industrial activity as a consequence of the conflict saw emissions decrease by 40% in Donetsk and 75% in Luhansk (compared to 2013),[38] the damage to some factories has meant that any short-terms alleviation of pollution may be undermined by long-term environmental harm from leaks and spills.

Extractive mines in the region have also been impacted. Several have stopped operating due to the shelling of electrical power plants, which hindered ventilation and water supply. The displacement of workers also had an impact. Overall, the lack of staff and electricity has meant that 36 mines have now flooded.[39] Such flooding released methane gases and toxic heavy metals into local groundwater pools, poisoning water supplies and potentially spreading radioactive contamination.[40] Such contaminated water is in danger of spreading to the central Siverskyi Donets river, a stream of water that provides up to 85% of the water used by the Donbas Water Company – Donbas' main supplier.[41] There are also transborder contamination risks to the Sea of Azov, connected to the Black Sea by the narrow Strait of Kerch.[42]

Such harm has already begun. One study early into the conflict found that the Siverskyi Donets river had elevated sulphate concentrations, as well as higher than normal nitrogen and phosphorous levels.[43] This was attributed, in part, to the disruption of wastewater treatment facilities operations.[44] Additionally, a five-fold increase in concentration levels of strontium and barium was recorded – both chemicals being widely found in modern munitions.[45]

In the Siverskyi Donets basin, sulphates were found at five-times greater levels than the maximum permissible concentrations; nitrates were twice as elevated.[46] Waters

A woman cycles past a bombed building in eastern Ukraine.

from the Lopan river tributary in the Siverskyi Donets basin were also found to contain high traces of heavy metal concentrations,[47] and alkylphenols levels were running at seven times greater than EU limits.[48] Many heavy metals have well-recorded deleterious health impacts due to their toxicity,[49] some of which are linked to organ damage and are carcinogenic, while many alkylphenols are toxic to aquatic life and also negatively impact human health.[50] Overall, an analysis on 61 soil and water samples collected in the Donetsk and Luhansk Oblasts within government and non-government controlled territory found that 100% of the surface water and 75% of underground water in the government-controlled areas were contaminated with alien chemical and mineral components.[51] In the non-government controlled areas, 85% of the surface and underground water was said to be contaminated.[52]

It is worth noting that the only other time the Donbas mines flooded was during WWII. The Soviet Union took five years to drain them[53] and the local population had to migrate during this period to safer areas to flee the dangers of contamination.[54]

A recent study by the Conflict and Environment Observatory found that contamination from the flooded mines had polluted a nearby reservoir and it was possible that radionuclides may also have been released into groundwater and the wider environment.[55] The pollution from mines also has the potential to make water permanently undrinkable.[56] The full impact on water quality will become clearer over the next decade. However, there have already been cases of ground subsidence and methane explosions in cellars – both thought to be linked to mine flooding. The ground is said to have subsided by as much as 92cm in some parts of Donetsk City, with an average of 25cm subsidence recorded.[57]

Syria

Studies by the NGO PAX found that industrial zones in Syria have been particularly targeted by explosive violence.[58] Other accounts from journalists detail wrecked industrial zones.[59] While it is not known exactly what type of factories and plants have been destroyed, and it is difficult to evaluate the scale of the damage, it is clear that the threats of contamination

Syrian children walk past the rubble of buildings destroyed by explosive weapons. Jordi Bernabeu Farrús, Flickr.

Apartment building destroyed during War in Donbass. Lysychansk, Lugansk region, Ukraine. Ліонкінг, 4 August 2014, https://commons.wikimedia.org/wiki/File:Lysychansk_16.jpg

Damaged home in Aleppo.

Syrian refugee camp in Arsal, Lebanon.

and reverberating pollutants still exist. Although there are critical gaps in data concerning most the industries damaged and the pollution caused, it is clear that that oil refineries and reservoirs have been a focus of bombardments throughout the conflict.

Syria's oil and gas infrastructure has been repeatedly targeted during the conflict. With the Islamic State controlling some 60% of Syria's petrol production at the height of the group's power, refinery infrastructure became a key target by the US-led coalition and others fighting ISIS.[60] By the end of 2016,[61] the coalition's military operation Inherent Resolve claimed to have destroyed at least 1,620 oil facilities. In 2015, in one attack alone outside Raqqa, 140 munitions were reported to have been dropped, striking five gas and oil separation points, as well as hitting two crude oil collection points.[62] The destruction of formal oil infrastructure had consequences. In part, it led to greater levels of artisanal oil structures – ones with fewer safety measures and with higher chances of creating pollution. In Deir Ezzor alone there were at-least 5,791 makeshift refineries reported in 2016.[63]

By 2018, the sheer damage to oil installations across Deir Ezzor, Al-Hasakah and Raqqa was made painfully evident from satellite imagery provided by the European Space Agency.[64] Several oil spills occurred throughout 2017 and 2018.[65] In Thayyem, Deir Ezzor, the oil spill was 7km long.[66] The human health consequences from such pollution include a significant escalation in cancer rates, especially those affecting the lungs and skin, as well as inducing foetal malformations, according to the Health Care Director based in Deir Ezzor.[67] The environmental damage of oil spills, depending on their size, can also include groundwater pollution, harm to wildlife habitats and food contamination, to name just some.

But, despite such horrors, as the armed conflicts continue in both Syria and Ukraine, it is likely further infrastructural harm will occur, adding to the toll. While some impacts are already clear, many may only reveal themselves in years to come. And it will take billions of dollars to remedy this harm – aid that is sorely absent from post-conflict territories. In the end, the surrounding populations and the natural world are destined to suffer as a result of the unwanted storm of steel that war so often brings.

UNEXPLODED ORDNANCE

- Modern weapons are estimated to have a failure rate of about 5%.
- The toxic residue from military munitions in drinking water, soil, surface water and air may sometimes present a greater hazard to more people than the actual explosion.
- Both Syria and Ukraine are among the countries most affected by landmines and UXO in the world.
- It is estimated to cost about 2.5 euros to lay a mine in Ukraine and about 900 euros to clear it.
- It is likely to take another 15 years at least to clear Ukraine and more than 30 to clear Syria.

Without even detonating, UXO can cause substantial civilian harm. It is well known that many of the different components of explosive weapons can be harmful to the environment, with consequences for human health. The composition of the munition shell is also concerning, as it is often made from heavy metals such as copper or lead. Explosive munitions will typically contain elements such as lead, antimony, uranium, dinitrotoluene, trinitrotoluene, and hexahydro-1,-3,5-trinitro-1,3,5-triazine (RDX) which are 'generally resistant to biological treatment and remain in the biosphere' – the contamination often has toxic environmental effects and can result in harm to human health.[68] For example, it has been demonstrated that humans exposed to trinitrotoluene (TNT) may experience several harmful health effects, including anaemia, abnormal liver function and cancer.[69] Other organisms, particularly aquatic organisms,[70] also experience lethal toxic effects.[71]

According to Richard Albright, a renowned expert in weapons, doctor in environmental sciences and former US Army officer, the toxic residue from military munitions in drinking water, soil, surface water and air may sometimes present a greater hazard to more people than the actual explosion.[72] One of the most dangerous aspects of this contamination is that it can escalate up the food chain. People might be harmed not because they were directly exposed to explosive weapons pollution, but because they ate contaminated crops or livestock, or drank contaminated water, months or years after the attack took place.

France, Belgium and Germany are even today still affected by the soil contamination from WWII;[73] with areas labelled "red zones", and their surrounding lands, still not used for agricultural purposes.

Modern weapons are estimated to have a failure rate of about 5%.[74] This is higher for older weapons still used in conflict and other weapons like cluster munitions. This means that of ordnance dropped in conflict, 5% is likely to remain on the ground, harming civilians, exacerbating displacement and preventing livelihood activities. Other weapons lie in wait too – those designed to only detonate when they come into contact with a person – landmines and improvised explosive devices (IEDs). Many of these remain without having been triggered after a conflict has come to an end.

Furthermore, as conflict has become more urbanised, it is often towns and cities which the UXO now contaminate. This increases the likelihood of civilians coming into contact with UXO and presents substantial challenges. For example, some UXO will be hidden under rubble and detonate when the debris is moved; it is difficult to prevent civilians returning to their homes until clearance is provided; and often in inner urban areas, there are hindrances to the movement of equipment and personnel. Of course, the presence of UXO in rural areas, including agricultural land and forests, also presents its own challenges.

The threat UXO poses is long-lasting. On August 4th 2019, two people were killed when a WWII bomb detonated in a garage in Poland.[75] Such a lasting threat poses a drain on state resources. For example, AOAV found that, between 2014 and 2018, there were 5,041 call-outs relating to munitions which may have been in service during WWI and WWII, according to a Freedom of Information request to the UK's Ministry of Defence.[76] In the UK, between 2010 and 2016, an average of 61 WWII air-dropped bombs had to be safely detonated every year. Total numbers of UXO in the UK could be even higher, with 15,000 items of UXO removed from UK construction sites between 2006 and 2008, at substantial cost.[77]

This is just the UK; the long-lasting legacy of UXO impacts dozens of nations around the world. The 'Iron Harvest' of the Somme, the UXO legacy of the 1916 offensive that took over a million lives, could take over 500 years to clear.[78]

Ukraine

Ukraine is said to be one of the most mine-affected countries in the world.[79] It has been estimated that 7000km^2 of the land[80] has been contaminated by UXO and that two million people are exposed to the risks of such pollution.[81] An estimated 70% of families struggle to conduct their lives and avoid contamination in affected lands. The Landmine Monitor recorded 2,078 mine casualties (725 killed and 1,353 injured) between 2014 and 2017 in eastern Ukraine alone.[82] Such contamination also means that villages and people are isolated from basic services including water, gas, electricity, all of which have seen damage during the conflict which often cannot be repaired due to the presence of UXO.[83]

Villages near the contact line, such as Troitske, suffer greatly from mine and UXO contamination, reducing the residents' access to farming as they are afraid to cultivate the land,[84] impacting their sustenance and agricultural economy.[85]

Farmers and children are particularly impacted by the contamination. In 2018, landmines and UXO were the leading cause of death among children in the conflict-affected areas,[87] while farmers are faced with a hard choice – either risk the explosion or lose their income.[87]

The type of contamination in Ukraine means that clearance, though it has already started in some areas, is likely to take many years. The most common devices encountered by the mine clearance agency HALO in Ukraine are tripwire-initiated hand grenades, anti-personnel mines and anti-vehicle mines, as well

Unexploded ordnance in eastern Ukraine. March 2015. EU Civil Protection and Humanitarian Aid. https://www.flickr.com/photos/eu_echo/16574994940/in/photostream/

as UXO.[88] Many minefields will contain a combination of different threats. Areas that are likely to contain tripwire devices and anti-vehicle mines that are minimum-metal, are far slower to clear. The presence of tripwire-initiated devices means that in one month a team may clear just 10% of the land they might typically be able to clear if these devices were not present.[89]

For minimum-metal mines, clearance teams must use more sensitive detectors but, due to shrapnel from shelling and other metallic clutter, this results in more time spent checking the ground for threats, when often it is just metallic clutter. This, as well as the climate in Ukraine, makes the clearance of such threats take longer than it might in other circumstances.

Anti-vehicle mines have a particular impact on rural communities and Ukraine is seeing more deaths from anti-vehicle mines than anywhere else in the world.[90] Many along the frontline rely on agriculture, and such communities have remained in limbo, unable to safely conduct their work.

Poster in eastern Ukraine warning of explosives.


Scrap metal yard in eastern Ukraine.

While there are at least 200 minefields across Luhansk and Donetsk, it is not just these that threaten civilians. UXO in populated areas has also caused casualties and prevented rebuilding.[91] With power cut off to some communities, locals are forced to face landmines and other UXO to collect firewood for heating.

It is thought that it costs about 2.5 euros to lay a mine in Ukraine and about 900 euros to clear it.[92] It is likely to take another 15 years at least to clear Ukraine of the explosive contamination.[93]

Syria

Syria is one of the most contaminated countries from UXO in the world. It is estimated that 10.2 million people are exposed to explosive hazards; more than half the population.[94] Owing to the fog of war, the scale of the contamination is not fully known, though the number of casualties and the levels of bombardment suggests it is alarmingly high. The UNMAS Syrian response unit in Jordan estimated that there has been, on average, one instance of explosive weapon use in Syria every ten minutes between 2015 and late 2018.[95] Each incident could likely mean the deployment of several munitions. With about one in twenty of these not detonating, it is clear that Syria faces a considerable amount of contamination.

This mountain of lethal legacy makes clearance a far deadlier task. While IEDs are likely to cause injuries, the UXO from manufactured weapons generally contains significantly higher levels of explosives and tend to result in fatalities.[96] Those carrying out the clearance are often unprepared for the task.

Due to the level of conflict that continues in the country demining organisations cannot carry out their work. This in many instances means civilians carry out clearance themselves, which has killed or injured many. An investigation by Amnesty International found at least 1,000 people were killed by explosives between October 2017 and April 2018 in contaminated areas and many more may die before reaching medical care, many more are likely harmed.[97]

The local organisations that have been able to carry out work have faced significant challenges. When AOAV interviewed members of the Rojava Mine Control Organisation (RMCO),[98] they reported significant challenges to clearance efforts in Raqqa, including a lack of large, armoured vehicles to clear the rubble; something necessary due to the likelihood of explosives among the debris.

The casualties from these weapons are just the tip of the iceberg. UXO leaves far more civilians living in impoverished conditions, displaced or otherwise unable to access livelihoods. The impact on Syrian agriculture and redevelopment is profound, with the potential to cause long-lasting harm even once the munitions are removed due to the damage from the pollution and the abandonment of contaminated areas. Such issues are discussed in more detail in other areas of this report.

While there are admirable goals in place to rid the world of landmines by 2025,[99] such goals seem unattainable when you note that contamination continues apace in countries like Syria and Ukraine. Although these countries see high levels of humanitarian aid and funding compared to others, it is clear that while many governments sign off on billions to fund war and military might, they rarely part with similar sums for demining or other peacebuilding initiatives. In 2013, for example, Legacies of War calculated that the United States had averaged an annual contribution of $2-2.5 million for UXO clearance in Laos.[100] In contrast, the US spent $13.3 million (in 2013 dollars) per day, or $44 billion in total, bombing Laos over nine years.

Similarly, while the US provided the Pentagon with $15.3 billion in 2019 to fight in Syria and Iraq, President Donald Trump in August 2018 withdrew the yearly development payment of $230 million to support stabilisation efforts, including demining.[101] Though many states will contribute billions as part of a warfare effort, few are willing to part with similar sums to deal with the consequences. This means that while demining operations have begun in both Syria and Ukraine, much of this is underfunded, especially local initiatives. Leaving these munitions in the earth for longer increases the polluting impact.


Unexploded ordnance in eastern Ukraine. May 2017. EU Civil Protection and Humanitarian Aid.
https://www.flickr.com/photos/eu_echo/16762376215/

AGRICULTURE

- In Ukraine's Donetsk region, agricultural production had fallen by almost 35% by 2016.
- The amount of irrigated land in Syria shrunk by 47% by 2015, and water reservoirs by 49%.
- In the conflict-impacted areas in Ukraine, the livestock population is said to be at about half or less than pre-conflict levels.
- In some areas of Syria, bee colonies have decreased by as much as 86%.

Explosive violence causes damage to crops, the soil and livestock; displaces farmers and other experts who are essential to ensuring the smooth running of farms and other agricultural industries; damages water networks essential for irrigation; and the resultant UXO can prevent many from accessing and using the land for decades. Additionally, it is frequently those who work in agriculture who are among the most economically vulnerable.

In both Syria and Ukraine, the agricultural impacts are profound. In the Donbas region of Ukraine, the sale of agricultural produce is the second-largest source of income, behind only pensions.[102]

CROPS

Ukraine

Most of the production of fruit and vegetables in Ukraine is generally for consumption in households. Those that do sell fruits and vegetables generally do so on a small scale and only when there is a surplus from their household. 91% of households in Donbas are thought to be engaged in plant production, with the majority engaged in subsistence farming.[103] Between 2014 and 2016, vegetable yields in Luhansk and Donetsk fell, according to a 2018 FAO report.[104] Though the drop was only slight in Luhansk, in Donetsk yields fell by 22%. Surrounding regions saw increases in these years. Donetsk was particularly impacted, with total agricultural production having fallen by 34.7% by 2016, compared to 2014.

The damage to industrial facilities and mines also poses a significant threat to agriculture in eastern Ukraine. For example, the high mineralisation of mine waters, as well as the sulphates and chlorides, can lead to the salinisation of flooded soils, which can negatively impact plant growth. The irrigation of agricultural land with surface waters polluted by mine waters can also harm. This is likely to lead to 'a significant drop in the quality and quantity of agricultural products produced,' according to the FAO's 2018 report.[105]

In Donbas, AOAV met with Igor Mashakin, a Ukrainian farmer. He explained that before the conflict, his farm of 900 hectares was producing 2,000 tonnes of wheat, sunflower and barley a year, and he had 13 employees. Throughout the conflict, however, much of his land was shelled, destroying equipment, including a combine harvester, a bulldozer and a drying machine. "They estimated the cost of the harvester to be $9,000", according to Igor. "The bulldozer was $15,000. And then the missiles hit a fuel depot, and the holes made by the shrapnel meant the fuel seeped out overnight. That was another $6,000." This, combined with the loss of the crop drying machine, the costs incurred hiring another machine to dry those crops, and damage to the outhouses in the farm, put the total estimated direct costs of the war at some $100,000.

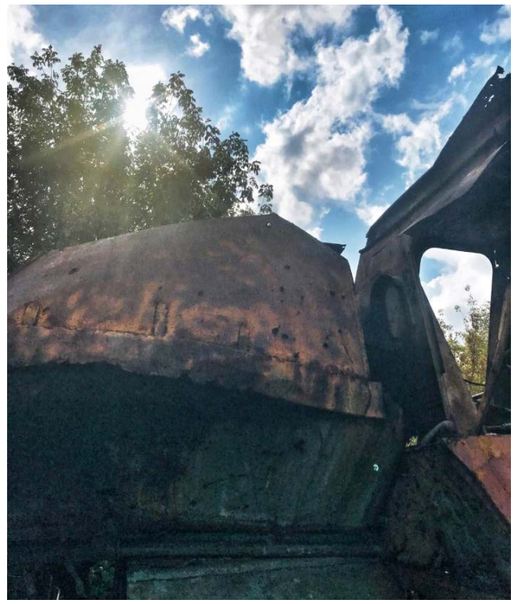
Igor Mashakin, a farmer in Eastern Ukraine.

Three of Igor's employees quit, while others turned to drinking. Some of his employees have been injured by the shelling. Much of the land surrounding Igor's farm is also contaminated by landmines.

By 2015, production levels were down 50%, and they were unable to harvest sunflowers or sow more seeds for next season's crops. As well as the estimated $100,000 direct damage, they lost a further $45,000 in revenue.

This lower rate of income also meant that the farm could not buy more modern equipment. Instead, they rely on agricultural machinery that should long ago have been scrapped. Logistical problems also emerged; before the war, the farm's workers travelled just to Donetsk to sell their product at market, some ten kilometres away. Now, they have to go all the way to Dnipropetrovsk, as the company that used to buy from them had to shut down owing to the conflict.

New buyers also push down the price; deliberately reducing their offers because they know the farmers are already under the thumb: "The buyers in Dnipropetrovsk are asking for 30% lower than the price we used to get."



Damaged machinery from rocket shelling on Igor's farm in eastern Ukraine. 2019.

Syria

The bombardment of agricultural sites has persisted throughout the conflict in Syria, including crop fields, storage facilities, irrigation networks and bakeries.[106] The supply of wheat and the production of bread, Syria's staple food, has been particularly targeted by armed actors to hurt food supplies. As one Syrian told AOAV, 'for Syrians, a meal without bread, is not a meal'. Grain silos and wheat warehouses have been destroyed or damaged in airstrikes. In some cases, this has occurred by accident,[107] while in others such strikes were part of cold-calculated strategic objectives.[108]

ISIS are well known for their 'scorched earth' tactics, torching hundreds of acres of agricultural land in eastern Syria and Iraq. But the harm to the environment there has worsened owing to the use of IEDs and landmines around these areas.[109] This makes putting out such fires too dangerous to risk. Overall, some 74,000 acres of farmland in Hasakah, Raqqa and Aleppo were burnt by ISIS in 2019.[110] The loss from the fires in Raqqa alone has been valued at $9million. Bombardment by regime forces and their allies have also started fires,[111] exacerbating the crisis, particularly in Idlib.[112] And though it is unclear whether this was intentional or collateral damage, the impact on farmers there has been extensive.

Water and irrigation facilities have also frequently been damaged in attacks. As early as 2014, 35% of water treatment plants had been damaged, with the bombing of water facilities carried out by many forces.[113]

The further contamination of water has lead to many health problems among residents, an issue exacerbated by the increase of toxic chemicals in the soil and groundwater - a result of weapon use and arms manufacturing.[114] Faisal Hejji, a Syrian farmer, claimed to be, "depending more on rain rather than other irrigation methods".[115] In a country with such volatile temperatures and weather patterns, such concern for the safety and quality of groundwater offers a further setback for those who normally rely on irrigation.

This concern has had dramatic consequences. Stanford researchers have estimated that the amount of irrigated land in Syria shrunk by 47% by 2015.[116] Water reservoirs were down by 49%. Such a drop is further impacted by damage to power infrastructure,

which makes it difficult to supply remaining irrigation systems with the necessary energy.

All of this has consequences. The area of land sown with wheat and barley in Syria stood at 2.16 million hectares in 2015-16. This was a 30% decrease from the 3.12 million hectares sown in 2010. Admittedly, recent years have seen things improve slightly; in 2019 the Syrian wheat harvest reached 2.2 million tonnes, an almost doubling of the paltry 1.2 million in 2018.[117] But this is a far cry from the pre-conflict levels of production, of some 4.1 million tonnes. Moreover, this 2019 improvement in cereal harvests has been largely attributed to heavier rains.[118] The national damage to infrastructure, the burden of ongoing conflict and instability, and the mass displacement of Syrian agricultural workers have all impacted, and continue to impact, food production in this sorrowful country.

So, whilst there have been some improvements and recovery in some areas of Syria, millions still live under the daily burden of food insecurity, and those brave enough to carry on farming face a dangerous occupation.[119] This enduring conflict continues, unrelentingly at times, to displace farmers, contaminate land and destroy agricultural infrastructure.[120]

LIVESTOCK

Ukraine

Livestock is not free from the tyranny of the conflict that has visited Ukraine. Farmers and herders fear using their lands for grazing, as numerous cattle have already been killed by landmines.[121] They are also concerned with a rise in natural predators, such as wolves, foxes and jackals, all of which have reportedly increased since the conflict began.[122]

The number of livestock has dropped significantly across the country.[123] The only exception has been the number of pigs, whose numbers rose between 2013 to 2016, boosted by so-called ‘Enterprise’ farms. Cattle and sheep, though, who have a greater need for outside pasturelands, decreased in numbers by 39% and 52% respectively. The number of pigs on farms classified as a ‘legal farm’ or a ‘private entrepreneur’ also decreased over this period. On ‘legal’ farms the number of cattle, pigs and sheep decreased by 65%, 87%, and 99% respectively.

The number of poultry appears to have remained stable or increased on enterprise farms. It is clear that a conflict marked by its explosive ordnance impacts livestock in different ways.

Giant livestock facilities in Donbas also put areas surrounding the sites at risk. Due to the levels of animal waste such facilities produce, the damage caused by shelling can threaten nearby water sources.[124] For example, shelling damage to one pig farm caused sewage to leak into water sources used by cattle, killing one and leaving seven animals sick.[125]

Milk production has also been highly affected, halving in 2016 in Luhansk compared to 2010.[126] In surrounding regions, those not in the conflict zone, production however remained stable. Many of the dairy farmers in the government-controlled areas have also been cut-off from their previous consumer markets, as well as from large-scale processing facilities now based in non-government-controlled areas and beyond the frontier. In general, the livestock population is said to be at about half or less than half of pre-conflict levels.[127]

Damage to Igor’s farm from shelling is estimated to have direct costs of some $100,000.

Farmer of his farm in eastern Ukraine.

Syria

Displacement appears to have had one of the biggest impacts to livestock in Syria, with livestock abandoned, sold early or butchered. The decreases in livestock that have been exacerbated by not only the displacement of farmers but also other skilled livestock workers, including veterinary staff. Despite very limited information on livestock levels, it is estimated that during the first three years of the conflict in Syria, sheep numbers fell by 45%, goats by 30%, cattle by 40%, and poultry by 55%.[128] The numbers are thought now to be stabilising though nowhere near the pre-conflict levels.

In the Badia rangelands, which accounts for 86% of grassland and natural pastures in Syria, about 28% of sheepherders have lost their herds.[129] The main risks in the area include threats from fighting, as well as landmines and other UXO; during the height of the conflict, many herders were forced to flee Badia.

Indeed, so many left that their absence has caused pasture regeneration in the region.[130] Livestock production has also become more expensive owing to price inflation for feed, as well as lack of water access – a factor exacerbated by the bombardment of water infrastructure and networks.

It was recently reported that water buffalo in the countryside surrounding Hama have been highly impacted by the continued use of explosive violence in the region in recent years.[131] Not only have water buffalo become direct casualties of the bombardment, but much of the land has become unusable, and farmers and their buffalo have been displaced by the shelling. The total number of water buffalo in the area had decreased by two-thirds compared to the pre-conflict level by 2017.[132]

Bee-hives have also been heavily impacted. This not only has consequences for livelihoods but may also hamper pollination unless addressed. In some areas, bee colonies have decreased by as much as 86%. Much of this is thought to be due to bombardment and the resulting air pollution and displacement.[133]

The devastation of agricultural land not only has had consequences for livelihoods but also health, with many Syrians now depending on food assistance and others facing malnourishment. In one week of early February 2020 alone, dozens of children perished due to the terrible conditions within the displacement camps, including lack of access to food and medicine.[134] In Ukraine too, food insecurity has risen amongst the conflict-affected population, with a particular impact on the elderly. The elderly thought to account for half of those facing food insecurity in eastern Ukraine.[135]

The impact of explosive weapons on food security has been seen most starkly in Yemen, where the conflict has seen the humanitarian crisis deepen due to heavy bombardments across the country. Attacks on food and agricultural sites have been a concerning strategy of the Saudi-led coalition and the impact has been devastating.[136] Such targeting has contributed significantly to the wider humanitarian emergency with 22.2 million Yemenis now in need of humanitarian assistance, according to UN figures.[137]

FLORA AND FAUNA

- Shelling, landmines and other UXO are not just a potential trigger for fires, but also prevent people from stepping in to effectively extinguish the blaze.
- Mountain gazelles, which used to be seen in their hundreds before the conflict are now considered extinct in Syria.
- 70% of trees were thought to have been burnt or cut down in Idlib by 2018, compared to the pre-conflict levels.
- In Ukraine's Donetsk region, the population of wolves has risen by approximately 50% from pre-war levels.

The natural environment can be impacted in complex and various ways from explosive weapons. In some cases, there can even be benefits to habitats and biodiversity. These benefits, however, are usually short-lived and most consequences are detrimental. In general, there is little research on the impact of explosive weapons on flora and fauna, despite the subsequent harm this may have on humans. The current or lingering presence of explosive weapons can also make it difficult to monitor such impact.

It has been estimated that over 90% of major armed conflicts between 1950 and 2000 occurred within countries containing biodiversity hotspots.[138] More than 80% took place directly within 'hotspot' areas. Such findings from the University of Idaho's review 'Warfare in biodiversity hotspots' provides a rare insight into the impact explosive violence may have on wildlife. Such insight is important. Biodiversity is integral to delicate ecosystems, both locally and globally, and the destruction of this biodiversity – be it through the bombing of oil infrastructure, weapon storage sites or other industrial infrastructures – can have profound reverberating effects.

Ukraine

It was highlighted during AOAV's research in the Donbas region of eastern Ukraine that when people were displaced, nature had in many ways stepped into the breach.[139] Some animal species, previously rare, began to proliferate in abandoned places. However, other species were devastated by the conflict; for instance, a colony of Dalmatian pelicans — the only one in Ukraine — was reportedly decimated by explosive violence and over-fishing. Some species of snakes are thought to have been particularly impacted by a spike in forest fires,[140] exacerbated by shelling and other blasts (in 2014, there were at least 3,000 fires, 15 times more than the previous year[141]). Shelling, landmines and other UXO are not just a potential trigger for fires, but also prevent actors stepping in to effectively extinguish the blaze.[142] In addition to this, years of conservation data was lost during the fighting, and environmental projects were disrupted.

When rewilding has occurred, following the exodus the war has precipitated, it has brought its own problems. A reported rise in wolves has stoked fears, with farmers saying they have taken chickens and puppies and villagers claiming they fear to send their children down to rivers to swim alone. A bigger concern is the increase in wild dogs, with mayors of small towns across the region complaining of feral packs. The department of environment and natural resources in the Donetsk region has secured over 22 million UAH (almost $1 million) to establish 20 sterilisation centres through this region, aiming to stem the rise in wild puppies.

A woman at an animal shelter in Ukraine pets a dog who lost his leg in the conflict.

Some of the abandonned cats in Syria, Ernesto's Sanctuary.

Syria

While there is not much data on the impact of explosive weapons on wildlife in Syria, a few examples shed some light. Mountain gazelles, which used to be seen in their hundreds before the conflict are now considered extinct in Syria, an eradication that has been put down to the ongoing conflict.[143] These gazelles have been pushed across the border into the Turkish province of Hatay; there some have received treatment before being released.[144] By late 2019, the number of mountain gazelles in Turkey's Kirikhan district stood at 670, a 570% rise compared to the pre-conflict levels in the district.[145] The construction of a border wall along the Turkish border which was complete in 2018, now prevents the cross-border movement of the gazelles, and they have disappeared completely, it seems from Syria.[146]

Other animal populations, including the Northern Bald Ibis, an endangered species, have been threatened by the conflict. Such a threat is, in large part, due to a rise in the numbers of displaced people and the impact this increase has had on the ibis's habitat, along with a spike in illegal hunting. Illegal logging is thought to have increased dramatically across the country following an increased demand for firewood, as well as a consequence of reduced control measures, with armed groups using logging to bolster their incomes. In Idlib, known as the Green Governorate, 70% of trees were thought to have been burnt or cut down by 2018, compared to pre-conflict levels.[147] Displaced communities also rely on logging as an income, which brings in approximately $5 a day. The forests of Idlib used to be home to more than 100 species of trees and shrubs, and more than 50 species of animals and birds. The extent of the impact of mass deforestation upon these species remains unclear.

Forest fires are also thought to have contributed to this loss, with intensive regime bombardment of woodlands having occurred, in an attempt to deny opposition factions the benefits of forest cover.[148] Loss of forest has also been reported in Aleppo and Latakia. The destruction of such trees presents a severe concern in a region where forests are scarce and is likely to contribute to desertification following soil erosion and land degradation. Since the conflict began, Syria has lost at least a quarter of its forests.[149]

The political instability in the country has also contributed to species loss. For example, Turkey's dam-building, one that can continue owing to a breakdown in the international order in the region, has already severely impacted Syria's water supply, reducing water flows to Syria by about 40%, and more dams are expected.[150] Turkey started building a new dam in 2019 which will flood over 400km of riverine habitat, further endangering the Euphrates soft-shelled turtle.[151] With the increase in hostilities between Syria and Turkey, it is unlikely Syria will be able to negotiate the water-sharing agreements to prevent further environmental harm.

Other pressures on wildlife may also stem from the proliferation of arms, the presence of UXO and the bombardment of weapon stockpiles. The bombing of stockpiles in Libya, for example, has led to a huge dispersal of weapons that have, in turn, been linked to poaching in other areas of the world, such as Gabon, Cameroon and the Central African Republic.[152]

ANIMALS IN URBAN SETTINGS

Human populations and animals often have very interdependent relationships. In conflict, these relationships can be challenged, and the balance upset. When this happens, it can be harmful to both humans and animals.

As explosive violence drives displacement, some areas can become more sparsely populated and, due to the violence, services can become interrupted. Both may contribute to the numbers of urban animal populations. For example, garbage may not be collected creating a ready supply of food. In urban areas, the number of animals considered pests are likely to increase. In many instances, the wildlife outside the city may flourish as well. And as growing animal populations compete for food, some rural animals are forced into populated areas, causing conflict between animals and animals, and animals and humans.

Explosive weapons impact pets too and this can have a considerable impact on their owners, who are often forced into putting their pets down or abandoning them in times of need. For instance, the so-called 'British Pet Massacre' happened in 1939 in the United Kingdom when over 750,000 pets were killed in preparation for food shortages during World War II.[153] The emotional and psychological impact of such actions can be profound on owners and while such actions may seem logical at the time, the long-term loss of a cat or a dog to an owner may also add to the psychological stresses that war already brings.

A dog shelter in eastern Ukraine.

One recent study, 'Effect of Pets on Human Behaviour and Stress in Disaster', examined the impact of pets on people living with PTSD after an earthquake; the results were thought to be relevant to disaster victims in general.[154] The study found that the PTSD scores of pet-owners were higher than those of non-pet owners immediately after a disaster but were significantly lower in the years following the disaster. The initial PTSD scores were linked to the possibility that pet-owners were less likely to evacuate if pets were not included in evacuation measures. Other studies have found that pets contribute to human resilience following a disaster, particularly for the vulnerable.[155] If pets aren't incorporated into evacuations or other security measures, people are more likely to take risks to remain with or to protect their pets. If animals are lost in a disaster, psychological and physical recovery can be slower and could increase psychological trauma.[156]

Abandoned pets in areas experiencing high levels of explosive violence may also impact the local environment, such as increasing the likelihood of diseases or impacting indigenous flora and fauna in unexpected ways.

Ukraine

The Donbas region was the most populated in Ukraine, outside Kyiv, before the conflict and some wildlife in the region has flourished following it, as civilians move out of areas and hunting decreases due to a ban.[157] For example, the numbers of pheasants and hares in the region have increased, which has also contributed to a rise in foxes and wolves. In Donetsk, the population of wolves has risen by approximately 50% since prior to the war, with a population now standing at 300.[158] Foxes are estimated to have increased by as much as four-fold in eastern Ukraine.[159] Alongside this, there has also been a rise in rabies in the human population, especially in Donetsk (foxes are thought to be responsible for almost a third of rabies cases in Ukraine).[160]

A dog lies outside the hospital in eastern Ukraine.

Today, wolves, jackals and foxes are reported to be endemic, roaming the streets, hunting for unguarded pets or livestock.[161] Though many animals tend to migrate from those regions worst impacted by explosive violence, intimidated by the noise and chaos of war, the conflict has also accustomed some animals to sound and human activity, making them bolder in their incursions into urban areas.

Other invasive species, such as the jackal, sunfish and the Asian lady beetle have also expanded and colonised the conflict zones – even impacting adjacent areas.[162] Other species have demonstrated abnormal behaviours, including aggression; one incidence reported to AOAV was of a snake attacking a woman in a city centre, though it did not bite her.[163] Many animals have been forced from their natural habitats, due to shelling or mining, as well those seeking food and establishing new territories – all of which brings them into increasing contact with humans.

Dogs, a popular pet in Donbas, now roam the streets, and the population of street dogs has soared.[164] In one animal shelter, the number of stray dogs rose to some 800 during 2016 alone. Some of these bear the wounds of war, with shrapnel and other injuries, causing them to be aggressive and fearful of men, in particular, who they associate with soldiers.

Prior to the conflict, Ukraine already had high levels of animal cruelty, but there had been steps towards better animal welfare. This, however, was stifled by the onset of the conflict in Donbas. Kateryna Havrish, who runs an animal shelter in Stakhanov, explained to AOAV that, in Stakhanov, a city in Luhansk Oblast, the situation for animals had been beginning to improve before the conflict, with most neutered and vaccinated against rabies, but the situation quickly changed: "There were lines in vet clinics to put unwanted animals to sleep. When the shelling began, people fled, leaving dogs and cats closed in apartments without water and food."[165]

Most of those euthanised occurred just before the conflict but once active hostilities began it was far more common for people to just abandon their animals. Furthermore, as people fled and military presence increased, dog shelters were targeted by soldiers where they abused and killed the animals. Havrish claimed this occurred in Luhansk and Almaznaya, and that in Almaznaya the owner was reportedly tortured and the animals eaten. That shelter later closed. In addition, Larisa Tsybulnik, who cares for dogs left behind in Maryinka, and runs an animal shelter in the town, estimated that about half of the dogs had died in the town by early 2017.[166] Havrish reported to AOAV that while some suffered directly from the impact of the shelling, others died from fear-induced heart attacks or shock.

There are also stories of people who did not flee the encroaching explosive threat so that they could remain with their animals. These families hid with their animals in the basements during bombing and many took on additional animals that had been abandoned. Others were said to have died in bombardments trying to rescue and protect animals from the shelling.[167]

The harm to animals in Donbas has had impacts reaching far beyond the territory. In one shelter in Kyiv, which holds over 1,300 animals, it is estimated that about 15% have come all the way from the frontlines in Donetsk, over 600km away.[168] Havrish, who now lives in Kyiv, continues to volunteer at an animal shelter and supports her own in Stakhanov. Her hope for the animals in Donbas is to bring them to Kyiv and then seek adoption for them abroad in countries with working laws on animal welfare.

When AOAV met Marina Shazhko from the Bakhmut Community for Animal Protection – or LADA – she explained that it is hard to get animals placed with a family, especially mongrels.[169] She continues to run the shelter for over 100 dogs on a shoestring budget.

A civilian sits with a cat in eastern Ukraine.

A cat in rescued from the rubble in Syria, Ernesto's Sanctuary.

Vets from Ernesto's treat an injured horse, Ernesto's Sanctuary.

Shelters, both in Kyiv[170] and Donbas[171] are often under threat from armed men, in a country where weapons have proliferated in the violence.

Syria

In Syria, many have heard about the Cat Man of Aleppo, who has risked his own life to rescue and care for pets left behind in Aleppo and Idlib.[172] With the help of donations and assistance, Mohammad Alaa Aljaleel has set up a sanctuary in rural Aleppo, with 200 cats in residence.[173] His previous sanctuary in Aleppo city, where he cared for 170 cats and a dog, was bombed, shortly before eastern Aleppo was captured by government forces in December 2016.[174]

Alaa fled to western Aleppo with the 22 cats that remained. Then, following the bombardment of Idlib in 2019, Alaa managed to rescue about 80 stray cats from Kafrnabel, 40 from Maaret al-Nouman and more than 100 from Khan Sheikhoun.[175] Ernesto's Sanctuary for Syrian Cats is a refuge: it has seen 'too many animals to count' hurt by explosive violence, with many left with shrapnel wounds.[176] When AOAV spoke to Alessandra Abidin, co-founder of the sanctuary, she highlighted that Ernesto's had just treated a horse injured by shelling. Smaller animals, she said, are often left with crush injuries after being trapped under rubble. 'They become nervous and agitated whenever the planes fly over', she said. 'Now, planes in the sky are a regular occurrence. They remain on edge. We have had cases of cats dying from shock and fear – not just from bomb injuries.'

Like humans, the consequences for animals from the use of explosive weapons are complex and lasting. As Alessandra told AOAV: 'animals are a forgotten statistic in this war. So many are abandoned, so many are left behind when people flee from the advancing war.'

Wildlife, pets and other urban wildlife appear resilient. However, the interdependent nature of many human-animal relationships often leaves both animals and people vulnerable when explosive violence breaks down their bonds. When displaced, civilians are often unable to find shelter if they have an animal with them. Non-domesticated animals may also see population increases when towns are partly abandoned, placing both humans and them at risk.

Evidence also points to the devastating impact explosive violence can have on wildlife, particularly from fires caused by bombardment, and the resultant tree and habitat loss. Whilst the long-term impact of explosive violence on flora and fauna needs more research, especially in areas such as war-induced desertification or flooding, it is clear that the reverberating impact of explosive weapons on natural ecosystems and wild and domestic animals is profound and under-discussed.

Conclusion

The impact the use of explosive weapons with wide-area effects, especially in populated areas, has on the environment are wide and diverse, and often have severe implications for human populations. This harm is caused by both the direct impact of the explosive weapons, and also from reverberating effects, such as the long-term displacement of civilians and the concomitant impact this has on pollution levels or habitat devastation.

Such environmental harm is all too often overlooked, as it is deemed of lower importance both during the conflict and after. But it is clear that such impact – from infrastructural damage to unexploded ordnance to agricultural harm, to the devastation of flora and fauna – can further devastate the lives of those who have already had their world torn apart by conflict.

What can be seen by each section of this report is the polluting impact of explosive weapons. Such weapons cause contamination in both urban and rural areas, affecting food chains, water sources, and air quality. The reverberating impacts further devastate the environment, particularly habitats. Such impacts are often lasting as previous AOAV research has shown.[177]

The harm from the use of explosive weapons is also grimly predictable, with environmental devastation and its long-term consequences repeated across a variety of conflicts, from the world wars of the first half of the twentieth century to the most recent wars of this century. And yet, while such harm is foreseeable, little is done to prevent it or address its aftermath.

One of the best ways to prevent such devastation would be to avoid the use of explosive weapons with wide-area impacts in populated areas in the first place. Indeed, AOAV, along with our partners in the International Network of Explosive Weapons (INEW)[178] are calling on states and other actors to face up to this problem as a policy challenge, to meet the needs of victims and survivors, to review their national practices and to come together to develop stronger international standards to curb this pattern of violence.

This action would minimise infrastructural damage and pollution, and reduce displacement, and all the consequences from such. While efforts to develop a political declaration to avoid the use of such weapons in populated areas are on-going, the commitment by states cannot come soon enough.

As a member of the International Network on Explosive Weapons (INEW), AOAV and its colleagues urge states and all users of explosive weapons to:

- Acknowledge that the use of explosive weapons in populated areas causes severe harm to individuals and communities and furthers suffering by damaging vital infrastructure;
- Strive to avoid such harm and suffering in any situation, review and strengthen national policies and practices on the use of explosive weapons and gather and make available relevant data;
- Work for the full realisation of the rights of victims and survivors;
- Develop stronger international standards, including certain prohibitions and restrictions on the use of explosive weapons in populated areas.

In developing these standards, states, and other actors should make a commitment that explosive weapons with wide-area effects will not be used in populated areas.

RECOMMENDATIONS

- AOAV calls on states and other actors to politically commit to avoid using explosive weapons with wide-area effects in populated areas.
- States should work towards the full realisation of the rights of victims, including those killed and injured, their families, and affected communities.
- States should strive to ensure the timely and adequate provision of needed services for the recovery, rehabilitation and inclusion of victims of explosive violence, without discrimination. This necessitates the consideration of environmental issues within this provision.
- States should be cognisant of the fact that, even when civilians are not killed, destruction to civilian infrastructure and land can have widespread and long-term harm for communities.
- More research is needed to better understand the long-term harm from the use of explosive weapons on the environment.
- Greater efforts should be made to recognise and swiftly address the environmental harm that such violence can cause.

Bombed buildings in eastern Ukraine.

NOTES

1 Dathan, J. 'When the bombs fall silent', *AOAV*, May 2018, https://aoav.org.uk/wp-content/uploads/2018/06/Reverberating-effects-v5.pdf (Last accessed 07 Apr 2020)
2 Save the Children, 'Stop the War on Children', 2019, https://www.savethechildren.org.uk/content/dam/gb/reports/stop_the_war_on_children_report_2019.pdf (Last accessed 07 Apr 2020)
3 Article 36 and PAX, 'Explosive weapons with wide area effects and risk to civilians', Feb 2020, http://www.article36.org/wp-content/uploads/2020/02/Wide-area-effects-1.pdf (Last accessed 07 Apr 2020)
4 Humanity and Inclusion, 'Syria, a mutilated future', May 2016, https://handicap-international.fr/sites/fr/files/documents/files/syria-mutilated-future_handicap-international.pdf (Last accessed 07 Apr 2020)
5 Dathan, J. 'Explosive Violence Monitor 2018', May 2019, https://aoav.org.uk/wp-content/uploads/2019/05/Explosive-Violence-Monitor-2018-v5.pdf (Last accessed 07 Apr 2020)
6 Garrity, A. 'Conflict rubble: a ubiquitous and under-studied toxic remnant of war', *Conflict and Environment Observatory*, 10 Jul 2014, https://ceobs.org/conflict-rubble-a-ubiquitous-and-under-studied-toxic-remnant-of-war/ (Last accessed 07 Apr 2020)
7 Li, J. et al. 'Association Between World Trade Center Exposure and Excess Cancer Risk', *JAMA*, 19 Dec 2012, https://jamanetwork.com/journals/jama/fullarticle/1486831 (Last accessed 07 Apr 2020)
8 Cockburn, H. 'Notre Dame residents told to test blood for lead poisoning after cathedral fire', *Independent*, 04 Jun 2014, https://www.independent.co.uk/news/world/europe/notre-dame-paris-fire-lead-poisoning-roof-cathedral-air-safe-a8944041.html (Last accessed 07 Apr 2020)
9 *Financial Times*, 'Threat of Syrian home demolitions sparks anger over redevelopment', 09 Dec 2018, https://www.ft.com/content/8b44a17c-e2ae-11e8-a6e5-792428919cee (Last accessed 07 Apr 2020)
10 UN Environment Programme, 'Rising from the rubble: Iraq's Mosul takes steps to deal with war debris', 26 Mar 2018, https://www.unenvironment.org/news-and-stories/story/rising-rubble-iraqs-mosul-takes-steps-deal-war-debris (Last accessed 07 Apr 2020)
11 Dathan, J. 'When the bombs fall silent', *AOAV*, May 2018, https://aoav.org.uk/wp-content/uploads/2018/06/Reverberating-effects-v5.pdf (Last accessed 07 Apr 2020)
12 Sherlock, R. 'Environmentalists Warn Of Mediterranean Pollution From Lebanon Land Reclamation', *NPR*, 11 Jan 2018, https://www.npr.org/sections/parallels/2018/01/11/575925118/environmentalists-warn-of-mediterranean-pollution-from-lebanon-land-reclamation?t=1575642389887&t=1586259928371 (Last accessed 07 Apr 2020)
13 Khawaja, B. '"As If You're Inhaling Your Death" The Health Risks of Burning Waste in Lebanon', *HRW*, 01 Dec 2017, https://www.hrw.org/report/2017/12/01/if-youre-inhaling-your-death/health-risks-burning-waste-lebanon (Last accessed 07 Apr 2020)
14 *Angewandte Geologie*, 'Zur Geschichte des Silbersees und Silberbucks', 03 Apr 2012, http://www.angewandte-geologie.geol.uni-erlangen.de/silber02.htm (Last accessed 07 Apr 2020)
15 *Angewandte Geologie*, 'Zur Geschichte des Silbersees und Silberbucks', 03 Apr 2012, http://www.angewandte-geologie.geol.uni-erlangen.de/silber02.htm (Last accessed 07 Apr 2020)
16 OCHA, 'Ukraine administrative levels 0-2 population statistics', *HDX*, https://data.humdata.org/dataset/ukraine-administrative-levels-0-2-population-statistics (Last accessed 07 Apr 2020)
17 Office of the United Nations High Commissioner for Human Rights, 'Report on the human rights situation in Ukraine 16 November 2018 to 15 February 2019', *OHCHR*, https://www.ohchr.org/Documents/Countries/UA/ReportUkraine-16Nov2018-15Feb2019.pdf (Last accessed 07 Apr 2020)
18 OCHA,' UKRAINE Situation Report', *Relief We*b, 15 Aug 2019, https://reliefweb.int/sites/reliefweb.int/files/resources/Situation%20Report%20-%20Ukraine%20-%2015%20Aug%202019.pdf (Last accessed 07 Apr 2020)
19 *UNIAN*, 'Ruined village of Shyrokyne in Donbas remains fully mined by Russian invaders', 05 Aug 2019, https://www.unian.info/war/10640919-ruined-village-of-shyrokyne-in-donbas-remains-fully-mined-by-russian-invaders-photo.html (Last accessed 07 Apr 2020)
20 *Norwegian Refugee Council*, 'Humanitarian Shelter Damage Assessment', 01 Oct 2018, https://www.nrc.no/globalassets/pdf/reports/ukraine/damage-assessment-report_nrc_luhansk_loc.pdf (Last accessed 07 Apr 2020)
21 Hardy-Françon, G. 'Researcher measures environmental impact of war in Donbas', *Kyiv Post*, 22 Apr 2019, https://www.kyivpost.com/ukraine-politics/researcher-measures-environmental-impact-of-war-in-donbas.html?cn-reloaded=1 (Last accessed 07 Apr 2020)
22 Yakovliev, Y and S Chumachenko, 'Ecological Threats in Donbas, Ukraine', *Centre for Humanitarian Dialogue*, October 2017, http://www.igns.gov.ua/wp-content/uploads/2018/02/Ecological-Threats-in-Donbas.pdf (Last accessed 07 Apr 2020)
23 *UN News Centre*, 'Ukraine: 750,000 children at risk of losing access to safe drinking water, warns UN', 16 Jun 2017, https://www.un.org/sustainabledevelopment/blog/2017/06/ukraine-750000-children-at-risk-of-losing-access-to-safe-drinking-water-warns-un/ (Last accessed 07 Apr 2020)
24 *UNICEF*, 'Children living in protracted conflicts are three times more likely to die from water-related diseases than from violence', 22 Mar 2019, https://www.unicef.org/india/press-releases/children-living-protracted-conflicts-are-three-times-more-likely-die-water-related (Last accessed 07 Apr 2020)
25 *World Bank*, 'The Toll of War: The Economic and Social Consequences of the Conflict in Syria', July 2017.
26 *UNDP*, 'Basic Infrastructure & Service Rehabilitation', https://www.sy.undp.org/content/syria/en/home/development-impact.html (Last accessed 07 Apr 2020)
27 *REACH*, 'SYRIAN CITIES DAMAGE ATLAS', 15 Mar 2019, https://reliefweb.int/sites/reliefweb.int/files/resources/reach_thematic_assessment_syrian_cities_damage_atlas_march_2019_reduced_file_size_1.pdf (Last accessed 07 Apr 2020)
28 *REACH*, 'SYRIAN CITIES DAMAGE ATLAS', 15 Mar 2019, https://reliefweb.int/sites/reliefweb.int/files/resources/reach_thematic_assessment_syrian_cities_damage_atlas_march_2019_reduced_file_size_1.pdf (Last accessed 07 Apr 2020)
29 *The World Bank*, 'The Visible Impacts of the Syrian War May Only be the Tip of the Iceberg', 10 Jul 2017, https://www.worldbank.org/en/news/press-release/2017/07/18/the-visible-impacts-of-the-syrian-war-may-only-be-the-tip-of-the-iceberg (Last accessed 07 Apr 2020)
30 *AP*, 'The Latest: UN says civil war has cost Syria $388B in damage', 09 Aug 2018, https://apnews.com/aa0aaa2c44cd-430196f572227b45c150/The-Latest:-UN-says-civil-war-has-cost-Syria-$388B-in-damage (Last accessed 07 Apr 2020)
31 *UNHCR*, 'Syria emergency', https://www.unhcr.org/syria-emergency.html (Last accessed 07 Apr 2020)
32 *World Bank*, 'The Toll of War: The Economic and Social Consequences of the Conflict in Syria', July 2017.
33 *United Nations Environment Programme* and *United Nations Centre for Human Settlements (Habitat)*, 'The Kosovo Conflict – Consequences for the Environment & Human Settlements', 1999, http://wedocs.unep.org/bitstream/handle/20.500.11822/8433/-The%20Kosovo%20Conflict%20Consequences%20for%20the%20Environment%20%26%20Human%20Settlements-1999378.pdf?sequence=3&isAllowed=y (Last accessed 07 Apr 2020)
34 Brown, P. "No one will be able to prove what killed us" *TheGuardian*, 15 May 2001, https://www.theguardian.com/world/2001/may/15/balkans (Last accessed 07 Apr 2020)
35 *U.S. Department of Veteran Affairs*, 'War Related Illness and Injury Study Center', https://www.warrelatedillness.va.gov/education/exposures/oil-well-fires.asp (Last accessed 07 Apr 2020)
36 *PAX*, 'Amidst the Debris: A Desktop Study on the Environmental and Public Health Impact of Syria's Conflict', October 2015
37 Rozwadowski, R. et al. 'The agriculture sector in eastern Ukraine: analysis and recommendations', *FAO*, 2018, http://www.fao.org/3/i8862en/I8862EN.pdf (Last accessed 07 Apr 2020)
38 Rozwadowski, R. et al. 'The agriculture sector in eastern Ukraine: analysis and recommendations', FAO, 2018, http://www.fao.org/3/i8862en/I8862EN.pdf (Last accessed 07 Apr 2020)
39 Zwijnenburg, W. 'Donbas: A Ticking Toxic Time Bomb', *Bellingcat*, 30 Mar 2017, https://www.bellingcat.com/news/uk-and-europe/2017/03/30/donbas-ticking-toxic-time-bomb/ (Last accessed 07 Apr 2020)
40 Zwijnenburg, W. 'Donbas: A Ticking Toxic Time Bomb', *Bellingcat*, 30 Mar 2017, https://www.bellingcat.com/news/uk-and-europe/2017/03/30/donbas-ticking-toxic-time-bomb/ (Last accessed 07 Apr 2020)
41 UN Environment, 'Ukraine's Donbas bears the brunt of toxic armed conflict', 25 Jul 2018, https://www.unenvironment.org/news-and-stories/story/ukraines-donbas-bears-brunt-toxic-armed-conflict (Last accessed 07 Apr 2020)

42 Yakovliev, Y and S Chumachenko, 'Ecological Threats in, Donbas Ukraine', *Centre for Humanitarian Dialogue*, October 2017, http://www.igns.gov.ua/wp-content/uploads/2018/02/Ecological-Threats-in-Donbas.pdf (Last accessed 07 Apr 2020)
43 *Environment People Law*, 'Military Conflict in Eastern Ukraine — Civilization Challenges to Humanity', 2015, http://epl.org.ua/wp-content/uploads/2017/04/1817_EPL_Posibnuk_ATO_English.pdf (Last accessed 07 Apr 2020)
44 *OSCE*, 'ENVIRONMENTAL ASSESSMENT AND RECOVERY PRIORITIES FOR EASTERN UKRAINE', 2017, https://www.osce.org/project-coordinator-in-ukraine/362566?download=true (Last accessed 07 Apr 2020)
45 *OSCE*, 'ENVIRONMENTAL ASSESSMENT AND RECOVERY PRIORITIES FOR EASTERN UKRAINE', 2017, https://www.osce.org/project-coordinator-in-ukraine/362566?download=true (Last accessed 07 Apr 2020)
46 *Environment People Law*, 'Military Conflict in Eastern Ukraine — Civilization Challenges to Humanity', 2015, http://epl.org.ua/wp-content/uploads/2017/04/1817_EPL_Posibnuk_ATO_English.pdf (Last accessed 07 Apr 2020)
47 Vystavna, Y. et al. 'Priority substances and emerging pollutants in urban rivers in Ukraine: Occurrence, fluxes and loading to transboundary European Union watersheds', *Science of The Total Environment*, Vol 637–638, 01 Oct 2018, Pages 1358-1362.
48 Vystavna, Y and D Diadin, 'Water scarcity and contamination in eastern Ukraine', *Hydrological Sciences and Water Security: Past, Present and Future*, 2015, https://www.proc-iahs.net/366/149/2015/piahs-366-149-2015.pdf (Last accessed 07 Apr 2020)
49 Tchounwou, P. et al. 'Heavy Metals Toxicity and the Environment', *Molecular, Clinical and Environmental Toxicology*, 2012, pp 133-164.
50 *Pollution* Tracker, 'Alkylphenols', https://pollutiontracker.org/contaminants/alkylphenols/ (Last accessed 07 Apr 2020)
51 Yakovliev, Y and S Chumachenko, 'Ecological Threats in Donbas, Ukraine', *Centre for Humanitarian Dialogue*, October 2017, http://www.igns.gov.ua/wp-content/uploads/2018/02/Ecological-Threats-in-Donbas.pdf (Last accessed 07 Apr 2020)
52 Yakovliev, Y and S Chumachenko, 'Ecological Threats in Donbas, Ukraine', *Centre for Humanitarian Dialogue*, October 2017, http://www.igns.gov.ua/wp-content/uploads/2018/02/Ecological-Threats-in-Donbas.pdf (Last accessed 07 Apr 2020)
53 Hardy-Françon, G. 'Researcher measures environmental impact of war in Donbas', *Kyiv Post*, 22 Apr 2019, https://www.kyivpost.com/ukraine-politics/researcher-measures-environmental-impact-of-war-in-donbas.html?cn-reloaded=1 (Last accessed 07 Apr 2020)
54 Gavrishin, A. 'Environmental conditions in the region of coal mines in East Donbass', *Gornyi Zhurnal*, January 2018.
55 Darbyshire, E. 'Are abandoned mines flooding in Ukraine's Donbass region?', *The Conflict and Environment Observatory*, 27 Apr 2020, https://ceobs.org/abandoned-mines-are-flooding-in-ukraines-donbass-region/ (Last accessed 28 Apr 2020)
56 Hamilton, R. 'Coal Mines, La nd Mines and Nuclear Bombs: The Environmental Cost of War in Eastern Ukraine', *Foreign Policy Research Institute*, 26 Sep 2019, https://www.fpri.org/article/2019/09/coal-mines-land-mines-and-nuclear-bombs-the-environmental-cost-of-the-war-in-eastern-ukraine/ (Last accessed 07 Apr 2020)
57 Hamilton, R. 'Coal Mines, Land Mines and Nuclear Bombs: The Environmental Cost of War in Eastern Ukraine', *Foreign Policy Research Institute*, 26 Sep 2019, https://www.fpri.org/article/2019/09/coal-mines-land-mines-and-nuclear-bombs-the-environmental-cost-of-the-war-in-eastern-ukraine/ (Last accessed 07 Apr 2020)
58 *PAX*, 'Amidst the Debris: A Desktop Study on the Environmental and Public Health Impact of Syria's Conflict', October 2015, and *PAX*, 'Scorched earth and charred lives', August 2016.
59 Fisk, R. 'Aleppo's Sheikh Najjar: The death of a once-rich city', *Independent*, 06 Jun 2014, https://www.independent.co.uk/news/world/middle-east/aleppos-sheikh-najjar-the-death-of-a-once-rich-city-9503699.html (Last accessed 07 Apr 2020)
60 Levallois, A. 'The financing of the 'Islamic State' in Iraq and Syria (ISIS)', *European Parliament*, 11 Sep 2017, https://www.europarl.europa.eu/RegData/etudes/IDAN/2017/603835/EXPO_IDA%282017%29603835_EN.pdf (Last accessed 07 Apr 2020)
61 *PAX*, 'Scorched earth and charred lives', August 2016.
62 Ferdinando, L. 'Coalition, Local Forces Making Gains Against ISIL', *Operation Inherent Resolve*, 22 Dec 2015, https://www.inherentresolve.mil/Media-Library/Article/674836/coalition-local-forces-making-gains-against-isil/ (Last accessed 07 Apr 2020)
63 *PAX*, 'Scorched earth and charred lives', August 2016.
64 Zwijnenburg, W. 'Nefarious Negligence: Post-Conflict Oil Pollution in Eastern Syria', *Bellingcat*, 09 Apr 2018, https://www.bellingcat.com/news/mena/2018/04/09/nefarious-negligence-post-conflict-oil-pollution-in-eastern-syria/ (Last accessed 07 Apr 2020)
65 Zwijnenburg, W. 'Nefarious Negligence: Post-Conflict Oil Pollution in Eastern Syria', *Bellingcat*, 09 Apr 2018, https://www.bellingcat.com/news/mena/2018/04/09/nefarious-negligence-post-conflict-oil-pollution-in-eastern-syria/ (Last accessed 07 Apr 2020)
66 Zwijnenburg, W. 'Nefarious Negligence: Post-Conflict Oil Pollution in Eastern Syria', *Bellingcat*, 09 Apr 2018, https://www.bellingcat.com/news/mena/2018/04/09/nefarious-negligence-post-conflict-oil-pollution-in-eastern-syria/ (Last accessed 07 Apr 2020)
67 *PAX*, 'Scorched earth and charred lives', August 2016.
68 Lima, D. 2011, 'Impact of ammunition and military explosives on human health and the environment', *Reviews on Environmental Health*, Vol 26(2).
69 Agency for Toxic Substances & Disease Registry, 'Toxicological Profile for 2,4,6-Trinitrotoluene', September 1996, https://www.atsdr.cdc.gov/toxfaqs/tfacts81.pdf.
70 Pichtel, J. 'Distribution and Fate of Military Explosives and Propellants in Soil: A Review', *Applied and Environmental Soil Science*, 2012, http://downloads.hindawi.com/journals/aess/2012/617236.pdf (Last accessed 07 Apr 2020)
71 Robidoux, P. et al. 'Acute Toxicity of 2,4,6-Trinitrotoluene in Earthworm (Eisenia andrei)', *Ecotoxicology and Environmental Safety*, November 1999, Vol 44, 3, Pages 311-321
72 Richard Albright, *Cleanup of Chemical and Explosive Munitions Locating, Identifying Contaminants, and Planning for Environmental Remediation of Land and Sea Military Ranges and Ordnance Dumpsters* (2012), 33.
73 Garrity, A 'Assessing the Toxic Legacy of First World War Battlefields', *Toxic Remnants of War Project* (blog), 2013, http://www.toxicremnantsofwar.info/assessing-the-toxic-legacy-of-first-world-war-battlefields/ (Last accessed 07 Apr 2020).
74 Overton, I. 'UK won't say how many RAF bombs fail to explode – harms manufacturer's 'trade secrets'", *AOAV*, 07 Feb 2020, https://aoav.org.uk/2020/uk-government-refuses-to-release-data-on-how-many-missiles-fail/ (Last accessed 07 Apr 2020)
75 *Brussels Times*, 'World War II bomb explosion kills two men in Poland', 05 Aug 2019, https://www.brusselstimes.com/all-news/eu-affairs/62705/world-war-ii-bomb-explosion-kills-two-men-in-poland/ (Last accessed 07 Apr 2020)
76 Freedom of Information request dated 30 May 2019 to the Ministry of Defence. FOI reference number: FOI2019/05144/18/06
77 Leatherdale, D. 'How much of a threat are unexploded bombs?', *BBC News*, 11 Aug 2015, https://www.bbc.co.uk/news/uk-england-33861431 (Last accessed 07 Apr 2020)
78 Samuel, H. 'Somme 'Iron Harvest' will take 500 years to clear, say bomb disposal experts on centenary of bloody battle', 30 Jun 2016, https://www.telegraph.co.uk/news/2016/06/30/somme-iron-harvest-will-take-500-years-to-clear-say-bomb-disposa/ (Last accessed 07 Apr 2020)
79 Grytsenko, O. 'Clearing landmines in Ukraine, one careful step at a time', *UNHCR*, 02 Apr 2019, https://www.unhcr.org/uk/news/stories/2019/4/5ca200c04/clearing-landmines-ukraine-careful-step-time.html (Last accessed 07 Apr 2020)
80 *UNHCR*, 'UNHCR says Ukraine landmine risk needs urgent action', 02 Apr 2019, https://www.unhcr.org/news/briefing/2019/4/5ca31cb74/unhcr-says-ukraine-landmine-risk-needs-urgent-action.html (Last accessed 07 Apr 2020)
81 *OCHA*, 'Eastern Ukraine one of the areas most contaminated by landmines in the world', 04 Apr 2019, https://www.unocha.org/story/eastern-ukraine-one-areas-most-contaminated-landmines-world (Last accessed 07 Apr 2020)
82 *Landmine and Cluster Munition Monitor*, 'Ukraine: Casualties', 21 Oct 2018, http://www.the-monitor.org/en-gb/reports/2019/ukraine/casualties.aspx (Last accessed 07 Apr 2020)
83 *Landmine and Cluster Munition Monitor*, 'Ukraine: Mine Action', 12 Nov 2018, http://www.the-monitor.org/en-gb/reports/2019/ukraine/mine-action.aspx (Last accessed 07 Apr 2020)
84 Brown, J. 'Ukraine: The lasting impact of landmines on civilians', *Al Jazeera*, 05 Dec 2019, https://www.aljazeera.com/indepth/features/2016/11/ukraine-lasting-impact-landmines-civilians-161117114427487.html?xif=%20DEC%202016 (Last accessed 07 Apr 2020)
85 *UNHCR*, 'UNHCR says Ukraine landmine risk needs urgent action', 02 Apr 2019, https://www.unhcr.org/news/briefing/2019/4/5ca31cb74/unhcr-says-ukraine-landmine-risk-needs-urgent-action.html (Last accessed 07 Apr 2020)

86 Grytsenko, O. ‘Clearing landmines in Ukraine, one careful step at a time’, *UNHCR*, 02 Apr 2019, https://www.unhcr.org/uk/news/stories/2019/4/5ca200c04/clearing-landmines-ukraine-careful-step-time.html (Last accessed 07 Apr 2020)
87 *UNOCHA*, ‘Humanitarian Response Plan 2019: Ukraine’, Dec 2018, https://www.humanitarianresponse.info/sites/www.humanitarianresponse.info/files/documents/files/ukraine_2019_humanitarian_response_plan_en.pdf (Last accessed 07 Apr 2020)
88 Robinson, T. and R O’Keeffe, ‘The Challenges of Humanitarian Mine Clearance in Ukraine’, *The Journal of Conventional Weapons Destruction*, April 2019, Issue 23.1, pp 17-23.
89 Robinson, T. and R O’Keeffe, ‘The Challenges of Humanitarian Mine Clearance in Ukraine’, *The Journal of Conventional Weapons Destruction*, April 2019, Issue 23.1, pp 17-23.
90 Losh, J. ‘Land mines in Ukraine’s east put it among world’s most dangerous areas for civilians’, *Washington Post*, 18 Nov 2017, https://www.washingtonpost.com/world/europe/land-mines-in-ukraines-east-put-it-among-worlds-most-dangerous-areas-for-civilians/2017/11/17/bff0d024-c8b2-11e7-aa96-54417592cf72_story.html (Last accessed 07 Apr 2020)
91 Liubchenkova, N. ‘There’s only one way to tackle Ukraine’s infestation of mines ... slowly’, *Euronews*, 13 Mar 2019, https://www.euronews.com/2019/01/28/mine-ridden-areas-in-eastern-ukraine-face-deadly-threat (Last accessed 07 Apr 2020)
92 Liubchenkova, N. ‘There’s only one way to tackle Ukraine’s infestation of mines ... slowly’, *Euronews*, 13 Mar 2019, https://www.euronews.com/2019/01/28/mine-ridden-areas-in-eastern-ukraine-face-deadly-threat (Last accessed 07 Apr 2020)
93 Liubchenkova, N. ‘There’s only one way to tackle Ukraine’s infestation of mines ... slowly’, *Euronews*, 13 Mar 2019, https://www.euronews.com/2019/01/28/mine-ridden-areas-in-eastern-ukraine-face-deadly-threat (Last accessed 07 Apr 2020)
94 UNOCHA, ‘2019 Humanitarian Needs Overview: Syrian Arab Republic’, March 2019.
95 Interview with Matthew Williams, Head of the Programme and Coordination Unit at UNMAS Syria response in Jordan, 19 Oct 2019.
96 *UN News*, ‘Mosul’s ‘3D contamination’ adds to challenges of deadly mine clearance work’, 07 Feb 2019, https://news.un.org/en/story/2019/02/1032191 (Last accessed 07 Apr 2020)
97 *Amnesty International*, ‘“WAR OF ANNIHILATION” DEVASTATING TOLL ON CIVILIANS, RAQQA – SYRIA’, 2018, https://www.amnesty.org/download/Documents/MDE2483672018ENGLISH.PDF (Last accessed 07 Apr 2020)
98 Interview with Mustafa, Vice President at RMCO Syria, Via Whatsapp, 4 Oct 2018.
99 *Landmine Free* 2025, https://www.landminefree2025.org/about-us.html (Last accessed 07 Apr 2020)
100 Legacies of War, ‘Cluster Bomb Facts’, 26 Jul 2013, http://legaciesofwar.org/wp-content/blogs.dir/1/files/ClusterBomb-Facts_REVISED_July26-2013.pdf (Last accessed 07 Apr 2020)
101 Calamur, K. ‘The U.S. Will Spend Billions in Syria—Just Not on Rebuilding It’, *The Atlantic*, 20 Aug 2018, https://www.theatlantic.com/international/archive/2018/08/us-syria/567895/ (Last accessed 07 Apr 2020)
102 Angelovski, D. ‘Socio-Economic impact and needs assessment: Donbass – Ukraine’, FAO, 2015. http://www.fao.org/3/a-i5171e.pdf (Last accessed 07 Apr 2020)
103 Angelovski, D. ‘Socio-Economic impact and needs assessment: Donbass – Ukraine’, FAO, 2015. http://www.fao.org/3/a-i5171e.pdf (Last accessed 07 Apr 2020)
104 Rozwadowski, R. et al. ‘The Agriculture sector in eastern Ukraine: analysis and recommendations’, *FAO*, 2018 http://www.fao.org/3/i8862en/I8862EN.pdf (Last accessed 07 Apr 2020)
105 Rozwadowski, R. et al. ‘The Agriculture sector in eastern Ukraine: analysis and recommendations’, *FAO*, 2018 http://www.fao.org/3/i8862en/I8862EN.pdf (Last accessed 07 Apr 2020)
106 Beals, E. ‘Wheat As a Weapon of War in Syria’, *Vice*, 23 Jun 2016, https://www.vice.com/en_us/article/jpka5k/wheat-as-a-weapon-of-war-in-syria (Last accessed 07 Apr 2020)
107 *Reuters*, ‘U.S-led raids hit grain silos in Syria, kill workers: monitor’, 29 Sep 2014, https://www.reuters.com/article/us-mideast-crisis-syria-idUSKCN0HO0EV20140929 (Last accessed 07 Apr 2020)
108 Erkendi, L. ‘Turkish offensive in northeast Syria uproots farmers, families’, *Al-Monitor*, 03 Jan 2020, https://www.al-monitor.com/pulse/originals/2019/12/syria-turkish-offensive-kurdish-farmers-looting.html#ixzz6lwtYOJ22 (Last accessed 07 Apr 2020)
109 *Asharq Al-Awsat*, ‘Crop Fires Ruin Iraqi, Syrian Harvests’, 30 May 2019, https://aawsat.com/english/home/article/1746196/crop-fires-ruin-iraqi-syrian-harvests (Last accessed 07 Apr 2020)
110 *Asharq Al-Awsat*, ‘Crop Fires Ruin Iraqi, Syrian Harvests’, 30 May 2019, https://aawsat.com/english/home/article/1746196/crop-fires-ruin-iraqi-syrian-harvests (Last accessed 07 Apr 2020)
111 McKay, H. ‘Syria’s opposition farmlands set on fire by regime bombs, satellite images show’, 28 May 2019, https://www.foxnews.com/world/syria-opposition-lands-fire-as-sad-regime-satellite-images (Last accessed 07 Apr 2020)
112 El Deeb, S. ‘Satellite images show crops on fire in Syria rebel enclave’, *Associated Press*, 28 May 2019, https://apnews.com/07c29acbf6204181b6a569038adec7d0 (Last accessed 07 Apr 2020)
113 Triebert, C. ‘Syria’s Bombed Water Infrastructure: An OSINT Inquiry’, *Bellingcat*, 11 Dec 2015, https://www.bellingcat.com/news/mena/2015/12/11/syrias-bombed-water-infrastructure/ (Last accessed 07 Apr 2020)
114 *PAX*, ‘Amidst the Debris: A Desktop Study on the Environmental and Public Health Impact of Syria’s Conflict’, October 2015
115 El Dahan, M. ‘Syrian food crisis deepens as war chokes farming’, *Reuters*, 26 Apr 2016, https://www.reuters.com/article/us-mideast-crisis-syria-wheat/syrian-food-crisis-deepens-as-war-chokes-farming-idUSKCN0XN0G0 (Last accessed 07 Apr 2020)
116 Müller, M. et al. ‘Impact of the Syrian refugee crisis on land use and transboundary freshwater resources’, *Proceedings of the National Academy of the Sciences of the United States of America*, 05 Dec 2016, https://www.pnas.org/content/early/2016/11/29/1614342113.full (Last accessed 07 Apr 2020)
117 *FAO*, ‘“So much to be done” to improve agriculture in Syria’, 20 Oct 2019, http://www.fao.org/neareast/news/view/en/c/1240723/ (Last accessed 07 Apr 2020)
118 Global Information and Early Warning System, ‘Country Briefs: Syrian Arab Republic’, *FAO*, 05 Sep 2019, http://www.fao.org/giews/countrybrief/country.jsp?code=SYR (Last accessed 07 Apr 2020)
119 *FAO*, ‘“So much to be done” to improve agriculture in Syria’, 20 Oct 2019, http://www.fao.org/neareast/news/view/en/c/1240723/ (Last accessed 07 Apr 2020)
120 *SOHR*, ‘Turkish warplanes bomb “Sherkrak” silos as US Forces return with massive reinforcements’, 31 Oct 2019, http://www.syriahr.com/en/?p=145897&__cf_chl_jschl_tk__=b05e2c2fc15ff7d896a4beccb6505b6e58c42e76-1586281535-0-ASQCOeP_UM2OtS6Yp-P2cWyyxKSh3UaP5zmXXSuqCKX-6fT93HFaMD6xpj2xLiOQHi7kQ-R4mF-AhRM0zoSjVUhRcdB-FERFHHgHoJKp6lPyqenvQfcKORhtsVfsb5N-UT0lt_QvpSHO9u-AUxXF_SvN3aJ3-Cms-Y62-KaUNuGMedl4uCy1mwBs19FMJux-6sR55ifyFzgoyibqLBulAA5w4qcuqcK3hthQRw4TTXSDneH2Wht-SEkYESUz2Vljtk2E0j2WzxTU6JTgpS97_MQD5w2gAHeBEuXnv-ee26Sk9cKR_I (Last accessed 07 Apr 2020)
121 Grytsenko, O. ‘Vacation from war: Children of embattled Donbas village go to summer camp’, *Kyiv Post*, 19 Jun 2017, https://www.kyivpost.com/ukraine-politics/vacation-war-children-embattled-donbas-village-go-summer-camp.html (Last accessed 07 Apr 2020)
122 Hyde, L. ‘All wild on Ukraine’s eastern front’, *Politico*, 17 Jul 2018, https://www.politico.eu/article/ukraine-border-war-wildlife-all-wild-on-the-eastern-front/ (Last accessed 07 Apr 2020)
123 Rozwadowski, R. et al. ‘The Agriculture sector in eastern Ukraine: analysis and recommendations’, *FAO*, 2018 http://www.fao.org/3/i8862en/I8862EN.pdf (Last accessed 07 Apr 2020)
124 Zwijnenburg, W. ‘A Ukrainian Stand-Off: The Toxic Consequences of Armed Conflict in Donbass’, *New Security Beat*, 07 May 2018, https://www.newsecuritybeat.org/2018/05/ukrainian-stand-off-toxic-consequences-armed-conflict-donbass/ (Last accessed 07 Apr 2020)
125 Duprey, B. ‘ASSESSING ENVIRONMENTAL SSESSING ENVIRONMENTAL IMPACTS OF ARMED CONFLICT: MPACTS OF ARMED CONFLICT: THE CASE OF EASTERN UKRAINE’, *Truth Hounds*, 2019, https://truth-hounds.org/wp-content/uploads/2018/12/Ecology_crimes_TruthHounds.pdf (Last accessed 07 Apr 2020)
126 Rozwadowski, R. et al. ‘The Agriculture sector in eastern Ukraine: analysis and recommendations’, *FAO*, 2018 http://www.fao.org/3/i8862en/I8862EN.pdf (Last accessed 07 Apr 2020)
127 *FAO*, ‘Socioeconomic impact and needs assessment Donetsk and Lugansk regions – Ukraine’, 2017, http://www.fao.org/3/a-i8171e.pdf (Last accessed 07 Apr 2020)
128 *FAO*,. ‘Special Report - FAO/WFP Crop and Food Security Assessment Mission to the Syrian Arab Republic’, 2019, http://www.fao.org/3/ca5934EN/ca5934en.pdf (Last accessed 07 Apr 2020)
129 *FAO*,. ‘Special Report - FAO/WFP Crop and Food Security Assessment Mission to the Syrian Arab Republic’, 2019, http://www.fao.org/3/ca5934EN/ca5934en.pdf (Last accessed 07 Apr 2020)
130 *FAO*,. ‘Special Report - FAO/WFP Crop and Food Security Assessment Mission to the Syrian Arab Republic’, 2019, http://www.fao.org/3/ca5934EN/ca5934en.pdf (Last accessed 07 Apr 2020)
131 Jawad, I. ‘Water buffalos: an endangered livestock in northern Syria’, *Enab Baladi*, 22 Nov 2019, https://english.enabbaladi.net/archives/2019/11/water-buffalos-an-endangered-live-stock-in-northern-syria/#ixzz6lx3nArPb (Last accessed 07 Apr 2020)

132 Clark, J. ‘Northwest Syria’s disappearing water buffalo’, *Syria Direct*, 11 Dec 2017, https://syriadirect.org/news/northwest-syria%E2%80%99s-disappearing-water-buffalo/ (Last accessed 07 Apr 2020)
133 *FAO*,. ‘Special Report - FAO/WFP Crop and Food Security Assessment Mission to the Syrian Arab Republic’, 2019, http://www.fao.org/3/ca5934EN/ca5934en.pdf (Last accessed 07 Apr 2020)
134 Alsaafin, L. “Breaking point’: Babies freezing to death amid Idlib push’, *Al Jazeera*, 18 Feb 2020, https://www.aljazeera.com/news/2020/02/point-babies-dying-freezing-cold-idlib-push-200217094010212.html (Last accessed 07 Apr 2020)
135 *UNOCHA*, ‘Humanitarian Response Plan 2019: Ukraine’, Dec 2018, https://www.humanitarianresponse.info/sites/www.humanitarianresponse.info/files/documents/files/ukraine_2019_humanitarian_response_plan_en.pdf (Last accessed 07 Apr 2020)
136 Mundy, M. ‘Empire of Information: The War on Yemen and its Agricultural Sector’, *LSE*, 19 Jun 2017, https://blogs.lse.ac.uk/mec/2017/06/19/empire-of-information-the-war-on-yemen-and-its-agricultural-sector/ (Last accessed 07 Apr 2020)
137 *UNHCR*, ‘Yemen Emergency’, 09 Feb 2018, https://www.unhcr.org/uk/yemen-emergency.html (Last accessed 07 Apr 2020)
138 Hanson, T. et al. ‘Warfare in Biodiversity Hotspots’, *Society for Conservation Biology*, 2009, 23(3):578-87
139 Overton, I. ‘Red in tooth and claw: how war has impacted the regional parks of eastern Ukraine’, *AOAV*, 07 Oct 2019, https://aoav.org.uk/2019/red-in-tooth-and-claw-how-war-has-impacted-the-regional-parks-of-eastern-ukraine/ (Last accessed 07 Apr 2020)
140 Vasyliuk O. et al. ‘A review of major impact factors of hostilities influencing biodiversity in the Eastern Ukraine (Modeled On Selected Animal Species)’, *Vestnik Zoologii*, Volume: 49 Issue: 2, P. 145-158.
141 *State Emergency Service of Ukraine*, ‘Ecological aspect of the reintegration of the occupied territories of Donetsk and Lugansk regions’, 18 Sep 2018, https://www.dsns.gov.ua/en/Ostanni-novini/82386.html (Last accessed 07 Apr 2020)
142 *State Emergency Service of Ukraine*, ‘Ecological aspect of the reintegration of the occupied territories of Donetsk and Lugansk regions’, 18 Sep 2018, https://www.dsns.gov.ua/en/Ostanni-novini/82386.html (Last accessed 07 Apr 2020)
143 Kesler, M. ‘Protection zone established for displaced Syrian gazelles’, *Hurriyet Daily News*, 30 Dec 2019, https://www.hurriyetdailynews.com/protection-zone-established-for-displaced-syrian-gazelles-150433 (Last accessed 07 Apr 2020)
144 *Daily Sabah*, ‘Mountain gazelle population grows in Turkish border district due to Syrian conflict’, 20 Nov 2018, https://www.dailysabah.com/turkey/2018/11/20/mountain-gazelle-population-grows-in-turkish-border-district-due-to-syrian-conflict (Last accessed 07 Apr 2020)
145 *Daily Sabah*, ‘Mountain gazelle population grows in Turkish border district due to Syrian conflict’, 20 Nov 2018, https://www.dailysabah.com/turkey/2018/11/20/mountain-gazelle-population-grows-in-turkish-border-district-due-to-syrian-conflict (Last accessed 07 Apr 2020)
146 Kesler, M. ‘Protection zone established for displaced Syrian gazelles’, *Hurriyet Daily News*, 30 Dec 2019, https://www.hurriyetdailynews.com/protection-zone-established-for-displaced-syrian-gazelles-150433 (Last accessed 07 Apr 2020)
147 Ahmed, F. ‘They are killing the trees: THE GREEN FOREST OF EDLIB …. ANOTHER VICTIM OF THE WAR IN SYRIA’, *ARIJ*, 10 Nov 2018, https://en.arij.net/investigation/they-are-killing-the-trees-the-green-forest-of-edlib-another-victim-of-the-war-in-syria/ (Last accessed 07 Apr 2020)
148 Ahmed, F. ‘They are killing the trees: THE GREEN FOREST OF EDLIB …. ANOTHER VICTIM OF THE WAR IN SYRIA’, *ARIJ*, 10 Nov 2018, https://en.arij.net/investigation/they-are-killing-the-trees-the-green-forest-of-edlib-another-victim-of-the-war-in-syria/ (Last accessed 07 Apr 2020)
149 Berdikeeva, S. ‘Woodlands of the Middle East: Missing the Forest for the Trees’, *Inside Arabia*, 20 Oct 2019, https://insidearabia.com/woodlands-of-the-middle-east-missing-the-forest-for-the-trees/ (Last accessed 07 Apr 2020)
150 Dilleen, C. ‘Turkey’s dam-building program could generate fresh conflict in the Middle East’, *The Strategist*, 05 Nov 2019, https://www.aspistrategist.org.au/turkeys-dam-building-program-could-generate-fresh-conflict-in-the-middle-east/ (Last accessed 07 Apr 2020)
151 Egret, E. ‘Turkey is about to wipe hundreds of historic Kurdish villages off the map’, *The Canary*, 06 Jun 2019, https://www.thecanary.co/global/world-analysis/2019/06/06/turkey-is-about-to-wipe-hundreds-of-historic-kurdish-villages-off-the-map/ (Last accessed 07 Apr 2020)
152 Dathan, J. ‘Explosive weapons and their impact on wildlife – a global assessment’, *AOAV*, 17 Feb 2020, https://aoav.org.uk/2020/explosive-weapons-and-their-impact-on-wildlife-a-global-assessment/ (Last accessed 07 Apr 2020)
153 Feeney-Hart, A. ‘The little-told story of the massive WWII pet cull’, *BBC News*, 12 Oct 2013, https://www.bbc.co.uk/news/magazine-24478532 (Last accessed 07 Apr 2020)
154 Tanaka, A. ‘Effect of Pets on Human Behavior and Stress in Disaster’, *Frontiers in Veterinary Science*, 18 Apr 2019, https://www.frontiersin.org/articles/10.3389/fvets.2019.00113/full (Last accessed 07 Apr 2020)
155 Thompson, K. ‘No Pet or Their Person Left Behind: Increasing the Disaster Resilience of Vulnerable Groups through Animal Attachment, Activities and Networks’, *Animals*, 2014, 4(2), 214-240.
156 Thompson, K. ‘No Pet or Their Person Left Behind: Increasing the Disaster Resilience of Vulnerable Groups through Animal Attachment, Activities and Networks’, *Animals*, 2014, 4(2), 214-240.
157 Hyde, L. ‘All wild on Ukraine’s eastern front’, *Politico*, 17 Jul 2018, https://www.politico.eu/article/ukraine-border-war-wildlife-all-wild-on-the-eastern-front/ (Last accessed 07 Apr 2020)
158 Longman, J, ‘A Consequence of Ukraine’s War: Less Hunting, More Wolf Attacks’, *New York Times*, 15 Aug 2018, https://www.nytimes.com/2018/08/15/sports/ukraine-war-hunting.html (Last accessed 07 Apr 2020)
159 Longman, J, ‘A Consequence of Ukraine’s War: Less Hunting, More Wolf Attacks’, *New York Times*, 15 Aug 2018, https://www.nytimes.com/2018/08/15/sports/ukraine-war-hunting.html (Last accessed 07 Apr 2020)
160 Europa, ‘Epizootic situation on rabies in Ukraine’, 29 Sep 2017, https://ec.europa.eu/food/sites/food/files/animals/docs/diseases_erad_rb_report_rou_201710_pres-09.pdf (Last accessed 07 Apr 2020)
161 Hyde, L. ‘All wild on Ukraine’s eastern front’, *Politico*, 17 Jul 2018, https://www.politico.eu/article/ukraine-border-war-wildlife-all-wild-on-the-eastern-front/ (Last accessed 07 Apr 2020)
162 *UNEP*, ‘Ukraine’s Donbas bears the brunt of toxic armed conflict’, 25 Jul 2018, https://www.unenvironment.org/news-and-stories/story/ukraines-donbas-bears-brunt-toxic-armed-conflict (Last accessed 07 Apr 2020)
163 Email from Kateryna Havrish, Formerly ran an animal sanctuary in Donbas and continues to help rescue and rehome Donbas’ animals, 04 Sep 2019.
164 *CNN*, ‘UKRAINE: THE ABANDONED DOGS OF DONETSK’, 21 Jul 2016, https://www.youtube.com/watch?v=R9OSX8JdPOs (Last accessed 07 Apr 2020)
165 Email from Kateryna Havrish, Formerly ran an animal sanctuary in Donbas and continues to help rescue and rehome Donbas’ animals, 04 Sep 2019.
166 *Radio Free Europe/Radio Liberty*, ‘A New Home For The Abandoned Dogs Of Donbas’, 23 Feb 2017, https://www.youtube.com/watch?v=Cs7ZIktUFtM (Last accessed 07 Apr 2020)
167 Email from Kateryna Havrish, Formerly ran an animal sanctuary in Donbas and continues to help rescue and rehome Donbas’ animals, 04 Sep 2019.
168 Miller, C. ‘The Former ‘Killing Factory’ For Ukrainian Strays That Became A Sanctuary’, *Radio Free Europe/Radio Liberty*, 04 Dec 2018, https://www.rferl.org/a/former-killing-factory-for-ukrainian-strays-that-became-sanctuary/29637414.html (Last accessed 07 Apr 2020)
169 Overton, I. ‘It’s a dog’s life: the impact of explosive violence on dogs in Eastern Ukraine’, *AOAV*, 27 Sep 2019, https://aoav.org.uk/2019/its-a-dogs-life-the-impact-of-explosive-violence-on-dogs-in-eastern-ukraine/ (Last accessed 07 Apr 2020)
170 Miller, C. ‘The Former ‘Killing Factory’ For Ukrainian Strays That Became A Sanctuary’, *Radio Free Europe/Radio Liberty*, 04 Dec 2018, https://www.rferl.org/a/former-killing-factory-for-ukrainian-strays-that-became-sanctuary/29637414.html (Last accessed 07 Apr 2020)
171 Komarnyckyj, S. ‘The Dogs of War Part 1: Kateryna Havrish on Saving the Animals of Danbas’, *Byline*, 12 Apr 2018, https://www.byline.com/column/81/article/2127 (Last accessed 07 Apr 2020)
172 *The Aleppo Catmen*, https://ernestosanctuary.org/ (Last accessed 07 Apr 2020)
173 *The Aleppo Catmen*, ‘Our Story’, https://ernestosanctuary.org/story/ (Last accessed 07 Apr 2020)
174 *Qantara*, ‘Syria’s ‘cat man’ brings hope to abandoned animals in Idlib’, 14 Aug 2019, https://en.qantara.de/content/syrias-cat-man-brings-hope-to-abandoned-animals-in-idlib (Last accessed 07 Apr 2020)
175 *Qantara*, ‘Syria’s ‘cat man’ brings hope to abandoned animals in Idlib’, 14 Aug 2019, https://en.qantara.de/content/syrias-cat-man-brings-hope-to-abandoned-animals-in-idlib (Last accessed 07 Apr 2020)
176 Email from Alessandra Abidin, Co-founder, Ernesto’s Sanctuary for Syrian Cats, 01 Sep 2019.
177 Dathan, J. ‘When the bombs fall silent’, *AOAV*, May 2018, https://aoav.org.uk/wp-content/uploads/2018/06/Reverberating-effects-v5.pdf (Last accessed 07 Apr 2020)
178 *INEW*, http://www.inew.org/ (Last accessed 07 Apr 2020)

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