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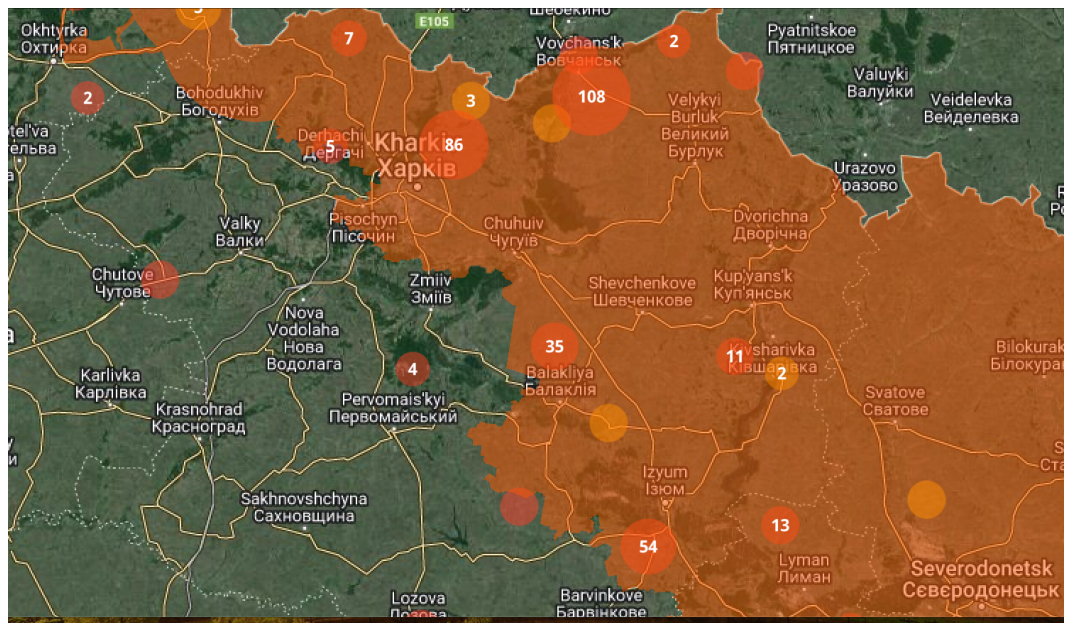
The dangerous work  
of demining Ukraine



## Introduction

Following two Russian invasions in 2014 and 2022, Ukraine is the [most mined country in the world](#). Efforts to clear mines from large parts of the country are underway, but local activists say that demining operations are severely hampered by bureaucracy and a lack of resources that slow the process.

About 30 percent of Ukraine's territory -- an area roughly the size of Florida -- is [contaminated](#) by anti-personnel landmines (APLs), anti-tank mines, and various other explosives.<sup>1</sup> The Kharkiv Oblast is [one of the most heavily mined regions](#) in the country; the forests around Kupiansk, Vovchansk, and Izyum are deeply contaminated with explosive devices.



Mines in the Kharkiv Oblast. Orange is the area suspected contaminated by mines. Numbers denote zones being demined.

APLs are [devastating weapons](#), designed to indiscriminately kill or maim by shattering limbs of their victims. Decades after the end of a conflict, APLs continue to injure and kill

<sup>1</sup> A wide variety of munitions are locally called mines, including KPOM-2 and KPOM-3 cassettes, PFM 1-S, PMN-2, and PMN-4s. They include trip-wired explosives and fragmentation munitions, and explosive booby traps left in buildings by retreating Russian forces. The TM-62P3 anti-tank mine is made of plastic and it is very difficult to find with a metal detector. For more information, see [here](#).





people as well as cripple social and economic endeavors by preventing the use of large portions of land for farming or other needs.

Many APLs in Ukraine are hand-sized weapons that were delivered by aircraft or mortars. Known locally as “petals” because of their shape, they are increasingly difficult to spot as new vegetation covers them in the spring. These “petal” mines saturate much of the country, including the fields and roads in the Kharkiv region in northeast Ukraine. Much of this region borders Russia and was occupied by Russian forces for most of 2022.

Ukraine’s counteroffensive in the fall of 2022 reclaimed much of the territory, pushing the battle front back toward the Russian border. A huge demining operation has begun in this area, but the massive undertaking is made even more challenging by regular missile bombardments and recent Russian [advances from the east](#).

In March 2024, Human Rights First visited minefields in the Kharkiv region and spoke to civilians supporting mine clearance work including demining specialists -- known locally as sappers – working for the emergency services.<sup>2</sup> Some sappers use metal detectors to clear the fields by hand, while others use remote-controlled vehicles. It is slow, difficult, and highly dangerous work.

Fully demining Ukrainian land is likely to take decades, and as authorities are overwhelmed by the scale of work required, unlicensed demining operations are springing up. Some desperate civilians do the enormously dangerous job for themselves.

In the 1990s, the [International Campaign to Ban Landmines \(ICBL\)](#) advocated for countries to abide by the Ottawa Convention, also known as the Mine Ban Treaty, which banned APLs among signatories. In 1997, the ICBL was awarded the [Nobel Peace Prize](#) for its efforts.<sup>3</sup>

Ukraine signed the Mine Ban Treaty in 1999, and ratified it in 2005. Russia has not joined the treaty, but its use of antipersonnel mines violates international law due to the inherently indiscriminate effects of these weapons. Human Rights First has for years [urged](#) the United States to ratify the Mine Ban Treaty.

<sup>2</sup> Ukraine's official emergency services have sappers that work across the country within approximately 1.5 miles of the front line - military sappers handle areas closer to the front.

<sup>3</sup> The 1997 Mine Ban Treaty comprehensively bans antipersonnel mines and requires destruction of stocks, clearance of mined areas, and assistance to victims. The Mine Ban Treaty entered into force on March 1, 1999, and its 164 states include all NATO member states except the United States, and all European Union member states. Human Rights First has for years urged the United States to ratify the Mine Ban Treaty.



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## Human Rights First's history in Kharkiv

Human Rights First has reported from the city of Kharkiv and its surrounding area since 2017 when we [documented](#) attacks on local HRDs who had exposed corruption in the mayor's office.

Since Russia's full-scale invasion in 2022, Human Rights First has made eleven research trips to the Kharkiv region. In May 2022, we [reported](#) from Kharkiv while it was under almost constant bombardment and its suburbs were under Russian occupation. We produced reports and articles throughout 2022 [documenting](#) how Kharkiv's activists and the public resisted Russian aggression.

In May 2023, Human Rights First [reported](#) on how Tsyркunь, a village north of Kharkiv, survived Russian occupation. We released [another](#) report in June 2023 on the Russian occupation of the city of Izyum and surrounding villages in the Kharkiv Oblast.

In July 2023, we worked with local NGO the Kharkiv Anti-Corruption Center to [report](#) on dubious contracts for the reconstruction of public buildings awarded by Kharkiv's authorities. In August 2023, we published a [report](#) from the frontline city of Kupiansk on how locals were holding out against the threat of a Russian re-occupation.

In November 2023, we returned to the region and issued a [report](#) on how civilians in Kharkiv prepared for a bitter winter war as Russia renewed its bombing attacks on Ukraine's heating infrastructure.

In January 2024 we [reported](#) from Kharkiv on the need for greater psychological support for civilians, and in March 2024 returned to the region to research this report on demining efforts.

In villages and towns outside of the city, locals repeatedly remind visitors not to step off roads onto any grassy areas because of the constant danger of mines.

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## Fields saturated with mines

Pete Smith, formerly in command of the British army's explosive ordnance disposal assets and now the Ukraine program manager of the mine-clearing international NGO [The Halo Trust](#), [said](#) the level of mine contamination in Ukraine is "unrecognisable in modern history."

[The Halo Trust](#) estimates that up to two million landmines may have been laid in Ukraine since February 2022. In the Kharkiv region, over 70 percent of minefields or battle areas it has assessed for clearance "contain tripwire devices, magnetic influence mines (activated by the presence of metallic objects and changes in the magnetic field around the mines), or seismic influence mines (activated by vibrations in the earth)."



The World Bank estimates it will cost at least \$37 billion to fully demine Ukraine.

Defense Minister Oleksii Reznikov estimates that it will take at least 30 years to demine Ukrainian territory. Others calculate that it will take over a century. Ukrainian Economy Minister Yulia Svyrydenko estimates that at the current rate, it will take Ukraine 757 years to clear the mines from its territory.<sup>4</sup>

Oleksii Dokuchaev, commander of a demining brigade based in the Kharkiv region, said "One year of war equals 10 years of demining... even now we are still finding munitions from World War II, and in this war they're being planted left and right." Local sappers stress that all predictions are unreliable as the war is still on, and an unknown number of APLs and other devices are yet to be deployed.



Patron, the bomb-sniffing terrier.

<sup>4</sup> Media reports suggest an official plan to identify all mined areas by 2029 and to clear 80% of previously occupied territory by 2033.





Ukraine's national authorities constantly issue public reminders about the dangers of mines. Patron, a bomb-sniffing Jack Russell terrier, has become the [mascot of Ukraine's demining efforts](#).

On billboards, in PSAs on trains, and on TV Patron (whose name means "Bullet" in Ukrainian) is shown finding mines, booby traps, and other explosives and warning children and adults not to touch them. Patron stars in a children's television series, an effort to educate children in Ukraine about the rules of mine safety. He warns that mines are often small and hidden.

Patron is also the face of the Ministry of Internal Affairs mobile application, "Demining of Ukraine." The app provides users a map of known mines and encourages people to inform law enforcement when they find explosives.

[According to the Ukrainian Ministry of Defense](#), between February 2022 and December 2023, about 900 civilians in Ukraine were injured by mines and explosive objects; 279 died. As of February 2024, [223 people in the Kharkiv region](#) have been injured by landmines. During a single week in February 2024, mines [killed](#) two civilians and injured two more.

PFM-1s are APLs commonly used by the Russian military in the Kharkiv region. They are known locally as the Green Parrots or the Butterfly Mines. They are scattered from helicopters or other aircraft, sometimes by mortars, and glide to the ground without detonating. They explode when stepped on or driven over.

Across Kharkiv they are found in forests, on roads and trails, in parks, and in the yards of people's houses.

Butterfly mines are not the only weapons the Russians use. They hide booby-trapped munitions in houses and attach mines to dead bodies. One local resident told Human Rights First he had seen a pair of women's shoes at the edge of a forest which, on closer inspection, were wired to explosives.<sup>5</sup>

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## Efforts to clear mines

A combination of State Emergency Services, the military, licensed operators, unlicensed freelance outfits, and local civilians are trying to locate and immobilize the mines all over the Kharkiv region.

In one week in February 2024, official sappers [neutralized 168 explosive munitions](#) in the Kharkiv region. There are still too many mines for official sappers to clear them, and the necessary vehicles are in very short supply. Ivan Sokol, head of the regional department for

<sup>5</sup> Human Rights Watch has reported the use of APLs by Russian and Ukrainian militaries in the Kharkiv region.



civil defense, which coordinates Kharkiv region's sappers, [said](#) in August 2023 that the entire Kharkiv region had only seven remote-controlled vehicles for mechanical demining, and at least 500 were needed.



### Sapper clears brush to reach mines.

In March, Human Rights First visited minefields in and around Balakliia, a small city on the road from Kharkiv to Izyum, about 30 miles from the current front line. The area was taken by Russian troops in early March 2022, and retaken by the Ukrainian army six months later. Battles for Balakliia and the area around it have left mines and other explosives scattered in fields, forests, gardens, homes, and on roads and pathways. Demining has begun, but there's a huge gap between existing resources and what is needed to clear the mines.

The engineering is also complex. Clearing the land between utility poles that hold up power lines is prioritized so that electricity can be restored. After that, sappers will focus on infrastructure, including areas around water plants, key roads, and vital factories. Then focus shifts to people's homes and businesses, and finally, fields.

Those working on demining emphasize there can be no 100% guarantee that even in areas deemed "clean," all mines have been cleared. Some sink too deep in the ground to be detected, only to emerge years or decades later. When there are floods, mines can drift into areas previously cleared. It is also possible for an area to be cleared, only for the Russian military to recontaminate it with fresh APLs.





Human Rights First saw sappers at work in and around Balakliia. Some were operating remote-controlled vehicles, others using hand-held metal detectors to clear fields. This extraordinarily stressful and dangerous work is made more difficult by the Russian military who frequently targeted sappers because they are so important to Ukraine's war effort. "Of course it's scary," says one. "But if not us, who will do it?"<sup>6</sup>



The MV4 finds and explodes small mines.

Sappers in Balakliia use two small MV4 vehicles to find and explode petal mines in people's gardens and other areas in the city. A sapper wearing a protective helmet and flak jacket stands behind a low makeshift wall and holds a red box that controls the vehicle. It trundles across the land, digging into the earth. Then, about 20 yards from where we watch, there is a sharp crack, a nano-second boom, followed by the scent of explosives. The vehicle found and destroyed another mine.

<sup>6</sup> Officials say five emergency workers have been killed and 35 injured while demining in the Kharkiv region since February 2022.





The demining work resumed here in late February after the harsh winter freeze. The sappers using the MV4 say they had exploded around 30 small mines in the two days before Human Rights First visited.

Outside the city, other sappers use much bigger machines called MV10s to clear large agricultural areas. MV10s can cover about 800 square meters (about 950 square yards) a day. They are the size of small tanks, with chains at the front that spin and dig down about 12 inches into the ground. They can handle much larger mines than the smaller MV4 vehicles, and are designed to detonate anti-tank mines.<sup>7</sup>



Two MV10s and a command vehicle clear a field.

Two sappers sit in a large KOZAK armored vehicle to operate two MV10s. They work to clear a huge area, about 170 hectares. The machines move slowly and must cover fields many times for them to be considered cleared. The sappers using these large vehicles say they cleared about five hectares in the previous three weeks, and detonated about 20 mines.

<sup>7</sup> While they can withstand the force of an anti-tank mine exploding under them, the Russian military often stack two or more anti-tank mines on top of each other, producing enough force to destroy an MV 10.





Up the road, another team of five sappers is clearing a field using hand-held metal detectors and knives. The big demining vehicles have already been over this ground and found 92 anti-tank mines. Now the fields must be combed by hand for smaller mines. These sappers start at 8 am every day and work until sundown.



Oleksii Haiovyi shows a munition exposed by his team.

Spaced about 50 yards apart, they get on their hands and knees to clear away the brush a few yards in front of them, then walk slowly forward with metal detectors until they beep. Many of the mines are made primarily of plastic, which makes them harder to detect. They usually have enough metal parts to set off metal detectors. When the detectors beep, the





sappers are back on their knees, probing the ground with sticks, then digging up the mines with knives.

They find an assortment of mines and other explosives. Oleksii Haiovyj, head of the local pyrotechnic department of the State Emergency Service's demining unit, showed us the fin of a rocket-propelled grenade one of his team has just found sticking out of the ground. "This field is about 10 hectares in size," he says, "It was a combat zone where there are unexploded dangerous objects or remnants of weapons. We are carrying out continuous demining here."



Head sapper Roman says this work is best done by hand.





It's excruciatingly tense, nerve-wracking work. And it's slow going, as they are clearing huge fields inch by inch.

Roman, the head sapper in the area, says, "The most difficult territory contaminated by explosive objects is Kharkiv Region. All types of mines are found here... One trained sapper using a metal detector can clear 20 to 30 square meters (24-35 square yards) in a day." High technology -- drones and artificial intelligence -- might be helpful, he says, "but nothing is as reliable as someone who is trained with a metal detector doing the work by hand."

Some sappers using metal detectors in Kharkiv wear specially designed "Spider Boots" which offer some protection, making a leg fracture more likely than the loss of the limb.



The "Spider Boots" worn by some sappers.

Authorities call unlicensed operators "Black Sappers" or "Dark Deminers." Officials warn that they are unreliable and dangerous. But these freelance demining outfits are likely to become more popular if the official efforts continue at such a slow pace.

It's also an expensive business. Those costs are being weighed against the need to clear fields around Kharkiv that are currently too dangerous for agricultural work or livestock but if free of mines could feed people and employ locals.

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## Civilians do it themselves

Some civilians who say they cannot wait for the authorities remove landmines themselves.

Russian forces took control of Izyum on April 1, 2022. On September 11, 2022, after six months of Russian occupation, Izyum was retaken as part of Ukraine's counteroffensive. In



June 2023, we traveled to the bombed-out city of Izyum and surrounding villages, and spoke with locals confronting the danger of landmines.

Local woman Lyuda returned with her family to Izyum after the worst part of the shelling in 2022, and removed the mines from her land.

"When the Russians left, the fields were covered in mines, so I demined the land around us with my husband, by hand," she told Human Rights First. It took her and her husband a month of extremely dangerous, delicate, and exhausting work to clear the mines.



Lyuda demined her own fields by hand.

"We wanted to help ourselves," she said. "We see that those giving humanitarian aid are busy, and there are so many people worse off than us. We can reclaim the land, plant



vegetables, and sell them. But the people we lost, the family, the friends, they can't come back."

Farmers are some of the most affected by landmines. Unable to wait when their communities depend on them for crops and jobs, many farmers are [clearing their land themselves](#). In Lebyazhe, a village in Kharkiv, farmers use [remote-controlled tractors](#) to clear their fields for sowing rather than waiting and paying for professional sappers.

The financial burden of paying for professional demining is another challenge for farmers. Denys Marchuk, deputy chairman of the All-Ukrainian Agrarian Council, an advocacy group for farmers, [said](#) the cost for a group of professional sappers to clear an "intensively mined" field can run "from between \$1,000 to \$1,300 per hectare," not including surveying fees.

Other civilians say they face bureaucratic obstacles to demining. After 25 years as a volunteer firefighter in North Carolina and course work in demining Texas A&M University and in Kosovo, American Alan Clegg arrived in Kharkiv in June 2023, hoping to assist in demining efforts. He says local bureaucracy has prevented him from using his skills.

"There are various stages in demining," he says. "There's the identifying what mines are where, then removing them and/or safely destroying them. I can do the technical surveying of where mines are, and what sort of ordinance they are, but the local authorities aren't really set up to enable independent operators like me."

Clegg is now based in Kharkiv and splits his time between making food at local NGO Hell's Kitchen and using his demining knowledge to help the Hell's Kitchen team develop new technology to identify hidden explosives.

"Local farmers need help now," Clegg says. "Spring is virtually here. They need to work the land and they can't wait around for the big demining operations to eventually find them and make the field safe. They need to work now. We're going to see a lot more people trying to clear their own land of explosives."

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## High- and low-tech ingenuity

A variety of high and low-tech is being used to clear mines. The Ukrainian government contracts with international companies to digitize data on the mines, and to put artificial intelligence to work on clearances. In Kharkiv, sappers [use drones](#) to detect tripwires, anti-tank mines, and APLs, and then explode them using robots.

Yehor Horoshko is from Kharkiv, and with his former colleague Ivan Berezhnoy, he founded [Hell's Kitchen](#) there after the full-scale invasion of February 2022. The NGO first started by making and distributing meals for vulnerable locals, and it still runs a major food kitchen that Yehor and his wife Liuda manage to provide a thousand meals a day to local hospitals.







A working prototype of the Hell's Kitchen deminer.

Now the Hell's Kitchen team of over 100 people also runs several other projects, including designing demining equipment. "We're trying to get our equipment certified," Horoshko says, "but the certification process for civilian use of demining vehicles isn't clear."

He explains that most demining vehicles are made to deal with all types of mines, light and heavy, so need to be the size of a tank.

He says his organization has developed a working prototype of a lightweight demining vehicle suited to clear the smaller mines that commonly litter farms and laneways. It is faster and cheaper than the heavier, more powerful models, and can reach paths and smaller areas of land where bigger vehicles would struggle.

He says his new machines will run on electricity and be easier and cheaper to produce than existing models -- around \$20,000 compared to current costs of \$100,000.

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## U.S. policy

Human Rights First has [long urged](#) the United States to ratify the Ottawa Convention, and although it has not, in June 2021 the Biden administration [announced](#) it was "committing to limit the use of anti-personnel landmines (APL). These changes reflect the President's



belief that these weapons have disproportionate impact on civilians, including children, long after fighting has stopped, and that we need to curtail the use of APL worldwide.”<sup>8</sup>

The Biden administration committed the United States to “Not export or transfer of APL, except when necessary for activities related to mine detection or removal, and for the purpose of destruction... Not use APL outside of the Korean Peninsula, [and] Not assist, encourage, or induce anyone, outside of the context of the Korean Peninsula, to engage in any activity that would be prohibited by the Ottawa Convention.”

While previous presidential administrations criticized countries such as Syria for using cluster bombs, the Biden administration [announced](#) in July 2023 that it would for the first time send [cluster munitions](#) to Ukraine. The United States, Russia, and Ukraine have not joined the more than 120 countries that signed on to the [convention](#) banning cluster bombs.

These bombs break apart in the air and spread smaller bomblets across an area the size of a football field. Often fired from artillery, cluster bombs can also be dropped from the air. Many of the bomblets — between 10 percent and 40 percent, according to the International Committee of the Red Cross — fail to detonate initially, in effect turning them into landmines.

Local experts in Kharkiv say detonation rates are hard to predict because much depends on where the bomblets land. On hard ground, they are far more likely to explode than if their landings are cushioned by snow or mud.

The Biden administration now [says](#) mine clearance in Ukraine is a priority. In September 2023, they announced they would donate an extra \$90 million in demining aid to fund NGOs focused on the issue, almost double the amount the United States has provided to demining Ukraine since 2014.

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## Conclusion and recommendations

Even if no more mines or similar munitions are deployed in Ukraine – unlikely as the war shows no sign of ending soon -- it will take many years of intensive demining, backed by huge resources and advanced technology, to make the land safe. At current rates, achieving the large-scale clearances required to restore Ukraine’s agricultural industry in the coming years is impossible.

<sup>8</sup> Meanwhile, authorities in all the Baltic states— Lithuania, Latvia and Estonia — are said to be considering pulling out of the anti-APL convention. All have borders with Russia. So far none has announced leaving the convention, but all are investing in antitank mines and other munitions less hazardous to civilians.





There are, nonetheless, some actions that can be taken to mitigate and remediate the situation in Ukraine:

- International donors, including governments, should prioritize demining efforts. They should send more experts and equipment to Ukraine to help with the clearance of mines.
- Ukrainian authorities should streamline certification and other bureaucratic processes to allow properly trained and equipped demining experts to help clear explosives.
- National and international technology firms should invest in the research and development of landmine clearance technology, then make it available to Ukraine at affordable costs.
- The U.S. government should ratify the Ottawa Convention on APLs.



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## Mission Statement

Human Rights First works to create a just world in which every person's intrinsic human rights are respected and protected, to build societies that value and invest in all their people. To reach that goal demands assisting victims of injustice, bringing perpetrators of abuse to justice, and building institutions that ensure universal rights.

Human Rights First is a nonprofit, nonpartisan international human rights organization based in Los Angeles, New York, and Washington D.C.

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