In Lampalzer/Hainzl (eds.): Climate.Changes.Security. – Navigating Climate Change and Security Challenges in the OSCE Region. Schriftenreihe der Landesverteidigungsakademie No. 04/2024.

Mine Action and Climate Change: The Legacy of Explosive Ordnance Contamination and Future Needs

Kristin Holme Obrestad, Linsey Cottrell, Sarah Njeri

Land contaminated by landmines and other explosive remnants of war poses a significant and long-term threat to communities living in conflict or post-conflict areas. These threats are exacerbated due to regional vulnerabilities to climate change and environmental degradation; this is particularly the case with communities that rely on agriculture. However, there are opportunities to mitigate these negative impacts and to support the climate resilience of communities through co-ordinated mine clearance activities, locally led climate adaptation and environmental initiatives.

Areas contaminated with landmine and other explosive ordnance include ecologically sensitive and important natural habitats. (Credit: Norwegian People's Aid)

Mine action – a global perspective and the OSCE

Anti-personnel mines and other explosive ordnance (EO) kill or injure thousands of people each year. EO includes conventional landmines and landmines of an improvised nature, cluster munitions remnants, and other explosive ordnance that may remain in the ground for decades and prevent a community's safe access to land, local resources and livelihood assets (Cottrell & Dupuy, 2020a).

Globally, an estimated 60 million people live in areas affected by, and facing, the dangers and indirect consequences caused by landmines and other explosive ordnance (Global Protection Cluster, 2021). On average, 10,000 people are killed, injured or traumatised each year by explosive remnants of war, with mine action operators playing a vital role in supporting local communities. In 2021, at least 5,544 people were killed or injured, with children accounting for half of all civilian casualties – where the age was known – and with men and boys making up the majority (81%) of all casualties (ICBL-CMC, 2022a). Mine action operators remove EO to make areas safe for people to use, together with international humanitarian mine action (HMA) organisations – such as DanChurchAid (DCA), the Foundation Suisse de Déminage (FSD), the International Committee for the Red Cross (ICRC), Norwegian People's Aid (NPA), the Mines Advisory Group (MAG) and The HALO Trust – as well as national demining operators, civil protection and the military (ICBL-CMC, 2022a). In some regions – for example Kyrgyzstan, the Russian Federation or Uzbekistan – there are no national mine action programmes, and all mine clearance activities are carried out by the military (Mine Action Review [MAR], 2022d; MAR, 2022e; MAR, 2022g).

Demining may involve the removal of vegetation and the use and deployment of heavy machinery, which can cause adverse environmental effects, if not properly managed. (Credit: Norwegian People's Aid)

In 2021, donors and affected states contributed US$ 598.9 million to mine action (ICBL-CMC, 2022a). A large part of international mine action assistance comes from a handful of donors, with the five largest donors – the US, Germany, Japan, the UK, and the EU – accounting for 70 percent of all international support in 2021 (see Table 1). Total expenditures on mine action, however, have dropped by around 14 percent since 2017. Donors fund HMA programmes across the globe, and several OSCE participating States remain directly affected by contamination from anti-personnel mines, cluster munition remains or other EO. Of the OSCE participating States, Ukraine, Türkiye, and Bosnia and Herzegovina (BA) were among the highest recipients of mine action support and globally in the top twelve (see Table 2) (ICBL-CMC, 2022a). In 2021, the top five global recipients of mine action support were Iraq, Lao PDR, Afghanistan, Cambodia and Colombia. Since

Russia has been waging war on Ukraine, mine action funding for Ukraine has increased significantly, with the US alone announcing a further US$ 47.6 million as a part of an overall US$ 91.5 million demining project (US Department of State, 2022). The OSCE also announced an extra-budgetary support programme for Ukraine, which includes demining and improving disaster risk reduction (OSCE, 2022).

Table 1 – Mine action contributions by donors, 2017-2021
(table from the ICBL-CMC Landmine Monitor 2022(a) report)

	Contribution – US$ millions					
Donor	**2021**	**2020**	**2019**	**2018**	**2017**	**TOTAL**
US	194.5	204.8	177.4	201.7	320.6	**1,099.0**
Germany	64.8	54.3	38.6	42.5	84.4	**284.6**
Japan*	42.3	39.8	36.9	37.2	32.5	**188.7**
UK	38.2	32.3	71.7	58.1	26.7	**227.0**
EU	37.8	89.8	76.0	108.1	67.6	**379.3**
Norway	35.5	37.4	43.0	47.7	39.2	**202.8**
Netherlands	21.5	12.7	14.9	19.4	19.2	**87.7**
Canada	16.3	8.4	8.7	11.3	10.9	**55.6**
Switzerland	15.2	15.4	14.8	15.0	19.5	**79.9**
Denmark	14.8	13.8	17.6	23.4	15.5	**85.1**
Sweden	4.3	9.1	8.8	18.6	5.2	**56.0**
New Zealand	9.9	8.1	9.1	9.2	5.4	**41.7**
France	9.6	8.5	5.3	12.7	11.9	**48.0**
Italy	5.4	4.8	5.1	4.3	3.9	**23.5**
Australia*	4.4	6.5	10.8	7.8	4.0	**33.5**
Finland	3.7	3.3	3.4	3.2	3.3	**16.9**
Ireland	3.7	3.8	3.7	3.9	1.8	**16.9**
Belgium	3.5	4.5	4.3	3.3	0.9	**16.5**
Austria	3.5	2.3	2.0	1.8	1.2	**10.8**
Luxembourg	1.5	1.3	1.3	1.4	1.4	**6.9**
Others	3.1	4.3	7.9	12.0	21.2	**48.5**
Total	**543.5**	**562.2**	**561.3**	**642.6**	**696.3**	**3,008.9**

Bold denotes OSCE participating States
* denotes OSCE Partners for Co-operation

Table 2 – Top 22 recipients of international support in 2021
(table from the ICBL-CMC Landmine Monitor 2022(a) report)

Recipient	Amount US$ millions	Recipient	Amount US$ millions
Iraq	95.5	**Türkiye**	11.2
Lao PDR	53.8	Libya	10.0
Afghanistan*	49.5	**BA**	9.6
Cambodia	37.3	Angola	9.5
Colombia	31.4	Zimbabwe	8.8
Syria	24.2	Somalia	8.6
Vietnam	21.4	Yemen	8.4
Ukraine	21.2	**Croatia**	6.5
Sri Lanka	18.0	Myanmar	6.1
Lebanon	13.2	**Tajikistan**	4.3
South Sudan	12.0	DRC	4.0

Bold denotes OSCE participating States
* denotes an OSCE Partner for Co-operation

Data certainty varies, and in some cases, the extent of contamination within an affected state remains unknown. OSCE participating States, for example, still do not know the precise extent of contamination with anti-personnel mines in Azerbaijan but consider it to be significant. This is the case primarily along the former Line of Contact between forces from Armenia and Azerbaijan, which extends for 254 kilometres and varies between three and seven kilometres in width and lies in areas previously occupied by Armenia but retaken by Azerbaijan during the 2020 conflict (MAR, 2022b, MAR, 2022a). Türkiye reported around 140 square kilometres of mined areas in 2021, predominantly located along the border with Syria (MAR, 2022f). Before the war in Ukraine, BA was classified as one of the most heavily mined countries in Europe, with the BA Mine Action Centre (BHMAC) reporting that around 922 km^2 were contaminated as of January 2022 (MAR, 2022c).

In Ukraine, estimates regarding explosive ordnance (EO) contamination following Russia's 2022 invasion remain unclear, yet it is considered to be among the most mined countries in the world (UNDP, 2023). The extent of

pre-existing UXO contamination from both World Wars and the 2014 conflict in the east of Ukraine is also unclear (ICBL-CMC, 2022b), although preliminary estimates specify the affected area to cover 7,000 square kilometres (ICBL-CMC, 2018). The reckless attacks on the Nova Kakhovka dam and the smaller Mokri Yaly dam in June 2023 have also aggravated this uncertainty because of the devastating floods they caused, which severely complicate mine clearance activities and produce the risk of moving EO (ACAPS, 2023; RFI, 2023). Overall, approximately 700 square kilometres from the Nova Kakhovka dam to the Dnieper River mouth have been impacted by floodwaters. The flood affected Khersonskyi district is reported to be one of the most severely mined in Ukraine (OCHA, 2023). As a part of both short-term and long-term planning for tackling EO contamination, flooding due to climate change as well as other climate-related impacts must be considered.

Climate change will present additional challenges for all countries affected by EO in terms of both how mine action operations are carried out and the way that EO-contaminated areas and communities will be affected. Climate change will affect OSCE sub-regions differently, depending on shifting weather patterns, extreme weather conditions, climate resilience and any coping or national adaptation strategies in place. For mine action, this may require prioritising certain areas that are prone to flooding, landslides or landscape fires, or other forward planning on clearance techniques or the equipment used in the process. People living in communities affected by EO contamination may also be less able to adapt to, or withstand, climate trends or shocks.

A red sign that reads "Mine Field" sits on the shore of river Sava near the Bosnian town of Orasje during the massive flood in 2014. Flooding and other extreme weather incidents can move landmines and can require re-survey of mined areas and emergency disposals of unexploded ordnances. (Credit: AP/Amel Emric)

Similarly, climate change is also predicted to increase the risks for the marine environment caused by the global problem of sea-dumped munitions. Most sea-dumped munitions originate from the large-scale dumping activities after World War II.[1] Rising sea temperatures, increased seawater acidity and higher frequency and intensity of extreme weather events, including storms, are all factors that could accelerate the corrosion rates of munition casings and the leakage of toxic munitions components (Scharsack et al., 2021).

Climatic impacts and vulnerabilities of states affected by conflict

Climate change does not only complicate mine action activities, but also burdens local resources. It may force different patterns of behaviour to be adopted, people to move and resettle, and land-use to be limited. An understanding of how climate change will affect EO contaminated areas and mine

[1] See https://legacy.amucad.org/map.

action activities is required, exactly as knowledge of the climatic impacts that communities have to expect, the uncertainties involved, and the measures needed to ensure that climatic risks are not exacerbated.

The effects of climate change are wide-ranging and can lead to more intense rainfall, increased risk of floods and landslides, more frequent and intense dry spells, higher average temperatures, increased risk of wildfires, warming oceans, rising sea-level, and thawing permafrost (Cottrell & Stowe, 2021). The implications for mine action are therefore broad.

Mine action activities, such as demining, may include the removal of vegetation, the use of heavy machinery, the detonation or disposal of large quantities of explosives and the generation of hazardous and non-hazardous waste – all of which have the potential to result in adverse environmental effects if they are not properly conducted (Cottrell & Dupuy, 2020b; 2020a). How the land is used after demining could have great influence on the environment and our climate. This means that it is important to ensure that sustainable land use practices are championed, including embedding climate adaptation measures, which could benefit local communities and support nature.

A country's vulnerability and ability to adapt to climate change also varies. Across OSCE participating States, countries with known or suspected high levels of EO contamination – such as Azerbaijan, BA, and Ukraine – score lower on the ND-GAIN index[2] than most other OSCE participating States. The ND-GAIN index summarises a country's vulnerability and readiness to support climate change based on 45 indicators.[3] Ukraine's ND-GAIN index indicates that although climate adaptation challenges exist, the country is well positioned to adapt. However, the index-score pre-dates Ukraine's invasion by Russia. Tajikistan's ND-GAIN index, for example, also indicates that climatic vulnerabilities are manageable, but improvements in readiness will better support the adaptation needs for future challenges. Iraq, which receives the highest mine action support in the world, scores poorly under the ND-GAIN index, ranking 120th out of 182. Iraq has a high climate vulnerability and a low readiness to adapt, with water resources and agriculture being identified as key weaknesses.

---

[2] See https://gain.nd.edu/our-work/country-index/rankings/.

[3] ND-GAIN stands for 'Notre Dame Global Adaptation Initiative' and is compiled by researchers at the University of Notre Dame.

Other countries that receive international mine action funding and have a long legacy of EO contamination – such as Afghanistan, Angola, Cambodia, Colombia, Lao People's Democratic Republic (Lao PDR), and Vietnam – also experience the combined adverse effects of climate change and high levels of deforestation. Globally, the rate of deforestation is declining, but still recorded at ten million hectares lost each year in 2015-2020 (FAO, 2022). Tree cover and forests provide multiple environmental mitigation benefits, whereas tree and vegetation loss exacerbates the effects of climate change. Heavy rainfall on bare or sparsely vegetated slopes can cause flash floods since the ground has minimal capacity to retain water. Floods cannot only devastate farmland and directly destroy crops, but can also erode the soil, which can reduce soil productivity in the long-term and further impact food security.

Soil is a precious resource, vulnerable either from the conflict itself or from demining activities. Explosive ordnance can damage vegetation and cause soil degradation, chemical contamination and compaction when it explodes, consequently destroying the soil structure, reducing soil stability and reducing soil fertility (MAR, 2021). The use of mechanical demining equipment or the destruction of munitions can also damage soils and cause compaction. Degraded soils lose their capacity to store water, nutrients and carbon, as well as the capability to support important soil microbes, thus weakening its ability to support growing crops or the wider ecosystem (Bach et al., 2022).

While many human activities degrade soil – e.g. intense agriculture, deforestation, overgrazing and loss of cover vegetation – conflict-ridden areas are typically highly vulnerable because of various factors, including pressure caused by the displacement of people and their impact on natural resources (Bach et al., 2022). In Syria, change of vegetation and soil erosion are among the most serious environmental issues associated with the conflict (Abdo, 2018). Even at the local level and for land use practices after demining activities, the protection and recovery of soils must be considered. This could include the need for support in adopting more sustainable land use practices, forest management or alternative farming models.

In Germany, Slovenia, and pre-2022 Ukraine, the ability of firefighters to tackle landscape wildfires has been severely inhibited in EO-contaminated areas (Connolly, 2022; Zitser, 2022; Varenikova, 2020). Landscape fires also

affect the soil by burning near-surface organic matter, causing the loss of certain nutrients, killing soil microbes and exposing bare ground. For Ukraine, landscape fires larger than one hectare are estimated to have increased in 2022 by thirty-six times as compared to the pre-war period, and soil erosion was identified as a national concern (de Klerk et al., 2023). In 2020, an estimated 57.5% of agriculture was subject to erosion and forecast to increase (Institute of Soil Protection of Ukraine, 2020). Ongoing demining and EO clearance activities must therefore minimise the impact on, and damage to, soils and the wider environment, avoiding rapid or improvised clearance techniques when possible (Focus, 2023).

A new momentum for change?

There is increased momentum on taking practical steps to improve environmental benefits across mine action. The plenary sessions of this year's intersessional meetings for the Anti-Personnel Mine Ban Convention (APMBC) (Anti-Personnel Mine Ban Convention Implementation Support Unit, 2023) and the 26th International Meeting of Mine Action National Directors and United Nations Advisers (NDM-UN26, 2023) addressed the environmental matters and climate change. This included contributions from the United States – the largest single donor to mine action – and the Director of the State Department's Bureau of Political-Military Affairs and Office of Weapons Removal and Abatement (PM/WRA). The PM/WRA has also commissioned a climate study to identify and analyse the best measures for mine action to support efforts in climate change resilience in the future. The study features case study countries – including Palau, Vietnam, Tajikistan, Kosovo, Colombia, Somaliland, Yemen and Ukraine – and is due for publication towards the end of 2023.[4]

The International Mine Action Standard (IMAS) on environmental management (IMAS 07.13) serves as a key guide for National Mine Action Authorities (NMAAs), seeking to develop environmental strategies for their respective national mine action programs (UN Mine Action Service, 2017). IMAS 07.13 is under review, and updates will incorporate climate risks. IMAS 07.13

[4] As announced at the 26th NDM, Geneva International Centre for Humanitarian Demining (GICHD) has been commissioned to deliver the PM/WRA climate study report.

outlines the importance of establishing, reviewing, and maintaining an environmental policy that aligns with national and international legislations. NMAAs are expected to define and communicate environmental obligations through national mine action standards (NMAS) and the respective national mine action strategy. This highlights the need for more states to adopt and integrate climate and environmental management principles within their mine action frameworks to improve environmental protection as a part of mine action and demining operations.

However, to date only a few states have adopted specific environmental management principles within their mine action frameworks (MAR, 2021). Of the OSCE countries, only Croatia has embedded environmental protection measures in its 2015 act. The Ministry of the Interior is conceived as a competent ministry in terms of environmental protection and drafts a National Mine Action Programme and annual Mine Action Plan. Other national bodies, such as the Ministry of Economy and Sustainable Development, include specific protection measures in their preliminary demining plans, based on environmental surveys and approval processes (MAR, 2021, p.14).

Although the environment is not explicitly addressed, Tajikistan's 2017-2020 national mine action strategy acknowledges the potential consequences of natural disasters and risk from displaced mines (National Strategy of the Republic of Tajikistan on Humanitarian Mine Action for 2017-2020, n.d.). In Tajikistan's mountainous areas – where mines were typically dropped by helicopter, heavy rain and snowmelt transport mines down slopes and into areas where they are not expected. This uncertainty highlights the need for continued efforts in mine action and the importance of addressing the potential risks posed by displaced mines resulting from natural disasters, extreme weather events and other climate change impacts, such as landslides. The recording or reporting of these events is not yet standardised but will be necessary as they become more frequent as climate change progresses. The impact of severe floods on mine action in Bosnia and Herzegovina, Croatia, and Serbia has already been well-documented (Orahovac, 2014; Bajic et al., 2015). It is important that practical and emergency measures learnt from tackling the impacts of the catastrophic floods caused by the destruction of the Nova Kakhovka dam are shared so as to enhance future climate change related responses.

For countries in which the NMAA has still to develop fully or in which a set of national mine action standards concerning the environment needs to be adopted, the use of guidance – such IMAS 07.13, which is to be updated shortly – to establish a framework for environmental management as well as climate risks management and climate adaptation should be prioritised.[5]

Mine action faces challenges in Tajikistan's mountainous areas, where heavy rain and snowmelt can transport mines down slopes. (Credit: Norwegian People's Aid)

[5] Detailed guidance is provided in ISO 14090 (2019) Adaptation to climate change - Principles, requirements and guidelines and ISO 14091 (2021) Adaptation to climate change – Guidelines on vulnerability, impacts and risk assessment, both available at https://www.iso.org/.

How is the environment addressed in international disarmament treaties?

The APMBC,[6] according to which state parties commit to not develop, produce, acquire, stockpile or use anti-personnel mines, and to ensure that mined areas within their territory are cleared, is a disarmament treaty signed by more than 80 per cent of the world's countries. Similarly, the Convention on Cluster Munitions (CCM) prohibits all use, production, transfer and stockpiling of cluster munitions and, in addition, requires clearance of contaminated areas.[7] Environmental considerations are addressed differently in both treaties; yet, both require state parties to include information on the environmental implications when they apply for an extension of their respective deadlines for clearing areas contaminated by anti-personnel mines and cluster munitions, as well as transparency measures for applicable safety and environmental standards.

Beyond that, the Lausanne Action Plan (LAP) lays out actions and good practices for states with regard to their implementation of the CCM, including several actions that are aimed to improve environmental protection measures (Convention on Cluster Munitions, 2008). The LAP also advocates research and development into innovative survey and clearance methodologies, which consider environmental effects and concerns, actions aimed at furthering the sharing of good practices and lessons learnt on environmental impact assessments and on incorporating environmental protection considerations. Action 30 of the LAP calls for risk education initiatives to take into account risks caused by changing climatic and environmental conditions. Although the activities set forth in the Action Plan are not legally binding, an indicator or indicators to monitor progress and identify challenges in their implementation accompany each action. While the LAP is explicit and identifies environmental concerns as a cross-sectional matter, the five-year Oslo Action Plan supporting the implementation of the APMBC does not mention the environment (APMBC Review Conference, 2019). Revisions of the Oslo Action Plan are planned for 2024.

---

[6] Convention on the Prohibition of the Use, Stockpiling, Production and Transfer of Anti-Personnel Mines and on their Destruction, Oslo, 18 September 1997 (entered into force 1 March 1999) (Mine Ban Treaty).

[7] Convention on Cluster Munitions, Dublin, 30 May 2008 (entered into force on 1 August 2010).

Expectations and progress across the wider humanitarian sector

The broader humanitarian sector has already begun to address climate change and integrate environmental considerations into their operations. In 2014, the United Nations UNEP/OCHA Joint Environment Unit established the Environment and Humanitarian Action (EHA) network to promote environmentally responsible humanitarian programmes. The ICRC has also been actively working to embed environmental practices in their operations and, together with IFRC, launched the *Climate and Environment Charter for Humanitarian Organisations* (ICRC & IFRC, n.d.). The charter emphasises the need to adapt humanitarian aid to address the impacts of climate change and environmental crises and includes seven commitments that reduce the environmental impact of humanitarian activities. The ICRC itself has set organisational targets, including the reduction of its greenhouse gas emissions by at least 50% by 2030, and strengthening awareness, understanding, and the implementation of International Humanitarian Law (IHL) with regard to environmental protection among states and parties involved in conflicts.

Such initiatives demonstrate the humanitarian sector's recognition of the need to take concrete action to mitigate the environmental consequences of humanitarian operations and build resilience. Enhancing resilience and reducing poverty are among the goals of the UNDP mine action programs, which call for integrating mine action and long-term development processes in crisis and post-crisis settings as an avenue of addressing these critical factors. Humanitarian mine action offers the opportunity to support more sustainable future land-use practices and helps deliver climate resilience and long-term environmental benefits.

In October 2020, the European Commission's Directorate-General for European Civil Protection and Humanitarian Aid Operations (DG ECHO) released its approach to reducing the environmental footprint of humanitarian aid (European Commission, Directorate-General for European Civil Protection and Humanitarian Aid Operations [ECHO], 2020). HMA organisations as a part of the humanitarian aid sector are encouraged to adopt the 'do no harm' principle and adopt a precautionary approach and apply mitigating measures to reduce potential negative environmental impacts. To support relevant organisations, DG ECHO launched project-level minimum environmental requirements for partners, covering key priority areas and aiming

to reduce the impact of EU funded humanitarian operations on local ecosystems (ECHO, 2022a). The DG ECHO expects these measures to be reflected in project proposals, with the issued guidance encouraging a holistic approach when designing and implementing actions (ECHO, 2022b), and ensuring that activities are planned and modified as required. Similarly, guidance calls for minimum environmental requirements to complement national laws and regulations including environmental laws and regulations of the wider context where programs are being implemented. Few mine action organisations currently receive DG ECHO funding, yet this reflects the general ambition of donors and the need for humanitarian organisation to embed these environmental requirements as a minimum demand (ECHO, 2022b; ECHO 2020).

Nature-based solutions (NbS) and other positive action to support climate resilience

In partnership with environmental stakeholders, mine action activities can directly support more sustainable future land-use practices and community climate adaptation. Land contaminated with explosive ordnance frequently includes areas that are agriculturally important or rich in biodiversity, with HMA often operating areas that are vulnerable to climate and with insufficient climate adaptation and climate financing. In Ukraine, the estimates of the agricultural areas affected by munitions and military debris vary considerably, with reports listing ranges from 200,000 up to 470,000 hectares (Decyk et al., 2022; NV, 2023). The delivery of HMA, together with initiatives for environmental recovery and climate resilience initiatives, can provide multiple community benefits and contribute to climate resilience in the longer term.

Although the links between clearing EO and the environment have not been a priority, their importance and relevance are gaining traction: in this manner, practical environmental initiatives by several mine action organisations are already underway, there is increased donor interest, and updates to the IMAS 07.13 are already in progress. The application of nature-based solutions can be another approach to support climate resilience in communities and across areas that previously included EO-contaminated land.

The term nature-based solutions (NbS) has been adopted by the International Union for Conservation of Nature (IUCN), which broadly defines NbS as actions that can be taken to protect, manage or restore ecosystems,[8] and that simultaneously address societal challenges and provide benefits to people and nature. They target "the major challenges that communities face, such as climate change, disaster risk reduction, food and water security, biodiversity loss and human health, and are critical to sustainable economic development." (IUCN, n.b., para.5) Careful design, collaboration and meeting community needs are critical. Guidance developed through the *NbS in Humanitarian Contexts Working Group* is of particular relevance to the context of HMA programmes (IUCN, 2022), and the Partnership for Environment and Disaster Risk Reduction (PEDRR).[9]

NbS broadly fall into three categories: ecosystem conservation, ecosystem restoration, and land management improvement, with the priority "to leverage the potential NbS to provide multiple benefits, whereby one intervention addresses several challenges." (IUCN, 2020, p.3) While NbS will not be the "silver bullet" to societal challenges, they can support these challenges, depending on how they are implemented. There can be a host of other important NbS that could be applicable for communities and regions, where HMA programmes are taking place. For HMA programmes or any situation, in which NbS are taken into account, it is important that the environmental setting and its sensitivity and the societal challenges to be addressed are well understood.

Societal challenges will vary depending on the regional context. To give an example, increased vegetation could help a mountainous area alleviate the increased risk of more frequent landslides, whereas elsewhere, tree planting can affect water recharge rates and water supply. However, a suite of NbS could be applicable for communities where mine action programmes are taking place, which could include landscape or wetland restoration, or climate-smart agriculture and agroforestry.

---

[8] An ecosystem is a dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit, see https://ipbes.net/glossary-tag/ecosystem.

[9] PEDRR is a global network of UN agencies, NGOs and specialists working on "promoting and scaling up eco-system-based approaches to reducing disaster and climate risks", see https://pedrr.org/about-us/.

There are parallels between effective NbS and mine action implementation (Alavi et al., 2022). Implementing NbS can also be a stimulus for other socio-economic benefits, such as education and skills development, which will provide the basis for more successful long-term outcomes, as it can help people make more informed decisions because they are more aware of climate change and of how to adapt and develop skills needed for climate adaptation (UNESCO & UNEVOC, 2021). As for mine action programmes, a participatory approach including women, men, boys and girls is needed for the successful implementation of NbS initiatives, ensuring that the needs and structure of local communities are understood and met. Moreover, it is also important for NbS that succession planning is incorporated to ensure that the initiative succeeds and is sustained over time. For example, without aftercare in place, failure rates for planting schemes can be high. For finite HMA programmes, where HMA actors do not stay involved once land is released back to the community, it is necessary to secure community buy-in and support from local people to ensure long-term viability.

HMA actors have an extensive background, community trust, and experience in working with vulnerable groups and supporting building more sustainable livelihoods in the areas in which they work. They have a broad approach to entering into close dialogue with communities when they identify what areas are confirmed hazardous areas when conducting Explosive Risk Ordnance Education (EORE) to reduce the risk of accidents, and impact assessments. Close community dialogue can help identify local priorities and, if needed, the opportunity to communicate environmental risks in addition to the risks from explosives. This community engagement can also help assess the nature and severity of challenges that the community may face from climate change, including the possible effects on livelihoods and income. As a part of community engagement and surveys, mine action typically collects data about intended land use following EO clearance and can help identify the needs and challenges in a community. Increased sharing and coordination with other key stakeholders, such as national environmental authorities and development organisations and conservation organisations, is also key.

Community engagement is critical for mine action programmes, and necessary for understanding climate risks facing local people. (Credit: Norwegian People's Aid)

In BA, Norwegian People's Aid (NPA) is one of several organisations that conduct clearance and increase access to land for agricultural and grazing pastures. In 2021, this included the NPA's start of work along the Inter-Entity Boundary Line between the Republika Srpska and the Federation of Bosnia and Herzegovina. An inter-municipality working group was set up for the mayors of Majevica's five municipalities – Čelić, Lopare, Sapna, Teočak and Ugljevik to help overcome environmental challenges and support the work. As a part of the NPA's assessments, large numbers of previous landslides were recorded across the north-eastern region, where approximately 400 homes were destroyed.[10] Analysis of such data is important to understand both the potential risk from landslides causing landmines and other ERWs to move and remaining ground stability risks. Released land following EO-clearance contributes to economic initiatives, such as tourism

[10] Information provided by Norwegian People's Aid Bosnia and Herzegovina and collected during impact assessment, by NPA' s Selma Antic, TIA/MRE Coordinator.

and environmental initiatives, including a reforestation programme in Majevica, supported by the association "Majevicka Akcija".

Only 7 percent of the land in Tajikistan is usable for agriculture due to the country's mountainous terrain (World Bank Group, 2021). NPA has been working in Tajikistan since 2010 and is now focused along the Tajik and Afghan border, where there are the risks of floods and landslides. The shifting Panj river that makes up the Tajik and Afghan border also creates additional challenges, and the Tajik Mine Action Centre has begun to consider how these challenges can be addressed within the national mine action standards and strategy.

Important lessons can be learnt in countries that receive funding from OSCE participating States and shared best practice. The examples given below demonstrate how mine action can help deliver positive action to address climate change, supported by strong local and indigenous knowledge. The potential extends beyond those areas where direct HMA activities are taking place, and includes enhancing sustainable livelihood opportunities, prevents deforestation and bolsters the protection of natural resources, which are all regarded as key objectives for peacebuilding and defueling conflicts (Ahmadnia et al., 2022). Note that the shown examples cover only the work of international HMA operators, whereas further examples from local and indigenous HMA programmes may exist.

In Lao PDR – the country most severely contaminated by cluster munitions in the world – NPA has been working with local partner Zero Waste Laos (ZWL) to promote staff environmental awareness, reduce the environmental footprint of NPA and support wider community initiatives, such as the Youth Climate Action initiative. In 2022, the initiative had 3,000 fruit trees distributed to, and planted at, 100 schools.

APOPO[11] is the acronym of Anti-Personnel Landmines Detection Product Development, but it denotes also an NGO that undertakes mine clearance work in Cambodia, Angola, and Zimbabwe (APOPO, 2022), and has incor-

[11] APOPO is an acronym for Anti-Personnel Landmines Detection Product Development in English and Anti-Persoonsmijnen Ontmijnende Product Ontwikkeling in Dutch and is a non-profit organisation with Belgian roots.

porated environmental restoration into its 2023-2025 strategy.[12] APOPO promotes syntrophic agroforestry, which is a traditional agricultural technique that combines reforestation with food production. In Tanzania, it has been cooperating with Sustainable Agriculture Tanzania (SAT) to train farmers in sustainable practices, including tree planting, and the use and production of natural fertilizers. APOPO currently has demonstration plots in Tanzania, Ethiopia and Zimbabwe, with plans to expand and establish training and syntrophic farms in Cambodia, Angola and the rest of its programmes and projects.

A pilot project by Apopo was started in 2023, to demonstrate how syntropic farming could support communities impacted by landmines in Zimbabwe. (Credit: Apopo)

In El Salvador, the HALO Trust has been working in a local partnership with Asociación Mangle, on a mangrove restoration project. HALO Trust has been operating in El Salvador since 2017, supporting the government's weapons and ammunitions management programme. El Salvador has seen over sixty percent of its mangrove forests disappear since the 1950s. Mangroves stabilise and protect coastlines, reduce erosion, and provide critical habitats and breeding grounds for fish, shrimps and other marine species.

[12] See https://apopo.org/herotrees/?v=c2f3f489a005.

Mangroves are also important for carbon sequestration,[13] and can be up to four times more effective than terrestrial forests. The project aims to restore 6.8 hectares of mangrove located within the Jiquilisco Bay Reserve, which is designated as an ecologically important wetland under the Ramsar Convention.[14] Similarly, further case study examples in Sri Lanka, Somalia and Ukraine indicate that ecosystem restoration, biodiversity conservation and sustainable land use practices can be integrated into mine action work to provide direct and indirect environmental benefits (Chrystie, 2023).

Restorative mangrove planting in previously mined lagoon and coastal areas, aims to improve biodiversity and provide climate resilience in Sri Lanka. (Credit: The HALO Trust)

[13] The process of capturing and storing carbon dioxide from the atmosphere.

[14] See "The Ramsar Sites Information Service (RSIS)" a platform that provides online information on wetlands that have been designated as internationally important. https://rsis.ramsar.org/ris/1586.

In most conflict-ridden countries, the scale of communities impacted by climate change will likely far outweigh the scope and reach of any mine action programmes, but mine action could be a conduit for hard-to-reach and poorly supported communities. Locally led climate adaptation initiatives also help avoid the risk of maladaptation and ensure that priorities and needs of local communities are reflected and fulfilled better (Rahman et al., 2023). There is ample need for longer-term or area-wide initiatives as well as rapid and disaster-related responses to address impacts from conflict or the displacement of people (Broek & Hodder, 2022), and HMA can assist by opening up opportunities to support sustainable livelihoods once areas have been cleared of explosive ordnance.

Planning for the future

Some HMA actors already implement environmental initiatives. This happens in different regions affected by conflict; yet much more could be done. HMA actors sit in a unique position and can therefore facilitate the much-needed support of local communities.

HMA organisations play a unique role when they work in conflict-ridden areas, given their strong community engagement, close dialogue with national authorities, and often advanced programme and information management systems. In addition to their main objective, i.e. to release safe land, they are familiar with assessing and integrating specific target areas, such as gender mainstreaming. HMA actors should be well positioned in this function to strengthen the link between environmental recovery, climate resilience initiatives and mine action. This includes EORE and community outreach, which can help to improve environmental literacy and empower communities to address the local and global environmental challenges that lie ahead. If sufficient resources and training are provided for the mine action staff, this could serve as an important contribution to conflict-affected regions. By training locals, mine action operators and national authority staff in the value and implementation of climate resilience, environmental initiatives can provide skills that are also relevant when mine action work is complete. In BA, NPA integrates more specific impact assessment indicators and questions on environmental and climate risks and trends, data, and findings that it will be able to share with the local community and other relevant stakeholders, which may serve as the foundation for future environmental protection and initiatives.

Women and girls face higher risks and heavier burdens from the consequences of climate change, since they depend more on natural resources, spend disproportionately more time securing food, water and fuel, and struggle more under climate change pressures (UN Women, 2022). Similarly, in mine action, while women and girls may not account for the majority of mine casualties, they may still be disproportionally disadvantaged (Laws, 2017). Gender and diversity has been a key priority for HMA in conflict-affected areas, with guidelines aiming to integrate gender perspectives in mine action operations and to ensure that everyone benefits equally from mine action activities (UNMAS, 2019). The HMA sector's experience in gender mainstreaming could be applied to climate and the environment in a similar manner.

As climate change and extreme weather threats increase, mine action must assess local climate risks and better understand how climate change could affect their work, whether certain areas – such as those prone to floods, landslides or wildfires – must be prioritised, and how local communities can be better supported. Planning and prioritisation is usually carried out by the national mine action authority, but more support is needed to ensure that adequate climate change adaptation planning is integrated into national strategies and standards, and fully implemented. The OSCE's core donors in the field of mine action can help ensure that these matters are addressed.

The updates that are currently being made to the existing IMAS 07.13 should provide additional guidance on good practices to HMA actors in order to reduce the vulnerability of communities to the effects of climate change once land has been cleared and released. However, IMAS 07.13 is guidance only, and implementation requires a larger environmental awareness to be developed.

With support from OSCE mine action donors and national authorities, there is the opportunity to provide multiple benefits to communities. This should also be embedded into the revision of the Oslo Action Plan for the implementation of the APMBC planned for 2024. The five-year Oslo Action Plan, which was adopted in 2019, does not currently address the environment. National Adaptation Plans (NAPs) under the United Nations Framework Convention on Climate Change are a means for climate adaptation needs and implementation strategies to be set out, yet information on progress in-

dicates that NAPs have not been submitted for most conflict-ridden states to date.[15] The OSCE can provide support by highlighting the gaps and value of integrating mine action into climate adaptation priorities under a country's NAP where this is relevant. The NAP for BA submitted in December 2022, for example, does not refer to EO contamination or mine action (UNFCCC, 2022).

Guidance already exists on how to gather and analyse information on community-level climate vulnerability and capacity, which involves gathering local perspectives and traditional knowledge (CARE, 2019). Combined with country profiles and summaries of climate trends (World Bank Group, n.d.), climate risk information can be used by mine action actors to inform programmes. Knowledge-sharing must be encouraged, which means sharing details on both success stories as well as lessons learnt from implementing environmental projects and the challenges faced in doing so. Sharing outputs from climate risk assessments and information collected on community vulnerabilities with other agencies can enhance knowledge and inform others even after demobilisation and the completion of HMA programmes. The OSCE provides an important platform for supporting collaborations, the exchange of information and best practice, including direct knowledge from OSCE Field Officers.

Data from HMA actors could help disseminate data on environmental degradation, especially given HMA expertise in data management systems, GIS mapping, the evaluation of risk, understanding risk priorities, and communicating these risks to local communities. In all cases, monitoring and evaluation of the HMA activities must properly consider the long-term environmental implications based on planned use once land is deemed safe and released back to the community. Strong local partnerships are important for both delivering environmental initiatives, but also ensuring their success in the long term with successive planning in place. National mine action standards and strategies must also embed these long-term environmental objectives, with the launch of well-planned and designed NbS and climate resilience initiatives to support communities where HMA is active.

[15] The national adaptation plan (NAP) Interactive map of countries with NAPs as of 5 August 2023, https://napcentral.org/submitted-naps.

Ultimately, the potential and planned environmental, socio-economic and cultural impacts of the initiatives must be well understood, and the benefits communicated, helping inform donors and decision-makers, especially where OSCE donors have supported traditional HMA in the past. A centralised database of implemented environmental initiatives and an evaluation of their success would assist in promoting wider adoption and support.

Funding streams are often specific to HMA and disarmament programmes, so encouraging donors to support programmes that have specific environmental objectives may remain a challenge to overcome. Signatories to the Humanitarian Aid Donors' declaration on Climate and Environment are also mine action donors.[16] The declaration recognises the need to increase climate resilience, with an increased focus on the adoption of nature-based solutions, which could be implemented in those communities where HMA is already active.

Importantly, the OSCE ministerial council decision on *"Strengthening the Co-operation to Address the Challenges Caused by Climate Change"* (OSCE, 2021) acknowledges the increasing challenges that climate change poses for both the economy and the environment, aiming *"to facilitate collective and cooperative responses"*. This acknowledgement could provide leverage for better coordination across the OSCE, especially on sharing good practice regarding mine action, increasing capacity for mine action programmes to adapt to the challenges ahead, and supporting the inclusion of the environment as a part of thematic discussions at all forthcoming APMBC and CCM review meetings.

[16] "Humanitarian Aid Donors' Declaration on Climate and Environment" Available at https://humanitarian.forum.europa.eu/system/files/2022-03/Donor%20declaration%20on%20climate%20and%20environment_ENG_0.pdf#:~:text=Climate%20change%20is%20already%20affecting%20the%20frequency%20and,to%20infrastructure%20and%20human%20establishments%2C%20morbidity%20and%20mortality.

References

Abdo, Hazem Ghassan. *Impacts of war in Syria on vegetation dynamics and erosion risks in Safita area, Tartous, Syria.* Regional Environmental Change 18, 2018. 1707–1719. https://doi.org/10.1007/s10113-018-1280-3.

ACAPS. *Ukraine: Flooding due to the destruction of the Kakhovka Dam.* ACAPS, 9 June 2023. Available at: https://www.acaps.org/sites/acaps/files/products/files/20230609_acaps_briefing_note_ukraine_flooding_due_to_the_destruction_of_the_kakhovka_dam.pdf.

Ahmadnia, Shaadee Jasmine, Christien, Agathe Marie, Spencer, Phoebe Girouard, Hart, Tracy, and De Araujo Barbosa, Caio Cesar. *Defueling Conflict: Environment and Natural Resource Management as a Pathway to Peace*. Washington, D.C: World Bank Group, 2022. Available at: http://documents.worldbank.org/curated/en/099520010272224660/P1771510b38fda01e0afec01edd810d8cde.

Alavi, Ayub, Cottrell, Linsey, Njeri, Sarah, and Whitbread-Abrutat, Peter. *Out with War and in with Nature: Supporting climate resilience and sustainable livelihoods through mine clearance in Afghanistan*. In: THE FUTURE OF ENVIRONMENTAL PEACEBUILDING Nurturing an Ecosystem for Peace: A White Paper and Compendium, 2022. 120 – 122. Available at: https://www.ecosystemforpeace.org/compendium/out-with-war-and-in-with-nature.

Anti-Personnel Mine Ban Convention Implementation Support Unit. *Cross-cutting priorities of the Presidency: Green Implementation: Integrating Environmental Considerations in the Convention's Implementation*. 2023. https://www.apminebanconvention.org/fileadmin/_APMBC-DOCUMENTS/Meetings/2023/IM23-Programme.pdf.

APMBC Review Conference. *Oslo Action Plan.* Document number APLC/CONF/2019/5/Add.1, Adopted at the final plenary meeting on 29 November 2019. Available at: https://www.osloreviewconference.org/fileadmin/APMBC-RC4/Fourth-Review-Conference/Oslo-action-plan-en.pdf.

APOPO. *APOPO Annual report 2022*. 2022. https://apopo.org/wp-content/uploads/2023/06/APOPO_annual-report-2022-final.pdf.

Bach, Bui Doan, McCosker, Kimberly, and Cottrell, Linsey. *Environmental Soil Sampling and Analysis: Application in Supporting Sustainable Land Use Practices in Areas Impacted by Explosive Ordnance*. The Journal of Conventional Weapons Destruction, Vol. 25, Iss. 3, Article 12, 2022. Available at: https://commons.lib.jmu.edu/cisr-journal/vol25/iss3/12.

Bajic, Milan, Ivelja, Tamara, Hadzic, Emina, Balta, Haris, Skelac, Goran, and Grujic, Zoran. *Impact of Flooding on Mine Action in Bosnia and Herzegovina, Croatia, and Serbia.* The Journal of ERW and Mine Action, Vol. 19, Iss. 1, Article 12, 2015. Available at: https://commons.lib.jmu.edu/cisr-journal/vol19/iss1/12.

Broek, Eilie and Hodder, Cristophe M. *Towards an integrated approach to climate security and peacebuilding in Somalia*. Stockholm: SIPRI, 2022. Available at: https://www.sipri.org/sites/default/files/2022-06/2206_towards_an_integrated_approach_to_climate_security_and_peacebuilding_in_somalia_0.pdf.

CARE. *Climate Vulnerability and Capacity Analysis Handbook Version 2.0 Informing community-based adaptation, resilience and gender equality*. 2019. Available at: https://careclimatechange.org/wp-content/uploads/2016/06/CARE-CVCA-Handbook-EN-v0.8-web.pdf.

Connolly, Kate. *Series of explosions hamper attempts to tackle Berlin forest fire*. The Guardian, 4 August 2022. Available at: https://www.theguardian.com/world/2022/aug/04/series-of-explosions-hamper-attempts-to-tackle-berlin-forest-fire.

Convention on Cluster Munitions. *Lausanne Action Plan*. Geneva: Implementation Support Unit of the Convention on Cluster Munitions Convention, 2008. available at: https://www.clusterconvention.org/files/action_plans/Lausanne-Action-Plan-eng-v1.pdf.

Cottrell, Linsey and Stowe, Carlie. *Climate Change and Extreme Weather: How Can Mine Action Programs Adapt to Our Changing Environment*?. The Journal of Conventional Weapons Destruction, Vol. 25, Iss. 2, Article 6, 2021. Available at: https://commons.lib.jmu.edu/cisr-journal/vol25/iss2/6.

Cottrell, Linsey, and Dupuy, Kendra. *Landmines and the environment: can we do better?* CEOBS blog, 2020a. https://ceobs.org/landmines-and-the-environment-can-we-do-better/.

Cottrell, Linsey, and Dupuy, Kendra. *Environmental mainstreaming at the 23rd National Mine Action Directors and UN Advisers meeting*. CEOBS blog, 2020b. https://ceobs.org/environmental-mainstreaming-at-the-23rd-national-mine-action-directors-and-un-advisers-meeting/.

Chrystie, Emily. *Opportunities in Mine Action for Mainstreaming of Environmental Protection and Conservation*. Submission for the academic degree of Master of Science – Management of Conservation Areas, Carinthia University of Applied Sciences, 2023. Available at: https://www.linkedin.com/posts/activity-7087338202109239298-QZ4q.

Decyk, Oleksandr and Alekseev, Vitaly. *To save the Ukrainian chernozems. How war destroys the fertility of our lands and what to do about it*. LB.ua, 19 December 2022. Available at: https://lb.ua/economics/2022/12/19/539410_uryatuvati_ukrainski_chornozemi_yak.html.

De Klerk, Lennard, Shlapak, Mykola, Shmurak, Anatolii, Mykhalenko, Oleksii, Gassan-Zade, Olga, Korthuis, Adriaan, and Zasiadko, Yevheiia. *Climate damage caused by Russia's War in Ukraine*. Center for Environmental Initiatives Ecoaction, 2023. Available at: https://en.ecoaction.org.ua/climate-damage-by-russia-12-months.html.

European Commission, Directorate-General for European Civil Protection and Humanitarian Aid Operations (ECHO). *DG ECHO's approach to reducing the environmental footprint of humanitarian aid*. Publications Office, 2020. https://data.europa.eu/doi/10.2795/074887.

European Commission, Directorate-General for European Civil Protection and Humanitarian Aid Operations (ECHO). *DG ECHO's minimum environmental requirements and recommendations*. Publications Office of the European Union, 2022a. Available at: https://op.europa.eu/en/publication-detail/-/publication/295a4570-031d-11ed-acce-01aa75ed71a1/language-en.

European Commission, Directorate-General for European Civil Protection and Humanitarian Aid Operations (ECHO). *Guidance on the operationalization of the minimum environmental requirements and recommendations for EU-funded humanitarian aid operations*. Publications Office of the European Union, 2022b. https://data.europa.eu/doi/10.2795/467817.

FAO. *The State of The World's Forests: Forest pathways for green recovery and building inclusive, resilient and sustainable economies*. Rome: FAO, 2022. Available at: https://www.fao.org/3/cb9360en/cb9360en.pdf.

Global Protection Cluster. *The Primacy of Protection: Mine Action Area of Responsibility, Strategy 2022-2024*. 2021. Available at: https://www.globalprotectioncluster.org/sites/default/files/2022-09/MA_AoR_Strategy_%28English%29.pdf.

ICBL-CMC. *Landmine Monitor 24th Edition. International Campaign to Ban Landmines*. 2022a. Available at: http://www.the-monitor.org/me2dia/3352351/2022_Landmine_Monitor_web.pdf.

ICBL-CMC. *'Ukraine: Impact'. International Campaign to Ban Landmines.* February 2022b. Available at: http://the-monitor.org/en-gb/reports/2022/ukraine/impact.aspx.

ICBL-CMC. *Ukraine Mine Action.* 12 November 2018. Available at: http://www.the-monitor.org/en-gb/reports/2018/ukraine/mine-action.aspx

ICRC and IFRC. *The Climate and Environment Charter for Humanitarian Organisations*. N.d. https://www.climate-charter.org/.

IUCN. *Nature-based Solutions.* N.d. https://www.iucn.org/our-work/nature-based-solutions.

IUCN. *Nature-based Solutions in Humanitarian Contexts: Key Messages*. 2022. Available at: https://www.iucn.org/sites/default/files/2022-07/nbs_in_humanitarian_contexts_key_messages_1.pdf.

IUCN. *Global standard for nature-based solutions: A user-friendly framework for the verification, design and scaling up of NbS*. Gland, Switzerland: International Union for Conservation of Nature, First edition, 2020. Available at: https://portals.iucn.org/library/sites/library/files/documents/2020-020-En.pdf.

Institute of Soil Protection of Ukraine. *Periodic report on the state of the soil based on the results of the 10th round of agrochemical soil survey*. 2020. Available at: https://tinyurl.com/3z8nzc45.

Laws, Edward. *The impact of mines and explosive remnants of war on gender groups*. Brighton, UK: Institute of Development Studies, K4D Helpdesk Report, 2017. available at: https://assets.publishing.service.gov.uk/media/59844e0c40f0b61e4b00005c/149-the-impact-of-mines-and-explosive-remnants-of-war-on-gender-groups__1_.pdf.

Mine Action Review. *Armenia: Clearing the Mines 2022*. 2022a. Available at: https://www.mineactionreview.org/assets/downloads/Armenia_Clearing_the_Mines_2022.pdf.

Mine Action Review. *Azerbaijan: Clearing the Mines 2022*. 2022b. Available at: https://www.mineactionreview.org/assets/downloads/Azerbaijan_Clearing_the_Mines_2022.pdf.

Mine Action Review. *Bosnia and Herzegovina: Clearing the Mines 2022*. 2022c. Available at: https://www.mineactionreview.org/assets/downloads/BiH_Clearing_the_Mines_2022.pdf.

Mine Action Review. *Kyrgyzstan: Clearing the Mines 2022*. 2022d. Available at: https://www.mineactionreview.org/assets/downloads/Kyrgyzstan_Clearing_the_Mines_2022.pdf.

Mine Action Review. *Mitigating the environmental impact of explosive ordnance and land release*. Oslo, October 2021. available at: https://tinyurl.com/4fwtz22n.

Mine Action Review. *Russia: Clearing the Mines 2022*. 2022e. Available at: https://www.mineactionreview.org/assets/downloads/Russia_Clearing_the_Mines_2022.pdf.

Mine Action Review. *Türkiye: Clearing the Mines 2022*. 2022f. Available at: https://www.mineactionreview.org/assets/downloads/Turkey_Clearing_the_Mines_2022.pdf.

Mine Action Review. *Uzbekistan: Clearing the Mines 2022*. 2022g. Available at: https://www.mineactionreview.org/assets/downloads/Uzbekistan_Clearing_the_Mines_2022.pdf.

Focus. *Ukrainian Farmers turned a Tractor into an Unmanned Demining Machine.* 24 April 2023. https://focus.ua/uk/amp/auto/562330-ukrayinski-fermeri-peretvorili-traktor-na-bezpilotnu-mashinu-dlya-rozminuvannya-video.

National Strategy of the Republic of Tajikistan on Humanitarian Mine Action for 2017-2020. n.d. Available at: https://cloud.mail.ru/public/Fnqq/Hhin1wStY.

NDM-UN26. *The 26th International Meeting of Mine Action National Directors and United Nations Advisers*. 20 June 2023. https://www.mineaction.org/sites/default/files/ndm-26_summary_report.pdf; recordings: https://www.youtube.com/watch?v=-IeAXXMiFwY&list=PLdhkSNQEnOOT8g4UIIPKeyvLUgXIEqvQP&index=4&t=250s&pp=iAQB.

NV. *Ukraine urgently requires $1.5 billion for demining agricultural land*. The New Voice of Ukraine, 4 April 2023. Available at: https://english.nv.ua/business/ukraine-urgently-requires-1-5-billion-to-demine-agricultural-land-50315429.html.

OCHA. *Ukraine Humanitarian Needs Overview*. Office for Co-ordinations of Humanitarian Affairs, 2023. Available at: https://reliefweb.int/attachments/18db203c-0d11-440b-958b-40ef16607cdc/Ukraine%20Humanitarian%20Needs%20Overview%202023.pdf.

Orahovac, Ahdin. *Mine Action After the floods: regional synergy in emergency response, technology development and capacity building*. Prague: 22nd OSCE Economic and Environmental Forum "Responding to environmental challenges with a view to promoting cooperation and security in the OSCE area" CONCLUDING MEETING, Session 1, 10-12 September 2014. https://www.osce.org/files/f/documents/f/b/123394.pdf.

OSCE. *New donor-funded Support Programme for Ukraine*. press release, 1 November 2022. https://www.osce.org/chairpersonship/530219.

OSCE. *Decision No. 3/21 – Strengthening Co-operation to Address the Challenges Caused by Climate Change*. OSCE, 2021. Available at: https://www.osce.org/files/f/documents/2/f/507050.pdf.

Rahman, M. Feisal, Falzon, Danielle, Robinson, Stacy-ann, Kuhl, Laura, Westoby, Ross, Omukuti, Jessica, Schipper, E. Lisa F., McNamara, Karen E., Resurrección, Bernadette P., Mfitumukiza, avid, and Nadiruzzaman, Md. *Locally led adaptation: Promise, pitfalls, and possibilities*. Ambio, 2023. https://doi.org/10.1007/s13280-023-01884-7.

RFI. *Ukraine dam's destruction increases mines threat. Red Cross*, 9 June 2023. Available at: https://amp-rfi-fr.cdn.ampproject.org/c/s/amp.rfi.fr/en/international-news/20230607-ukraine-dam-s-destruction-increases-mines-threat-red-cross.

Scharsack, Jörn Peter, Koske, Daniel, Straumer, Katharina, and Kammann, Ulrike. *Effects of climate change on marine dumped munitions and possible consequence for inhabiting biota*. Environmental Sciences Europe 33, 2021. 102. https://doi.org/10.1186/s12302-021-00537-4.

UNDP. *Making Ukraine safe again: Cleaning up one of the world's most mine-contaminated countries*. 3 April 2023. https://reliefweb.int/report/ukraine/making-ukraine-safe-again-cleaning-one-worlds-most-mine-contaminated-countries.

UN Mine Action Service. *Environmental Management in Mine Action*. 1st ed., International Mine Action Standard, IMAS 07.13, 2017. Available at: https://www.mineactionstandards.org/fileadmin/user_upload/IMAS_07-13_Ed1.pdf.

UN Women. *Explainer: How gender inequality and climate change are interconnected*. UN Women 28, 2022. Available at: https://www.unwomen.org/en/news-stories/explainer/2022/02/explainer-how-gender-inequality-and-climate-change-are-interconnected.

UNMAS. *United Nations Gender Guidelines for Mine Action Programmes*. New York: 3rd Edition, 2019. Available at: https://unmas.org/sites/default/files/mine_action_gender_guidelines_web_0.pdf.

UNFCC. *United Nations Climate Change: Annual Report 2021*. 2022. Available at: https://unfccc.int/sites/default/files/resource/UNFCCC_Annual_Report_2021.pdf.

UNESCO and UNEVOC. *Skills development and climate change action plans: enhancing TVET's contribution*. 2021. Available at: https://unevoc.unesco.org/pub/skills_development_and_climate_change_action_plans.pdf.

US Department of State. *United States launches $47.6 million demining training project in Ukraine*. 1 November 2022. https://www.state.gov/united-states-launches-47-6-million-demining-training-project-in-ukraine/.

Varenikova, Maria. *Battling Wildfire and Pandemic, Ukraine Faces a New Foe: Landmines*. The New York Times, 3 October 2020. Available at: https://nyti.ms/3leWLFS.

World Bank Group. *Asian Development Bank Climate Risk Country Profile: Tajikistan.* 2021. https://climateknowledgeportal.worldbank.org/sites/default/files/2021-09/15919-WB_Tajikistan%20Country%20Profile-WEB.pdf.

World Bank Group. *Climate Change Knowledge Portal for Development Practitioners and Policy Makers: Climate Risk Country Profiles*. N.d. Available at: https://climateknowledgeportal.worldbank.org/country-profiles.

Zitser, Joshua. *Wildfires are setting off hundreds of unexploded bombs on WWI battlefields, endangering firefighters. Business Insider*, 31 July 2022. Available at: https://www.businessinsider.com/slovenia-wildfires-set-off-hundreds-of-unexploded-wwi-bombs-2022-7.

Websites

- https://legacy.amucad.org/map.
- ND-GAIN stands for 'Notre Dame Global Adaptation Initiative' https://gain.nd.edu/our-work/country-index/rankings/.
- The national adaptation plan (NAP) Interactive map of countries with NAPs as of 05 August 2023 https://na2pcentral.org/submitted-naps.
- "The Ramsar Sites Information Service (RSIS)" a platform that provides online information on wetlands that have been designated as internationally important. https://rsis.ramsar.org/ris/1586.
- https://apopo.org/herotrees/?v=c2f3f489a005.
- PEDRR a global network of UN agencies, NGOs and specialists working on "promoting and scaling up eco-system based approaches to reducing disaster and climate risks", see https://pedrr.org/about-us/.
- Adaptation to climate change – Guidelines on vulnerability, impacts and risk assessment, both available at https://www.iso.org/.
- "Humanitarian Aid Donors' Declaration on Climate and Environment" Available at https://humanitarian.forum.europa.eu/system/files/2022-03/Donor%20declaration%20on%20climate%20and%20environment_ENG_0.pdf#:~:text=Climate%20change%20is%20already%20affecting%20the%20frequency%20and,to%20infrastructure%20and%20human%20establishments%2C%20morbidity%20and%20mortality.