MINE ACTION REVIEW

MITIGATING THE ENVIRONMENTAL IMPACTS OF EXPLOSIVE ORDNANCE AND LAND RELEASE

MINE ACTION REVIEW
POLICY BRIEF NO.1 2021

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SUMMARY OF KEY FINDINGS

- **There is not only a humanitarian and legal imperative to clear explosive ordnance for the safety and security of the population, but also an environmental imperative to do so because of the negative impact munitions can have on the natural environment.**
- **Clearance programmes have a responsibility to "do no harm" to the communities in which they work, which includes mitigating the negative environmental impact of their activities and systematically integrating environmental assessments into the planning process.**
- **Clearing ordnance inevitably has an environmental impact, but employing efficient and effective land release methods minimises this impact by ensuring that assets are only used on contaminated land.**
- **The environmental impact of clearance programmes goes beyond the clearance itself and also includes the generation of waste, soil degradation from vegetation removal or mechanical demining, and pollution resulting from the detonation of items of explosive ordnance.**
- **Even small changes can make a positive difference to the protection of the natural environment, and environmental mitigation measures may demand only limited additional resources.**
- **Post-clearance land use should be actively considered when planning clearance activities, particularly in areas where contamination can be protective of certain aspects of the natural environment.**
- **Over the medium to long term, climate change has the potential to significantly impact mine action activities, both in how tasks are prioritised and how mine clearance is conducted.**
- **Most mine action actors are not yet gathering and reporting sufficient data on the environmental impact of their work. The sector would benefit from increasing the evidence base of what works and what doesn't in terms of environmental mitigation interventions.**
- **The mine action sector would benefit from further cross-sectoral experience from, and knowledge sharing with, environmental organisations and institutions involved in community-based sustainable agriculture, forest preservation, and environmental safeguarding. Involving environmental experts together with local communities from the start of the land release process is key to improving environmental management practices.**

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INTRODUCTION

Environmental considerations are rightly gaining increased prominence and awareness. Environmental experts agree that unprecedented changes in climate and biodiversity are taking place, threatening nature and human livelihoods around the world. The humanitarian community increasingly understands the need to identify and assess how their operations affect the natural environment and to mitigate the negative environmental impacts wherever possible.

In May 2021, the Climate and Environment Charter for Humanitarian Organisations, led by the International Committee of the Red Cross (ICRC) and the International Federation of Red Cross and Red Crescent Societies (IFRC), was opened for signature. The Charter includes seven high-level commitments to guide the humanitarian sector's response to the climate and environmental crises. The ICRC has also proposed a set of three organisational targets and a roadmap for the implementation of these commitments.[1]

The mine action sector has begun to recognise that in order to follow the humanitarian principle of "do no harm" it must be aware of and take action to mitigate the potential environmental damage that can occur during land release operations. While an affected community clearly benefits from the removal of explosive ordnance from nearby land, long-term harm may also be caused when environmental mismanagement occurs during clearance operations. Environmental impacts were first reported by the mine action sector more than thirty years ago, and in recent years the sector has begun to engage ever more meaningfully with the topic.

This Policy Brief builds on existing knowledge and research, and aims to outline the key environmental impacts of explosive ordnance contamination and land release operations and the potential impact of climate change on land release. It also offers an overview of the environmental impacts of post-clearance land use; outlines some of the relevant regulatory frameworks and treaty commitments; and emphasises the importance of environmental management. The aim is to present the key issues in an accessible format while offering recommendations of measures that would improve environmental management practices within the sector.

The Policy Brief has benefited from interviews with clearance operators and other implementing partners, and through written input from stakeholders across the sector, including affected States. It does not lay claim to being comprehensive and it will certainly not be the last word on this complex issue. Rather it offers straightforward guidance which, it is hoped, will promote discussion and stimulate further research, including more systematic follow-up once land is safely released in order to monitor environmental impacts. Mitigation measures should be chosen based on their appropriateness to the local context and should be evaluated to assess whether the desired outcomes are being achieved.

This brief uses the term explosive ordnance which, as per the International Mine Action Standards (IMAS) Glossary of mine action terms, definition and abbreviations, encompasses mine action's response to the following munitions: mines, cluster munitions, unexploded ordnance, abandoned ordnance, booby traps, and improvised explosive devices when their clearance is undertaken for humanitarian purposes and in areas where active hostilities have ceased.[2]

ENVIRONMENTAL IMPACTS OF EXPLOSIVE ORDNANCE CONTAMINATION

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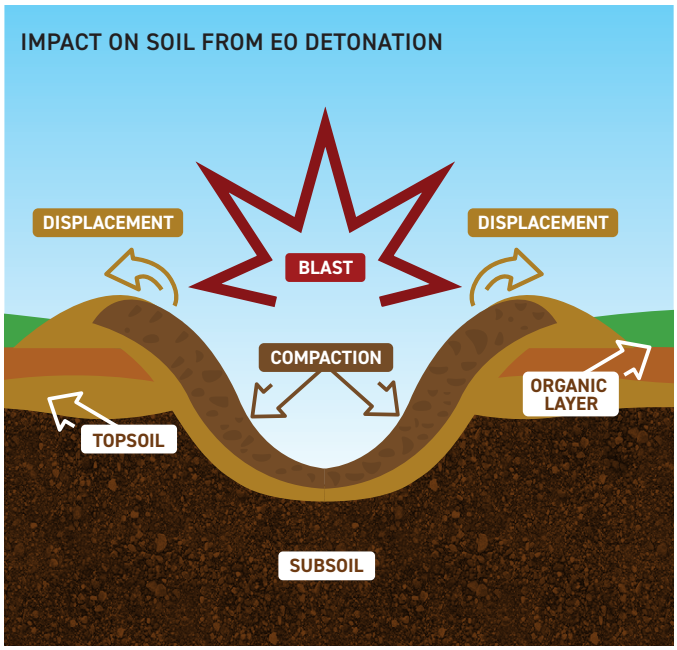
WHILE FOREST FIRES ARE A NATURAL OCCURRENCE WITHIN SOME ECOSYSTEMS, FIRE SEASONS ARE BECOMING INCREASINGLY FREQUENT EACH YEAR DUE TO CLIMATE CHANGE AND POOR LAND MANAGEMENT.

SOIL DEGRADATION

Soil is a living ecosystem and a finite resource, meaning its loss and degradation is not recoverable within a human lifespan: depending on the ecosystem it can take 1,000 years to generate just 3 centimetres of topsoil. When an item of explosive ordnance explodes, it can cause soil degradation by shattering the soil structure and damaging soil stability, causing local compaction, and increasing the susceptibility of fertile topsoil to erosion.[4]

When soil compaction occurs, networks of tunnels and pores created by various organisms collapse under the pressure and air is squeezed out, threatening underground habitats and the availability of nutrients.[5] According to the United Nations (UN) Food and Agriculture Organization (FAO) a third of the world's soil has already been degraded, and if current rates of degradation continue all of the world's top soil could be gone within 60 years.[6] The main causes of human-induced soil erosion globally are ploughing, unsuitable agricultural practices, deforestation, and overgrazing.[7]

The detonation of an item of explosive ordnance, such as a landmine, generates a crater that displaces topsoil while compacting subsoil into the side of the crater. The extent of the impact depends on the type of soil, the type and composition of the explosive, and the type of munition. Impact is greater in dry, loosely compacted, and exposed desert soils and less severe in humid soils that contain vegetation.[8] The crater can become a stable part of the landscape if repeated explosions do not occur in the same location and, depending on the ecosystem, can even, potentially, benefit wildlife by holding water and becoming a habitat for breeding frogs. Alternatively, it may pose a threat to humans by becoming a breeding ground for mosquitoes.[9]



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RELEASE OF HAZARDOUS CHEMICALS

Toxic pollutants, such as TNT, RDX or Cyclonite, or tetyrl, may be released into the environment when ordnance detonates.[10] Along with explosive residues, this can include toxic breakdown products and other munition components such as heavy metals, some of which are also carcinogenic.[11] While, to date, data on impacts from activities within the mine action sector have been limited, substantial research has been conducted on the environmental impact of military training ranges. It has been well documented that explosive residue deposition results in contamination of soil and groundwater.[12] That said, the amount of contaminant deposition in a military training range is far greater than in a typical battle area, although as access to military training areas is typically restricted, there is a higher risk of exposure to the general public in a civilian setting.[13]

As ordnance degrades over time, casings corrode and hazardous chemicals can leak into the soil and groundwater, posing a threat to the health of humans, animals, and flora alike.[14] Explosives can take between 10 and 90 years to leach from an item of explosive ordnance, depending on various factors such as soil condition, climate, and the type of munition. Understanding how these hazardous chemicals can harm the environment can be conceptualised using the "source-pathway-receptor" (SPR) approach. The "source" or contaminant is a munition component or waste which has the potential to cause harm and a "pathway" is a route by which a receptor might be affected by a contaminant.[15] A receptor is an entity (e.g. local communities, flora, or fauna) that may be adversely affected by interaction with a contaminant.[16]

In Vietnam, Norwegian People's Aid (NPA), working in partnership with a local university, is planning to analyse soil samples in ordnance-contaminated areas to better understand the types of pollutants and chemicals found in the soil. It will use the information to support local communities to make better choices about suitability of use and where appropriate, which types of crops would be most suited to these soil types.[17]

ACCESS AND PRESSURES ON NATURAL RESOURCES

Munitions found in productive arable or pastoral land can of course significantly restrict access, and even displace communities into more marginal areas.[18] Indeed, for some, the most prominent ecological issue associated with the presence of landmines—or fear thereof—is denial of access to vital resources.[19] Displaced persons have sometimes contributed to biodiversity loss when hunting wildlife for food or inadvertently destroying their habitats in search of shelter or fuel.[20] Valuable forest products, including fruits and timber, taken from sensitive, endangered ecosystems that were previously avoided have been exploited by affected populations who could no longer access their own farmland.[21]

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IT CAN TAKE

1,000

YEARS TO GENERATE JUST 3 CENTIMETRES OF TOPSOIL

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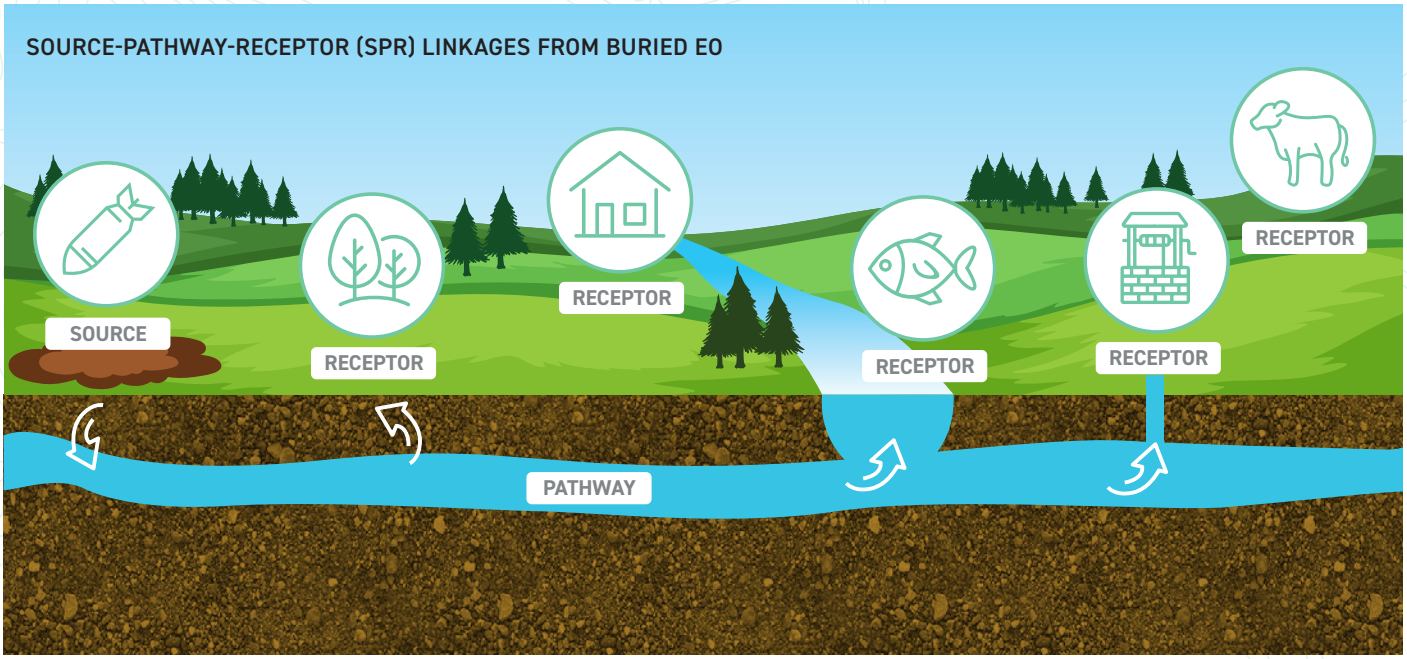
SOIL IS A LIVING ECOSYSTEM AND A FINITE RESOURCE, MEANING ITS LOSS AND DEGRADATION IS NOT RECOVERABLE WITHIN A HUMAN LIFESPAN.



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In an analysis of cluster bomb strike locations in Lebanon by the UN Environment Programme (UNEP), valuable pasture land was rendered unusable due to the presence of contamination. This in turn led to overgrazing in accessible areas and consequent habitat degradation. In some cases, local farmers were setting fires on contaminated areas in the hope this would detonate the cluster munition remnants, allowing them access to their land once again. Unfortunately, this remedial action exposed the soil to erosion once the vegetation cover was lost.[22] What is more, declining availability of land can increase the intensity of the remaining agricultural production systems where they rely on higher levels of chemicals, fertilisers, pesticides, and mechanisation, causing further degradation of the land.[23]

RISK FROM FOREST FIRES

When items of explosive ordnance detonate they may trigger forest fires, and then these fires can trigger further explosions, making it even more challenging for fire fighters to extinguish the blaze because of the contamination. Every year in Bosnia and Herzegovina, firefighters are prevented from accessing forest fires due to explosive ordnance contamination. The village of Slivnica, in the south of the country, had major wildfires a few years ago, and when firefighters attempted to set up a fire line, blasts began in the minefield forcing them to retreat to safety.[24] There have also been instances of fires in eastern Syria, Iraq, Lebanon, and in the Palamu Tiger Reserve (PTR) in India being exacerbated by contamination, as extinguishing the blaze became too dangerous for the firefighters due to the exploding munitions.[25]

While forest fires are a natural occurrence within some ecosystems, fire seasons are becoming increasingly frequent each year due to climate change and poor land management. Wildfires release carbon dioxide and other pollutant gases into the atmosphere, exacerbating global warming. The resulting smoke and haze can travel miles, creating public health crises as people breathe in unhealthy levels of pollutants. As well as destroying habitat and killing wildlife, uncontrolled wildfires can also cause economic damage as property and natural tourist attractions are destroyed, water supplies are polluted, and people are evacuated.[26]

RISK TO ANIMALS

Few data exist on the number of animals killed or injured by explosive ordnance each year. But the animals that have been recorded as falling victim to landmines include: brown bears in Croatia; Andean bears and pumas in Colombia; barking bears, clouded leopards, snow leopards, and royal Bengal tigers in India; gazelles in Libya and other parts of North Africa; elephants in parts of Africa, in Thailand and in Sri Lanka; and leopards in Afghanistan.[27] Many of these animals are protected and endangered species.

WILDFIRES RELEASE CARBON DIOXIDE AND OTHER POLLUTANT GASES INTO THE ATMOSPHERE, EXACERBATING GLOBAL WARMING.

ENVIRONMENTAL IMPACT AND LAND RELEASE

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ENVIRONMENTAL IMPACTS OF LAND RELEASE OPERATIONS

The primary concern of national mine action authorities and clearance operators in affected countries is of course the efficient and effective clearance and disposal of explosive ordnance. When areas are cleared of contamination, this improves the safety and security of the local population and increases opportunities for socio-economic development.

Most ordnance continues to be cleared manually today, with the remainder identified through the use of animal detection systems (ADS), mechanical systems, and robotics and remote-sensing equipment. The decision to select a particular combination of clearance methods is context specific and influenced by the extent and type of threat which the munitions pose, as well as other important factors such as cost and security, infrastructure and terrain, and national laws.[28] However, each clearance method also has a distinct impact on the environment, which should be factored into decision-making. According to the IMAS on Environmental Management in Mine Action (07.13), the greatest concerns arise from mechanical clearance and bulk demolition since these processes can have a severe environmental impact.[29]

VEGETATION REMOVAL AND GROUND PREPARATION

Vegetation clearance to prepare the ground for both manual clearance and ADS is usually needed. This is often performed by mechanical means. As environmental assessments are generally not conducted as part of the pre-clearance process, this can lead to the removal of rare species or those that are vital to the natural habitat or are of specific importance to the local population, and which sometimes need years to be restored. Land may still have high ecological value even if the ambient area is not designated or regionally recognised as important habitats.[30] When clearing vegetation in Bosnia and Herzegovina during land release operations, care is taken not to remove young shoots and seedlings of coniferous trees and of rare or endangered species, in order to preserve the local habitat.[31]

The removal of vegetation down to ground level may also result in soil erosion and speed up deforestation. In Somalia, deminers from The HALO Trust cut down trees during clearance of explosive ordnance. Although only as much vegetation is removed as is necessary to the land release process, a local Somalian interviewed for a post-clearance evaluation of the programme said that "a lot of areas where mine action occurs become pockmarked by holes and are left with almost no trees or vegetation, ... which can amplify the risks of flooding." This may subsequently undermine the livelihood opportunities the cleared land could have offered to primarily agro-pastoralist communities.[32]

In Colombia, the national mine action authority, in partnership with the Swiss Foundation for Mine Action (FSD), had to provide clarification on the concept of "mulch" or leaf litter as during manual clearance one operator was removing up to two metres of what it considered to be mulch but was actually topsoil until they reached subsoil.[33] The confusion is said to be due to the operator not differentiating between leaves and loose branches on top of the soil ("mulch") and the abundant presence (in Colombia) of organic soil, which also contains leaves, branches, and roots, and that can be several metres deep.[34]

MECHANICAL SYSTEMS

Although mechanical systems may be the most efficient clearance method in certain contexts, if used as the primary clearance asset, machines will have a significant impact on the soil and ecosystem. The most common types of machinery used in demining are equipped with flails, tillers, or rollers. As is the case with agricultural machinery, these disrupt soil structure, which can accelerate surface run-off and soil erosion; loss of organic matter and fertility; and disruption in cycles of water, organic carbon, and plant nutrients.[35] Vegetation will also be removed but potentially on a larger scale than during manual clearance or ADS, and the soil will be processed. This can change the physical or chemical properties of the soil and damage the soil structure as well as affect soil fertility, rooting potential, and water-retention capacity.[36]

Heavy machines also need to be transported to contaminated areas on trailers or trucks. Depending on the route taken, this may also cause greater damage due to the tracking and rutting of the soil. This was the case in the Al Salmi area of Kuwait, for instance, where the transportation and use of heavy demining equipment and machinery during clearance operations in the area in the 1990s caused soil compaction and reduced the rate of water infiltration by up to 97 per cent in certain cases (compared to unaffected soils).[37] A study of the impact of mechanical clearance activities in the Halgurd-Sakran National Park, the first national park in Iraq, established that erosion had been accelerated by the use of machinery, leading to soil degradation and loss.[38]

WORKSITES AND WASTE

In addition to the clearance methods themselves, negative environmental impact may also result from the establishment of worksites and temporary accommodation to house deminers and other operational staff, as well as from the repair, maintenance, and servicing of mine action equipment.

This may include:

- ground and surface water contamination linked to sanitation activities at worksites and temporary accommodation facilities
- destruction of flora and fauna during construction of worksites and temporary facilities; and
- ground and surface water contamination from leakages of fuel, lubricants, hydraulic fuel, oil, and other chemicals from mine action equipment.

Waste generated by mine clearance operations includes human waste, hazardous waste, domestic rubbish, and wastewater at worksites, temporary accommodation, and in offices. If not disposed of appropriately, these forms of waste may contaminate land or water systems, affecting local flora and fauna and posing a health hazard to local communities. Many of the countries contaminated by explosive ordnance lack a fully functioning public waste management

HEAVY METALS IN THE SOIL INCREASED BY UP TO

30%

AROUND THE IN SITU DETONATION POINT

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infrastructure, and it may be common for people to dump rubbish along roads, in rivers, on unused land, and in illegal or unregulated rubbish dumps. Rubbish may also be burnt, which is particularly problematic as the quantity of disposable plastic increases.

EXPLOSIVE ORDNANCE DISPOSAL

Once landmines and items of unexploded ordnance (UXO) have been found during clearance, they must be disposed of. Open burning or open detonation (OBOD) remains a basic and widely used disposal method, but it releases explosive residues into the environment. TNT, a common explosive, when absorbed into soil, slowly leaches and degrades to form degradation products such as 2,4-Dinitrotoluene (DNT), which has a higher toxicity than TNT itself.[39] DNT, which is listed by the United States Environmental Protection Agency (EPA) as hazardous waste, is highly toxic to humans. Another common explosive, RDX, leaches from soil more readily, degrades slowly, and can persist in the environment. Munitions containing RDX, and especially those with more modern shaped charges, will often contain a small amount of cyclotetramethylene-tetranitramine (HMX), which also has a degree of toxicity.[40]

Explosive ordnance is most often destroyed by "second order" demolition, which is when a donor charge is used to trigger a detonation in the main charge. The contamination risk is highest in bulk demolition sites, where repeated "second order" demolitions occur, which are in areas of substantial precipitation with sandy porous or loam soils, a shallow groundwater table and that are adjacent to marshes, swamps, or estuaries.[41] Using the SPR model for OBOD, there is also the potential for exposure through local air pollution, as well as nuisance from the generation of black smoke. The grounding of smoke plumes also has the potential to cause contamination from the deposition of explosive residues, soot, and heavy metals.[42]

In 2018–19, Mines Advisory Group (MAG) partnered with Ohio State University to conduct an analysis of the soil around detonation sites in Cambodia following destruction in situ of items of explosive ordnance. It was found that heavy metals in the soil (specifically arsenic, cadmium, and copper) increased by up to 30% following detonation in a one-metre radius around the detonation point. It was recommended that MAG take remedial measures to prevent heavy metals entering crops if agricultural activities were planned on the site. MAG is continuing to assess potential mitigation measures, including through soil removal or dispersal.[43] However, dilution or dispersal of contaminants by mixing or spreading is not regarded as good environmental practice.[44]

GREENHOUSE GAS EMISSIONS AND USE OF RESOURCES

When considering the potential direct environmental impacts of land release operations, we must also take into account the use of resources and carbon footprint of clearance operators, national mine action authorities, and other partner organisations within the mine action sector. The carbon footprint—or greenhouse gas (GHG) emissions—of land release operations relate to the use of fuel, electricity, and resources and the supply chain. GHGs are produced by an organisation's fleet of vehicles, which are used to transport people and equipment; its generators, which are often powered by diesel fuel; by fossil fuel-generated electricity in offices and at worksites; by flights, both national and international; by the production of goods and services that are purchased; and by the treatment of waste.[45]

MANY OF THE COUNTRIES CONTAMINATED BY EXPLOSIVE ORDNANCE LACK A FULLY FUNCTIONING PUBLIC WASTE MANAGEMENT INFRASTRUCTURE.

POTENTIAL IMPACT OF CLIMATE CHANGE ON LAND RELEASE OPERATIONS

Scientists are observing changes in the Earth's climate in every region and across the whole climate system. This is directly due to human activity, as the latest Intergovernmental Panel on Climate Change (IPCC) report released in August 2021 describes. The report projects that, in the coming decades, climate change will increase in all regions with the global temperature rise, bringing more intense rainfall and associated flooding, as well as more intense drought and extreme heat in many regions.[46] Mine clearance programmes are already being negatively impacted by the effects of climate change and this will increase in the coming years. However, the impacts of climate change are not currently being considered during tasking and prioritisation processes which, predominantly, are still focused on land use for socio-economic development.

Central Vietnam was subjected to unprecedented flooding and landslides during 2020 following seven tropical cyclones in October to November, which brought six times higher than average rainfall. Flood waters in some areas exceeded previous historical highs recorded in 1979 and 1999.[47]

NPA Vietnam and PeaceTrees Vietnam reported that clearance operations were forced to stand down for several weeks due to the flooding. More broadly, the organisations have observed heavier rain and greater flooding in the areas in which they work in recent years, with increased deforestation contributing to greater numbers of landslides. The likelihood is that over the next twenty years the local population will move from flatter, flood-prone areas to higher ground nearer to the borders with Cambodia and the Lao People's Democratic Republic (Lao PDR). These are also the areas that are still heavily contaminated with UXO but have not yet been cleared because they are currently sparsely populated and have not yet been prioritised in clearance strategies.[48]

Although not a comprehensive list, flooding in contaminated areas has also been reported in Bosnia and Herzegovina, Cambodia, Lao PDR, and Mozambique, as well as in Western Sahara.[49] In 2021, landmines planted along the Lebanese-Syrian border were washed into Lebanese territory following winter flooding, making them harder to clear and causing multiple incidents.[50]

The danger is that the flooding will both displace landmines and UXO, meaning that previously cleared areas become re-contaminated; that mapping and minefield marking is made redundant; and that, as people are evacuated from their homes, they could be relocated to places which have not yet been cleared. The ICRC has noticed this trend in Vietnam and, together with the national Red Cross society, has designed a UXO Risk Awareness component in its Disaster Risk Reduction training for Red Cross volunteers and local community response.[51] It is also understood that increased exposure to water will likely increase the corrosion rates of explosive ordnance casing, which could lead to increased leakage of hazardous chemicals, make the explosives unstable, or, conversely, could transform some explosives into non-explosive biproducts.[52]

As rainy seasons lengthen, the operational period for demining programmes in some countries is expected to decrease as access to these areas is restricted or by limiting the use of machinery or mine detection dogs (MDDs). Sudan, for example, has explicitly cited this as a potential barrier to it meeting its Article 5 clearance deadline under the 1997 Anti-Personnel Mine Ban Convention (APMBC).[53] Spiralling temperatures may interrupt demining operations in certain countries as it becomes too dangerous for deminers to work outside due to intense heat. High temperatures may also have an adverse impact on munitions, as intense heat can weaken munitions' structural integrity, cause the thermal expansion of explosive chemicals, and damage protective shields. Although the exact causes are not known it is thought that hot weather was at least partly the cause of explosions in six different munition sites across Iraq in 2018–19.[54] Harsh environments can also impact the appearance of explosive ordnance making it more difficult to conduct explosive ordnance risk education (EORE).[55]

In the long term, the impact from future population movements and climate refugees may also require consideration in mine clearance because of increasing pressures on land use.[56]

ENVIRONMENTAL IMPACT OF POST-CLEARANCE LAND USE

Landmines can have a protective effect on the natural environment and halt the exploitation of natural resources as they act as a barrier to human intrusion. Without human intervention, plants and animal species can flourish, as seen in the mined borderland between Iran and Iraq. This became a significant stronghold of the endangered Persian leopard.[57] The "demilitarized zone" between the Democratic People's Republic of Korea (North Korea) and the Republic of Korea (South Korea), one of the most heavily mined areas in the world, has become a relative paradise for wildlife and biodiversity.[58]

In contaminated zones where the threat to life is not as profound, areas may be prioritised for clearance for reasons of national, provincial, or local socio-economic development. Land release may therefore act as an indirect driver of deforestation and land degradation by allowing access to previously inaccessible land for agricultural expansion and infrastructure construction. Clearance of vegetation and soil structure disruption may follow. If land release takes place in environmentally sensitive areas and in proximity to protected areas of biodiversity, it may encourage agricultural encroachment into these areas and adversely affect local biodiversity.[59] Many States contaminated with explosive ordnance, including Angola, Cambodia, Colombia, Ecuador, Myanmar, Peru, and Vietnam, as well as both North and South Korea, have experienced high rates of deforestation in recent years. The drivers of this situation are a complex

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290,400

TREES HAVE BEEN PLANTED IN COLOMBIA BY THE NATIONAL ARMY'S HUMANITARIAN DEMINING BRIGADE

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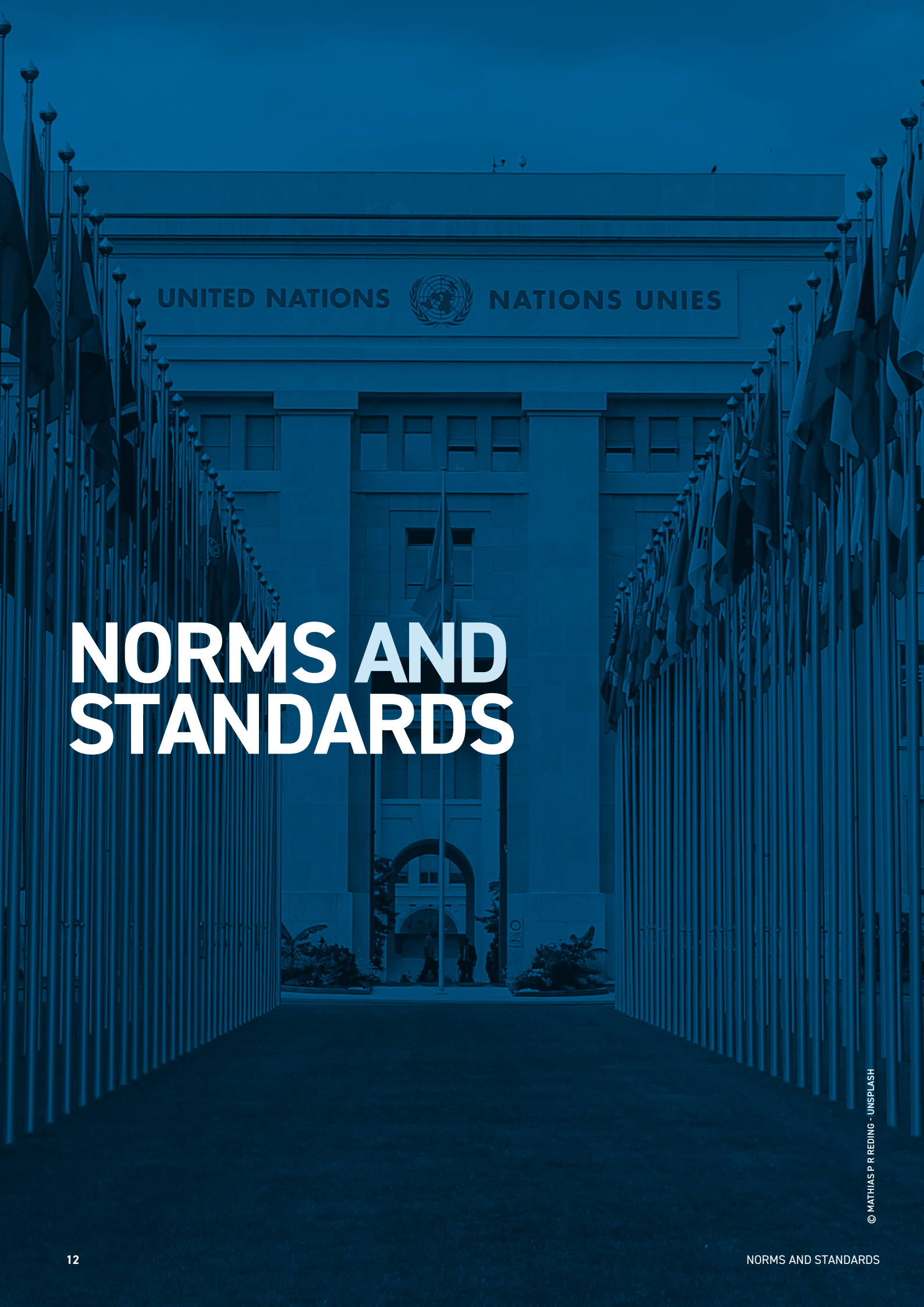
and interconnected web of social, political, economic and environmental factors.[60] The drivers of deforestation in Colombia, for example, include the expansion of cow pastures, extractive industries, palm oil plantations, and illicit industries such as illegal gold mining, logging, and drug trafficking.[61] The largest demining operator in Colombia, the National Army's Humanitarian Demining Brigade (Brigada de Desminado Humanitario (BRDEH), has conducted reforestation projects in the departments with the highest rates of deforestation in which they have demining operations. Since 2016, 290,400 trees have been planted, 80% of which are grown in BRDEH nurseries. BRDEH also supports regional environmental authorities with transport for seized animals and wood that have been illegally trafficked.[62]

Mine action actors should engage with local communities on environmental issues during the land release process to ensure meaningful and inclusive participation and leadership of local actors and affected communities in the design, management, implementation, and evaluation of survey and clearance activities and their environmental impact. This could include, for example, incorporating lessons on environmental protection during land handover ceremonies. Historically, donor budgets have not included funding for the long-term collection of data by demining organisations on how land is being used after clearance and any data collection by national authorities is often not systematic. However, it is clear that post-clearance land use interacts with sustainable development, land rights, and land distribution, as well as the localisation of aid. While outside the scope of this Policy Brief, each also has the potential to affect the natural environment.

An increasing number of projects within the mine action sector incorporate sustainable land management principles by using landmine clearance to open up biodiverse area to conservation and eco-tourism. For such programmes to work well, conservation strategies and environmental governance must be in place with clear guidance on the role of demining in this process. In Angola, The HALO Trust is working with the National Geographic Society and the Government of Angola to clear landmines surrounding the headwaters of the Okavango Delta. The threat of landmines, along with the remoteness of the region, protected this ecosystem from degradation, but as the areas are cleared the plan is to establish a mosaic of protected areas in the Water Tower which will connect onto a series of transboundary protected areas. This will ultimately allow the free migration of wild animals throughout the Okavango system, including the iconic African savannah elephant. In conjunction, employment opportunities in conservation and sustainable tourism will be made available to the local population, which will help to reduce the illegal commercial bushmeat trade, unregulated development, charcoal production, and logging.[63]

In Zimbabwe, the clearance organisation APOPO has been tasked with clearing mines inside the Sengwe Wildlife Corridor. This protected area is aimed at allowing the free movement of wildlife, including elephants, pangolins, lions, and endangered wild dogs, between Kruger National Park in South Africa and Gonarezhou National Park in Zimbabwe while also increasing the potential for eco-tourism to the area. APOPO will be working with the Gonarezhou Conservation Trust, a partnership between the Zimbabwe Parks and Wildlife Management Authority (ZPWMA) and the Frankfurt Zoological Society (FZS), which are responsible for managing the national park.[64]



NORMS AND STANDARDS

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INTERNATIONAL LAW AND STANDARDS

THE ANTI-PERSONNEL MINE BAN CONVENTION AND THE CONVENTION ON CLUSTER MUNITIONS

Limited environmental obligations are included in the relevant conventional arms disarmament treaties.[65] The APMBC and the Convention on Cluster Munitions (CCM) both require that requests for extensions to the deadlines for the clearance of areas contaminated by anti-personnel mines and cluster munition remnants, respectively, must contain information on the environmental implications of that extension. Both the APMBC and the CCM further require States Parties to furnish reports on transparency measures being taken, which shall include reference to the applicable safety and environmental standards to be observed.[66]

In reality, when the environment is referenced in extension requests it is usually very brief and only refers to how landmine or cluster munition contamination denies access to productive land and natural resources to local communities. Cambodia was one of the few States to refer to the protection of the environment in relation to mine action activities in its 2019 APMBC Article 5 deadline extension request. It stated its intention to provide guidelines to operators on the minimum environmental protection measures needed during operations.[67]

The five-year Oslo Action Plan for the APMBC, adopted at the Fourth Review Conference in 2019, does not mention the environment, but the Lausanne Action Plan, adopted at Part Two of the Second Review Conference of the CCM in September 2021, contains several actions that refer to the environment and are relevant to land release activities:

- **Action #8** refers to the national and international environmental legislation applicable in individual States and relevant for mine action activities;
- **Action #21** promotes research and development into innovative survey and clearance methodologies which consider environmental impacts and concerns;
- **Action #23** calls for activities related to survey and clearance to be accorded due priority based on clear nationally driven humanitarian and sustainable development criteria that consider environmental concerns; and
- **Action #39** refers to the sharing of best practices and lessons learnt through international, regional, North-South, South-South, and/or bilateral and trilateral cooperation. These include exchanging best practices on environmental impact assessments and sharing experiences on incorporating environmental protection into mine action.[68]

In addition, States Parties to the APMBC and the CCM are also guided by the objectives of the Paris Agreement, the Sendai Framework for Disaster Risk Reduction, and the UN Sustainable Development Goals (SDGs), as well as other relevant international law and standards, including international human rights law, international humanitarian law, and international environmental law.

The Geneva International Centre for Humanitarian Demining (GICHD) has looked into how mine action can contribute to the implementation of the SDGs and how they can be mainstreamed within mine action. The GICHD study shows that 12 of 17 SDGs are directly relevant for mine action, observing that the SDGs can bring a new emphasis on environmental mitigation measures in mine clearance for sustainable development impacts like "deforestation, land degradation, climate change vulnerability and loss of biodiversity".[69]

IMAS 07.13 ON ENVIRONMENTAL MANAGEMENT IN MINE ACTION

IMAS 07.13, published in 2017, is the only international mine action standard to be dedicated to environmental management in mine action. It recognises that shortcomings in environmental management can cause adverse short- and long-term environmental impacts, resulting in direct harm to the affected communities and reducing the positive results and outcomes expected to arise from mine action operations.[70] According to the IMAS, the aim of mine action operations is to "leave the environment in a state that is similar to, or where possible better than, before mine action operations commenced, and that permits the intended use of land once mine action operations have been completed".[71]

The environment should therefore be taken into consideration at the earliest possible stages before land release takes place during the planning and tasking process, during survey and clearance as part of the land release system, and after completion of land release.[72] It is a stipulated requirement within IMAS 07.13 that national mine action authorities (NMAAs) should have an environmental management system. An NMAA has primary responsibility for assessing the impact of mine action operations on the environment and establishing mitigation measures that reflect the local and/or national needs. Planning, prioritisation, and tasking that meaningfully includes environmental and social considerations understands that risk management is not just the immediate risks to life but also the damage that can be done to the environment. Indeed, potentially such environmental damage could pose a far greater threat to the wider health and wellbeing of the local population.[73]

Incorporating environmental and social safeguards into mine action should not be seen as an additional activity, but rather as essential to its purpose.[74] An understanding of the physical environment and the needs and expectations of mine action stakeholders should inform the planning for, and establishing

ACCORDING TO THE IMAS, THE AIM OF MINE ACTION OPERATIONS IS TO "LEAVE THE ENVIRONMENT IN A STATE THAT IS SIMILAR TO, OR WHERE POSSIBLE BETTER THAN, BEFORE MINE ACTION OPERATIONS COMMENCED".

of, environmental protection and mitigation measures.[75] Environmental management requires holistic solutions that assess different impacts, mitigate adverse effects (avoid or reduce), and demonstrate an increased awareness towards environmental protection among all mine action organisations. In accordance with IMAS 07.13, each NMAA should: establish, review, and maintain an environmental policy; identify and assess environmental obligations, relevant to the national mine action programme, contained in applicable national and international legislation; and define and communicate environmental obligations in national mine action standards (NMAS) and national mine action strategy.

In addition to IMAS 07.13, five other IMAS refer to environmental impact according to an online search of the normative references to the environment in the IMAS ("shall", "should", and "may") using mineaction.net.[76]

NATIONAL STANDARDS AND LEGISLATION

NATIONAL MINE ACTION STANDARDS (NMAS)

According to available information, of the 34 States Parties to the APMBC affected by anti-personnel mines,[77] only Afghanistan, Cambodia, Palestine, Senegal, Sudan, Turkey, and Zimbabwe are believed to have an NMAS on the environment in place, while of the 10 States Parties to the CCM affected by cluster munition remnants,[78] only Afghanistan and Lao PDR do. In Croatia, which is a State Party to both the APMBC and CCM, the national mine action standards, including environmental protection measures, are encompassed within the 2015 Law on Mine Action.[79] The remaining States Parties should fill this gap as soon as possible (if they have not yet done so).

CAMBODIA

One of the objectives of Cambodia's National Mine Action Strategy 2018–2025 is to "mainstream environmental protection in mine action". In order to do this, Cambodia has developed an NMAS on the environment. It is working to strengthen capacity of the national authority (Cambodian Mine Action and Victim Assistance Authority, CMAA), regional and local government authorities, and operators to comply with the NMAS.[80] Capacity will be built through planned training sessions on erosion control, biodiversity conservation, climate change adaptation, resource use efficiency, and pollution prevention.[81] However, while the NMAS has been developed, as of writing it had not yet been approved. Considerable work will be needed to ensure its implementation by all the operators.[82]

LAO PDR

Lao PDR has had a NMAS on the environment in place since 2012, which stipulates the procedures for environmental management that operators must comply with, in addition to national statutory requirements. The standard should be updated to take into account the stronger national legislation on environmental protection passed in 2013. In addition, the guidance on dealing with domestic rubbish in Lao PDR's NMAS needs to be brought up to date as current guidance is to dispose of it at rubbish dumping sites, bury, or burn it. There is no mention of recycling, and as single-use plastics are now very common in Lao PDR, burning rubbish would lead to the release of toxic pollutants.[83]

AFGHANISTAN

Afghanistan has recently launched an online database of its NMAS, linking them digitally to the IMAS database and including "smart" updating, which flags when IMAS entries have been introduced or changed.[84] This allows operators to assess their compliance with the NMAS more easily, including for Afghanistan's NMAS on environmental management. The national mine action centre (Directorate of Mine Action Coordination, DMAC) introduced a policy and standing operating procedure (SOP) for environmental protection in mine action in 2018.[85] DMAC has also produced a set of guidelines on environmental control during demining activities for implementing partners.

CROATIA

Croatia's national mine action standards, including environmental protection measures prescribed for the destruction of EO and marking of mine suspected area, are encompassed within the 2015 Law on Mine Action. Under this legislation, the draft of the National Mine Action Programme and the proposed annual mine action plan are prepared by the Ministry of the Interior after obtaining the opinion of the competent ministry on environmental protection. Other specific protection measures are included in preliminary demining plans, based on environmental protection surveys and/or approval of the competent national body/public administration, such as the Ministry of Economy and Sustainable Development.[86]

NATIONAL ENVIRONMENTAL LEGISLATION

In addition to mine action-specific rules, States have their own national legislative requirements for protection of the environment more generally, which are often embedded in either national policy or law (or both). When conducting survey and clearance of explosive ordnance, operators must comply with all of the environmental obligations that are relevant to national mine action programmes.

In Colombia, Decree 1195 determines that all demining operations must be approved by the national authority and outlines the mitigation and correction measures that must be applied by operators when demining in national parks and other protected areas.[87] For example, operators could be requested to re-forest in protected areas after clearance to mitigate environmental impact if the environmental authority considers it necessary in the specific hazardous area. However, there has been a lack of consistency in the application of the decree at a regional and local level with some environmental authorities expecting operators to re-forest areas and then provide follow-up for up to three years.[88]

In response, the NMAA in Colombia (Oficina del Alto Comisionado para la Paz – Descontamina Colombia [OACP-DC]), with the support of FSD, has created a supporting toolkit. Its aim is to clarify the obligations for operators and the process they should follow to comply with the decree; to define certain concepts and terminology; and to

IMAS 07.13

SAYS EACH NATIONAL MINE ACTION AUTHORITY SHOULD ESTABLISH, REVIEW, AND MAINTAIN AN ENVIRONMENTAL POLICY

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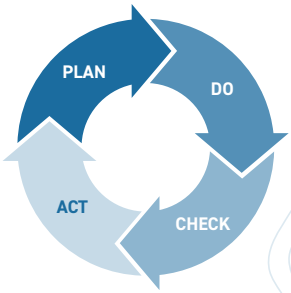
confirm the roles and responsibilities at local, regional, and national level within the environmental authorities.[89] The FSD and the OACP-DC also held training sessions with all national and local environmental authorities to develop their understanding of demining operations and the appropriate use of clearance assets. [90]

ENVIRONMENTAL MANAGEMENT SYSTEMS AND IMPACT ASSESSMENTS

ENVIRONMENTAL MANAGEMENT SYSTEMS AND MONITORING

An environmental management system (EMS) offers a systematic approach to help organisations understand their impacts and prioritise how they will be addressed. The best-known approach to EMS is laid out by the International Organisation of Standards (ISO) 14000 series of standards, with ISO 14001 providing the requirements for an EMS, and ISO 14004 giving general EMS guidelines.[91] The other standards and guidelines in the series address specific environmental aspects, such as labelling, performance evaluation, life-cycle analysis, communication, and auditing. ISO 14000 has been adopted by more than 300,000 organisations worldwide. The ISO 14001 and the Plan-Do-Check-Act (PDCA) cycle, which is the operating principle of all ISO management system standards, provided the framework for the IMAS 07.13.[92]



The HALO Trust, Humanity and Inclusion (HI), NPA, MAG, and FSD all have organisational environmental policies in place which set out their commitments to minimise the climate and environmental impact of their activities. Other leading mine action organisations should adopt a policy as soon as possible if they do not already have one in place, and those organisations that do have policies should ensure they are up to date, fit for purpose, and that implementation is being monitored across the organisation.

ENVIRONMENTAL IMPACT ASSESSMENTS

An environmental impact assessment (EIA) is an environmental management tool, which aims to predict environmental impacts at an early stage in project planning and design, find ways and means to reduce adverse impacts, shape projects to suit the local environment, and present the predictions and options to decision-makers. An EIA is a widely recognized environmental management tool for mainstreaming the environment into development projects

IN THE FALKLAND ISLANDS, THE AREA AT YORKE BAY HAD BECOME A DE FACTO NATURE RESERVE FOR PENGUINS AND THERE WERE CONCERNS THAT CLEARANCE WOULD DISRUPT OR EVEN DESTROY THEIR HABITAT AND THE WIDER ECOSYSTEM.

and is often mandated by law. In some cases, the EIA process can take two years or more to complete.[93]

In addition to the EIA a range of more rapid environmental assessment tools have been developed for the humanitarian sector such as the Rapid Environmental Impact Assessment in Disasters (REA) tool and the Flash Environmental Assessment Tool (FEAT), which are both used in the immediate aftermath of complex disasters to identify environmental impacts and support initial response actions, the Post-Disaster Needs Assessment (PDNA) and the Nexus Environmental Assessment Tool (NEAT+), which are both designed for more longer term emergency or recovery interventions.[94] HI is currently piloting the NEAT+ tool across all its programmes in Colombia.[95]

It is good practice for organisations to incorporate at least a basic environmental assessment as part of the planning process in mine action operations in order to minimise potential harm from demining activities. NPA has developed two simplified Environmental Assessment and Management (EAM) tools for use by its offices and mine action operations. These can be carried out by a staff member, with recommendations to complete the tool before initiating operations or opening an office, and then re-collecting (updating) the data at least once a year. These EAM tools have been made available to the mine action sector and can be found on the Mine Action Review website.[96]

EIAs were used to great effect during landmine clearance of the Falkland Islands and at Skallingen in Denmark. Both were considered to be environmentally sensitive areas with ecosystems that presented their own unique challenges to mine clearance.

The United Kingdom conducted an EIA of the anti-personnel mine contaminated areas in the Falkland Islands in 2017, which was discussed with the Falkland Islands Government. The EIA identified two particular issues: a) the penguins on the islands; and b) the area at Yorke Bay, which was to be addressed in such a way as to ensure impact to the existing environment from clearance operations was limited to the minimum practically possible.[97] The area at Yorke Bay had become a de facto nature reserve for penguins and there were concerns that clearance would disrupt or even destroy their habitat and the wider ecosystem, and further that the reopening of Yorke Bay would bring tourists and locals to the beach, further disrupting the natural environment.[98]

The EIA also identified the peatlands on the island, which act as a carbon store and are also an important habitat for wildlife, with the Falklands being one of the most peat-rich places on the planet.[99] Certain mitigation measures were put in place to minimise the disruption to the environment. This included manual deminers and machines maintaining certain distances from occupied penguin burrows and carrying out work at times that still allowed penguins access to their burrows, with routes for vehicles restricted to certain areas.[100]

Skallingen, in Denmark, is part of the largest undyked salt marsh in northern Europe and is designated as a national park and a Natura 2000 area, a European ecological network of conservation areas. The landscape offers a rich fauna consisting of a number of endangered species including birds, seals and reptiles. An EIA was conducted along with surveys and analysis on the depth and functionality of the remaining mines. The environmental mitigation measures mainly focused on protecting wildlife, minimising erosion, and re-establishing the area, including through removal of waste generated from the clearance work. Vehicles and the use of explosives were banned in the southern part of the minefield from April to August to avoid disturbing the breeding season of endangered birds and seals. Clearance hours were limited outside of these times and demining operators had to carry out scare-off actions before detonating mines on the seabed to ensure that porpoises, seals, and fish were not killed or injured.

To avoid erosion, transport of detection and other equipment was done on foot with driving only allowed on pre-existing roads to avoid damaging the topsoil. Dune and beach areas had to be re-established after clearance using sand that had been stored in areas where it would not be subject to erosion. After the dunes were reshaped, the area was replanted with vegetation that had also been stored during clearance.[101]

In Croatia, if demining activities are planned in Natura 2000 ecological network areas or national parks there is national legislation in place and international directives that contractors must follow. The Decree on Environmental Impact Assessment (OG 61/14 and 3/17) stipulates that pre-clearance EIAs must be carried out and submitted to the Ministry of Economy and Sustainable Development, who will supervise the demining from an environmental perspective. An EIA defines the specific measures that have to be undertaken throughout the demining activities.

These include the following:

- keeping the national park authority informed about demining activities
- ensuring that demining is carried out carefully, allowing wildlife time to adapt, with a corridor left free so that wildlife can leave the area
- ensuring that demining is considerate of breeding seasons, with all activities suspended in September during the deer-breeding season
- prohibiting the use of machines and MDDs in some areas; and
- prohibiting demining if they are too close to nesting birds.[102]

ENVIRONMENTAL MITIGATION INTERVENTIONS

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Once the potential negative environmental impacts from mine action operations have been identified, appropriate mitigation measures can be formulated in response. IMAS 07.13, along with environmental NMAS and organisational environmental SOPs (where available), propose measures that can mitigate negative impacts. These negative impacts include erosion and soil degradation; pollution of air, water, and soil by toxic and hazardous chemicals; pollution from disposal of mines, UXO, and hazardous waste; pollution from transportation of hazardous materials; degradation of air quality; impact on wildlife and vegetation; and pollution from waste. Measures to mitigate these negative impacts can—and should—vary in scale and scope and will depend upon the local context and resources available. These can range, for example, from organisation-wide initiatives to reduce their carbon footprint, to more local initiatives in improving waste management practices.

Some examples of mitigation interventions are provided below but there is a need within the mine action sector to provide evidence of what has and has not worked effectively in addressing environmental issues. This evidence-based evaluation of interventions can then inform and support decision-making. Alongside this, mitigation interventions should be guided by the leadership and experience of local actors and communities. During the planning, prioritisation, and tasking process there should be meaningful consultation with the local community and other key stakeholders with an aim to diminish risks to beneficiaries and the environment on which they depend.

REDUCING EMISSIONS

As part of its environmental policy, HI has made an organisational commitment to reducing its carbon emissions. It is part of a consortium with ten other non-governmental organisations (NGOs) to calculate its carbon footprint with the aim of producing, by the middle of 2022, a baseline of total GHG emissions that are produced by the organisation. Once the baseline has been calculated, the effectiveness of mitigation measures that target emissions from, for example, travel and energy consumption, can be measured.[103] At a country level, NPA Vietnam has also set up its own system to monitor its GHG emissions, which they were planning to launch before the end of 2021.

It is possible to reduce an organisation's carbon footprint by targeting the sources of these GHG emissions. The HALO Trust in Afghanistan, for example, has 180 solar panels in 7 locations across the country, complementing—and reducing—the energy that is drawn from fuel-powered generators. By increasing the number of solar panels, in 2020 the programme consumed 8,000 litres of fuel less every month at a cost saving of US$4,675. The proportion of energy generated by solar panels has gone from 18% of the total in 2018 to 32% in 2020.[104]

MAG started using solar panels in its programme in Angola more than 10 years ago but has recently made a more concerted effort to increase their use. Solar power is now also used by the organisation to generate power in Lebanon and Zimbabwe. This has reduced diesel use in generators, enabling carbon neutral charging of essential field equipment such as VHF radios and laptops, and also offers some protection against fuel shortages (in Lebanon), or fuel price changes (in Zimbabwe). MAG has also sought to localise procurement of equipment, such as personal protective equipment (PPE), vehicles, and uniforms at either country or regional level to limit the carbon footprint generated by freighting.[105]

Once organisations have reduced their GHG emissions as much as possible, carbon offsetting could be considered to deal with their remaining emissions by financially contributing to projects which have a positive carbon impact (e.g. re-forestation or promotion of renewable energy).[106] However, while a useful tool for speeding up climate action, this is not a silver bullet, and carbon offsetting risks complacency. It has been estimated by Oxfam that to meet the combined net zero targets for carbon emissions announced to date by governments and corporations, the total amount of land required for planned carbon removal could potentially be five times the size of India, or the equivalent of all the farmland on the planet.[107]

In addition, viable carbon offsetting requires the carbon to be locked away for hundreds of years and this cannot be guaranteed by many offsetting projects.[108] Care needs to be taken that the transition to carbon neutral is not done in a crude way that fails to take into account other environmental considerations (e.g. protecting the natural environment) and at the expense of vulnerable and marginalised people.[109] An alternative could involve mine action organisations partnering with local community-led climate initiatives on land cleared of explosive ordnance, which in turn would support sustainable livelihoods.

WASTE MANAGEMENT

NPA country programmes in south-east Asia have been supporting low-cost waste management initiatives. Waste management has been identified by local populations and by the country programmes as a priority environmental issue.

Thus, for example, in Lao PDR, NPA has committed to improving its waste management systems by reducing the amount of rubbish it produces through minimising single-use plastics and re-using items where possible. NPA's offices and field teams separate waste at source, re-use waste as compost or animal feed, or reclaim waste for recycling, for example by using intermediaries who make a living from collecting and reselling waste. This prevents rubbish and hazardous waste from being burned or dumped on the side of the road or in illegal rubbish dumps, a common practice in Lao PDR. A local youth movement, Zero Waste Laos, found large gaps in knowledge among NPA staff about environmental protection, waste management, and recycling. In response, Zero Waste Laos conducted training where staff learned how to recycle and minimise waste, including on how to set up their own home composting.[110]

THE ROLE OF NEW TECHNOLOGIES IN MORE ENVIRONMENTALLY FRIENDLY LAND RELEASE

In addition to better targeting of clearance, new technologies and innovation within the mine action sector can both improve land release efficiency and offer less invasive approaches to mine clearance. Unmanned aerial systems (UAS) are being used to support various mine action activities, such as pre-deployment planning, remote monitoring of operations, terrain inspection, and impact assessment. For example, MAG have

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THE HALO TRUST IN AFGHANISTAN HAS

180

SOLAR PANELS IN 7 LOCATIONS ACROSS THE COUNTRY

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used UAS in north-east and north-west Cambodia to collect high-resolution images for terrain and vegetation analysis to plan task sites prior to clearance. These also provide a better overview for decisions on deployment of mine clearance assets (mechanical, animal, and manual detection systems).[111]

When UAS are combined with thermal-imaging cameras and machine-learning technology there is also the potential that this methodology could help increase the pace of detection and disposal of explosive ordnance. Thermal-imaging cameras attached to UAS, which are flown at an altitude of around 10 metres or less, can capture differential heat signals at or just below the surface of the ground. That said, while landmines and UXO give off heat signals, so too does scrap metal, and currently there is no clear differentiation between the two. The ICRC is developing a project to use machine learning to improve the probability of detection and reduce the rate of false positives. It planned to pilot this system before the end of 2021.[112]

ALTERNATIVE DISPOSAL METHODS FOR EXPLOSIVE ORDNANCE

OBOD remains the primary disposal method for explosive ordnance across the mine action sector. While new technologies are being developed, there is currently no single disposal method which can be used in place of OBOD.[113] Examples of mine action programmes using alternative disposal methods include deflagration techniques, listed in IMAS 09.12 *(EOD clearance of ammunition storage area explosions)*, such as Point Focal Charges (such as the Swiss SM Series), Thermites, 'Baldrick', and 'Crackerbarrel'; and explosive harvesting, which can be used to recover and re-purpose high explosives, with appropriate environmental controls.[114] Developed by Golden West, explosive harvesting can yield small donor charges for use in disposal or for commercial use as quarry charges. For the mine action sector, this eliminates the need to buy in explosives for use as donor charges. It is not suitable for all types of explosives, though, and environmental impacts may still occur as the harvested explosive remains available for re-use (although demand for other purchased explosives is reduced, as are the impacts from their production and use).[115]

In Cambodia, Golden West in cooperation with the Cambodian Mine Action Centre (CMAC), the largest national clearance operator in the country, conducts explosive harvesting of items of explosive ordnance that contain large amounts of TNT (e.g. anti-tank mines, artillery shells, and aircraft bombs). These are transported to a training centre where the ordnance is cut open and the TNT extracted and casted. The extracted TNT is used to make explosive charges which are distributed to clearance operators across Cambodia.[116]

ENVIRONMENTAL CERTIFICATION

Environmental certification schemes allow organisations to evaluate, report on, and improve their environmental performance. Several different certification schemes are available, such as the European Union (EU) Eco-Management and Audit Scheme (EMAS); the B Corporation certification, which measures a company's entire social and environmental performance; and the ISO 14001 certification. NPA's head office in Oslo has been certified by the Eco-Lighthouse initiative, Norway's most widely used certification of environmental performance. In accordance with its membership, it has committed to:

- Increase the number of environmentally certified suppliers from which NPA purchases goods and services through forthcoming new procurement requirements
- Maintain the 2018 levels of energy use in the office, and if possible, reduce it through focus on energy efficiency
- Maintain the 2019 levels of waste production (both sorted and non-sorted waste), and if possible, reduce these levels, including through installing a new food-waste sorting system; and
- Reduce NPA's carbon emissions from air travel through improved oversight and coordination of staff travel.[117]

THE WAY FORWARD

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There is increased recognition from within the mine action sector that the environment is important, and some progress is being made in environmental mainstreaming across mine action programmes. However, there is still a long way to go before environmental protection forms an integral part of the mine action sector. The following conclusions and recommendations build on existing good practices and highlight gaps in provision.

The mine action sector is an innovative sector that works within an increasingly complex landscape. It is no longer just about getting explosive ordnance out of the ground or fulfilling Treaty obligations: the sector is focusing increasingly on how affected States achieve completion, ensuring that considerations such as the environment or on other important topics such as gender and diversity, are actively considered and mainstreamed along the way.

CONCLUSIONS

There is a lack of systematic monitoring of environmental impacts by national mine action authorities, clearance operators, and donors, which is a significant impediment to the delivery of quality initiatives and learning what works and what does not. Many operators are working to implement key performance indicators on the environment that are meaningful but also not excessively burdensome. Donors have also yet to implement any meaningful monitoring of environmental performance in the programmes they fund. Evidence of the effectiveness of interventions to address environmental issues in mine action is field based and has not been subjected to extensive comparative qualitative or quantitative research.

There is a chronic lack of funding for environmental safeguarding in mine action. Donors should lead by example and ensure that the environment is an integral part of their decision-making processes in allocating humanitarian funding. As well, funding for operators is often siloed, making it harder for mine clearance projects to include environmental aspects.

Climate change planning is still at an early stage within the mine actor sector as a whole and there is little guidance currently in place to support national authorities or mine clearance operators in assessing or managing the ways in which climate change can affect their work. Currently, no IMAS refers to the impacts of climate change on mine action operations. One suggested task could be the development of a Technical Note on how to evaluate or plan for the impacts of climate change.[118] In the meantime, national authorities and operators can begin considering their own contexts and experiences of climate change. Mine action operators are also in a unique position to be able to engage with local communities and begin collecting data on climate change and the environment during survey processes. Mine action stakeholders should be starting to incorporate climate change into mine action planning and operations.

RECOMMENDATIONS

NATIONAL MINE ACTION STANDARD ON ENVIRONMENTAL MANAGEMENT

National mine action authorities should at the very least, have an NMAS in place on environmental management that is in line with IMAS 07.13. As far as we are aware, only nine mine- or CMR-affected countries currently have such an NMAS in place. States Parties to the APMBC and CCM should also ensure they comply with the environmental commitments within the treaties, including the guidance under the newly adopted CCM Lausanne Action Plan. It would be helpful if there was an online database of environmental NMAS that could be made publicly available to all States.

ENVIRONMENTAL MANAGEMENT SYSTEM

Operators should ensure that they have an environmental management system in place that includes an environmental policy and environmental SOP that is adapted by operations managers and field staff for country-specific programmes. Naturally, these should be in line with the relevant NMAS and IMAS. An action plan should also be developed to implement and monitor compliance with the environmental policy. Information on operators' environmental compliance, activities, and key achievements as measured against the goals set forth in the environmental policy and accompanying action plans should be reported annually. This could include, for example, reporting on GHG emissions and how they are being reduced.

ENVIRONMENTAL ASSESSMENTS

In accordance with the humanitarian principle of "do no harm", environmental assessment tools (or where appropriate or required an EIA tool) should be integrated into programme planning activities to minimise environmental damage from demining activities. See the Mine Action Review website for NPA's simplified Environmental Assessment and Management (EAM) tools which have been made available to the mine action sector.[119]

COMMUNITY ENGAGEMENT

National mine action authorities and mine action operators should meaningfully engage with the local communities in which they work. During the planning, prioritisation, and tasking processes and in the design and implementation of mitigation interventions there should be meaningful consultation with the local community and other key stakeholders in order to reduce risks to beneficiaries and the environment on which they

THERE IS A CHRONIC LACK OF FUNDING FOR ENVIRONMENTAL SAFEGUARDING IN MINE ACTION. DONORS SHOULD LEAD BY EXAMPLE AND ENSURE THAT THE ENVIRONMENT IS AN INTEGRAL PART OF THEIR DECISION-MAKING PROCESSES IN ALLOCATING HUMANITARIAN FUNDING.

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depend, while improving common knowledge of environmental issues. This could also be extended to the local workforce through training on the IMAS on environmental management, climate change, and basic mitigation interventions, such as improved waste management practices.

BUILDING NETWORKS AND PARTNERSHIPS

National mine action authorities and mine action operators should not "re-invent the wheel" but should instead build networks and partnerships with local or national organisations working within the environmental and climate-change mitigation sector. Partnerships with organisations and local groups experienced in participatory natural resource management is critical. The mine action community could be an important bridge for linking communities to the right organisations, integrating mine action response with re-greening and wider development initiatives. Building networks and partnerships with environmental organisations can also open up new funding streams for national authorities and mine action organisations.

DATA COLLECTION

National mine action authorities and mine action operators should conduct more systematic data collection on the environment in all phases of operations. Data gathered would inform risk assessments for mine action operators and could help to direct more comprehensive post-conflict environmental assessments conducted by others. This would include questions on biodiversity (including wildlife), environmentally protected areas, and existing pollution (water, air, and ground). Another priority is to create a baseline of data on what has happened to land previously released back to communities. Documenting this would help us understand land use pressures in different countries and help identify different opportunities for a range of nature-based solutions

FUNDING

Donors should ensure that dedicated funding is available for environmental mitigation activities and include meaningful Key Performance Indicators (KPIs) on the environment in their reporting processes. Donors should be encouraged to fund more systematic follow-up after land is released to monitor environmental impacts.

BUILDING KNOWLEDGE

It would be helpful to document detailed case studies of mitigation intervention built on field and management perspectives to provide evidence of what has and has not worked effectively. Case studies should cover a range of environmental issues impacting on mine action, describe how these have been addressed, extract best practices for adoption and adaptation elsewhere, and provide practical suggestions on how lessons can be applied for ongoing and future planning and programming. A resource hub could be created to share information more easily on specific areas of interest and make expertise more readily available across the sector and with the wider humanitarian community.

GLOSSARY OF KEY TERMS

CLIMATE CHANGE
Refers to a change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer.

Climate change may be due to natural internal processes or external forcings such as modulations of the solar cycles, volcanic eruptions and persistent anthropogenic changes in the composition of the atmosphere or in land use (IPCC, 2021).

ENVIRONMENT
Refers to the "surroundings in which an organization operates, including air, water, land, natural resources, flora, fauna, humans and their interrelationships" (ISO 14001:2015).

ENVIRONMENTAL IMPACT
Refers to "change to the environment, whether adverse or beneficial, wholly or partially resulting from an organization's environmental aspects" (ISO 14001:2015).

ENVIRONMENTAL IMPACT ASSESSMENT (EIA)
Refers to "the process of identifying, predicting, evaluating and mitigating the biophysical, social, and other relevant environmental impacts of activities prior to and during operations" (IMAS 07.13).

ENVIRONMENTAL MANAGEMENT SYSTEM (EMS)
Refers to the "part of the management system used to manage environmental aspects, fulfil compliance obligations and address risks and opportunities" (ISO 14001:2015).

ENVIRONMENTAL MITIGATION INTERVENTIONS
Refers to actions taken before, during and/or after mine action operations to lower adverse environmental impact (IMAS 07.13).

EXPLOSIVE ORDNANCE
Defined as encompassing mine action's response to the following munitions: mines, cluster munitions, unexploded ordnance, abandoned ordnance, booby traps, and improvised explosive devices when their clearance is undertaken for humanitarian purposes and in areas where active hostilities have ceased (IMAS 04.10)

GREENHOUSE GAS (GHG)
Refers to gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and emit radiation at specific wavelengths within the spectrum of terrestrial radiation emitted by the Earth's surface, the atmosphere itself and by clouds.

This property causes the greenhouse effect. Water vapour (H_2O), carbon dioxide (CO_2), nitrous oxide (N_2O), methane (CH_4) and ozone (O_3) are the primary GHGs in the Earth's atmosphere.

Moreover, there are a number of entirely human-made GHGs in the atmosphere, such as the halocarbons and other chlorine- and bromine-containing substances, dealt with under the Montreal Protocol. Beside CO_2, N_2O and CH_4, the Kyoto Protocol deals with the GHGs sulphur hexafluoride (SF6), hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs). See also Carbon dioxide (CO_2), Methane (CH_4), Nitrous oxide (N_2O) and Ozone (O_3) (IPCC, 2021).

PROTECTED AREAS
A clearly defined geographical space, recognised, dedicated and managed, through legal or other effective means, to achieve the long term conservation of nature with associated ecosystem services and cultural values (IUCN Definition 2008).

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