# Do No Harm in Mine Action: Why the Environment Matters

Explosive remnants of war negatively impact the environment and some clearance methods used by mine action organizations can potentially lead to environmental degradation. Mine action organizations need to consider the negative impact potential of their operations and adopt mitigation measures to ensure they do no harm

by Ursign Hofmann and Pascal Rapillard [ GICHD ]

## Environmental Impact of Contamination from Remnants of Conflict

It is generally understood that durable peace cannot be achieved if the natural resources sustaining livelihoods and ecosystem services are damaged, degraded or destroyed. On the contrary, environmental protection and the sustainable management of resources are important pathways to consolidate peace and promote long-term development.[1,2] Similarly, environmental degradation increases the intensity of natural hazards and may result in disasters that can destroy livelihoods. [3,4,5]

Explosive hazards such as mines and other explosive remnants of war (ERW) may not only cause unacceptable harm to civilians during armed conflict but can do so long after hostilities have ceased. As a legacy of conflict, they hamper post-conflict peacebuilding and development efforts and directly affect the environment.[2,6] However, the environment can also be affected indirectly. Figure 1 illustrates schematically the environmental impact chain that may result from ERW.

## Access Denial

The confirmed or suspected presence of ERW deprives communities access to land and natural resources, rendering livelihoods inaccessible. Valuable pastures are blocked, potentially leading to overgrazing in accessible areas and causing habitat degradation. Land scarcity resulting from contamination has the potential to generate environmental deterioration. Facing livelihood pressures, people are forced to resort to survival strategies by intensifying exploitation of the diminished areas available, in order to meet short-term needs that might have unsustainable consequences for the environment.[1,6,7,8] Thus, ERW can trigger a chain of events leading to environmental harm in the form of soil degradation or

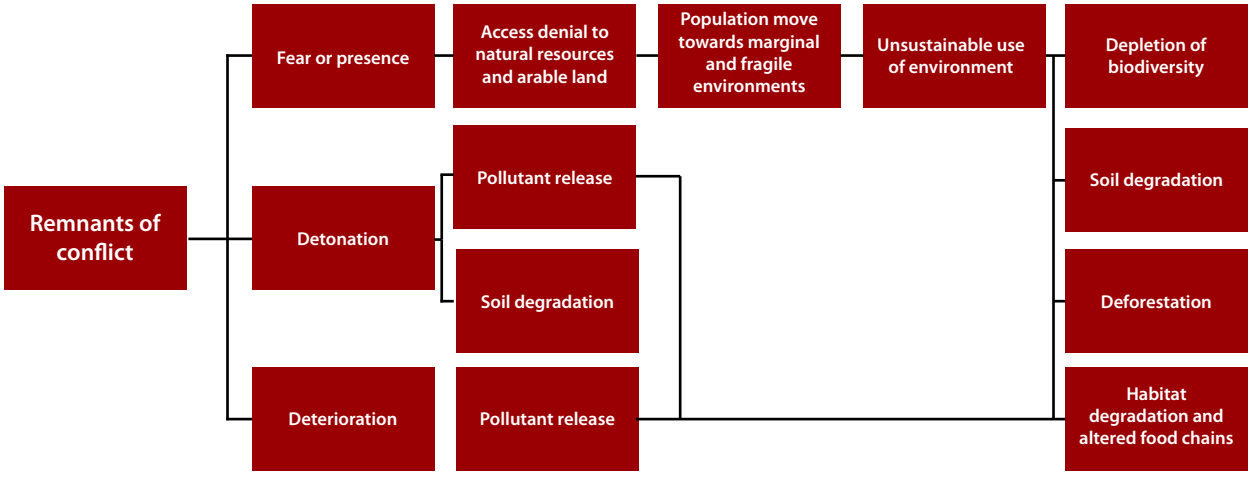


Figure 1. Environmental impact chain of remnants of conflict.
*All graphics courtesy of GICHD.*

Mechanical demining in action.

deforestation, possibly affecting entire populations of species by damaging habitats and altering food chains.[8,9,10]

### Soil Degradation and Loss of Productivity

The environment can be seriously affected when ERW detonate. Exploding munitions degrade land through topsoil damage or erosion with sustained impacts on moisture availability, soil structure, vulnerability to water flows and erodibility.[10,11] Soil productivity dramatically decreases if land is contaminated, as recorded in Vietnam with a reduction of 50 percent in rice production per hectare of affected land.[12]

### Chemical Contamination

Besides its physical hazard, ammunition can cause chemical contamination, both when it functions or if it fails to function. When it explodes ammunition can produce contamination due to gases and ash resulting from the chemical reaction. Chemical contamination of a different kind also occurs when ammunition fails to function as the explosive contents undergo chemical breakdown over time, whether loose due to the impact or still in the ammunition casing. If ammunition is unused, over time, a chemical breakdown will occur at a rate influenced by how it is stored. Toxic substances released from explosives can contaminate the water table and pollute soil through dust and ash. All these scenarios pose environmental health problems. Additionally, any ammunition body fragments remaining in the environment for extended periods are subject to corrosion and weathering, subsequently releasing various heavy metals such as chromium, zinc, iron and copper into the surrounding soil. In agricultural regions in particular these heavy metals will penetrate the soil, which can eventually affect the human food chain.[13]

### Environmental Impact of Mine Clearance

Survey and clearance operations address the physical and environmental impacts of contamination. However, by its very nature, mine action involves direct interaction with the ecosystem and precautions need to be in place to prevent nega-

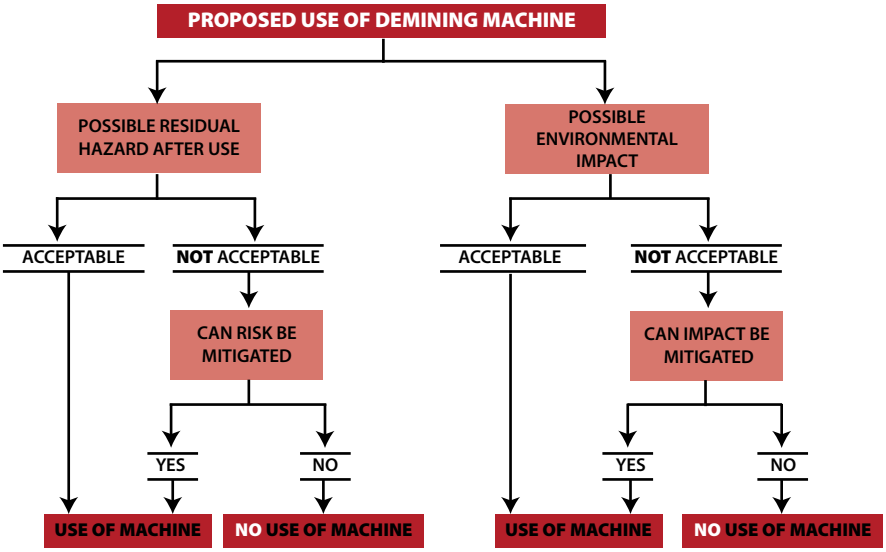


Figure 2. Environmental issues in community discussions.

tive effects on the environment.

Generally, mine action activities can have an impact on the environment similar to that of other humanitarian operations. The mere presence of demining personnel and temporary field camps might lead to over-exploitation of local resources such as water, wood and food and produce waste that, if not properly managed, can result in persistent environmental degradation after the camp has left.

### Clearance Operations

Specific to mine action, clearance operations can be undertaken using a variety of tools and methods, each of which has its own characteristics and advantages. Whereas the choice of methodology and technical tools is often guided by the working area and cost-efficiency considerations, the potential impact on the environment also needs to be taken into consideration.

When land is cleared manually, fertile topsoil has to be removed, soil and root systems are likely to be disturbed and lower vegetation may need to be cut in order to get access to a suspected or confirmed contaminated area. This process may induce erosion. However, given that only locations with an indication of metal contamination will be subject to manual digging, the impact on the environment is reduced. Nonetheless, manual clearance is time consuming and exhausting; however, mechanical systems can be used to speed up the clearance process. Although machines considerably increase the efficiency of clearance, they can have a greater impact on the soil and the ecosystem. Inevitably, their use will disturb and possibly damage soil conditions. Trees may need to be removed; this implies the removal of plant litter, which plays a crucial role in how the soil absorbs surface water and protects the soil from erosion and raindrop impacts. Clogged soil negatively affects water absorption. Trees and their roots positively clean the soil creating stable micro-pores to maintain infiltration rates and keep the ecosystem functioning. Plant litter also provides organic matter that is important to the stability of the soil structure.[10]

Soil is sometimes moved to a separate location where it can be distributed evenly over a large, flat surface and subsequently checked for explosive items or evidence of such. Alternatively, when soil passes through flails and tillers it remains in the same location after being processed, potentially leading to various types of erosion. Tillage increases wind erosion rates by dehydrating the soil and breaking it up into smaller particles that can be picked up by the wind. During mechanical demining, surface soil and the organic layer are processed, which can cause the properties and structure of the soil to become changed or damaged. This can affect soil fertility, rooting potential, and water-holding capacity.[10,14] Less fertile soils are naturally associated with losses in agricultural production. Some believe that environmental degradation reduces the capacity of ecosystems to meet community needs for food and the ability to protect against hazards. On the contrary, healthy ecosystems reduce vulnerability to hazards by supporting livelihoods and acting as physical buffers against hazardous events.[4]

With mechanical clearance, the risk of chemical pollution in soil and water might also arise through detonations, the destruction of explosive items in the ground or by leaking hy-

draulic fluids and fuel when refueling demining machines. When hydraulic fluids enter the environment through spills and leaks from machines or storage areas, severe environmental damage can result.

Finally, animal detection systems (ADS) are powerful tools when used in combination with manual and mechanical systems. However, once an explosive item has been detected by an animal, it has to be removed manually or mechanically. The use of animals, therefore, does not avoid the potential environmental impact of other clearance tools.

### Do No Harm

To avoid undermining the positive contribution mine action has on people, livelihoods and global peacebuilding, mine action organizations, like other humanitarian stakeholders, must ensure they **do no harm** by considering any possible, unintended consequences of their operations.[15] This is as valid for land tenure considerations as for environmental aspects.[2,6,16] At political levels, States Parties to the *Anti-personnel Mine Ban Convention* (APMBC) and/or the *Convention on Cluster Munitions* have the obligation to reflect environmental implications when requesting an extension of their clearance deadlines and may report on observed environmental standards as part of their transparency reports. Despite its importance, the environment has thus far not been a high priority in mine action-related international humanitarian law treaties and meetings.

On the other hand, the International Mine Action Standard (IMAS) 10.70 specifically addresses environmental protection, acknowledging that national authorities and mine action organizations have the responsibility to minimize the impact of demining activities on the environment and to ensure that the latter is left in a state that permits the intended use of the land once demining operations are completed. The standard thus embraces the **do no harm** principle.[17] The International Ammunition Technical Guidelines (IATG) and the standards of the International Organization for Standardization (ISO) complement the normative framework regarding mine action in its broad sense.[18] Based on these standards and norms, the mine action sector has developed a wide set of operational good practices and determined measures that can be taken to avoid or mitigate the potentially negative impact of clearance operations on the environment.

Backed by IMAS 07.11, a land release process that promotes a system of escalating survey activities, only resorting to full clearance as a last option, is crucial. Clearance thus only takes place where there is confirmed contamination. Even though environmental considerations are not particularly referred to in the IMAS on land release, it constitutes an effective measure to avoid the potentially negative consequences of clearance activities.

Other measures that can be taken to reduce the harm and negative impact from clearance operations include:

- A comprehensive environmental assessment in the planning for any clearance activity
- Identifying land use at a planning stage after mechanical clearance
- Scheduling demining activities so that the site can be cultivated as soon as possible after clearance to ensure regrowth of a root system, which will to some extent prevent erosion
- Re-seeding and re-planting areas with indigenous grasses immediately after clearance
- Avoiding demining during periods of the year with strong winds and/or heavy rainfall
- Leaving three to four meter-wide strips of vegetative cover at intervals across the site horizontal to the likely route of erosion
- Ensuring that the topsoil structure is not broken up by the mechanical process through the use of machines in a ground preparation role (only removing vegetation), followed by manual clearance or ADS
- Returning processed soil layers to affected sites in the correct order so that the fertile topsoil is once again the top layer

IMAS also provides guidance on precautions to be taken regarding possible chemical pollution. Mine action organizations should take all reasonable care when selecting refueling sites, e.g., ensuring that fuel and lubricant spillage cannot contaminate water sources. Furthermore, there should be clear regulations for the replacement of such liquids and the measures to be taken with waste products.

The process of planning a mechanical demining operation should include an environmental management process so that the risks and control measures can be discussed with the local community. Figure 2 illustrates this process.

### Conclusions

Mine action involves direct interaction with the environment and thus can potentially have a negative impact on it. In the past, the mine action sector focused on developing tools and methods to conduct operations safely, efficiently and effectively. As the sector has matured and acquired significant expertise and experience, the environmental concerns have received increasing attention at various levels.

Normative gaps still exist within the IMAS. As environ-

mental protection is a mainstream issue, the entire IMAS series might need to be reviewed in order to incorporate environmental considerations, especially regarding environmental requirements for accreditation, monitoring and inspection of demining operations. In addition, the IMAS could have the potential to provide guidance on how to include environmental concerns in national policies.

Given this refinement of the normative framework, the need could arise to gather, further develop and disseminate good practices in the mine action sector and to strengthen policy and operational guidance. Environmental considerations and the do no harm approach have to be popularized further in mine action and applied more systematically throughout the entire project cycle.

This includes more research on an enhanced use of geographic information systems (GIS) for environmental impact assessments. Remotely sensed data represent a sound solution to evaluate pre-conflict characteristics of contaminated areas, reducing the risk of field surveys. Multi-temporal analysis of impact indicators can then help monitor the effect of mitigation activities. For example, unmanned aerial vehicles provide high resolution, high frequency and relatively low-cost survey data, which can be combined with other data sources in a GIS to perform multi-criteria analysis that can objectively quantify the environmental impact.[19] The GICHD has increased its involvement in this context and aims to conduct field tests and distill lessons learned for the benefit of the entire mine action sector and beyond.

Finally, it is also crucial to strengthen the evidence base for both the environmental impact of contamination from ERW and mine action activities. Important aspects of mine action, which were not addressed in this article, need further research, in particular the environmental impact of ammunition dumps and underwater ERW clearance. Furthermore, cooperation needs to be strengthened with humanitarian, development and disaster risk reduction actors in the hopes of building synergies and benefitting from each other's experiences.

*See endnotes page ##*

*This article is based on the previously published GICHD article "Peacebuilding and Environmental Damage in Contemporary Jus Post Bellum: Clarifying Norms, Principles and Practices," published in June 2014 and found at http://bit.ly/1zbwpVD.*

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1. *From Conflict to Peacebuilding: The Role of Natural Resources and the Environment*. Nairobi: UNEP, 2009. Accessed 30 October 2014. http://bit.ly/1zNreyd.
2. *Assessing and Restoring Natural Resources in Post-Conflict Peacebuilding.* Policy Brief 2. Washington, Geneva: ELI, UNEP, 2013. Accessed 30 October 2014. http://bit.ly/1tFGXe3.
3. UNISDR. Living with Risk. *A global review of disaster reduction initiatives*. Volume 1. New York, Geneva: United Nations, 2004.
4. Sudmeier-Rieux, Karen and Neville Ash. *Environmental Guidance Note for Disaster Risk Reduction: Healthy Ecosystems for Human Security.* Gland: IUCN, 2009. Accessed 30 October 30, 2014. http://bit.ly/1sL1KI2.
5. Amaral, Cristina et al. "The urgency to support resilient livelihoods: FAO Disaster Risk Reduction for Food and Nutrition Security Framework Programme." In *Building Resilience for Adaptation to Climate Change in the Agricultural Sector. Proceedings of a Joint FAO/OECD Workshop* 23-24 April 2012, ed. by Meybeck, Alexandre et al. Rome: FAO, 2012. Accessed 30 October 2014. http://bit.ly/1wIDv2h.
6. Conca, Ken and Jennifer Wallace. "Environment and peacebuilding in war-torn societies: Lessons from the UN Environment Programme's experience with post-conflict assessment." In *Assessing and Restoring Natural Resources in Post-Conflict Peacebuilding, ed.* by Jensen, David et al. London: Earthscan, 2012. Accessed 13 November 2014. http://bit.ly/1wslenh.
7. Lebanon. *Post-Conflict Environmental Assessment*, Nairobi: UNEP, 2007. Accessed 30 January 2015. http://bit.ly/1tEFpmG.
8. Roberts, Shawn and Jody Williams. *After the guns fall silent: The enduring legacy of landmines.* Washington: Vietnam Veterans of America Foundation, 1995.
9. Torres-Nachón, Claudio. "The Environmental Impacts of Landmines." In *Landmines and Human Security: International Politics and War's Hidden Legacy*, ed. by Matthew, Richard A. et al.New York: State University of New York Press, 2004.
10. Berhe, A.A. "The contribution of landmines to land degradation." *Land Degradation & Development* 18 (2007). Accessed 17 December 2014. http://bit.ly/1BYv8nY.
11. Misak, Rafaat and Samira Omar. "Environmental Damages from Minefields." *Journal of Mine Action*, 11.2 (2008). Accessed 17 December 2014. http://bit.ly/1wZdJul.
12. Monan, Jim. *Landmines and Underdevelopment: A Case Study of Quang Tri Province, Central Vietnam*. Hong Kong: Oxfam, 1995.
13. Kuznyetsov, Volodymyr. "Some Aspects of Environmental Interactions Related to UXO." Paper presented at the NATO Advanced Study Institute on Unexploded Ordnance Detection and Mitigation, II Ciocco, Italy, 20 July–2 August 2008. Accessed 28 January 2015. http://bit.ly/1DOirOx.
14. GICHD. *A Handbook of Mechanical Demining.* Geneva: GICHD, July 2009. Accessed 17 December 2014. http://bit.ly/1wFEvWv.
15. The Do No Harm framework is based on the belief that humanitarian actors should take steps to ensure that they do not make a situation worse through the assistance that they provide.
16. GICHD. *Land Rights and Mine Action: Frequently Asked Questions for Mine Action Organisations*. Geneva: GICHD, UN-HABITAT, 2012. Accessed 17 December 2014. http://bit.ly/1AciwaT.
17. Other technical IMAS include references to environmental considerations, such as IMAS 11.10 on the destruction of stockpiled anti-personnel mines and IMAS 11.20 on open burning and open detonation stockpile destruction operations.
18. Such as IATG 10.10 on *Demilitarization and destruction of conventional ammunition;* ISO 14000 on Environmental management; ISO 9612:2009 on *Acoustics -- Determination of occupational noise exposure -- Engineering method.*
19. De Santis, Angela and Ursin Hofmann. "Environmental risks of remnants of conflict: How to "do no harm" in mine action." In IDRC 2014. *Extended Abstracts, Oral Presentations, Special Panels, Sessions and Workshops*, 24-28 August 2014, Davos, ed. by Stal, Marc et al. Davos: Global Risk Forum, 2014. Accessed 30 January 2015. http://bit.ly/1yTUhy9.