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Environmental risks of remnants of conflict: How to “do no harm” in mine action

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ABSTRACT: Contamination from remnants of conflict is a legacy of many armed conflicts, threatening human security and impeding post-conflict reconstruction and development. Buried explosive devices can also negatively affect the environment directly, such as through contamination of soil, and indirectly, by denying access to land and other natural resources, which, in turn, results in increased pressure on available resources and unsustainable natural resource management practices.
One of the core objectives of mine action is the safe removal and destruction of the remnants of conflict in order to make land safe and accessible, thereby contributing to sustainable development. However, the methods used by mine action organisations can, under certain conditions, represent a risk to the environment, potentially leading to degradation of land through soil degradation, erosion, deforestation and chemical pollution. Mine action organisations, like all humanitarian actors, therefore need to consider the possible negative impacts of their mine clearance operations to ensure they do no harm, do not lead to longer-term vulnerability or threaten livelihoods and food security and, by mitigating environmental damage, effectively contribute to disaster risk reduction. The combined use of remotely sensed data and Geographic Information Systems (GIS) can be a sound solution to assess pre-contamination conditions and to monitor both the environmental impact and the effects of mitigation activities.

Keywords: Humanitarian demining, Land degradation, Prevention tools, Geographic Information Systems

1. INTRODUCTION

In times of armed conflict, the environment might be targeted deliberately to reach military or political goals. Whereas the most direct damage to the environment, such as the release of toxic substances during bombardments or the physical destruction of ecosystems, results from hostilities themselves (UNEP 2009), contamination of land from remnants of conflict[1] represents a further direct impact on the environment and a legacy of conflicts even long after they have ended (Conca et al. 2012, UNEP 2013).
In addition to the human toll, contamination from remnants of conflict is considered to be a significant obstacle to development. It leads to human displacement, delays the return and resettlement of refugees and internally displaced persons and blocks access to vital resources and social services (Shimoyachi-Yuzawa 2012). Similarly, by denying access to land, water sources, other natural resources and livelihoods, the presence or suspected presence of remnants of conflict can put increased pressure on the resources which remain available, resulting in unsustainable natural resource management practices by communities affected by conflict (UNEP 2007, Roberts et al. 1995).
Mine action[2] can do a lot of “good” to address the negative consequences of contamination from remnants of conflict, to restore livelihoods and contribute to sustainable development. However, some of the methods used by mine action organisations may cause unintended negative impacts on the environment. Clearance of remnants of conflict on soil, for instance, might affect vegetation, lead to erosion and degrade the quality and fertility of the soil, thereby putting food security at risk.
The environment and disasters are inherently inter-linked, with environmental degradation increasing the intensity of natural hazards and the risk of transforming hazards into disaster (Amaral et al. 2012, UNISDR 2004). In turn, disasters reverse development and destroy livelihoods (Sudmeier-Rieux et al. 2009, Amaral et al. 2012). Mine action organisations, like all humanitarian actors, therefore need to consider the possible negative impacts of their operations to ensure that they “do no harm”, do not lead to longer-term vulnerability and reduce natural disturbance in a manner that environmental vulnerabilities to disaster risks are limited to an acceptable level. By doing so, they support “economic, social and human development while facilitating ecosystem conservation, regeneration and resilience” (Report of the United Nations Conference on Sustainable Development).
This article will briefly discuss the potential negative environmental impact of remnants of conflict and mine clearance operations, and examine the measures mine action organisations could employ to ensure their operations do not result in further environmental damage. It will particularly focus on preventive and remedial tools and approaches to reduce the potential risk of their clearance operations with regards to soil fertility and productivity as well as erosion.

2. ENVIRONMENTAL IMPACT OF REMNANTS OF CONFLICT

The environmental impact of remnants of conflict can be direct or indirect. Direct environmental impacts can be defined as those effects, alterations and disruptions caused to a terrestrial or aquatic ecosystem at the moment and location of an explosive blast.

[1] For ease of reading, contamination by mines, cluster munitions and other explosive remnants of war (ERW) will be referred to simply as remnants of conflict.
[2] Mine action comprises five complementary groups of activities: Mine Risk Education; Mine Clearance; Victim Assistance; Stockpile Destruction and Advocacy.

On the other hand, indirect environmental impacts are those which occur in a different time and/or place from the original location or explosion of a device (Torres-Nachón 2004). Given that the natural environment constitutes the basis for livelihoods, the damage caused by remnants of conflict hampers socio-economic development (Matthew et al. 2002, Bruch et al. 2008).

2.1 Access denial, ecosystem degradation and loss of productivity

The principle impact of remnants of conflict is to deprive local communities of access to land and natural resources. Migration of displaced populations to available safe land or already fragile ecosystems may lead to overharvesting and resource degradation (Conca et al. 2012). If valuable pastures become inaccessible, that can potentially lead to overgrazing in accessible areas and subsequent habitat degradation. When arable land is blocked, the survival strategy can lead to the exploitation of forests. Deforestation generally accelerates as an indirect consequence of contamination and can, in turn, affect marshlands and water tables. Land scarcity resulting from contamination has the potential to generate new socio-economic dynamics and set new cycles of poverty and environmental degradation in motion. Faced with growing livelihood pressures, local populations are likely to resort to unsustainable practices and intensify exploitation of the diminished areas available in order to meet short-term needs (UNEP 2007, Roberts at al. 1995).

Thus, remnants of conflict can set in motion a chain of events leading to environmental harm in the form of soil degradation or deforestation, possibly affecting entire species populations by degrading habitats and altering food chains (Torres-Nachón 2004, Berhe 2007, Roberts et al. 1995). Disruption to soil structure further exacerbates the erosion problem and leads to increased sediment load in the drainage system (Monan 1995). The terrestrial environment can also be seriously affected when remnants of conflict explode. Exploding munitions degrade land through topsoil damage or erosion, with sustained impacts on moisture availability, soil structure, vulnerability to water flows, erodibility and productivity (Berhe 2007, Misak et al. 2008). Soil productivity dramatically decreases if land is contaminated, as witnessed in Vietnam with a reduction of 50% in rice production per hectare of affected land (Monan 1995).

2.2 Chemical contamination

Over time, ammunition and explosive remnants can also release toxic substances from their chemical constituents, and these may become environmental hazards. Research has shown that, in some heavily-used military training areas, munitions-related chemicals, such as explosives and perchlorate, can enter soil and groundwater (Kuznyetsow 2009). Furthermore, as an example of the fate of explosive energetic materials, the uptake of Trinitrotoluene (TNT) through the roots and stems of plants results in higher concentrations of this chemical in the leaves, making them dangerous to grazing animals. Ammunition fragments that have remained in the environment for prolonged periods are also subject to weathering and corrosion, subsequently releasing various heavy metals such as iron, manganese, chromium, zinc and copper. In agricultural regions in particular, toxic substances can easily penetrate the soil, arrive in the water table and pass into the human food chain (Kuznyetsow 2009).

3. ENVIRONMENAL IMPACT OF MECHANICAL CLEARANCE

By its very nature, mine action involves direct interaction with the environment, through physical activities such as clearance and destruction of explosives. Thus, clearance of remnants of conflict on land can potentially affect the environment. Clearance of areas contaminated by remnants of conflict can be undertaken using three different assets which together constitute the so-called mine action “toolbox”: animal detection systems, manual clearance and mechanical systems, with the latter having the potentially greatest impact on the environment.

Whereas machines have considerable potential for increasing efficiency, they can have a greater impact on the soil and the ecosystem. A variety of mechanical systems is used (tiller systems, flails or converted plant machinery) to process soil in the search for remnants of conflict. When using flails and tillers the soil will pass through those systems, which will inevitably disturb and possibly damage soil condition. The organic layer, as well as surface soil, will generally be processed, and the physical or chemical properties and the structure of the soil might be modified or damaged. The consequences of such practice could take the form of various types of erosion, changes to soil composition, affected rooting potential and water holding capacity of soil, and reduced soil fertility (GICHD 2009, Berhe 2007). This is similar to the impact of tillage in agriculture. Soil might also often be moved to another location where it will be distributed evenly over a large, flat surface and subsequently checked for explosive items.

Mechanical systems remove or destroy vegetative cover which in turn can lead to increased water runoff and wind 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. Deforestation is closely linked to erosion. The removal of trees implies the removal of litter that plays a crucial role in infiltration, protecting soil from erosion and raindrop impacts. Litter also provides organic matter that is important to the stability of soil structure (Berhe 2007). Deforestation can allow the wind to cut long, open channels as it travels over the ground at higher speeds and topsoil may be blown away by the wind and destroyed as a consequence (Whitford 2002). Less fertile soils are naturally associated with losses in agricultural production and threaten food security. There is recognition that environmental degradation reduces the capacity of ecosystems to meet the need of communities for food and to protect them from hazards (Sudmeier-Rieux et al. 2009). On the contrary, healthy ecosystems both reduce vulnerability to hazards by supporting livelihoods and acting as a physical buffer against the impact of hazards events (Sudmeier-Rieux et al. 2009).

With mechanical clearance, a risk of chemical pollution to soil and water might also arise such as by detonations or destruction of explosive items in the ground or by leaking hydraulic fluids and fuel when refuelling demining machines. When hydraulic fluids enter the environment through spills and leaks from machines or storage areas, severe environmental damage can result.

4. "BETTER SAFE THAN SORRY" OR MEASURES TO MITIGATE THE ENVIRONMENTAL IMPACT OF MECHANICAL CLEARANCE

4.1 Operational considerations

The environment and disasters are inherently linked and environmental damage such as deforestation or degradation of land may reduce the nature's defence capacity against hazards and, in turn, can even aggravate the impact of disasters. With a view to reducing risks, it is vital to build the resilience of the environment taking into account that healthy ecosystems are more resilient to hazards (UNISDR 2004, Amaral et al. 2012). Mindful of this fact and in order not to undermine the positive impact mine clearance can have, mine action organisations should ensure that their operations do no further harm to the environment and avoid increasing the long-term vulnerability of affected communities and that, by mitigating environmental damage, they can effectively contribute to disaster risk reduction (DRR) and thereby to sustainable development. Despite eventual lack of scientific certainty of the damage of mechanical demining, the precautionary principle shall prevail (Rio Declaration on Environment and Development 1992), often linked to the premise "Better safe than sorry" (De Sadeleer 2002).

At an operational level, measures can be taken to avoid or mitigate the potentially negative impact of mechanical clearance on the environment. Complemented by and based on good practice, the mine action sector has developed a normative framework in the form of the International Mine Action Standards (IMAS), which include a specific standard on environmental protection. The latter does not only address air, water and soil pollution or land use, but also tackles the reduction and disposal of waste (IMAS 10.70). Although not legally binding, IMAS are generally applied by mine action organisations.

The first way of mitigating the environmental impact of clearance is to limit the use of machines to a strict minimum. The mine action sector has developed the so-called "land release" approach. This consists of an iterative survey process that only resorts to full clearance as a last option where there is an evidence-based confirmation of contamination (IMAS 7.11).

Other mitigation measures could be to use the machine following the topographic contour lines to reduce erosion, re-seed and re-plant areas with indigenous grasses immediately after clearance and return processed soil layers to affected sites in the correct order so that the fertile top soil is once again the top layer. In the same vein, demining should be scheduled so that the site can be cultivated as soon as possible after clearance to ensure regrowth of a root system, which will, at least in part, prevent erosion. Another recommendation is to avoid demining during periods of the year with strong winds and/or heavy rainfall and to attempt to carry out demining tasks in the period of the year most suitable environmentally. In general, a comprehensive environmental assessment should be included in the planning for any demining activity (IMAS 10.70, GICHD 2009).

IMAS also provide guidance on precautions to be taken with regard to possible chemical pollution in order to avoid fuel and lubricant spillages, especially when selecting refuelling sites, for example, so as to ensure that diesel spillage cannot contaminate water sources.

4.2 Monitoring techniques: combined use of remote sensing and GIS

An effective impact reduction strategy starts from a baseline definition, which implies the assessment of both pre-contamination conditions and ecosystem vulnerability. 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 (UAVs) can provide high resolution, high frequency and relatively low cost survey data which can then be combined with other data sources (namely population, potential use of land, resource and infrastructures, etc.) in a Geographic Information System (GIS) to perform multi-criteria analysis and objectively quantify the environmental impact. In order to do so, however, sound information management, including appropriate tools, needs to be in place.

5. ADDED VALUE FOR THE POST 2015 FRAMEWORK FOR DISASTER RISK REDUCTION

Only indirectly contributing to DRR, mine action organisations are not necessarily guided by a DRR agenda and the Hyogo Framework for Action in their daily endeavour. However, as explained above, mine action, if undertaken respecting the "do no harm" approach, can have concrete spill-over effects on the resilience of ecosystems and affected communities. On this basis, the work of the mine action sector may have supported the implementation of the Hyogo Framework for Action in various ways, in particular with regards to the fourth priority aimed to reduce the underlying risk factors. By implementing measures to mitigate the environmental impact of their operations, mine action organisations contribute to food security which is an important factor in ensuring the resilience of communities to hazards which weaken agriculture-based livelihoods. By releasing land and making livelihoods accessible, they lay the foundations for sustainable ecosystems. Through post-clearance environmental impact assessments such as by surveys, GIS, remote sensing or the use of UAVs, mine action actors also support the second priority for action, namely the identification and assessment of potential disaster risks stemming from a given intervention. Where undertaken, such assessments may have allowed observing, analysing and mapping potential hazards and vulnerabilities. Several

new tools such as UAVs have been introduced to the mine action sector recently and their potential for use in mine action has still not yet been fully reached.
The example of mine action may serve as an illustration for the recognition that among actors outside the specialised DRR sector further steps in Disaster Risk Management may need to be taken with a view to continuing encouraging the integration of DRR into humanitarian and development policies and planning. Given the strong interconnectedness between mine action, sustainable development and the environment and the resulting positive impact on disaster prevention and reduction, an environmental and DRR lens should ideally be integral part of programming, implementation and assessment of projects. Among mine action organisations, awareness of the DRR implications, threats and benefits of their operations should still be strengthened and their capacities to do so developed. Further mainstreaming of a DRR perspective into humanitarian and development activities such as mine action is ever more required which might be addressed in the Post-2015 Framework for Disaster Risk Reduction.

6. CONCLUSION

The protection of the environment and disasters prevention are inherently interconnected. Some of the methods used by mine action organisations can potentially lead to environmental degradation and, ultimately, threaten livelihoods and food security. Consequently, mine action organisations should consider the possible negative impacts of their operations to ensure they do no further harm to the environment. In doing so, they can contribute to disaster prevention. The concern about the environmental impact is becoming highly relevant within the mine action sector. In fact, mine action actors have developed an important set of sector-wide norms and standards to ensure implementation of the "do no harm" principle. However, this normative framework may still need to be developed further and a more comprehensive and systematic approach is required. To do this, it is important to gather more evidences and develop good practice. Remote sensing and GIS technologies can support this process, enabling a wide range of data collection and the integration of different data sources for supporting the decision making.

7. REFERENCES

Amaral, Cristina et al. (2012). The urgency to support resilient livelihoods: FAO Disaster Risk Reduction for Food and Nutrition Security Framework Programme. In Meybeck, Alexandre et al. (ed.), *Building Resilience for Adaptation to Climate Change in the Agricultural Sector. Proceedings of a Joint FAO/OECD Workshop 23-24 April 2012*, 151-162, Food and Agriculture Organization, Rome.

Berhe, A.A. (2007). The contribution of landmines to land degradation. *Land Degradation & Development*, 18, 1-15.

Bruch, Carl E. et al. (2009). Post-conflict peace building and natural resources. In Fauchald, Ole Kristian et al (ed.), *Yearbook of International Environmental Law*, Vol. 19 (1), 58-96, Oxford University Press, Oxford.

Conca, K.; Wallace, J. (2012). Environment and peacebuilding in war-torn societies: Lessons from the UN Environment Programme's experience with post-conflict assessment. In Jensen, D.; Lonergan, S. (ed.), *Assessing and Restoring Natural Resources in Post-Conflict Peacebuilding*, 63-84, Earthscan, London.

De Sadeleer, Nicolas (2002). *Environmental Principles: From Political Slogans to Legal Rules*, 484, Oxford University Press, Oxford and New York.

GICHD (2009). *A Handbook of Mechanical Demining*, 127-137, GICHD, Geneva.

Kuznyetsow, Volodymyr (2009). *Some Aspects of Environmental Interactions Related to UXO*, 12, Paper presented at the NATO Advanced Study Institute on Unexploded Ordnance Detection and Mitigation II Ciocco 20 July-2 August 2008.

Matthew, Richard; Halle, Mark; Switzer, Jason (2002). Introduction. In Matthew, R.; Halle, M.; Switzer, J. (ed.), *Conserving the peace: Resources, livelihoods and security*, 1-28, International Institute for Sustainable Development, Winnipeg.

Misak, Rafaat; Omar, Samira (2008). Environmental Damages from Minefields. *Journal of Mine Action*, 11.2.

Monan, Jim (1995). *Landmines and Underdevelopment: A Case Study of Quang Tri Province, Central Vietnam*, first edition, 27, Oxfam, Hong Kong.

Report of the United Nations Conference on Sustainable Development (2012), A/CONF.216/6.

Rio Declaration on Environment and Development (1992), A/CONF.151/26 (Vol. 1).

Roberts, Shawn; Williams, Jody (1995). *After the guns fall silent: The enduring legacy of landmines*, 554, VVAF, Washington.

Shimoyachi-Yuzawa, N. (2012). Linking demining to post-conflict peacebuilding: A case study of Cambodia. In Jensen, D.; Lonergan, S. (ed.), *Assessing and Restoring Natural Resources in Post-Conflict Peacebuilding*, 181-198, Earthscan, London.

Sudmeier-Rieux, Karen; Ash, Neville (2009). *Environmental Guidance Note for Disaster Risk Reduction. Healthy Ecosystems for Human Security*, 34, IUCN, Gland.

Torres-Nachón, Claudio (2004). The Environmental Impacts of Landmines. In Rutherford, Kenneth et al. (ed.), *Landmines and Human Security. International Politics and War's Hidden Legacy*, 191-207, State University of New York Press, New York.

UNEP; ELI (2013). *Assessing and Restoring Natural Resources in Post-Conflict Peacebuilding. Policy Brief no 2*, 6, ELI; UNEP, Washington, Geneva.

UNEP (2009). *From Conflict to Peacebuilding: The Role of Natural Resources and the Environment*, 50, UNEP, Nairobi.

UNEP (2007). *Lebanon. Post-Conflict Environmental Assessment*, 184, UNEP, Nairobi.

UNISDR (2004). *Living with Risk. A global review of disaster reduction initiatives. Volume 1*, 431, United Nations, New York; Geneva.

Whitford, Walter G. (2002). Wind and water processes. In Whitford, Walter G. (ed.), *Ecology of Desert Systems*, 65-95, Elsevier Science, London.