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Peacebuilding and Environmental Damage in Contemporary *Jus Post Bellum*
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"Do no harm" and mine action: Protecting the environment while removing the remnants of conflict[1]

Introduction: Nexus between peacebuilding, mine action and the environment

In times of armed conflict, the environment might be targeted deliberately to reach military or political goals. However, most of the environmental damage resulting directly or indirectly from armed conflict can be understood as collateral damage. 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.[2] Contamination of land and water from remnants of conflict[3] or the presence of deteriorating ammunition stocks are further direct impacts on the environment and legacies of conflicts even long after they have ended.[4] If some of the environmental damage related to remnants of conflict results from the direct actions of armed conflict, the environment can also be affected indirectly, for instance as a consequence of the loss of basic services, displaced populations and the resulting survival strategies they adopt out of necessity.[5]

Referring to the case of Cambodia, Shimoyachi-Yuzawa found that in addition to the human toll, contamination from remnants of conflict is considered to be one of the most significant obstacles to post-conflict peacebuilding and development. It leads to human displacement, delays the return and resettlement of refugees and internally displaced persons (IDPs) and blocks access to vital resources and social services, including farmland, water, roads, schools or hospitals.[6] In response, mine clearance has become increasingly integrated into broader national programmes of reconstruction and development.[7]

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[1] The GICHD wishes to thank Dominic Eggel, Mohamed Ghalaieny, François Grünewald and Adam Koniuszewski for their valuable and insightful comments.
[2] UNEP, *From Conflict to Peacebuilding: The Role of Natural Resources and the Environment*, Nairobi: UNEP, 2009, p. 15.
[3] For ease of reading, contamination by mines, cluster munitions and other explosive remnants of war (ERW) will be referred to as simply as remnants of conflict, thus avoiding confusion with instances of chemical contamination.
[4] CONCA, K. and WALLACE, J., "Environment and peacebuilding in war-torn societies: Lessons from the UN Environment Programme's experience with post-conflict assessment" in JENSEN, D. and LONERGAN, S. (ed.), *Assessing and Restoring Natural Resources in Post-Conflict Peacebuilding*, London: Earthscan, 2012, p. 70; Environment Law Institute, UNEP, *Assessing and Restoring Natural Resources in Post-Conflict Peacebuilding. Policy Brief no 2*, p. 2.
[5] UNEP, *From Conflict to Peacebuilding*, *op. cit.*, p. 15. In addition to a direct and indirect pathway, UNEP also identified the institutional impact of conflict on the environment such as the disruption of state institutions.
[6] SHIMOYACHI-YUZAWA, N., "Linking demining to post-conflict peacebuilding: A case study of Cambodia" in JENSEN, D. and LONERGAN, S. (ed.), *Assessing and Restoring Natural Resources in Post-Conflict Peacebuilding*, London: Earthscan, 2012, p. 181.
[7] UN General Assembly Resolution 58/127. Assistance in mine action, A/RES/58/127 (2003); HARPVIKEN, Kristian Berg and ISAKSEN, Jan, *Reclaiming the field of war: Mainstreaming mine action in development,* Oslo; New York:

Similarly, by denying access to land, water sources and other natural resources, the 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.[8]

As a result of the presence or suspected presence of remnants of conflict rendering the means of livelihoods inaccessible, people are forced to resort to survival strategies which might have unsustainable consequences for the environment. Migration of displaced populations to available safe land or already fragile ecosystems may lead to overharvesting and resource degradation.[9] Further environmental degradation has been documented in post-conflict situations such as Lebanon where farmers set bushes ablaze in order to set off unexploded ordnance which blocks access to agricultural land. Such practices can, however, result in further environmental degradation such as soil erosion.[10] Additionally, remnants of conflict may release toxic substances into the soil, leading to further environmental damage.[11]

Despite the achievements of mine action during the past decades at political, normative and operational levels, remnants of conflict still affect more than 60 countries and their populations worldwide for many years. In this regard, mine action[12] can do a lot of "good" to restore livelihoods and contribute to peacebuilding. However, by its very nature, and some of the methods used by mine action organisations, it also has the potential to cause unintended negative impacts on the environment. Clearance of remnants of conflict on soil, for instance, might disturb and lastingly affect vegetation and the quality and fertility of the soil, thereby putting food security at risk. Underwater clearance might equally disturb aquatic ecosystems, and the destruction of stockpiled ammunition may lead to chemical contamination if not done properly. Mine action organisations, like all humanitarian actors, therefore need to consider the possible negative impacts of their operations and ensure they both "do no harm" and do not lead to longer-term vulnerability and threats to livelihoods.

This article will tackle the nexus between mine action and environmental protection from an operational viewpoint by reviewing policies and good practices for environmental protection in post-conflict mine action and discussing the normative framework applicable to mine action—such as International Humanitarian Law and International Environmental Law. It will also study how these legal requirements might be translated operationally into norms and standards and constitute an integral part of the broader humanitarian "do no harm" concept (chapter 1). Subsequently, the article will examine the negative environmental impact of remnants of conflict on land and under water as well as the potential damage to the environment resulting from mine action activities (chapters 2 and 3). Finally, the paper will also examine how, at an operational level, the normative framework and good practices within the mine action sector guide mine action organisations to ensure their operations do not result in further environmental harm during potentially invasive mine clearance in terrestrial and aquatic ecosystems. Mitigation measures should also be taken when destroying remnants of conflict and ammunition (chapter 4).

PRIO; UNDP, 2004; GICHD, *Linking mine action and development: Guidelines for policy and programme development: States affected by mines/ERW*, Geneva: GICHD, 2009.

[8] UNEP, *Lebanon. Post-Conflict Environmental Assessment*, Nairobi: UNEP, 2007, p. 155; ROBERTS, Shawn and WILLIAMS, Jody, *After the guns fall silent: The enduring legacy of landmines*, Washington: VVAF, 1995, p. 11.

[9] CONCA, K. and WALLACE, J., *art. cit.*, pp. 63, 70, 71.

[10] UNEP 2007, *op. cit*., p. 155.

[11] CONCA, K. and WALLACE, J., *art. cit.*, p. 70.

[12] Mine action comprises five complementary groups of activities: Mine Risk Education; Mine Clearance; Victim Assistance; Stockpile Destruction and Advocacy.

1. Normative framework

During armed conflict, the protection of the environment is regulated by both International Humanitarian Law (IHL) and International Environmental Law (IEL). There are also three international conventions[13] relevant to mine action which include references to the protection of the environment. Although not legally binding, a set of norms and standards such as the sector-wide International Mine Action Standards (IMAS), together with the "do no harm" and "conflict sensitivity" approaches, provide additional guidance at an operational level.

The "do no harm" principle requires that humanitarian actors take steps to ensure that the assistance they provide does not make a situation worse. The concept of "conflict sensitivity" emerged from "do no harm" and relates to an organisation's ability to understand both the context in which it operates and the interaction between the intervention and that context.[14] Indeed, both these approaches have become cornerstones of humanitarian assistance and development, but also in peacekeeping, and mine action—those activities which aim to reduce the impact of landmines and other explosive remnants of war (ERW)—is now understood as mandated to take into account environmental impacts as well as social and economic ones.[15]

Before analysing what international law provides for post-conflict mine action in particular, it is worth recalling that its general principles require all parties to conflict to mitigate environmental harm to the widest extent possible. Also, IHL and IEL contain a number of provisions addressing the short and long-term consequences of damage to the environment caused by the legacy of armed conflict.

1.1 The protection of the environment during armed conflict

IEL is the branch of international law aimed at protecting and preserving the environment. According to a recent UNEP[16] report, IEL could potentially be applied in times of armed conflicts, alongside IHL, the body of law which specifically regulates them. The relationship between the two branches of law is, however, complicated by the fact that IEL is still maturing, at both domestic and international levels, and states are still in the process of determining how it relates to IHL.[17]

An International Committee of the Red Cross (ICRC) study details three rules of customary international law which apply to the protection of the environment in armed conflicts:

- General principles on the conduct of hostilities apply to the natural environment (rule 43).
- Due regard to the protection and preservation of the natural environment shall always be a consideration when choosing methods and means of warfare (rule 44).

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[13] The Convention on the Prohibition of the Use, Stockpiling, Production and Transfer of Anti-Personnel Mines and on Their Destruction (also referred to as the Anti-Personnel Mine Ban Convention—APMBC); the Convention on Cluster Munitions (CCM); and the Convention on Prohibitions or Restrictions on the Use of Certain Conventional Weapons which May Be Deemed to Be Excessively Injurious or to Have Indiscriminate Effects (also referred to as Convention on Certain Conventional Weapons—CCW).

[14] Saferworld, *Conflict-sensitive approaches to development, humanitarian assistance and peace building: tools for peace and conflict impact assessment. Introduction*, 2004, p. 3.

[15] Mine Action and Effective Coordination: the United Nations Policy; Resolution A/53/26 on Assistance in Mine Action, 17/11/1998, A/53/26 (2008).

[16] UNEP, *Protecting the Environment During Armed Conflict. An Inventory and Analysis of International Law*, Nairobi: UNEP, 2009.

[17] *Ibidem*, p. 34; BOTHE, Michael, BRUCH, Carl, DIAMOND, Jordan, JENSEN, David, "International law protecting the environment during armed conflict: gaps and opportunities", *International Review of the Red Cross*, Volume 92 Number 879, 2010, p. 580.

- The use of methods and means of warfare that are intended, or may be expected, to cause widespread, long-term and severe damage to the natural environment is prohibited (rule 45).[18]

These rules have also been codified in Additional Protocol I to the Geneva Conventions in art. 35.3 and in art. 55.

Additionally, the Convention on Prohibitions or Restrictions on the Use of Certain Conventional Weapons which May Be Deemed to Be Excessively Injurious or to Have Indiscriminate Effects (also referred to as Convention on Certain Conventional Weapons—CCW) affirms, in its preamble, that "it is prohibited to employ methods and means of warfare which are intended, or may be expected, to cause widespread, long-term and severe damage to the natural environment."[19]

Various scholars and concerned organisations have reviewed environmental protection under IHL.[20] In its study on the protection of the environment during armed conflict, UNEP's assessment is that "a number of significant gaps and difficulties remain to be reconciled if the protection of the environment is to be enhanced within the IHL framework."[21] According to some authors[22], these difficulties are that: i) the threshold of harm to the environment established in IHL is almost impossible to reach as it must meet three cumulative conditions (widespread, long-term effects, severe) and be assessed before launching the attack; ii) no treaty norms explicitly address the issue of environmental damage in non-international armed conflicts; and iii) the proportionality of harm to the environment deemed to be "collateral damage" is difficult to determinate.

The ICRC has recognised that protecting the environment is one of the key areas where IHL needs to be reinforced, acknowledging that "the law protecting the environment during armed conflict is not always clear; nor is it sufficiently developed", and that "there is also an urgent need to find better ways of addressing the immediate and long-term consequences of damage to the environment."[23]

1.2 *Jus Post Bellum*, the protection of the environment and mine action

Long-term consequences of mines and other remnants of conflict fall under the scope of the laws applicable post-conflict. *Jus Post Bellum* has been defined as "a body of law after conflict (that) would identify legal rules, which ought to be applied by international actors (unless an exception applies) and clarify specific legal principles, which serve as guidance in making legal policy choices in situations of transition."[24]

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[18] ICRC, "Customary IHL Database", Rule 43 http://www.icrc.org/customary-ihl/eng/docs/v1_rul_rule43, Rule 44 http://www.icrc.org/customary-ihl/eng/docs/v1_rul_rule44, Rule 45, http://www.icrc.org/customary-ihl/eng/docs/v1_rul_rule45 (last accessed: 16/05/2014).

[19] Preamble CCW.

[20] BOTHE, Michael, "The protection of the environment in times of armed conflict", in *German Yearbook of International Law*, Vol. 34, 1991, pp. 54-62; AUSTIN, Jay E. and BRUCH, Carl E. (ed.), *The Environmental Consequences of War: Legal, Economic, and Scientific Perspectives*, Cambridge: Cambridge University Press, 2000.

[21] UNEP, *Protecting the Environment During Armed Conflict*, *op. cit*., p. 28.

[22] BOTHE, Michael, BRUCH, Carl, DIAMOND, Jordan, JENSEN, David, *art. cit.*, pp. 578-579.

[23] KELLENBERGER, Jakob, "Strengthening legal protection for victims of armed conflicts", statement on 21 September 2010, http://www.icrc.org/eng/resources/documents/statement/ihl-development-statement-210910.htm (last accessed: 16/05/2014).

[24] STAHN, Carsten and PAYNE, Cymie R., "The Norm of Environmental Integrity in Post-Conflict Legal Regimes", in STAHN, Carsten, EASTERDAY, Jennifer S., IVERSON Jens, *Jus Post Bellum – Mapping the Normative Foundations*, Oxford: Oxford University Press, 2014, p. 513.

There are three international conventions relevant to mine action which contain references to the protection of the environment: the Convention on the Prohibition of the Use, Stockpiling, Production and Transfer of Anti-Personnel Mines and on Their Destruction (also referred to as the Anti-Personnel Mine Ban Convention—APMBC); the Convention on Cluster Munitions (CCM); and the CCW.

The APMBC and the CCM have been instrumental in reducing drastically the number of victims, the global affected areas and the laying of new anti-personnel mines and the use of cluster munitions. 161 states have agreed to be bound by the APMBC, whereas 84 states are parties to the CCM (as of April 2014). Operationally, over 47 million stockpiled anti-personnel mines and more than 1 million cluster munitions have been destroyed thus far. An ever growing number of countries have minimised the impact of mines and cluster munitions, as each year hundreds of square kilometres of previously affected areas are released (in 2012: 526 km^2). Casualties from remnants of conflict have decreased from more than 9'000 in 1999 to about 3'600 in 2012 and thousands of survivors have been reintegrated into society.[25]

The APMBC and the CCM require that requests for extensions to the deadlines for the clearance of areas contaminated by anti-personnel mines and cluster munitions shall specifically contain information on the environmental implications of that extension.[26] 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.[27] The CCM has an even stronger reference to environmental protection, contained in art. 3.2 on stockpile destruction, requiring States Parties to ensure that destruction methods comply with the applicable international standards for protecting public health and the environment.

According to Torres-Nachón, the explicit references contained in the APMBC and CCM, and the inclusion of environmental implications in the extension requests, may be used as a negative tool for the effective implementation of the convention since states can always "make reference" to "environmental considerations" (according to their interpretation) to escape their obligations to clear and destroy all anti-personnel mines and/or cluster munitions in contaminated areas under their jurisdiction or control within the initial 10-year deadline enshrined in both conventions.[28] However, he also acknowledges that reference to the environment indicates the "strategic importance of environmental issues in the international humanitarian strategy to universally destroy landmines."[29]

Despite the introduction of these limited provisions on environmental considerations, and even the stronger call for environmental protection in the CCM, the meetings of the States Parties to both conventions have generally not addressed the issue of protecting the environment. The sole exception was the Cartagena Plan of Action for 2010-2014, adopted at the Second Review Conference of the APMBC, where Action 9 on stockpile destruction requires states to provide a plan to ensure compliance in conformity with relevant safety and environmental standards. As far as the CCW is concerned, its preamble recalls the prohibition in IHL against employing methods or means of warfare which are intended, or may be expected, to cause widespread, long-term and severe damage to the natural environment.

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[25] Figures taken from the Landmine and Cluster Munition Monitor (www.the-monitor.org; last accessed: 16/05/2014).
[26] Art. 5.3.c APMBC, art. 4.6.h CCM.
[27] Art. 7.1.f APMBC, art. 7.1.e CCM.
[28] Art. 5.1 APMBC, art. 4.1 CCM.
[29] TORRES-NACHÓN, Claudio, "Environmental Aspects of the International Crisis of Antipersonnel Landmines and the Implementation of the 1997 Mine Ban Treaty", in ICBL, *Landmine Monitor*, 2000, p. 2.

Despite the absence of other references to environmental considerations, the environmental impact of clearance activities emerged in the discussions concerning Protocol V (PV) to the CCW on ERW. In April 2009, at the Meeting of Experts of the High Contracting Parties to Protocol V, the issue of environmental protection was discussed for the first time. In this context, at the request of the Coordinator on Clearance, Removal or Destruction of Explosive Remnants of War, the Geneva International Centre for Humanitarian Demining (GICHD) presented a paper on the protection of the environment in mine action, recalling that operations should not only be carried out in a safe, effective and efficient manner, but also in a manner that minimises any impact on the environment. The IMAS on protection of the environment—discussed in more detail below—was also presented in that context. During the Third and Fourth Conferences of the High Contracting Parties to Protocol V, in 2009 and 2010, States Parties agreed to keep the potential environmental impact of ERW clearance under review.[30] However, in subsequent conferences, the issue of environmental protection was removed from the agenda and no longer discussed in this forum.

Summing up, only a few rules contained in international law or conventions take into account environmental protection during and after armed conflict, the environmental impact of mines and other remnants of conflict, or the impact of mine action activities. Even in States Parties meetings to the international conventions, the issue of environmental protection has not been discussed extensively. To fill this gap, however, instruments of soft law in the form of norms, standards and policy guidance were developed and accepted by mine action organisations aimed at providing a series of recommendations and guidelines complementing the few hard law provisions.

1.3 The "do no harm" principle and mine action

The principles established under international law which provide for environmental protection are reflected in the policies and standards of action which inspire and guide the operations of mine action organisations on the ground. The question arises of how these policies and standards interpret the above-mentioned provisions and put into practice the principles of "do no harm" and "conflict sensitivity".

Peacekeeping missions are often mandated to play a role in mine action activities[31] as part of a broader set of actions that peacekeeping troops carry out, but that are more linked to long-term recovery or post-conflict peacebuilding. Environmental concerns have started to be taken into account by the Department of Peacekeeping Operations (DPKO), in collaboration with UNEP, and in 2009 it developed an environmental policy—*Environmental Policy for UN Field Missions.* Accordingly, peacekeeping troops have to abide by a series of minimum operating standards for the protection of the environment, acknowledging the fact that dealing with natural resources as part of post-conflict peacebuilding is of paramount importance. In accordance with this policy, the DPKO is now responsible for ensuring that all missions integrate environmental considerations and respect certain minimum standards. As for demining activities carried out directly by peacekeepers, the policy highlights the challenges related to

[30] Third Conference of the High Contracting Parties to Protocol V on Explosive Remnants of War to the Convention on Prohibitions or Restrictions on the Use of Certain Conventional Weapons which May Be Deemed to Be Excessively Injurious or to Have Indiscriminate Effects, CCW/P.V/CONF/2009/9, (2009), §37; Third Conference of the High Contracting Parties to Protocol V on Explosive Remnants of War to the Convention on Prohibitions or Restrictions on the Use of Certain Conventional Weapons which May Be Deemed to Be Excessively Injurious or to Have Indiscriminate Effects, CCW/P.V/CONF/2010/11, (2011), §31.3.

[31] i.e. MONUSCO according to its mandate (in the original mandate of MONUC, UN Security Council Resolution 1925 (2010) S/RES/1925(2010), §12); UNMISS, in UN Security Council Resolution 1996 (2011) S/RES/1996 (2011), §3).

the disposal of stocks of chemicals, explosives and ammunition. These have to be addressed in compliance with international legislation, such as the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal. Similarly, it could be argued that, in instances in underwater clearance, the provisions of the UN Convention on the Law of the Sea should be followed.[32] The "do no harm" principle in general finds therefore its concrete application in peacekeeping missions and is specifically referred to in various policy handbooks for peacekeepers.[33]

The normative framework in mine action comprises a series of norms and standards, in particular IMAS, which are even enshrined in UN Security Council resolutions mandating peacekeeping missions. The mandate of the United Nations Mission in South Sudan (UNMISS), for example, requires the mission to "support the government of South Sudan in conducting de-mining activities in accordance with IMAS."[34]

In fact, IMAS are not legally binding obligations. However, they do provide guidance for the sector and translate the principles included in IHL treaties, basic human rights, clearance requirements and other general issues into practical and detailed norms. IMAS are developed, reviewed and adopted by a technical committee representing the whole mine action community. They have become the relevant standards implemented by mine action organisations, and constitute the basis of national mine action standards. IMAS 10.70, the specific standard on environmental protection, acknowledges that: "national authorities and demining organizations not only have a responsibility to ensure that demining operations are carried out in a safe, effective and efficient manner, but also in a manner that minimizes the impact on the environment. The aim should be to leave the environment in a state that is similar to, or where possible better than, before demining operations commenced, and in a state that permits the intended use of the land once demining operations have been completed." The standard thus includes a powerful statement referring to the "do no harm" principle in relation to environmental considerations. It requires, for instance, that "demining operations should be carried out without damaging property or infrastructure, in a manner that minimizes the impact on the environment…", and that "planning for demining operations shall take into account the effects of those operations, and any supporting activities, on the environment, and any possible damage to property or infrastructure, or harm to personnel". It further details the responsibilities and obligations of national authorities and mine action organisations. Finally, 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.

In its work, the mine action sector also draws on other relevant norms, such as the International Ammunition Technical Guideline (IATG) and the standards of the International Organization for Standardization (ISO), a network of national standards bodies.

The IATG are defined as "a documented agreement containing technical specifications or other criteria to be used consistently as guidelines, or definitions of characteristics to ensure that conventional ammunition stockpile management processes are safe, effective, efficient and fit-for-purpose."[35] Drafted by a technical panel consisting of experts from the UN, international organisations, NGOs and experts from states, the IATG are used at the logistical level and cover technical requirements for safe, effective and efficient storage, processing, transport and disposal of ammunition. IATG 10.10 on Demilitarisation

[32] Especially art. 192 and 194 on the obligation to protect and preserve the maritime environment, prevent, reduce and control maritime pollution.
[33] For instance, United Nations Department of Peacekeeping Operations and Department of Field Support, *Civil Affairs Handbook*, New York: United Nations, 2012, pp. 70-71.
[34] S/RES/1996 (2001).
[35] International Ammunition Technical Guidelines (2011), *IATG 01.10*, p. 1.

and Destruction of Conventional Ammunition, for example, makes reference to IEL and environmental considerations, and will be described more extensively in chapter 4.

Finally, ISO standards contain regulations addressing the environment. They are generally adopted by a wide range of countries as part of their own regulatory frameworks. Some of the general requirements relevant to stockpile management and destruction of conventional ammunition have a relevant ISO standard.[36] In addition, ISO standard 14000, on environmental guidance, sets a specific standard on the protection of the environment that is an additional reference for mine action organisations.

In summary, it can be observed that *Jus Post Bellum* contains few provisions addressing the environmental impact of mines and other remnants of conflict and mine action in international treaties. However, this does not imply that regulation of these matters is non-existent, as a more praxis-oriented body of norms and standards is emerging as a response to the evolution of the mine action sector. The ability of soft law to adjust constantly to new practices and programmes hence fills the gap which exists in hard law. This allows the practical implementation of the "do no harm" and "conflict sensitivity" principles, thus ensuring that environmental protection is duly taken into account. Mine action might be one of many examples where environmental considerations would deserve more attention in legally binding norms of *Jus Post Bellum*.

2. Environmental impact of remnants of conflict

During armed conflict, belligerents' rights to choose methods or means of warfare are not unlimited.[37] The principles surrounding the proportionality of an attack during hostilities is a related key provision of *Jus In Bello* enshrined in the Geneva Conventions.[38] However, explosive hazards such as mines and cluster munitions may not only cause unacceptable harm to civilians during armed conflict, but can do so long after the conflict has ended. As a legacy of conflict, lying in the ground or under water, they seriously affect the environment in various ways in post-conflict situations.

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. On the other hand, indirect environmental impacts are those which occur in a different time and place from the original location or explosion of a device.[39] Given that the natural environment constitutes the basis for livelihoods, the damage caused by remnants of conflict hampers socio-economic development.[40] Figure 1 below illustrates schematically the environmental impact chain which may result from remnants of conflict.

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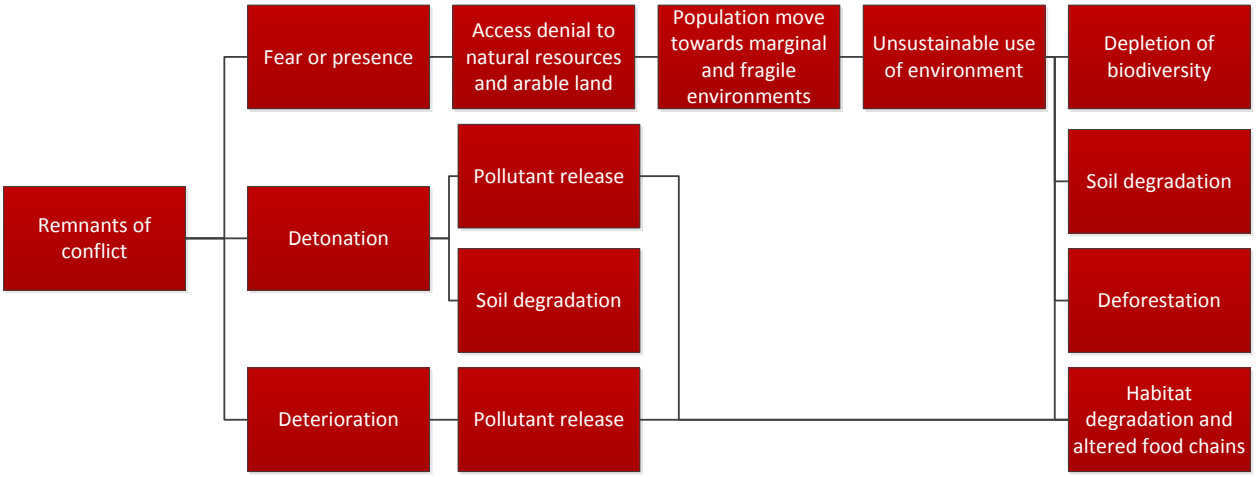
[36] Such as ISO 4220:1993 (E) on *Determination and measurement of air pollution from industrial processes* or ISO 9612:1997 (E) on *Guidelines for the measurement and assessment of exposure to noise in a working environment*.
[37] AP I, art. 35, para 1.
[38] AP I, art. 51; AP I, art. 48.
[39] TORRES-NACHÓN, Claudio 2000, *art. cit.*, p. 1.
[40] MATTHEW, R., HALLE, M., and J. SWITZER, J. (ed.), *Conserving the peace: Resources, livelihoods and security*, Winnipeg: International Institute for Sustainable Development, 2002, p. 16; GRAY, Bruce, *Landmines: The most toxic and widespread pollution facing mankind*, at ICBL Australia Colloquium – towards Ottawa and beyond: de-mining the region: The Environmental Impacts, July 1997, pp. 1 and 4; BRUCH, Carl E., JENSEN, David, NAKAYAMA, Mikiyasu, UNRUH, Jon, GRUBY, Rebecca and WOLFARTH, Ross, "Post-conflict peace building and natural resources", in FAUCHALD, Ole Kristian, HUNTER, David and XI Wang (ed.), *Yearbook of International Environmental Law*, Vol. 19 (1), 2008, Oxford: Oxford University Press, 2009, pp. 58-96.

Figure 1: Environmental impact chain of remnants of conflict



Source: GICHD.

2.1 Access denial

The principle impact of remnants of conflict is to deprive local communities of access to land and natural resources. This was highlighted in UNEP's assessment of the cluster bomb airstrikes in Lebanon in 2006, but is also valid more generally. Valuable pasture can become inaccessible, potentially leading to overgrazing in accessible areas and subsequent habitat degradation. 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, as illustrated in figure 1. 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.[41]

This finding is corroborated by the phenomenon of deforestation, which generally accelerates as an indirect consequence of contamination. Where arable land has been mined, the long-term consequences of selling forest and fruit trees give way to immediate pressures to simply survive. Deforestation can, in turn, affect marshlands and water tables, which has an impact on fish and other wildlife. 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.[42] Disruption to soil structure further exacerbates the erosion problem and leads to increased sediment load in the drainage system.[43]

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[41] UNEP 2007, *op. cit.*, p. 155; ROBERTS, Shawn and WILLIAMS, Jody, *op. cit.*, 1995, p. 11.

[42] TORRES-NACHÓN, Claudio, "The Environmental Impacts of Landmines", in RUTHERFORD, Kenneth *et alii* (ed.), *Landmines and Human Security. International Politics and War's Hidden Legacy*, New York: State University of New York Press, 2004, p. 197; BERHE, A.A., "The contribution of landmines to land degradation", *Land Degradation & Development*, 18 (2007), pp. 12-13; ROBERTS, Shawn and WILLIAMS, Jody, *op. cit.*, pp. 11, 93, 197, 247.

[43] MONAN, Jim, *Landmines and Underdevelopment: A Case Study of Quang Tri Province, Central Vietnam*, second edition, Hong Kong: National Political Publishing House; Oxfam, 1997, p. 13; MONAN, Jim, *Landmines and Underdevelopment: A Case Study of Quang Tri Province, Central Vietnam*, first edition, Hong Kong: Oxfam, 1995, p. 13; GRAY, Bruce, *art. cit.*, p. 5.

Remnants of conflict around the world, particularly ERW, also litter inland, coastal and international waters, restrict or deny access to livelihoods and constitute a direct hazard to coastal communities, maritime industry and recreational divers. They also impede development efforts, such as dredging, mineral exploration and the construction of bridges, pipelines, ports and other offshore projects. In addition, aside from immediate safety, concerns also relate to the environmental impacts of ordnance constituents.[44]

2.2 Soil degradation and loss of productivity

The terrestrial environment can 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.[45] 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.[46]

2.3 Chemical contamination

Besides its physical hazard as remnant of conflict, ammunition often results in contamination, either visible or invisible. This contamination consists of the various residues of chemical constituents released when ammunition functions or the contents of the ammunition when it breaks up on impact and has not functioned. Also, coloured smoke residue, ashes and other combustion products may result. Toxic explosive substances can be transported to contaminate aquifers and can also exist as inhalable dust. Both these routes pose environmental health risks. Research has shown that, in some heavily-used military training areas, munitions-related chemicals, such as explosives and perchlorate, can enter soil and groundwater. [47] 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 (see figure 1).[48]

Over time, ammunition and explosive remnants at sea can also release toxic substances from their chemical constituents, and these may become environmental hazards. As TNT slowly dissolves, it kills or inhibits the growth of a number of aquatic micro-organisms and is lethal to some fish.[49] However, the

[44] HELCOM, *Chemical Munitions Dumped in the Baltic Sea. Report of the ad-hoc Expert Group to Update and Review the Existing Information on Dumped Chemical Munitions in the Baltic Sea*, Helsinki: HELCOM, 2013, (B*altic Sea Environment Proceeding (BSEP), 2013, No. 142*).

[45] BERHE, A.A., *art. cit.*, p. 8; UNEP, *A rapid assessment of the impacts of the Iraq-Kuwait conflict on terrestrial ecosystems. Part II: Kuwait*, 1991; MISAK, Rafaat and OMAR S., "Environmental Damages from Minefields", *Journal of Mine Action*, 11.2 (April 2008).

[46] MONAN, Jim 1995, *op. cit.*, p. 13; MONAN, Jim 1997, *op. cit.*, p. 13.

[47] KUZNYETSOW, Volodymyr, "Some Aspects of Environmental Interactions Related to UXO" in BYRNES, Jim (ed.), *Unexploded Ordnance Detection and Mitigation. Proceedings of the NATO Advanced Study Institute on Unexploded Ordnance Detection and Mitigation II Ciocco 20 July-2 August 2008*, Springer: 2009, p. 8.

[48] KUZNYETSOW, Volodymyr, *art. cit.*, p. 8; OREHOVEC, Z. *et alii*, *Danger of Land Mines, Unexploded Shells, and Environmental Consequences of the Recent War on the Territory of the Republic of Croatia* (paper presented at the First International Conference on Addressing Environmental Consequences of War, Washington DC, June 10-12, 1998).

[49] A/38/383.

nature and extent of the environmental effects of remnants of conflict, and especially of their toxic substances, remain incompletely studied. There is still a considerable need for further research on the impact of such contamination on the environment and public health.[50]

3. Environmental impact of mine action

Mine action includes activities aimed at reducing the social, economic and environmental impact of mines, cluster munitions and other ERW[51]; it therefore addresses the different impacts explained above. In this way, mine action does a lot of "good", by restoring livelihoods and contributing to peacebuilding. However, by its very nature, mine action involves direct interaction with the environment, through physical activities such as clearance and destruction of explosives, and indirect interaction, for instance through the effect it has on land newly released to users. Thus, clearance of remnants of conflict on land and under water, as well as their destruction, can potentially affect the environment.[52]

Mine action activities can have an impact on the environment similar to that of other humanitarian operations. The mere presence of demining personnel on the ground and their temporary field camps might lead to an over-exploitation of local resources such as water, wood or food, and produce waste which, if not properly managed, can result in environmental degradation persisting long after the camp left. The specific environmental impact of clearance and destruction activities will be analysed more extensively below.

3.1 Clearance of remnants of conflict on land and under water

Clearance can be undertaken using a variety of tools and methods, each of which has its own characteristics and advantages. Many factors influence the choice of method in a given working environment. Whereas the choice of the correct methodology and technical tool is often guided by cost-efficiency considerations, the potential impact on the environment needs to be taken into consideration as well. Basically, land can be cleared using three different assets which together constitute the so-called mine action "toolbox": animal detection systems (ADS), manual clearance and mechanical systems. Assets can also be used in conjunction with one another depending on the specific requirements of a task.

Dogs and rats are the most commonly used mine detection animals because of their ability to detect specific vapours associated with the explosive or other components of mines and munitions. ADS cannot replace deminers, but they are powerful tools when used in combination with manual and mechanical systems. Once an explosive item has been detected, it has to be removed manually or mechanically. The use of animals, therefore, does not avoid *per se* the potential environmental impact of other clearance tools.

When demining manually, only locations where the metal detector has indicated metal contamination will be subject to manual digging. Fertile topsoil has to be removed, soil and root systems are likely to be disturbed and lower vegetation (bushes, *etc.*) may have to be cut in order to get access to a suspected or

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[50] GHALAIENY, Mohamed, *Toxic Harm: Humanitarian and Environmental Concerns from Military-origin Contamination*, pp. 3-4 (Discussion Paper February 2013).

[51] IMAS 04.10, art. 3.172.

[52] Environmental impact is defined as "any change to the environment, whether adverse or beneficial, wholly or partly resulting from an organisation's (…) activities or products or services than can interact with the environment." IMAS, 04.10, art. 3.87 and 3.85.

confirmed contaminated area. Erosion may result from this process. Manual clearance remains the preferred tool, especially in areas with dense vegetation where a primary environmental concern is to conserve as much vegetation as possible. Nonetheless, manual clearance is time-consuming and exhausting; consequently, mechanical systems can be used to speed up this process.

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. Inevitably, this will disturb and possibly damage soil conditions. Soil might often be moved to another location where it will be distributed evenly over a large, flat surface and subsequently checked for explosive items or evidence of such. When using flails and tillers the soil will pass through those systems, even though it will remain in the same location after being processed. The consequences of such practice could take the form of various types of erosion, deforestation, changes to soil composition, reduced soil fertility and soil contamination with energetic materials and machine oils and fuels.

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 and mechanical demining. 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.[53] 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.[54] Less fertile soils are naturally associated with losses in agricultural production.

Soil degradation occurs when changes in its depth, or in its physical or chemical properties, reduce its quality. During mechanical demining, 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 changed or damaged. This can again affect soil fertility, rooting potential and water holding capacity.[55]

Not only can mechanical mine clearance result in soil erosion and lead to other environmental damage, but there is also a risk of chemical pollution to soil and water. Contamination might be caused by detonations or destruction of explosive items in the ground or by leaking hydraulic fluids and fuel which can occur when refuelling demining machines. When hydraulic fluids enter the environment through spills and leaks from machines or storage areas and waste sites, severe environmental damage can result.

For the remediation of remnants of conflict under water, three basic options are available, each with different levels of potential environmental harm: disposal of remnants *in situ*; removal for disposal at an alternate location; or management/monitoring in their current location. Although disposal *in situ* (using a counter-charge) is the safest and simplest remediation method for deminers, it may present an unacceptable risk to marine life, coral or fauna in the area. An underwater explosion creates a blast wave that can kill or injure marine life (particularly marine mammals) at great distances. Removal of remnants of conflict from their original location for disposal at an alternate site provides other challenges and risks. Much of the underwater ERW has been in place for 70 or more years and has hence corroded,

[53] BERHE, A.A., *art. cit.*, p. 8.
[54] WHITFORD, Walter G., "Wind and water processes", in WHITFORD, Walter, G., *Ecology of Desert Systems*, London: Elsevier Science, 2002, p. 65; http://www.fao.org/docrep/t0389e/T0389E02.htm#Soil is a complex mixture (last accessed: 16/05/2014).
[55] GICHD, *A Handbook of Mechanical Demining*, Geneva: GICHD, 2009, p. 133; BERHE, A.A., *art. cit.*, p. 8.

decomposed or transformed into other compounds. Casings may be fully intact or completely decomposed, and as a consequence, explosive contents may remain or have completely dissolved. The potential instability and uncertainty of the condition of the explosive is a considerable issue.

3.2 Destruction of remnants of conflict

The destruction of remnants of conflict mainly entails the disposal of explosive ordnance—for instance stockpiled ammunition. Through the legal obligations of international law, States Parties to the APMBC or CCM are required to destroy anti-personnel mines and/or cluster munitions under their jurisdiction and control. However, countries may also wish to eliminate weapons and ammunition that are obsolete, dangerous or surplus to requirements.[56] The increasing number of reported unplanned explosions, in stockpiles of often aging and poorly managed ammunition, underlines the importance of controlled stockpile destruction.[57]

Deep-sea dumping and landfill of ammunition and explosives has been outlawed in response to environmental considerations.[58] The current emphasis is thus on a number of different approaches to disposal, in addition to more traditional methods. Of the available techniques, open burning (OB) and open detonation (OD) may be the biggest threats to the environment, but they are often the quickest and cheapest methods. There are a variety of other techniques for the destruction of explosive ordnance, with varying environmental impacts. They range from cryofracture, where the ammunition is frozen and then cracked open in order to separate casings from energetic materials, to highly sophisticated, contained industrial processes where any contaminants are removed from the waste gases prior to them being released into the atmosphere.

Destroying ammunition, whether in the field because it has been fired and is dangerous, or *en masse* during stockpile destruction, causes large quantities of gases and solid chemicals to escape into the atmosphere and the surrounding area. These must be controlled which is not the case for unplanned explosions. Despite states regarding OB/OD as the easiest means of destruction, it has been condemned by UNEP, as such open ammunition destruction can lead to surface and subsurface contamination with heavy metals and unexploded explosives, thereby posing a serious risk to the health of individuals and ecosystems. This can lead to carcinogenic compounds contaminating the ground and possibly drinking water and the food chain. Furthermore, secondary ground contamination can occur through the transport of contaminants by air[59], thus contaminating rain, rivers and groundwater.[60]

[56] GICHD, *A Guide to Mine Action*, Geneva: GICHD, 2014, p. 152.

[57] BERMAN, Eric G., REINA, Pilar, "Unplanned Explosions at Munitions Sites: Concerns and Consequences", *The Journal of ERW and Mine Action*, 16.2 (July 2012), p. 4.

[58] With regard to deep-sea dumping, the following international treaties may apply: the London Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 29 December, the 1996 Protocol to the London Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (Amended 2006), or the Convention for the Protection of the Marine Environment of the North-East Atlantic.

[59] Air pollution is a serious problem when burning explosives—one of the by-products of burning TNT is nitric oxide (NOx), a major contributor to air quality degradation.

[60] UNEP, *Depleted Uranium in Bosnia and Herzegovina. Post-conflict environmental assessment*, Geneva: UNEP, 2003, p. 11; BURGER, Mario, *War and Environment. Armed Conflicts: Explosive Remnants of War—Environmental consequences*, Presentation delivered on 23 April 2009; BOHLE, Vera, "Implementation aspects of stockpile destruction", in UNIDIR, *Implementing the Convention on Cluster Munitions*, Geneva: UNIDIR, 2010, p. 15 (Disarmament Forum 1-2010).

More sophisticated industrial destruction has the advantage of incineration in environmentally-controlled systems.[61] A number of countries have developed such alternative technologies, and have either prohibited or severely restricted OB and OD. Although these alternative disposal methods are more protective to human health and the environment than OB and OD, they are considerably more expensive; there are design and construction costs for new destruction facilities, and operations must be commissioned. The development of such facilities is therefore beyond the resources of most of the states concerned. Factors such as costs, location and safety may mean that OB/OD is the only pragmatic and feasible option for destroying items prohibited by law or stores of surplus, outdated, obsolete or dangerous ammunition.

4. Measures to ensure mine action does no harm to the environment

In order not to undermine the positive contribution of mine action to people, livelihoods and peacebuilding initiatives, and so as to address the potential impact of operations such as those outlined above, mine action organisations, much like other humanitarian stakeholders, must ensure they "do no harm" and are conflict sensitive. For instance, land cleared will increase in value, thus land tenure considerations have to be taken into account when mine clearance operations are planned and undertaken: disputes over property must be prevented from undermining peace at the local level.[62] This principle is at the core of IMAS on Land Release.[63]

Similarly, mine action operators must ensure they "do no harm" to the environment or livelihoods, and avoid increasing the long-term vulnerability of affected communities. Mine action organisations should therefore ensure that land treated during their operations is left in a state suitable for its intended use once demining operations have been completed.[64] Their operations, with the potential environmental impacts reviewed above, must do no further harm to the environment. At an operational level, measures can be taken to avoid or mitigate the potentially negative impact of mine action on the environment. On the basis of international legal obligations, IMAS and the IATG complement the normative framework relevant to the mine action sector. They also provide general norms about the identification, assessment and mitigation of potential environmental impacts. Finally, the sector has also developed a set of operational good practices which help mitigate the impact of clearance operations and the destruction of ammunition and remnants of conflict.

4.1 Clearance of remnants of conflict on land and under water

Clearance of remnants of conflict using mechanical means has the potential to disturb the environment. Special precautions should therefore be taken, and IMAS provide a good basis to do so, even though the normative framework could still benefit from further refinements. The first way of mitigating the environmental impact of mechanical demining is to limit the use of machines to a strict minimum. Backed by IMAS 07.11, the mine action sector has developed the so-called "land release" approach. This consists of a process of survey and clearance activities aimed at providing effective, efficient and reliable information about which land requires attention, which does not and how best to deploy precious technical assets. Land release promotes a system of escalating survey activities and only resorts to full

[61] For instance, volatile organic compounds can be destroyed, acid gases neutralised and particulate and solid matter filtered out.
[62] Environment Law Institute, UNEP, *op. cit.*, p. 3; GICHD, *Land Rights and Mine Action: Frequently Asked Questions for Mine Action Organisations*, Geneva: GICHD, UN-HABITAT, 2012; CONCA, K. and WALLACE, J., *art. cit.*, p. 63.
[63] IMAS 09.50, art. 10.2.
[64] IMAS 09.50, art. 10.1.

clearance as a last option. With the land release approach, clearance thus only takes place where there is confirmed contamination, which has become common practice.[65] Even though environmental considerations are not particularly referred to in the IMAS on land release, it constitutes an effective measure to avoid the potential negative consequences of clearance activities.

Based on the International Organization for Standardization's ISO 14000 standards, the mine action sector has developed specific standards for environmental protection. These do not only address air, water and soil pollution or land use, but also tackle the reduction and disposal of waste and the reduction of energy consumption.[66] The sector as a whole has thus complemented the normative framework through good practice at the operational level, and the GICHD Handbook of Mechanical Demining is a reference tool in this regard, containing practical recommendations and guidelines.

One measure that can be taken to reduce the harm and negative impacts from demining operations is to re-seed and re-plant areas with indigenous grasses immediately after clearance. Another is to return processed soil layers to affected sites in the correct order so that the fertile top soil is once again the top layer (please see figure 2 for an illustration of the effect that should be avoided when clearing topsoil). 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.[67]

Figure 2: What not to do in topsoil clearance

Source: GICHD, *A Handbook of Mechanical Demining*, *op. cit.*, p. 133.

IMAS also provide guidance on precautions to be taken with regard to possible chemical pollution.[68] This should be considered when planning mechanical demining operations in order to avoid fuel and lubricant spillages. Organisations should take all reasonable care when selecting refuelling sites, for example, so as to ensure that diesel spillage cannot contaminate water sources. Furthermore, they should have clear regulations for the replacement of fuel and lubricants, and the measures to be taken with waste products.

The normative framework for underwater clearance operations has not kept pace with the increasingly urgent need for addressing underwater contamination and ammunition dumps. General norms contained in IMAS 10.70 are also applicable to underwater operations, such as the provision that mines

[65] GICHD 2014, *op. cit.*, p. 121.
[66] IMAS 10.70.
[67] IMAS 10.70, art. 6.1; GICHD, *A Handbook of Mechanical Demining*, *op. cit.*, pp. 97 and 129.
[68] IMAS 09.50, art. 10.1; IMAS 10.70.

and ERW "should be disposed of in a manner that minimises environmental impact and without creating damage to property or infrastructure."[69] However, thus far, no specific international underwater mine action standards have been developed. Ultimately, and independently of the disposal technique, all operations have to be in line with the UN Convention on the Law of the Sea, particularly the obligation to protect and preserve the maritime environment and to prevent, reduce and control maritime pollution.[70]

Disposal of underwater ERW *in situ* requires analysis of the underwater environment and possible use of risk mitigation techniques to protect marine life. They include, for example, the creation of a cordon around the items to ensure marine mammals do not enter the area during disposal. Another technique that has proven effective is the use of bubble curtains to lessen the effect of the explosive shock wave.

Removal of ERW from their original location for disposal at another site provides other challenges and risks: due to age and exposure to water, the sensitivity of the explosives may have changed dramatically.[71] Although removal without detonation lessens the chances of marine life being harmed by an explosive shock wave, there may be an increased chance that ordnance constituents will be released into the underwater environment. The removal of ERW also increases the dangers of direct exposure for the personnel conducting the recovery. The option of leaving underwater ERW in place is a viable one; indeed, it should be the default option. The only reason which justifies removal of underwater ERW, or their disposal *in situ*, is evidence of an impact on the surrounding environment. Leaving underwater ERW in place can entail it being encased in concrete or covered in sand and rocks in order to limit the exposure to the marine environment and alleviate safety concerns.

4.2 Destruction of remnants of conflict and ammunition

As outlined above, the destruction of remnants of conflict is required by international norms such as the APMBC and the CCM. The CCW Protocol V, however, provides recommendations on how to best manage ERW stockpiles. Moreover, IMAS and the IATG address the various elements of stockpile destruction, safe storage or transportation of explosives. In particular, IMAS series 11 provides guidance on stockpile destruction, OBOD operations and national planning guidelines for destruction. IMAS also deal with monitoring the destruction of stockpiles (7.42) and the storage of explosives (10.15) on a small scale.

As discussed previously, destruction of ammunition and remnants of conflict—especially outside of a controlled operational environment—can ultimately result in the poisoning of water and food supplies. This issue can be addressed by being very selective of what is disposed of, where and how it is done, the quantities destroyed and the measures taken to restrict the spread of dangerous pollutants.

Unplanned explosions at ammunition storage facilities are reported with increasing frequency. Such uncontrolled explosions are, of course, a direct safety risk to communities living in proximity to the depot, as well as an environmental hazard. Accidental explosions can be reduced by establishing a formal ammunition management regime with strict on-site controls, whereby most items can be detected before they become dangerous. As part of this management regime, stockpile destruction is another practical method for reducing the probabilities of fires and explosions within the storage area. Since its recent establishment by the United Nations Office for Disarmament Affairs in 2011, the IATG have addressed ammunition safety and provided relevant norms on all major aspects of storage management through various standards: conditions, infrastructure and operation of explosive facilities (4.10; 5.10;

[69] IMAS 10.70, 6.2.
[70] Especially the UN Convention on the Law of the Sea, art. 192 and 194.
[71] University of Hawai'i at Manoa, *Hawai'I Undersea Military Munitions Assessment. Final Investigation Report HI-05, South of Pearl Harbor, O'Ahu, Hawai'I*, 2010.

6.10) and safety and risk reduction measures (7.10), among others. Additionally, the GICHD has developed a practical Ammunition Safety Management tool helping countries to implement these norms.

Destruction in sophisticated demilitarisation sites allows environmentally-controlled disposal and limits the contamination of soil and air by chemical substances. Thanks to its associated positive implications on safety and the environment, it should be the preferred alternative to OBOD operations.[72] The IATG recommends that states complete a formal environmental impact assessment before they select the OBOD option to dispose of remnants of conflict and, subsequently, that strict guidelines are followed in order to minimise environmental impact.[73] The IATG further refers to additional guidance and requirements regarding environmental management systems (ISO 14001:2004(E)), and the measurement of air pollution (ISO 4220:1993(E)) and acoustic pollution (ISO 9612:1997(E)) as governed by the ISO international environmental standards.

To avoid endangering life, and as a general principle, all demolitions should be carried out in a remote spot, avoiding water and food sources. If possible, demolitions should also be carried out in a natural hollow: surrounding hills will deflect sound and will block some of the fragments flying from the explosion. Construction of the demolition stack is another practical consideration: items with a large explosive force should go on top and smaller items underneath, thus ensuring that they are forced into the ground rather than upwards. Finally, it is of utmost importance to clear up the area afterwards. This not only ensures that no explosive items have been left behind to pose a hazard to humans and animals, but also that explosive-free ammunition casings cannot be cleaned out by rain, carrying the chemicals remaining after the explosion down into the water table.

5. Conclusion

Mine action provides a legitimate early entry point for positive interventions in conflict and post-conflict situations.[74] For instance, mine action fosters peacebuilding efforts by contributing to the social reintegration of former combatants, the repatriation of refugees and IDPs, the reduction of weapons in circulation and the safety and security of weapons storage sites.[75] Mine action furthermore offers opportunities for fostering cooperation and dialogue, building confidence, establishing governance structures and building national capacities.[76] More importantly in this context is the fact that by re-opening access to resources and livelihoods, mine action contributes significantly both to basic safety and security and to economic revitalisation—two core elements of any peacebuilding process.

Mine action can do a lot of "good", but by its very nature it involves direct and indirect interaction with the environment and thus can potentially have a negative impact on it. Clearance of remnants of conflict, on soil and under water, can affect ecosystems and have a negative impact on vegetation and marine life or on the composition and fertility of soil. In the past, the mine action sector's primary focus lay particularly on developing tools and methods to conduct operations safely, efficiently and effectively.

[72] GICHD 2014, *op. cit.*, p. 164.
[73] IATG 10.10.
[74] HARPVIKEN, Kristian Berg and ROBERTS, Rebecca, "Conclusions", in HARPVIKEN, Kristian Berg and ROBERTS, Rebecca (ed.), *Preparing the Ground for Peace. Mine Action in Support of Peacebuilding*, Oslo: PRIO, 2004, p. 56 (PRIO Report 2/2004).
[75] FAFO, AIS, Landmine Action, *Peacebuilding & Humanitarian Mine Action: Strategic Possibilities and Local Practicalities*, 2008, pp. 27 and 34.
[76] Environmental Law Institute, UNEP, *op. cit.*, p. 6; FAFO, AIS, Landmine Action, *op. cit.*, p. 34; HARPVIKEN, Kristian Berg and ROBERTS, Rebecca, *art. cit.*, p. 55.

Over more than two decades, as the sector has matured and acquired significant expertise and experience, the environmental concerns linked to mine action operations have received increasing attention.

The mine action sector is adapting to these increased concerns. Like other operational aspects of mine action, this greater focus on the environment is reflected in discussions at policy and normative levels. *Jus Post Bellum* only provides generic and limited provisions with regards to post-conflict mine action. Indeed, mine action could be used as a case study to reinforce the growing recognition that environmental considerations in *Jus Post Bellum* deserve a stronger legal focus. The mine action sector has therefore developed an important set of sector-wide norms and standards based on existing international law and complementing other international normative frameworks such as the IATG. The sector is also guided by the use of good practice, making mine action a well-regulated sector. However, normative gaps still exist and these need to be addressed. Underwater clearance is still not regulated by an IMAS and work on a relevant norm started only recently. As environmental protection is a mainstreaming issue, the entire IMAS series might need to be reviewed in order to incorporate environmental considerations into the relevant standards. For instance, IMAS might still be strengthened in order to provide further guidance on how to include environmental concerns in national policies. In particular, IMAS requirements for accreditation, monitoring and inspection of demining operations could be enhanced to ensure that mine action organisations take environmental protection into account in campsites and worksites.

Until recently, the environmental impact from the presence of remnants of conflict both in soil and under water, and the efforts to minimise the environmental impact of mine action operations, were not considered in a comprehensive and systematic manner. Today, more than ever, mine action organisations are aware of the imperative to ensure that they “do no harm” through their activities. They can do this by taking environmental considerations into account throughout the entire project cycle, from planning and implementation to evaluation of activities and post-clearance assessments. However, further mainstreaming of environmental considerations and of the “do no harm” approach to mine action operations and a more systematic monitoring of their application are critical. To do this, it is important to gather more evidence and develop good practice within the mine action sector.

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