landmine action

Counting the cost

The economic impact of cluster munition contamination in Lebanon

Report by: Greg Crowther
Editor: Richard Moyes, Landmine Action
Commissioning editor: Simon Conway, Director, Landmine Action

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Contents

List of Acronyms

AAL	Atlas Agricole du Liban
AFDC	Association for Forest Development and Conservation
BAC	Battle area clearance
DALY	Disability adjusted life years
DCA	DanChurch Aid
EC	European Commission
EOD	Explosive ordnance disposal
FAO	Food and Agriculture Organisation
GDP	Gross domestic product
GIS	Geographical information system
GoL	Government of Lebanon
ha	Hectare (10,000m²)
HI	Handicap International
IDF	Israeli Defence Forces
IFAD	International Fund for Agricultural Development
IMSMA	Information Management System for Mine Action
LAF	Lebanese Armed Forces
LMAC	Lebanese Mine Action Centre
LMRC	Landmine Resource Centre
MAG	Mines Advisory Group
NPA	Norwegian Peoples Aid
SRSA	Swedish Rescue Services Association
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNIFIL	United Nations Interim Force in Lebanon
UNMACC	United Nations Mine Action Coordination Centre
US$	United States Dollar *(US$1 equivalent to approximately 1,500 Lebanese pounds in this report.)*
UXO	Unexploded ordnance
WB	World Bank

Executive summary

This report seeks to estimate and project the economic cost of cluster munition contamination resulting from the 2006 conflict in Lebanon. It focuses on three areas:

- The cost of lost agricultural production specifically caused by cluster munition contamination;
- The cost of responding to cluster munition contamination through internationally assisted clearance and risk reduction operations;
- The economic cost of deaths and injuries directly resulting from this contamination.

Different methodologies and assumptions have been used in approaching these issues – resulting in upper and lower estimates of the cost. The methodologies and assumptions adopted are explained in detail in the report and its annexes. For all three areas of analysis, additional costs will have been incurred, and will continue to be incurred, as a result of cluster munition contamination which cannot be estimated in a reasonable or systematic way based on available data.

The summary results, in terms of the estimated financial cost of cluster munition contamination in Lebanon, are presented below:

Table 1a. Summary of current and projected losses due to cluster munition contamination

Area of economic cost	Lower estimated loss (US$)	Upper estimated loss (US$)
Costs of lost agricultural production	22.6 million	26.8 million
Cost of clearance and risk reduction activities	120.4 million	120.4 million
Cost of deaths and injuries	10.8 million	86 million
Total	**153.8 million**	**233.2 million**

- Considering only the costs of lost agricultural production, and estimating based on the size of average land holdings in affected areas, post-conflict cluster munition contamination would have cost some 3,105 individual landowners an average of around US$8,000 each – this in a country where the 2006 per capita GDP was US$5,300. In the area hardest hit by contamination the primary economic activities are agricultural, further exacerbating the impact.
- The estimate of US$120 million for cluster munition clearance and risk reduction activities is substantially higher than the US$30 million that Landmine Action estimated as the cost of the 1999-2005 response to NATO's use of cluster munitions in Kosovo in 1999.
- Estimates of the cost of death and injury vary greatly depending on the methodology adopted. The speed at which large-scale clearance commenced and the extent of work by international and local agencies no doubt contributed significantly to limiting the number of deaths and injuries from cluster munitions.
- Whilst post-conflict clearance and risk reduction mechanisms will have limited the costs incurred in other areas, substantial civilian harm has been incurred despite the large scale investment in clearance activities. This illustrates the limitations even of well-resourced post-conflict remedial operations, operating in favourable conditions, to protect civilian populations from cluster munition contamination.

- There is no doubt that in terms of post-conflict civilian casualties and the ongoing impact on agricultural production, cluster munitions have had a negative impact of a different magnitude to that presented by other weapons used during the conflict. This is also reflected in the scale and focus of the clearance and risk-reduction operations undertaken. More detailed data on the quantity of other ordnance used, and analysis of the comparative military effectiveness of cluster munitions and other types of ordnance in this context, would be necessary in order to better contextualise this conclusion. This data has not so far been made available by the Government of Israel.

Cost of lost agricultural production

In order to determine a monetary value for the impact of cluster munition contamination on agriculture, land use in 332 areas cleared and recorded in the Information Management System for Mine Action (IMSMA) database was assessed, and the findings extrapolated for the estimated 480 tasks remaining at the time the research was conducted. The key findings of this land use assessment were as follows:

- An estimated 3,897 ha of land was contaminated by cluster munitions as a result of the conflict in July-August 2006;
- Agricultural land was the most widely contaminated type of land, with 2,596 ha of such land affected. This represents 4.8% of all agricultural land in southern Lebanon;
- The most severely affected districts (*caza*) were Sour (7.2% of agricultural land affected, or 1,008 ha), Bent Jbeil, (7% of agricultural land affected, or 533 ha) and Nabatieh (5.9% of agricultural land affected, or 635 ha);
- The most heavily affected crops were olives, with 894 ha of olive groves contaminated, followed by cereal crops, tobacco and citrus fruits, all with over 400 ha of land contaminated.

The research process noted that contamination of land by cluster munitions in Lebanon does not, as is sometimes assumed, lead inevitably to complete land denial. A proportion of agricultural producers choose to access some contaminated land despite the risk this represents. There are many factors involved in the decision to use contaminated land, and once this decision has been made a range of risk management techniques have been adopted by agricultural producers in an effort to manage and reduce the threat level from unexploded submunitions. In this analysis it is estimated that between 15% and 30% of contaminated land has been and will be utilised by producers in advance of it being formally cleared.

By factoring in this use of contaminated land, and drawing on government figures regarding crop yields, prices and seasons, the report suggests lower and upper estimates for the direct economic cost of lost agricultural production. The key results from this process are as follows:

- The total value of current and projected lost agricultural production ranges from US$22.6 million to US$26.8 million;
- Losses in the three *caza* of Sour, Nabatieh and Bent Jbeil account for just over 80% of all estimated losses;
- Losses in olive production are estimated at between US$10milion and US$12 million, just under half of total agricultural losses. Citrus fruit production losses were also substantial, at between US$4-5 million;
- Based on patterns of landholding, these losses can be estimated to have affected approximately 3,105 individual producers at an average loss, per producer, equivalent to approximately US$8,000.

- In addition to the agricultural losses estimated here, which represent the projected income not achieved due to lost production, there are additional economic impacts to the agricultural sector not captured by this research, including but not limited to:
    - Individuals and companies providing goods and services to farmers that for a period lost approximately 10% of their customer base;
    - Wholesalers and exporters have fewer goods to purchase and sell on;
    - Certain crops, particularly fruit and olive trees, have been damaged due to neglect during the period in which land was inaccessible, and yields will be reduced for several years;
    - The total amount of money within farming communities is reduced, decreasing demand for other services;
    - Lower levels of production for personal use lead to greater dependence on food imports, and subsequently higher levels of vulnerability to increased food prices.

Cost of clearance and risk reduction activities

The financial impact of cluster munition contamination in Lebanon is also examined in terms of the cost of mitigating and removing the threat through clearance and risk reduction activities. The key findings in this section of the report are as follows:

- International funding to establish and run the initial cluster munition response programme in 2006–07 is estimated at US$80 million;
- Based on a projected end date of June 2009 for clearance of all impacted areas, a further US$40 million will be required to maintain the existing capacity. Of this, an estimated US$10 million has already been committed to clearance organisations. Although some teams are addressing minefields and unexploded ordnance (including cluster munitions) that pre-dated the 2006 conflict, the great majority of resources are tackling the immediate and urgent problem of cluster munition contamination from 2006;
- A combination of factors – including a small and accessible geographical area, national and international military capacity, a pre-existing UN coordination cell, established mine action operators and the availability of regional expertise – meant that the clearance operation was established extremely swiftly. This contributed to a rapid drop in casualty rates following an immediate post ceasefire increase and undoubtedly served to greatly mitigate the impact of cluster munition contamination. The response of the international mine action organisations, the national actors involved in mine action, and the international donors who supported the work should be recognised and commended.
- The cost of responding to cluster munition contamination includes additional expenditure not captured in this report, such as:
    - The direct costs borne by the government in funding the clearance activities of the Lebanese Armed Forces;
    - Beyond the end of the internationally funded clearance programme there will be a need for ongoing explosive ordnance disposal, risk education and victim assistance activities due to the level of residual risk: southern Lebanon is unlikely to be completely free of cluster munitions for many years.

Cost of deaths and injuries

Finally, the report provides an estimated financial cost of the deaths and injuries resulting from cluster munitions, based on a methodology adapted directly from a World Bank study conducted in 2007. The key findings in this section are as follows:

- Using a public health methodology for assessing the cost of diseases, accidents and so on, the estimated economic impact of cluster munitions in terms of lost output and income is between US$10.8 million and US$86 million;
- The lower estimate is based on a simple measure of the value of an individual life using GDP per capita. The upper estimate uses a methodology which incorporates individuals' willingness to accept the likelihood of injury or death when undertaking any given activity in order to identify a monetary value for life based on "willingness to pay";
- There a number of other costs not captured with regards to cluster munition victims, including:
  - Direct costs of health care, both in terms of emergency care and long-term rehabilitation;
  - The psychological and emotional impact of suffering either a loss of a family member, or of being a victim of a cluster munition incident;
  - The cost of domestic care provided to victims, particularly child victims, which may see parents or relatives forced to leave paid employment to work full time as carers for their family members.

Conclusions

The economic costs identified in this report are a burden borne by different groups. Significant expenditure on post-conflict clearance and risk reduction operations has been made by international governments in an effort to assist those communities affected by cluster munitions. The cost of these operations is substantial, but it is shared across a wide community of nations for whom such assistance is feasible without impact to the services they provide to their own domestic populations. If this 'loss' is to be conceptualised in practical terms it might be better to consider the 'opportunity cost' that without cluster munition use a substantial proportion of US$120 million could have been spent on other humanitarian or development needs, including in Lebanon itself which suffered a range of severe humanitarian and development setbacks in the wake of the 2006 conflict.

However, this expenditure on cluster munition clearance has not prevented direct economic impacts on the population of southern Lebanon. This analysis suggests that between US$33 million and US$122 million in economic losses will have been borne in this area as a direct result of cluster munition use. Here the costs fall much more heavily on individuals and families. Lost agricultural production and death, injury and disability to individuals all serve to reinforce poverty in communities already amongst the poorest in the country. All of these costs are in addition to the broader economic and social dislocation caused by the conflict.

It is still asserted in some quarters that cluster munitions are essentially the same as other weapons in the humanitarian problems that they cause both during and after conflict. For this reason it is argued that no substantial legal controls need to be developed to limit the humanitarian effects of these particular weapons. It is notable that in terms of post-conflict deaths and injuries, contaminated agricultural land and the prioritisation of clearance activities, cluster munitions in Lebanon clearly stand out from the rest of the weapons used in the conflict as having an indiscriminate and enduring impact on the civilian population. In contrast to the problems caused, no evidence has been provided that this use of cluster munitions achieved a direct military advantage that could justify this civilian cost.

Part 1: Introduction

1.1 Objective and structure of the report

This report aims to quantify the economic consequences of cluster munition contamination resulting from the 2006 conflict for the people of southern Lebanon and those organisations, institutions and states that provided assistance to them. The extent of cluster munition use during the 2006 conflict has been widely reported, as have the implications of that use in the context of international humanitarian law.[1] This report stems from a desire to assess and quantify the cost of cluster munition contamination in three areas: the cost of agricultural land denial, the cost of clearance and the cost for victims. This report examines these three areas and posits estimated costs that have been incurred for each.

Part 1 of the report contextualises the assessment, providing a brief overview of the conflict as well as outlining some of the broad costs incurred as a result. It goes on to summarise the importance of the agricultural sector in Lebanon, and then looks at cluster munition contamination resulting from the war in terms of the extent of this contamination, its impact on agriculture and some limitations regarding the existing data on the type of land affected by cluster munitions.

In Part 2 the report examines in detail the impact of unexploded submunitions on agricultural production in Lebanon, examining issues such as the types of land contaminated, crops affected by cluster munitions, and the deliberate use of contaminated land by agricultural producers. The report then goes on to examine the mine action response to cluster munition contamination in Part 3, describing the capacities deployed, outputs, methodologies used and the total projected cost of establishing and running the capacity required to remove the threat from cluster munitions. Finally, in Part 4 of the report, an overview of the impact of cluster munitions on the civilian population in terms of victims is provided, and a public health approach is used to estimate the economic cost of deaths and injuries.

It should be noted that the main body of the report contains summaries of the research and analysis conducted as part of the assessment process. More detailed information on the various aspects regarding cluster munition contamination in Lebanon and its impact on agriculture, public health and the mine action response are available in the annexes of the report.

1.2 Administrative areas in Lebanon

Lebanon is divided into six regional administrative regions, or *mouhafazat*. These are Beirut, Mount Lebanon, North, South, Nabatieh and Bekaa. These *mouhafazat* are sub-divided into districts called *caza*. South Lebanon is divided into three *caza,* Sour, Saida and Jezzine. Nabatieh is divided into four *caza* – Bent Jbeil, Marjeyoun, Hasbaya and Nabatieh itself. All references in the report to Nabatieh indicate the *caza* as opposed to the larger *mouhafazat*. These seven *caza* are collectively referred to as southern Lebanon in this report, and comprise of the area that was subject to much of the ground fighting and bombing during the 2006 conflict.

1.3 Overview of the conflict

The 2006 conflict between Hezbollah and Israel, although short, had a significant impact on Lebanon as a whole, and hit the south of the country, where much of the bombing was focused, particularly hard. The country was subject to an air and sea blockade for more than a month, almost 1,200 people were killed and more than 4,400 injured,[2] and the war temporarily displaced up to one million people who fled the fighting. NGO and U.N. operations in the south were suspended and the majority of international staff in these agencies and in private companies were evacuated.

Although hostilities were over by mid-August, and a
U.N. Security Council Resolution adopted that provided additional UNIFIL troops to monitor the ceasefire, the impact with regards to the social, political and economic structure of Lebanon has been significant and enduring. Tourism is reported to have slumped, insecurity is leading to increased emigration, and national politics remain deadlocked with no president and elections having been postponed 18 times since August 2007.

Along with the direct impact of the conflict on the economy and infrastructure of Lebanon, there has been an ongoing impact from cluster munitions, which were used in significant quantities and many of which failed to explode. These unexploded munitions have contaminated many populated areas and large amounts of agricultural and pasture land in the south of the country.

1.4 Conflict-related damage assessments

A number of studies have attempted to assess the overall impact of the conflict and apply a monetary value to the loss of trade and production, damage to infrastructure and assets, and the environmental degradation resulting from the war.

Four assessments that took place very shortly after the war attempted to quantify the total cost of the conflict to the Lebanese economy. A Government of Lebanon report, based on individual ministry estimates and an assessment carried out by an international consulting firm with the national Council for Reconstruction and Development, estimated total direct damages to infrastructure and economic activities at U.S.$2.8 billion,[3] of which U.S.$537 million was identified as being required to fund basic reconstruction of key infrastructure and re-establish basic services.[4] An EC assessment placed a figure of between U.S.$1 billion and U.S.$1.8 billion on the damage to public and private property.[5] Finally, a World Bank Impact Assessment indicated the war resulted in U.S.$2.4 billion of direct damage and U.S.$700 million of indirect damages.[6]

In addition to these reports looking at the total direct cost of the conflict, a series of thematic and sectoral damage assessments have been conducted by various agencies. These examine the direct and ongoing impact of the conflict on areas such as agriculture, forests and fisheries, as well as thematic aspects such as environmental degradation and impact on rural livelihoods. A list of these assessments is provided in Annex A.

1.5 Agriculture in southern Lebanon

Agriculture is an intrinsic and dominant feature of the economic and social fabric of southern Lebanon. Significant numbers of households produce a variety of crops for both personal consumption and for sale in the local, national and international markets. Whilst many households have a variety of income sources, agricultural produce represents a relatively dependable source of income, and personal use of produce decreases total household expenditure on food items and reduces vulnerability to increases in food prices. The agricultural sector received extensive direct damage during the conflict and suffered significant losses as a result of the disruption to harvesting and tending of crops and the abandonment of livestock.

The agricultural economy in southern Lebanon is a source of livelihood not only for farmers, but also for landowners, salaried and temporary agricultural workers, wholesalers, buyers, exporters, and individuals providing goods and support services to agricultural producers such as owners of tractors, stores selling agricultural goods and so on. A more detailed overview of the main characteristics of the agricultural sector in Lebanon can be found at Annex B.

1.6 Cluster munition contamination in southern Lebanon

A key feature of the 2006 conflict was the heavy air, sea and ground bombardment of Lebanon by Israeli forces, and particularly the extensive and intensive use of cluster munitions.[7] The propensity of the weapon to produce large quantities of unexploded ordnance,[8] combined with its use in a limited geographical area,[9] means that the resulting contamination has had a significant post-conflict impact.

Many munitions were fired at residential and agricultural areas,[10] which led to a high number of deaths and injuries in the immediate aftermath of the conflict[11] and has resulted in continued problems for reconstruction, rehabilitation and development activities. Contaminated agricultural and pasture land has resulted in lack of access to farm and grazing land for agricultural producers and livestock herders.

As of April 2008 a total of 965 cluster strike locations have been identified and recorded in the UNMACC database, equated to over 38 million square metres of contaminated land.[12] These sites were broken down by the UNMACC as follows:[13]

Table 1a. Status of contaminated areas as of 30 April 2008

Status	Number of CBU strike sites
Completed	217
Suspended	115
Subtotal	**332**
Completed, awaiting report	75
Ongoing as at 30 April 2008	55
Awaiting clearance	350
Subtotal	**480**
Duplicated[14]	96
Cancelled	57
Subtotal	**153**
Total	**965**

In the course of clearance operations and emergency response, over 142,000 submunitions had been cleared by the LAF, UNIFIL and international mine action organisations. An equivalent number are estimated to have been removed and destroyed by other actors, including local civilians and Hezbollah.[15]

Part 2: Cluster munition contamination and agriculture

2.1 Information required to determine agricultural losses

A major part of the research conducted for this report focused on identifying the impact on agricultural production from cluster munition contamination. The research was undertaken in order to identify several figures:

- An estimate of the amount of agricultural land contaminated and now cleared, reported and entered into the IMSMA database, broken down by location, crop type and date of clearance;
- An estimate of the amount of agricultural land contaminated and not cleared, or cleared but not entered into the IMSMA database, broken down by location and crop type;
- An estimated date for the clearance of agricultural land still contaminated;
- An assessment regarding how many producers were choosing to deliberately access contaminated land;
- An assessment of average yields, product prices and harvest seasons for various crops.

The methods used and the results of these assessments are presented briefly below. More detailed descriptions of methodologies applied and a detailed breakdown of the results can be found in the relevant annexes.

2.2 Existing assessments regarding the impact of cluster munitions on agricultural production

Several damage assessments have attempted to quantify the specific impact of cluster munitions on agriculture. A United Nations Environment Programme (UNEP) report,[16] for example, states that agricultural areas represent 62% of all land affected by cluster munitions, or 2,007 ha. A report by the Food and Agriculture Organisation (FAO)[17] states that 26% of all agricultural land in the south has been affected by cluster munitions, based on information obtained from the National Demining Office.[18] This is equated to 9,450 ha of land, broken down to 1,800 ha of citrus and banana plantations, 7,400 of field crops and 250 ha of olive groves.

Neither of these reports attempts to place a cost on this contamination in terms of lost production. A report by the World Bank,[19] however, does estimate and quantify production losses due to cluster munition contamination. It bases these figures on the approximate amount of land contaminated and therefore made inaccessible over a two-year period.[20] Using LMAC data on affected areas the report identifies between 5,689 ha and 14,224 ha of agricultural land as having been contaminated, and assumes that contamination is evenly distributed across crop categories in South Lebanon and Nabatieh. The report acknowledges that it is "difficult to quantify the total area of inaccessible agricultural lands",[21] but provides a range of between US$40 million and US$94 million of lost agricultural production over two years.

These reports base their assessments on estimates made by UNDP, UNMACC or LMAC regarding the extent of cluster munition contamination and the type of land affected. These estimates were made soon after the end of the conflict and are significantly larger than those presented in the current report. This led to an over-statement of the impact of cluster munitions on agriculture in previous assessments.[22]

More up-to-date information is now available regarding the extent of cluster munition contamination in southern Lebanon (i.e. the total number of suspect areas and their approximate size). However there are significant limitations with regards to this data that make assessing the type of land that has been contaminated, and therefore identifying and quantifying the impact of that contamination, extremely difficult.

Firstly, cluster munition contaminated areas have not been subject to a comprehensive survey. The emergency survey conducted by the UNMACC immediately following the conflict identified several hundred suspected strike sites, but collected limited information regarding these areas.[23] Land use in these areas has not been specified as part of the existing survey process

Secondly, land use on completed clearance tasks is not identified in a consistent and detailed manner. Once clearance tasks have been conducted a Completion Report (or a Suspension Report[24]) is submitted to the UNMACC, but these reports are limited in terms of the information they provide regarding land use. Although there is a specific section that enables land use to be identified, the options are limited and the reports have been inconsistently completed.[25] Whilst the site sketch attached to the reports identifies the boundaries of the cleared area,[26] there is no requirement to identify or provide measurements for each type of land use within the clearance site.

In order to provide an accurate figure for the economic impact of cluster munition contamination on agriculture, therefore, a more thorough assessment of land use in contaminated areas was required. This assessment formed a central part of the research conducted for this report.

2.3 Land use in cleared and uncleared areas

The lack of detailed survey data and the limitations of the data contained in the reports submitted to the UNMACC required the development of a land use assessment methodology. This combined analysis of mine action agency reports, a review of satellite imagery of clearance sites, a series of field visits to contaminated agricultural areas, and interviews with key informants, including agricultural producers. This was applied to all 332 sites entered on the IMSMA database at the time of the research, and then the findings extrapolated for the estimated 480 remaining sites. The results of this land use assessment is presented below.

2.3.1 Land use in areas cleared, reported and databased

At the time of this research the UNMACC has received Completion or Suspension Reports for 332 sites, which have been entered into the IMSMA database. For these sites it was possible to use the GIS-IMSMA database to view the exact boundaries of clearance sites overlaid on high-resolution satellite imagery.[27] The overall percentage of various types of land use within that cleared area could then be determined, including differentiation between various types of agricultural land.[28] A more detailed presentation of this methodology is presented in Annex C.

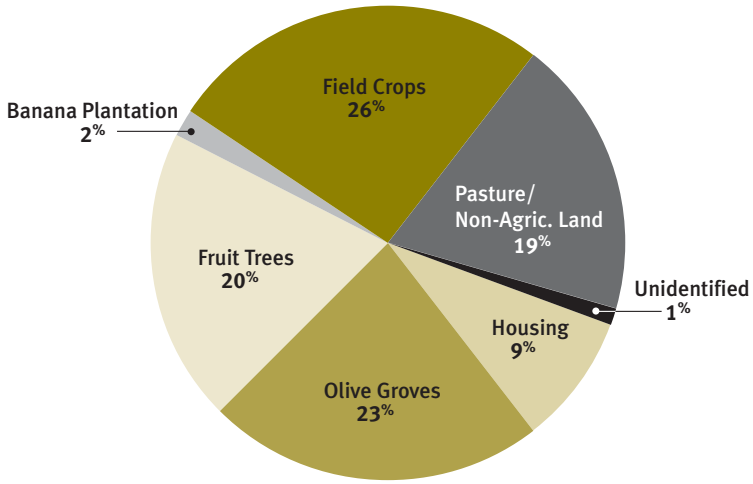
These reports indicate that 15,747,735 m², or 1,575 ha, of land has been cleared since September 2006, resulting in the removal of 22,524 unexploded cluster munitions. The average size of each clearance task was just under 4.75 ha and on average 68 submunitions were located on each task. Almost half of this clearance activity had taken place in the *caza* of Sour, and 35% in Bent Jbeil. These two *caza* represent nearly 80% of all tasks undertaken so far, and over 1,200 ha of land cleared. Nabatieh and Marjeyoun have received the remaining 20% of clearance work, with three *caza* – Hasbaya, Saida and Jezzine – having had no clearance work undertaken.

Table 2a. Number of tasks and land cleared by caza

Caza	# of tasks	%	Total area cleared (ha)	%
Sour	160	48%	707	45%
Nabatieh	32	10%	159	10%
Marjeyoun	44	13 %	181	11%
Bent Jbeil	96	29%	528	34%
Total	**332**	**100%**	**1,575**	**100%**

Of this contaminated area, 1,121ha were assessed as being agricultural land based on the analysis of satellite imagery, affecting approximately 1,243 individual producers. This agricultural land could be could be identified as being utilised for fruit crops, banana plantations, olive groves and field crops based on the satellite imagery. Other land was identified as beng pasture land or non-agricultural land, or land for housing. The breakdown of land use in cleared areas is presented in Graph 2a below.

Graph 2a. Land use identified in areas cleared, reported and databased as of 30 April 2008



Two of the agricultural categories identified in the satellite imagery, field crops and fruit trees, could be broken down into more detailed sub-categories based on information available in the *Atlas Agricole du Liban 2004*.[29] The category of 'fruit trees' can be divided into 'citrus fruits' and 'other fruits', whilst 'field crops' can be divided into 'tobacco', 'cereals' and 'other field crops'. A more detailed breakdown of land use in cleared areas in different *caza* and by crop types can be found in Annex D.

2.3.2 Land use in areas awaiting reports, ongoing and not cleared

Although the analysis of tasks captured in the IMSMA database represents a large proportion of the 965 suspect areas, a further 480 could not be analysed using satellite imagery as they were either completed but not entered into the database, were ongoing but not completed, or were awaiting clearance, as per the figures in Table 2b below.

These 480 tasks have been identified by *caza,*[30] and a total estimated area calculated. This area was based on the average clearance size of each completed task in each *caza* multiplied by the estimated number of remaining tasks.[31] This information is captured in the table below.

Table 2b. Estimated number of remaining tasks by caza

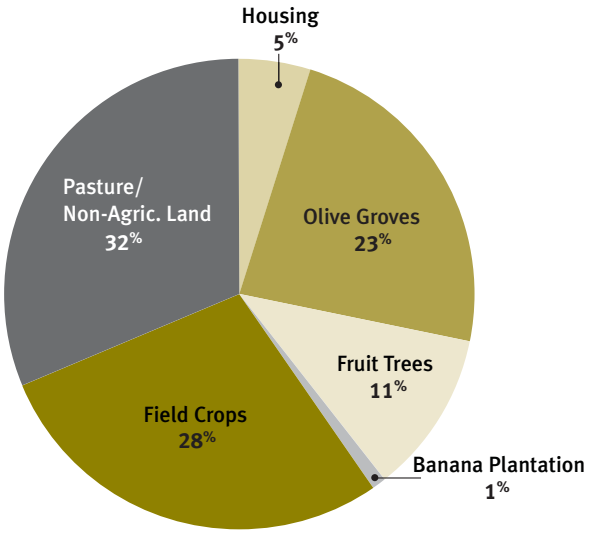
Caza	Estimated tasks outstanding	%	Estimated area outstanding (hectares)	%
Sour	131	27%	578	25%
Saida	3	1%	13	1%
Nabatieh	159	33%	791	34%
Jezzine	38	8%	189	8%
Marjeyoun	33	7%	136	6%
Hasbaya	17	4%	70	3%
Bent Jbeil	99	21%	545	23%
Total	**480**	**100%**	**2,322**	**100%**

This total area of suspect contaminated land was then broken down into land use categories in accordance with the same proportions identified in previously cleared areas, with some adjustments:

- The proportion of contaminated land categorised as housing was halved for future clearance as opposed to that already undertaken to reflect the fact that clearance tasks have thus far prioritised residential areas;
- The proportion of pasture /non-agricultural land was doubled for future clearance as compared to clearance undertaken to reflect the fact that suspect areas on this type of land have been classified as low-priority and not cleared.[32]

Based on this assessment process, an estimated 1,476 ha of contaminated agricultural land is ongoing or awaiting clearance, affecting an estimated 1,829 individual agricultural producers.

Graph 2b. Land use identified in suspect contaminated areas awaiting clearance



2.3.3 Contaminated areas as a percentage of all agricultural land

Based on the figures above, a total of 2,596 ha of agricultural land in southern Lebanon is estimated to have been contaminated by cluster munitions, equating to 4.8% of total agricultural land in this area. This figure is, however, higher for individual *caza* and for different crops. For example more than 7% of all agricultural land in Sour and Bent Jbeil was contaminated by cluster munitions. Over 10% of citrus orchards in Sour, 11% of the tobacco land in Bent Jbeil and almost 10% of olive groves in Nabatieh were contaminated.

This M42 submunition was one of several that had been moved out of an citrus orchard in the caza of Sour by the land owner. Despite the presence of unexploded submunitions, tending and harvesting of the crop had been ongoing since the end of the conflict.

2.4 Land denial and deliberate use of contaminated land

Although the total amount of contaminated land already cleared can be assessed, and the amount of land that is awaiting clearance projected, it is not necessarily the case that land denial across this contaminated area is total and absolute. Based on interviews carried out as part of this research, it is undoubtedly the case that a reasonable proportion of producers have been prepared to access suspect land in order to carry out agricultural activities. In doing so, they have adopted a variety of risk management techniques so as to reduce the threat from unexploded submunitions. Based on a variety of sources regarding this behaviour, a rate of deliberate use of contaminated has been estimated.

2.4.1 Factors influencing decision-making with regards to use of contaminated land

There are a wide range of factors that influence the decision to use or not use contaminated agricultural land and these can be divided into two groups. The first group are factors relating to income and land availability – whether producers have alternative land, alternative sources of income, the status of the land in terms of leasehold or owned, and the existence of production-backed loans. These factors relate to the individual producers' livelihood status. The second group of factors relate to issues regarding the perception of cluster munition contamination itself and personal attitudes towards risk-taking.

2.4.2 Risk reduction and mitigation

Farmers have adopted a range of techniques and practices to reduce the threat from unexploded submunitions. These include:

- Burning of land to identify contaminated areas;
- Destruction of submunitions through shooting, burning, throwing at hard surfaces;
- Attempting to make safe by taping, spraying with expandable foam or rendering safe;
- Dumping submunitions in unused areas (ditches, ponds etc.);
- Paying labourers to collect submunitions;
- Reporting submunitions to clearance organisations.

2.4.3 Assessing the extent of deliberate use of contaminated land

A number of information sources were used to assess the extent of deliberate use of contaminated land. These included direct interviews with farmers conducted during field visits, post-clearance assessment reports, information from MAG community liaison assessments, and analysis of Completion / Suspension Reports. Based on this analysis the extent of deliberate access and use of contaminated agricultural land is estimated at between 5% and 15% in the period up to March 2007, and then at between 15% and 30% in subsequent years. Full details regarding these information sources and this analysis are provided in Annex E.

2.5 Crop yields and values

Information regarding average yields for different types of crop, and of the average value of these crops at farm gate, wholesale and retail prices is produced annually by the Ministry of Agriculture, based on surveys of selected agricultural producers across Lebanon and cross-referenced with the baseline data established by the agricultural survey of 1998. These production statistics can be used to calculate the estimated total yield and value of that yield for any given amount of land, such as that identified as being affected by cluster munitions.

Table 2c. Average crop prices and yields (2005)

Crop	Price at farm gate (US$ / kg)	Yield / hectare (kg)	Value / hectare
Cereal crops	$0.24	2,696	$660
Tobacco	$6.80	1,000	$6,800
Other field crops	$0.22	27,438	$5,914
Olives (high yield)	$3.05	2,848	$8,694
Olives (low yield)	$3.05	1,302	$3,968
Citrus fruits	$0.28	23,775	$6,657
Other fruits	$0.49	29,000	$14,297
Bananas	$0.53	8,456	$4,481

Different crops vary in terms of production value per hectare. Tobacco is notable as it is licensed and subsidised, with producers permitted to grow a set amount which is sold to the state tobacco authority at a pre-determined price. This provides a degree of stability in terms of income in a volatile sector such as agriculture. Many farmers are reported to use licences as collateral to secure bank loans.[33] A brief overview of the values and yields of various crops per hectare is provided in the table above. A more detailed breakdown is provided in Annex F.

2.6 Economic impact of cluster munitions on agricultural production

The figures presented above provide information regarding the total amount of agricultural land contaminated in cleared and suspect areas, the breakdown of that land by crop production, the rate of deliberate use of contaminated land and the average yield and price of various crops. This provides a basis for estimating the economic losses resulting from lost agricultural production in southern Lebanon since 2006, projected until the end of the large-scale clearance process, estimated in this report as June 2009.

This projected end date is based on the figures provided by UNMACC and detailed in Table 2a above, showing that 55 sites ongoing and a further 350 awaiting clearance as of end of April 2008. Between January and December 2007 an average of 26 sites were completed each month. If the remaining tasks are completed at the same rate it is reasonable to assume that the majority of these 405 tasks will be completed by mid–2009.[34]

By combining this information with the date when sites were completed, or in the case of uncleared areas, the estimated completion date, and referring this to the agricultural year in terms of planting and harvest periods, the total number of seasons of production that have been and will be lost can be ascertained.

Using yield and price estimates it is then possible to extrapolate the total lost yield and the value of that yield for each type of crop. Finally, by factoring in the estimated lower and upper ranges of deliberate access of contaminated land, thus taking into account rates of *land denial* as opposed to simply *land contamination,* a final estimate can be calculated as to the value of lost agricultural production. For the period from September 2006 to June 2009 total agricultural losses are estimated to be within a range of US$22,602,221 to US$26,815,997. Broken down by *caza,* by crop, and then by year, total estimated losses are presented in the tables below.

Table 2d. Total estimated agricultural losses by caza

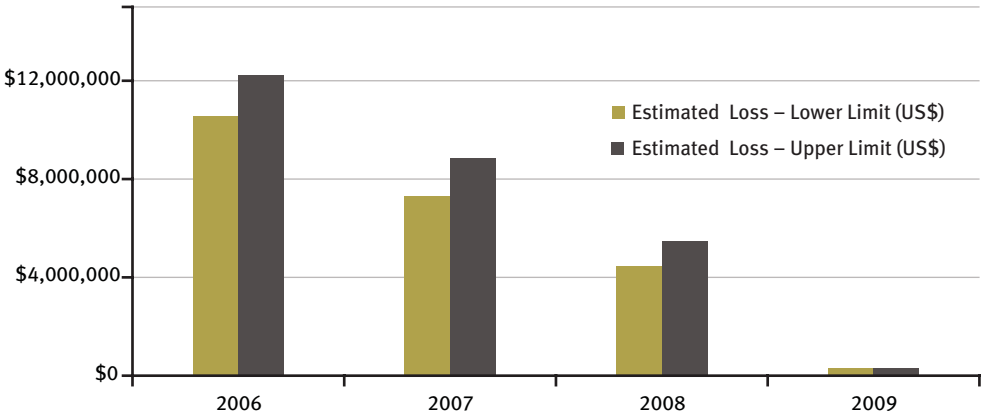
Area	Estimated loss – lower (US$)	Estimated loss – upper (US$)
Sour	9,760,824	11,422,388
Saida	125,125	147,254
Jezzine	1,100,357	1,301,951
Nabatieh	5,338,667	6,392,582
Bent Jbeil	4,156,060	5,060,720
Marjeyoun	1,685,707	1,981,299
Hasbaya	435,482	509,803
Total	**$22,602,221**	**$26,815,997**

Table 2e. Total estimated agricultural losses by crop

Crop	Estimated loss – lower (US$)	Estimated loss – upper (US$)
Olive groves	10,838,004	12,521,864
Fruit trees (citrus)	4,871,134	5,671,488
Fruit trees (other)	991,291	1,154,716
Banana	1,197,425	1,391,589
Tobacco	3,189,009	4,236,262
Cereal crops	377,606	458,521
Other field crops	1,137,753	1,381,557
Total	**$22,602,221**	**$26,815,997**

Graph 2c. Total estimated agricultural losses by year

A full set of tables detailing the estimated losses resulting from lost agricultural production is provided in Annex G and Annex H.



2.7 Economic impact of cluster munitions on producers

Based on average size of landholdings in southern Lebanon, the total number of producers affected by cluster munition contamination is estimated at 3,105. This represents 5% of all agricultural producers in South Lebanon and Nabatieh. Individual producers' losses can therefore be assessed as ranging from US$7,279 to US$8,636.

Table 2f. Total estimated agricultural losses by producer

Caza	Average land holding per user (hectares)	Estimated agricultural land contaminated (m²)	Total agricultural producers affected	Total losses per producers – lower limit (US$)	Total losses per producers – upper limit (US$)
Sour	1	10,077,325	1,008	9,686	11,335
Saida	1.1	99,077	9	13,892	16,349
Jezzine	0.6	1,244,199	207	5,306	6,279
Nabatieh	0.7	6,349,840	907	5,885	7,047
Bent Jbeil	0.8	5,333,337	667	6,234	7,591
Marjeyoun	1	2,356,572	236	7,153	8,408
Hasbaya	0.7	500,712	72	6,088	7,127
	Total	**25,961,063**	**3,105**	**(Avg.) 7,279**	**(Avg.) 8,636**

These figures clearly represent only the average loss, whereas actual losses per producer will vary greatly, depending on factors such as the size of land holdings, type of crop grown and, critically, when clearance work was or will be undertaken. For example, an olive farmer with one hectare of land would have lost approximately US$8,200 if his land had been cleared in early 2007, but if it is not cleared (and not used) until the end of 2008 they will have lost nearly US$20,000.

A more detailed breakdown of losses by agricultural producer is presented in Annex I.

Part 3: The mine action response to cluster munition contamination

3.1 Introduction

The intensive use of cluster munitions in Lebanon by Israeli forces resulted in an extremely high density of unexploded submunitions across southern Lebanon. The mine action response to this humanitarian crisis was swift and significant in its scope. Due to the established coordination capacities (both national and UN), existing clearance capacities, the presence of UN and Lebanese armed forces and the timely disbursement of funding by the international donor community, there was a rapid and structured response to cluster munition contamination. Explosive Ordnance Disposal (EOD) teams and Battle area clearance (BAC) teams were mobilised and had commenced clearance operations within days of the end of hostilities.

The UNMACC acted as the UN Mine Action Focal Point for other UN agencies, conducted a rapid emergency survey aimed at identifying all suspect contaminated areas, and was responsible for coordinating and accrediting all international mine action agencies seeking to work in the country, as well as taking ongoing responsibility for tasking and quality assurance.

3.2 Mine action capacities deployed

To deal with such widespread cluster munition contamination, agencies established BAC teams able to conduct thorough but relatively quick visual searches of affected areas. BAC teams also had the capacity to search below ground, as it quickly became apparent that unexploded munitions had buried themselves into softer ground in many areas. By October 2006, only two months after the ceasefire, there were four international organisations deploying a total of 34 BAC teams. The number of teams peaked at 60 in October 2007, and as of March 2008 stood at 50 teams, operated by seven international mine clearance organisations.[35] In addition to BAC teams, a wide range of additional clearance assets were mobilised. These included:

- *Lebanese Armed Forces:* The LAF conducted significant amounts of EOD and visual search following the conflict. The LAF and the UNMACC have established strong coordination structures with regards to quality assurance, survey, completion reports and handovers;
- *UNIFIL troops:* UNIFIL provided troop capacity to the UNMACC as additional clearance assets for both EOD and clearance work;
- *EOD teams:* Several organisations established a number of EOD teams to respond to requests for emergency clearance of submunitions and deal with reports of munitions in areas that had not yet received full clearance capacities;
- *Regional and international expertise:* the rapid scale-up of operations required a high level of international supervisory capacity. Some agencies were able to draw on "regional" expertise – Mines Advisory Group (MAG) deployed 16 senior national staff from within their Iraq programme, who were considered critical to the success of the clearance programme.[36] Other agencies, such as Dan-Church Aid (DCA) and Norwegian Peoples Aid (NPA), deployed staff from Kosovo and Bosnia;
- *Short-term international deployments:* The New Zealand Defence Forces seconded one BAC team for a period of 12 months, and SRSA mobilised an Icelandic EOD team for a period of approximately 6 months.

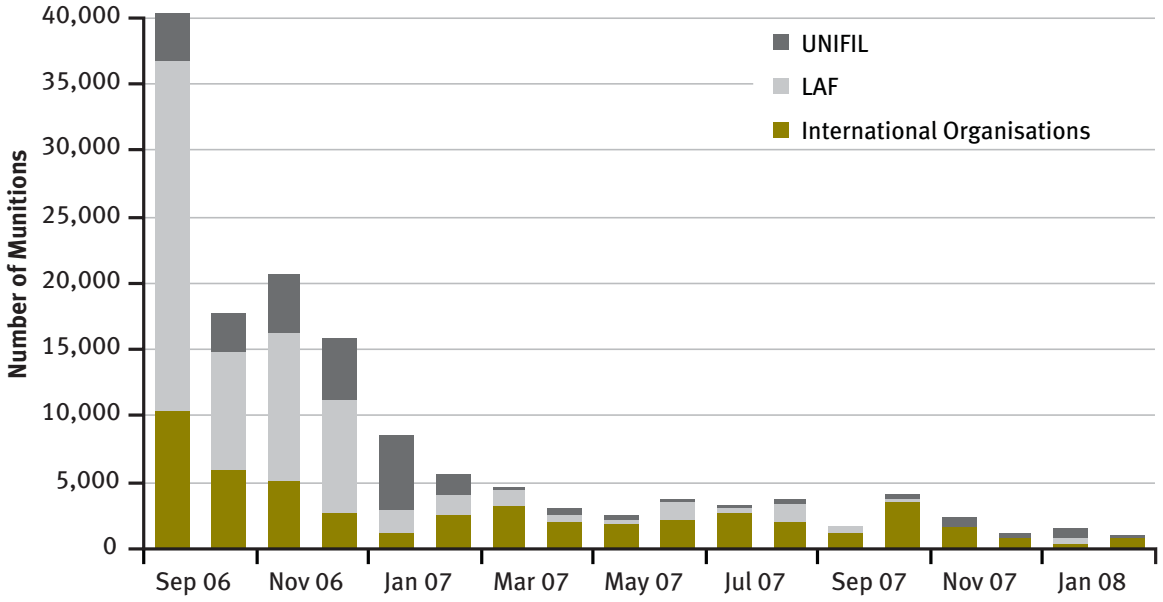
The ability to deploy a range of assets in such a short period of time with a specific focus on cluster munitions was undoubtedly an important factor in the rapid reduction in the accident rate in the period up to December 2006. It is likely that if similar levels of contamination were to occur in an environment that did not have recourse to this range of assets there would be far greater rates of deaths and injuries and a much more prolonged period of land denial.

3.3 Outputs and clearance results

The rapid mobilisation of the various assets outlined above allowed for the clearance of large numbers of unexploded submunitions. In the period up to the end of December 2006, teams from LAF, UNIFIL and international mine action organisations destroyed 94,544 submunitions, with LAF removing more than half of this total (54,820). As capacities moved from emergency response to systematic clearance of contaminated areas, the number of munitions found fell by half between January and March 2007. Since then there have been an average of 2,736 submunitions destroyed each month. By March 2008, a total of over 142,000 submunitions have been located and destroyed by the various organisations involved in formal clearance operations.

As illustrated in Graph 3a below, there was an extremely high rate of munition disposal in the first months after the end of hostilities, mostly conducted by LAF and UNIFIL forces.[37] This indicates both the extremely rapid response to the contamination by all mine action organisations, and the dense nature of the contamination in populated areas. It also reveals the ongoing challenge of clearing agricultural and pasture land, where vegetation and terrain slow the progress of clearance, and submunitions have become buried under the ground.

Graph 3a. Cluster munitions clearance by month and organisation



The number of munitions destroyed is only one aspect of the clearance process. The other is the amount of contaminated land being made safe through a combination of surface and sub-surface clearance. As noted in the Section 2.2.2 a total of 15,747,735 m² had been cleared in the 332 sites for which there are records in the IMSMA database. Completed tasks not entered into the database and ongoing tasks had resulted in a further 4,861,883 m² of land cleared as of 30 April 2008.

By April 2008, therefore, only 20 months after operations commenced, more than half of all contaminated land had been cleared.[38] This is a significant achievement and reflects the speed with which effective clearance operations were established.

3.4 Clearance methodologies and residual risk

The clearance methodology adopted in Lebanon has seen sites approached with a combination of visual search, instrument-aided visual search, and full instrumental search. These are also known as surface and sub-surface searches. The amount of land subject to sub-surface search in the 332 sites indicated above is 4,926,589 m², leaving 10,820,756 m² of cleared land subject to only visual or instrument-aided visual search. However a reasonably significant proportion of submunitions are found beneath the surface, approximately 38% in a sample of sites subject to both surface and sub-surface search. This proportion increases significantly for areas contaminated with BLU-63 submunitions.[39]

The clearance planning process requires that a series of factors are taken into account when deciding to conduct either surface or sub-surface searches on any given contaminated area. These include assessments of terrain, soil conditions, vegetation, type of bomblet, intended land use and so on. However on any areas (except hard surfaces such as tarmac or concrete) that have only been searched using a surface methodology, a higher level of residual risk will naturally remain than on areas where sub-surface search has been conducted.[40]

3.5 The cost and economic impact of mine action activities

3.5.1 Cost of clearance

Establishing and running a large-scale clearance programme requires a significant amount of funding in order to undertake initial procurement of capital items, to deploy international staff and establish the administrative and logistical infrastructure required to commence mine action operations. Once a capacity has been established, further funds are required for the ongoing running costs, such as salaries, expendable stores and training. The following table shows the amount of funding committed by the international donor community since 2006, and a projection of outstanding needs for 2008 and 2009.

Table 3a. Confirmed and estimated costs of mine action activities, August 2006 – June 2009[41]

Period	Amount awarded (US$)	Amount outstanding (US$)	Total (US$)
2006–07	80,591,159	–	80,591,159
2008	9,850,172	17,411,351	27,261,523
2009	–	12,500,000	12,500,000
Total	**90,441,331**	**29,911,351**	**120,352,682**

As illustrated in the table above, total confirmed and projected costs for the mine action programme in Lebanon, including clearance, coordination, information management, quality assurance, mine risk education and victim assistance is estimated at just over US$120 million.

This represents a minimum figure, as victim assistance, risk education, victim assistance and limited EOD response may be required for a period beyond June 2009. In addition, this does not include the costs incurred directly by the Lebanese government for clearance and coordination activities. A breakdown of these figures is provided in the table in Annex J. Although some teams are addressing minefields and unexploded ordnance that pre-dated the 2006 conflict, the great majority of resources are tackling the problem of cluster munition contamination

3.5.2 Implications for the local economy

The impact of such a large-scale clearance programme on the local economy is quite extensive, and can be identified in three main areas:

- Direct economic inputs from salaries
- Direct economic impact from expenditure on local products
- Other indirect impacts (positive and negative)

Based on figures obtained during the research process regarding staff numbers, salary levels and projected capacities, it is estimated that some US$22.7 million has been or will be transferred to the local community through salary payments. Expenditure on local goods and services, including items such as office and house rental, the purchase of expendable stores (such as stationary, marking materials for clearance sites etc.) is estimated at US$2.6 million. These figures are conservative, but on this basis we can estimate that, by the end of large scale clearance operations, as much as 20% of all funding provided for cluster munition clearance in Lebanon will have gone directly into the local economy.

There are a number of other ways in which the establishment of a large-scale clearance capacity impacts on the local economy, but which are beyond the scope of this report to examine in any detail. However it is worth noting that indirect impacts can be both positive and negative.

Part 4. The impact of deaths and injuries

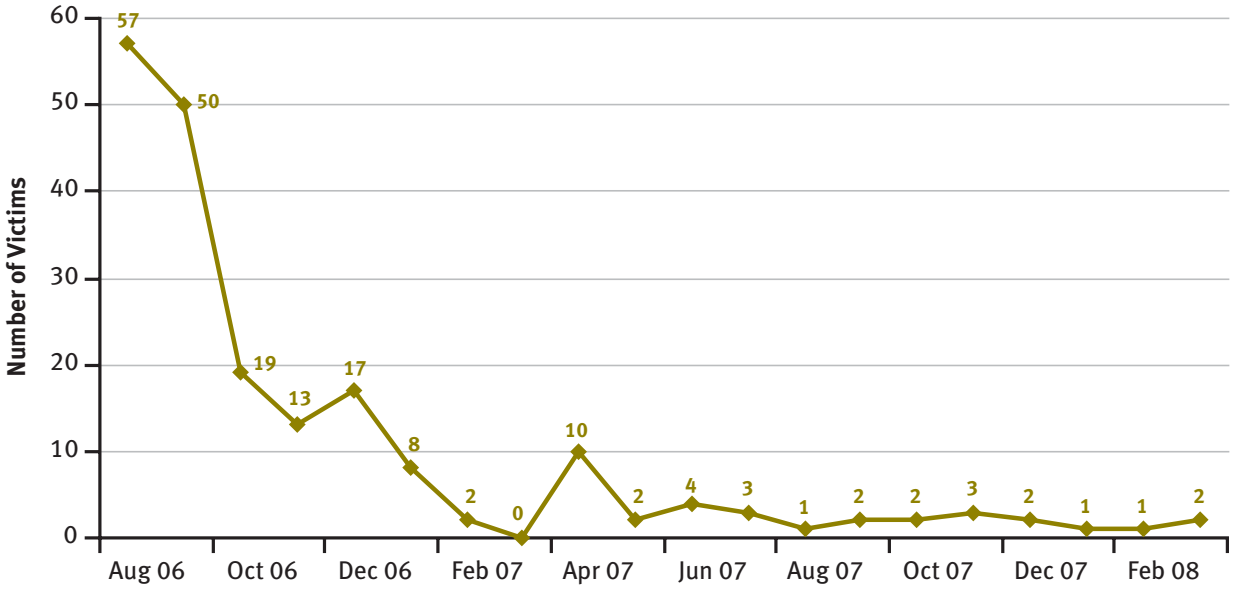
4.1 Number of deaths and injuries due to cluster munitions

Data collection on mine and UXO victims is conducted by all agencies involved in mine action in Lebanon, and held by the UNMACC and the LMAC. The data analysed in this section was provided by the UNMACC.

Since the end of hostilities up to the end of March 2008, there have been 197 victims of cluster munitions out of a total of 241 victims of all types of ERW in southern Lebanon, and out of a total of 287 victims across the entire country. A further 47 people have been killed or injured whilst conducting mine and UXO clearance operations, including clearance of cluster munitions.

The graph below, adapted from the UNMACC Monthly Report for March 2008, show the number of victims of all munitions by month. This illustrates the rapid decline over the first six months after the end of hostilities, after which the incident rate has remained steady at approximately 2 per month.

Graph 4a. Number of cluster munition victims (August 2006 – March 2008)



4.2 Breakdown of victims by munition, activity, age and gender

4.2.1 Munition type

Cluster munitions have been responsible for the vast majority of civilian deaths and injuries in southern Lebanon, accounting for 81.7% of all victims between August 2006 and February 2008. It is likely that at least a portion of the victims of unknown devices, which accounts for 20 out of the 241 victims, were also the result of unexploded submunitions. The following table shows the number of victims by munition type:

Table 4a. Number of victims by munition type in southern Lebanon (August 2006 – February 2008)

Type of munition	Injured	Killed	Total
Cluster munitions	177	20	197
AP mines	3	0	3
Unexploded ordnance	5	3	8
Unknown	17	3	20
Other (flare, booby trap, etc)	12	1	13
Total	**214**	**27**	**241**

4.2.2 Age and gender

The majority of those killed or injured by cluster munitions have been adults (64%), although 46 victims are between the age of 13 and 18, and 21 are children under 12 years of age. For the latter group the mortality rate is 20%, as opposed to 6.5% for victims aged 13–18 and 10% for adults. Although young children are not as likely to be victims of cluster munitions as other age groups, they are more likely to die as a result of the explosion.

The vast majority of victims have been male, with 175 victims (89%) having been boys or men. Only one of the twenty victims aged between 0 and 12 years old was female.

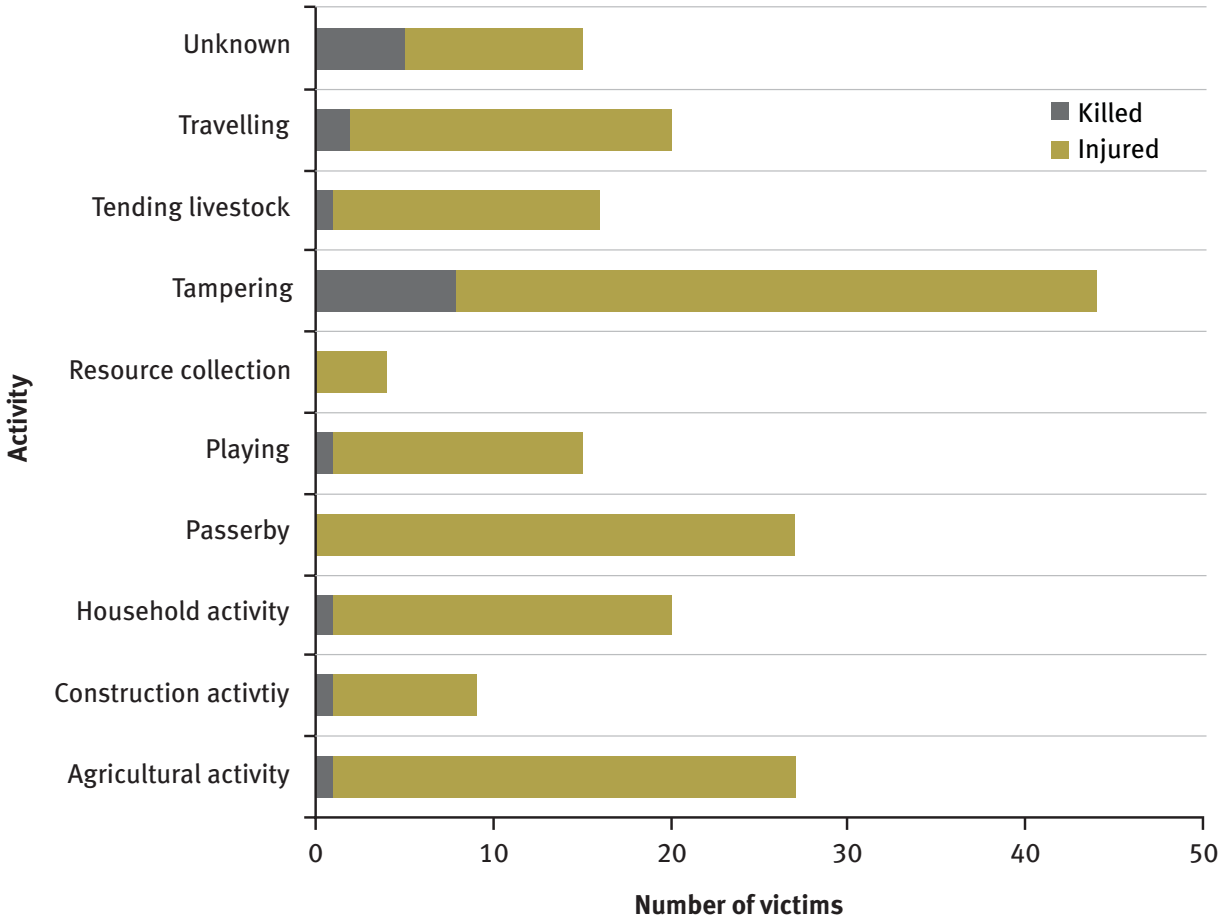
4.2.3 Activity at time of incident

The graph below shows the activity being undertaken at the time of the incidents involving cluster munitions.

Deliberate interaction, categorised as "tampering", represents the most common activity at the time of the incident, accounting for 44 of the 197 cluster munition victims. It is not possible to determine from available data where or why these victims engaged in deliberate interaction with munitions. This information could enable more detailed analysis regarding at-risk and risk-taking groups. Deliberate interaction can be undertaken to collect scrap metal, to impress other people (especially in the case of youths and young men), to remove a threat from a specific location where it is considered unacceptable (such as near a school or a children's play area) or to enable another activity, such as ploughing, to take place. This limits the usefulness of the blanket description of "tampering" as a description of behaviour.

Agricultural work, not including tending livestock which is categorised separately, is the second most common activity being undertaken at the time of the incident, with 26 victims, equal to that for the category of "passer-by".

Graph 4b. Activity at time of incident (August 2006 – March 2008)



The percentage of victims in each category has changed over time. Since January 2007 only one child under 12 has been injured or killed "playing" with cluster munitions, suggesting that child-focused risk education has had some impact. Since January 2007 no one has been classified as "travelling" at the time of the incident, which reflects the number of incidents that occurred during the initial period after the conflict when people were returning to their homes. However agricultural and household activities have accounted for a higher percentage of victims since 2007, rising from 12.8% to 17.1% for the former, and from 9% to 14.6% for the latter.

4.3 Estimating the economic impact of death and injuries from cluster munitions

The economic loss caused by premature death (mortality) or injury (morbidity) resulting from any specific event, such as a cluster munition explosion, can be calculated using a range of methods. In the World Bank's report on the economic impact of environmental degradation in Lebanon, a methodology based on Disability Adjusted Life Years (DALY) is used.[43]

This methodology assumes that death is equivalent to one whole DALY, and injuries are a proportion of a whole DALY dependent on severity. For cluster munition victims the DALY for injuries is calculated by the World Bank as 0.3. The scale of the DALY is then multiplied by the total number of years lost, and this figure is then used to calculate the economic cost of the death or injury. For example, a child under 12 killed by a cluster munition is assumed to have lost 33 years of productive life, equivalent to 33 DALYs. A child injured by a cluster munition is assumed to have lost 33 years x 0.3, equivalent to 9.9 DALYs.

The value per DALY can be calculated based on different rates. The World Bank use a lower level equivalent to GDP per capita for 2006 (US$5,300). The upper level is based on a more complex formula which calculates the value of a statistical life based on a "willingness-to-pay" methodology. The "willingness-to-pay" method is derived from the perceived value that people place on risk of death judged by decisions made with regards to salary and types of employment. A figure derived from a study conducted in the United States has been adjusted to reflect the GDP per capita difference with Lebanon, giving a figure of US$42,000 per DALY on the "willingness-to-pay" scale.

Adapted directly from the World Bank report but with updated victim figures, the table below shows the economic cost of cluster munitions in terms of mortality and morbidity. This shows a lower estimated economic cost of US$10.8 million and a higher estimated cost of almost US$86 million due to cluster munition casualties.

Table 4b. Economic loss due to deaths and injuries from cluster munitions

						Current & projected economic loss (US$)	
Age group	Current No of casualties[1]	Current and projected No of casualties[2]	DALYs per case	DALY (Lower estimate)	DALY (Upper estimate)	Lower estimate	Upper estimate
Mortality							
0 –12	4	4.4	33	5,300	42,000	769,560	6,098,400
13 –19	3	3.3	36	5,300	42,000	629,640	4,989,600
19+	13	14.3	20	5,300	42,000	1,515,800	12,012,000
Subtotal	**20**	**22**	–	–	–	**2,915,000**	**23,100,000**
Morbidity							
0 –12	17	18.7	9.9	5,300	42,000	981,189	7,775,460
13 –19	48	52.9	10.8	5,300	42,000	3,027,996	23,995,440
19+	112	123.4	6	5,300	42,000	3,924,120	31,096,800
Subtotal	**177**	**195**	–	–	–	**7,933,305**	**62,867,700**
Total	**197**	**217**	–	–	–	**10,848,305**	**85,967,700**

[1] Based on UNMACC statistics for cluster munition casualties only between Aug 2006 and February 2008

[2] Assumes casualty rate of two per month for 10 months, with death/injury distributed amongst future victims in the same proportion as current victims.

Whilst these figures represent the cost in terms of the projected output lost due to death or injury, there are a range of direct and indirect costs that they do not capture, including the costs of immediate and ongoing health care for cluster munition victims, and the emotional and psychological impact of incidents on both victims and the victim's family.

Additionally, there are wider ramifications for victims of cluster munitions: women or children may have to take on additional employment to make up for the loss of part of the household income, particularly if the victim was the main source of income; women may have to leave employment to take care of an injured child; child victims may have to leave school on a temporary or permanent basis; and so on. These wider costs are beyond the scope of this study, but they are recognised as significantly increasing the social and economic impact of cluster munitions on victims beyond the basic amount identified here.

Annex A: Selected list of information sources

A.1 Damage and impact assessments

1. JRC/EUSC (2006) *Rapid Preliminary Damage Assessment,* undertaken by the Joint Research Centre/ European Union Satellite Centre, Brussels
2. FAO (2006) *Damage and Early Recovery Needs Assessment of Agriculture, Fisheries and Forestry,* Food and Agriculture Organisation, Rome
3. IFAD (2006) *Analyse des moyens d'existence et du genre suite aux dommages de guerre dans les zones rurales pauvres,* International Fund for Agricultural Development, Rome[44]
4. UNEP (2007) *Lebanon: Post-conflict Environment Assessment,* United Nations Environment Programme, Nairobi
5. Association for Forests Development and Conservation/UNDP (2007) *War Impact on Forest Resources and Olive Groves in south Lebanon,* AFDC, Beirut
6. World Bank (2007) *Post-conflict Social and Livelihoods Assessment in Lebanon,* World Bank/ Ministry of Social Affairs, Beirut
7. World Bank, (October 2007) *Economic Assessment of Environmental Degradation Due to the July 2006 Hostilities,* Report No. 39787-LB, Sustainable Development Department, Middle East and North Africa Section, World Bank, Washington

A.2 Cluster munition use in Lebanon

1. Landmine Action (2003), *Cluster munitions in Lebanon,* Landmine Action, London. N.B. This report refers to cluster munitions used prior to 2006
2. Landmine Action (2006), *Foreseeable Harm: the use and impact of cluster munitions in Lebanon: 2006,* Landmine Action, London
3. Mukhtar, H., Salem, P. & Wareham, S. (2006) *Cluster Bombs: The Case of Lebanon.* Report of a humanitarian delegation to Lebanon of representatives of Australians for Lebanon and the Medical Association for Prevention of War (Australia).
4. UN OCHA (2006) *Lasting Legacy: The Deadly Impact of Cluster Bombs in Southern Lebanon,* U.N. Office for the Coordination of Humanitarian Affairs, Beirut.
5. Human Rights Watch (2007), *Flooding South Lebanon: Israel's Use of Cluster Munitions in Lebanon in July and August 2006,* Human Rights Watch, New York.

A.3 General information regarding cluster munitions

1. Prokosch, E. (1995) *The Technology of Killing,* Zed Books, London.
2. Landmine Action (2006), *Failure to protect: A case for the prohibition of cluster munitions,* London.
4. C. King Associates Ltd, Norwegian Defence Research Establishment and Norwegian People's Aid (2007) *M85: an analysis of reliability,* Norwegian Peoples Aid, Oslo
5. ICRC (2007) *Expert Meeting on Humanitarian, Military, Technical and Legal Challenges of Cluster Munitions,*

International Committee of the Red Cross, Geneva

A.4 Background reports on Lebanon

1. ICG (2007) *Lebanon at a Tripwire,* ICG Policy Briefing, International Crisis Group, Brussels/Beirut
2. ICG, *Israel/Hizbollah/Lebanon: Avoiding renewed conflict,* ICG Middle East Report N°59, International Crisis Group, Brussels/Beirut
3. ICG, *Hizbollah And The Lebanese Crisis,* ICG Middle East Report N°69 – 10, International Crisis Group, Brussels/Beirut
4. Government of Lebanon (2004), *Millennium Development Goals: Lebanon Report 2003*
5. Government of Lebanon (2004), *Atlas Agricole du Liban (2004),* Ministry of Agriculture, Beirut
6. Government of Lebanon (2007), *Agricultural Statistics 2005,* Directorate of Studies and Coordination, Ministry of Agriculture, Beirut.

A.5 Interviews and key informants

Maya Aoun, Director de Projet, AVSI
Dr. Christina Bennike, Programme Manage, DanChurchAid
Lindza Berbari, Program Coordinator, IOCC
Mikael Bold, Operations Officer, UNMACC South Lebanon
Chris Clark, Programme Manager, UNMACC South Lebanon
Rana Elias, IMSMA Programme Officer, UNMACC South Lebanon
Dalya Farran, Media and Post Clearance Officer, UNMACC South Lebanon
Colonel Fehmi, LMAC Representative, Lebanese Armed Forces
Catherine Isabelle Fleming, Transitional Programme Officer, UNMACC South Lebanon
Tekimiti Gilbert, Chief of Operations, UNMACC South Lebanon
Andy Gleeson, Technical Operations Manager, MAG
Johan den Haan, Operations Manager, BACTEC International
Mohammed Haida, Olive Farmer, Nabatieh
Mark Holyroyd, Chief of Operations, Handicap International
Ibrahim Jaffal, Landowner, Nabatieh
Mohammed Jaffal, Landowner, Nabatieh
Alan Kelly, Planning Officer, UNMACC South Lebanon
Abbas Khreibani, Tobacco Farmer, Nabatieh
Leyla Moubayed, Country Representative, International Relief and Development
Amer Musanavic, Technical Manager, Norwegian Peoples Aid
Ezat Musselamany, Citrus Farmer, Sour
Dr. Hussein Nasrallah, Director, Coordination and Studies Unit, Ministry of Agriculture
Rami Osayaran, Citrus Farmer, Nabatieh
Siaad Osayaran, Citrus Producer, Nabatieh
Mohammed Osayaran, Citrus Producer, Nabatieh
Amira Zeidan, Community Liaison Manager, MAG
Ibrahim Salaam, Olive Farmer, Nabatieh
Rami Samain, Emergency Coordinator, Food and Agriculture Organisation
Khaled Yamout, Landmine Action Program Coordinator, NPA
Moussa Yassin, Olive Farmer, Nabatieh

Annex B: The agricultural sector in southern Lebanon

B.1 Overview

Agriculture is a central features of the economic and social fabric of southern Lebanon. Significant numbers of households produce a variety of crops for both personal consumption and for sale in the local, national and international markets. Whilst many households have a variety of income sources, agricultural produce represents a relatively dependable source of income, and personal use of produce decreases total household expenditure on food items and reduces vulnerability to increases in food prices. Key feature of the agricultural sector in southern Lebanon are examined below.

B.2 Size, scope and character of agricultural sector

No comprehensive national agricultural land use survey has taken place since 1998, which was compiled into the Atlas Agricole du Liban of 2004.[45] However, production and price statistics have been gathered on an annual basis since 2001, the most recent available year being for 2005. Based on this information the following observations can be made regarding the size and scope of the agricultural sector in southern Lebanon.

B.2.1 Amount of land under production

South Lebanon and Nabatieh represent 12% and 11% respectively of the total agricultural land in use in Lebanon (55,597 ha out of a total of 248,000 hectares).[46] The amount of land that is used for agricultural production as a proportion of all land is particularly high in the areas around Tyre and Nabatieh, with many districts reporting more than 40% of all land used for agriculture.[47]

The average land holding in South Lebanon and Nabatieh is 1 ha and 0.8 ha respectively,[48] with more than 75% of producers using less than 1 ha of land.[49] This is lower than the national average, reflecting the fact that the majority of large-scale commercial farming takes place in the centre and north of the country.

B.2.2 Number of agricultural producers

There are an estimated 29,504 agricultural producers in the *mouhafazat* of South Lebanon, and 30,307 in Nabatieh,[50] out of a total population of 747,477. This represents just over 30% of the total number of agricultural producers in Lebanon. 35% of producers in South Lebanon and 27% of those in Nabatieh are entirely dependent on agriculture for their livelihoods, with the remainder having other sources of income.[51]

B.2.3 Commercial and personal production

More than 85% of total agricultural land in South Lebanon and 80% of land in Nabatieh is farmed for commercial purposes. However the 9,683 ha, or 17% of all agricultural land, that is farmed for personal use supports 50% of all farmers.[52] This reflects the extent and importance of small-scale production for families as an alternative to using limited income for the purchase of food.

Whilst the majority of agricultural land is in production by the owner, a reasonably high proportion of land is either leased or in use by someone other than the owner – 25% in Nabatieh and 19% in South Lebanon.[53]

B.2.4 Employment in the agricultural sector

Agriculture is the main form of economic activity amongst the employed, representing 56% of employment in South Lebanon and 64% in Nabatieh.[54] Agricultural producers employed over 5,000 salaried staff on a permanent basis in South Lebanon and Nabatieh, but occasional/casual work accounted for over 2,000,000 person-days of employment in these *mouhafazat,* 29% of which was for women and 71% for men.[55] At approximately US$8 per day this represents over US$16 million in income for temporary work on agricultural land.

Agricultural producers also provide employment and an economic base for a wide range of support services, such as nurseries growing seedlings and transplants, shops and companies selling agricultural products such as pesticide and fertiliser, and for people renting assets such as tractors and water haulers to farmers.

B.2.5 Crop variety in southern Lebanon

The relative proportion of land used for various crops differs widely between the seven *caza* of southern Lebanon, dictated by geography, irrigation and terrain. Crop types are divided into two groups: permanent crops, representing fruit trees including olives, citrus fruits and a wide variety of other fruit; and temporary crops (or field crops), which includes cereals, tobacco and others such as legumes, tubers and fruit-bearing vegetables.

Table B.1. Distribution of crops in southern Lebanon[56]

	Field crops				Permanent crops			
Area	Tobacco (%)	Cereals (%)	Other field crops(%) [1]	Total land (Hectares)	Olives (%)	Citrus (%)	Other fruit (%)[2]	Total land (Hectares)
Saida	4	39	57	3,348	28	52	20	9,110
Sour	32	49	19	3,809	49	40	11	10,320
Jezzine	7	50	43	259	51	5	44	2,511
S. Lebanon	**18**	**53**	**29**	**7,416**	**41**	**41**	**19**	**21,941**
Nabatieh	26	57	17	3,911	71	14	15	4,105
Bent Jbeil	65	31	4	2,855	86	0.5	13.5	3,044
Marjeyoun	24	66	10	4,218	87	10	3	3,646
Hasbaya	0.5	80.5	20	558	83	12	5	3,492
Nabatieh	**34**	**55**	**11**	**11,542**	**81.5**	**4.5**	**14**	**14,287**
Total	**28**	**54**	**18**	**18,958**	**57**	**36**	**7**	**36,228**

[1] For example, root vegetables, fruit-bearing vegetables, legumes etc

[2] For example, apples, pears, avocado, stone fruits, banana etc

Permanent crops make up approximately 65% of all agricultural land in use. The dominant crop, common in all *caza*, is olives, which accounts for over a half of all permanent crop land. Citrus fruits are also common, particularly along the coast where they represent more than 30% of all crops. Banana production is common along the coast between Tyre and Saida, and was widely observed to have increased in scope since the last agricultural survey.

Amongst field crops, cereal crops are the most common (wheat and barley), and are important throughout the south. Tobacco production, which is licensed, is particularly important in the *caza* of Nabatieh, Bint Jbeil, Marjeoun and Sour. A variety of other field crops, such as legumes, fruit-bearing vegetable, potatoes and so on, are also important in some *caza,* notably Saida and Jezzine.

B.2.6 Sale of agricultural products

The sale of agricultural products is quite fragmented, due largely to the small-scale of most agricultural holdings. There are a number of options for farmers seeking to sell products. These include direct sales through roadside stall, shops and local markets, sales through the wholesale markets in Nabatieh, Saida and Beirut, and sales to traders, some of whom may move crops to Beirut for processing and some of whom export crops to places such as Syria, Saudi Arabia and other locations. Farmers may use a combination of these options for selling products.

B.2.7 Seasonality and agricultural production

Various crops are planted, tended, harvested and sold at different times throughout the year. Planting of many field crops takes place between January and March, with harvesting in the summer and early autumn. Olives are harvested in October-November, whilst citrus fruits are harvested in either or spring or autumn, and bananas towards the end of the year.

Activity	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rainfall	Peak	Light								Light	Peak	Peak
Crop												
Tobacco	Sell		Transplant				Harvest/Dry/Bale					Sell
Citrus Fruits			Harvest		Irrigation/Tending				Harvest			
Olives										Harvest		
Bananas			Transplant									
Harvest												
Cereal Crops		Planting			Harvest							

The conflict in Lebanon took place at a critical time for the harvesting of tobacco crops, as well as other produce not identified specifically above, including potatoes and stone fruits. This resulted in a significant loss of income for farmers involved in the production of these crops, although no definitive figures exist with regards to the direct impact of the conflict on production levels.

The crop cycle identified above informed decision making by the UNMACC with regards to cluster munition clearance priorities, with resources directed to clear land around olive groves prior to and during the harvest period in October/November of 2006.[57]

Annex C: Methodology used in assessing land

C.1 Assessing land use in areas cleared, reported and databased

A key focus of the research activity undertaken was the production of a land use assessment of cluster munition contaminated areas. This assessment was based on analysis of information held within the Information Management System for Mine Action (IMSMA) database managed by the UNMACC for southern Lebanon.

All tasks that are completed, or that are started and then suspended, require a Completion or Suspension Report to be submitted to the UNMACC. These reports are completed using a standard format and contain precise details of the area cleared. These figures are entered into the IMSMA database, which then allows for polygons showing the area cleared to be displayed over a variety of maps. One of these maps consists of high-resolution satellite imagery, from which it is possible to determine the land use in terms of agricultural land, pasture land, housing and so on. Based on the imagery it is possible to make a reasonable judgement as to the type of crop being produced, although there are limitations to this as will be detailed below. In the following images cleared areas are shown displayed over satellite imagery.

The first image shows a detail from clearance site CBU-339 located in Sour *caza* near the village of Al-smaahieh. This clearance work was undertaken by MAG between September and November in 2006, and covered a total area of 39,600m². On this site it is estimated that 80% of the land is used for citrus production, 10% of the land for field crops and 10% is non-agricultural land (buildings, roads).

The second image shows clearance site CBU-466/467 located in the Sour *caza* near to the village of Jinnata. Clearance was conducted here between 2 February and 6 March 2007 by BACTEC International and covered a total area of 50,972m². The area cleared included residences (10%), olive groves (70%) and non-agricultural land (20%).

This methodology was applied to all 332 areas for which Completion or Suspension Reports have been submitted and entered into the IMSMA database. Confirmation of the methodology was achieved by cross-referencing land use designations based on satellite imagery to notes contained in the reports, which occasionally refer to the presence of specific types of crop within clearance sites. Additionally, a series of confirmation visits were also made to a selection of 18 cleared areas to assess the accuracy of the judgements. These visits showed that identification of crop types was accurate in all but one visit.

C.2 Assessing land use in suspect contaminated areas awaiting clearance

In addition to the 332 tasks that had been cleared, reported on and entered into the IMSMA database, there were approximately 480 tasks that were either completed but awaiting entry into the database, that were ongoing, or that were awaiting clearance. It was not possible to apply the methodology outlined above to these 480 tasks. Instead the tasks were divided across *caza* based on the existing coordinates recorded for the dangerous area reports in the IMSMA database. Using the average size of past clearance tasks in the respective *caza*, a total suspect area was estimated. The results of this assessment are presented in Table C1 below.

Table C1: Estimated tasks and area awaiting clearance by caza

Caza	Tasks to Date	Area cleared (m²)	Average site area (m²)	Estimated tasks outstanding	Estimated area outstanding (m²)
Sour	160	7,064,302	44,152	131	5,783,897
Saida	–	–	44,152	3	132,456
Nabatieh	32	1,592,335	49,760	159	7,911,915
Jezzine	–	–	49,760	38	1,890,880
Marjeyoun	44	1,807,467	41,079	33	1,355,600
Hasbaya	–	–	41,079	17	698,343
Bent Jbeil	96	5,283,631	55,038	99	5,448,744
Total	**332**	**15,747,735**	**47,433**	**480**	**23,221,836**

It was then assumed that the remaining suspect land would be comprised of different types of land (housing, agriculture, pasture land and so on) in similar proportions to that identified for sites that had already been cleared[58] and entered into the IMSMA database, with three adjustments:

- First, the proportion of housing was reduced by half in each *caza*, to account for the prioritisation of contaminated areas in villages and towns
- Second, the proportion of pasture/non-agricultural land has been doubled to allow for prioritisation of agricultural land in tasks already completed.
- Third, the amount of unidentified land is reduced to zero, as this reflects problems with the satellite imagery rather than any actual problem specifying land use for a given area.

The results of this assessment of the different types of land use in contaminated areas cleared and awaiting clearance are presented in detail in Annex D.

Although this land use assessment procedure for uncleared suspect areas is based on a series of estimations, the data on which it is based is taken from a significant number of actual clearance sites. This therefore provides a substantive empirical basis for the assumptions being made.

Annex D: Results of land use assessments

D.1. Results of land use assessment in cleared areas

The breakdown of land use in areas that had been cleared and for which reports had been submitted to the UNMACC is presented in Table D1 below.

Table D1: Land use in areas cleared and reported

Caza	Housing	Olive groves	Fruit trees	Banana plantation	Field crops	Pasture/non-agric. land	Unidentified	Total (m²)
Sour	407,222	1,112,254	3,192,218	301,166	1,145,332	805,576	100,534	**7,064,302**
	5.8%	15.7%	45.2%	4.3%	16.2%	11.4%	1.4%	**100%**
Nabatieh	217,119	484,236	19,400	0	640,164	217,745	13,671	**1,592,335**
	13.6%	30.4%	1.2%	0.0%	40.2%	13.7%	0.9%	**100%**
Marjeyoun	220,595	735,694	0	0	648,913	200,562	1,703	**1,807,466**
	12.2%	40.7%	0.0%	0.0%	35.9%	11.1%	0.1%	**100%**
Bent Jbeil	537,465	1,227,305	8,309	0	1,689,387	1,787,774	33,391	**5,283,631**
	10.2%	23.2%	0.2%	0.0%	32.0%	33.8%	0.6%	**100%**
Total (m²)	**1,382,401**	**3,559,490**	**3,219,927**	**301,166**	**4,123,797**	**3,011,658**	**149,299**	**15,747,735**
	8.8%	**22.6%**	**20.4%**	**1.9%**	**26.2%**	**19.1%**	**0.9%**	**100%**

The specific use of agricultural land can be estimated in more details based on statistics for production levels of various types of fruit and field crops in the 1998 agricultural survey, and captured in the *Atlas Agricole du Liban* of 2004:

Table D2. Breakdown of agricultural land in cleared areas by crop type

Caza	Area	Olive groves	Fruit trees (citrus)	Fruit trees (other)	Banana	Tobacco	Cereals	Other field crop	Total (m²)
Sour	m²	1,112,254	2,489,930	702,288	301,166	355,053	561,213	229,066	5,750,970
	Hectares	111.2	249.0	70.2	30.1	35.5	56.1	22.9	575.1
Nabatieh	m²	484,236	8,730	10,670	0	454,516	86,422	99,225	1,143,800
	Hectares	48.4	0.9	1.1	0.0	45.4	8.6	9.9	114.4
Marjeyoun	m²	735,694	0	0	0	159,633	430,878	58,402	1,384,607
	Hectares	73.6	0.0	0.0	0.0	16.0	43.1	5.8	138.5
Bent Jbeil	m²	1,227,305	0	8,309		1,087,959	528,775	72,643	2,924,992
	Hectares	122.7	0.0	0.8	0.0	108.8	52.9	7.3	292.5
Total	**m2**	**3,559,490**	**2,498,660**	**721,267**	**301,166**	**2,057,161**	**1,607,288**	**459,337**	**11,204,369**
	Hectares	**355.9**	**249.9**	**72.1**	**30.1**	**205.7**	**160.7**	**45.9**	**1,120.4**

D.2. Results of land use assessment in suspect contaminated areas awaiting clearance

The breakdown of land use in areas that had not yet been cleared and databased but are considered as suspect and recorded as Dangerous Areas in the IMSMA database was as follows:

Table D3: Estimated land use in suspect contaminated areas

Caza	Housing	Olive groves	Fruit trees	Banana plantation	Field crops	Pasture/non-agric. land	Total
Sour	138,814	838,665	2,400,317	225,572	861,801	1,318,729	5,783,897
	2.4%	14.5%	41.5%	3.9%	14.9%	22.8%	100%
Saida	3,179	19,206	54,969	5,166	19,736	30,200	132,456
	2.4%	14.5%	41.5%	3.9%	14.9%	22.8%	100%
Nabatieh	538,010	2,207,424	87,031	0	2,911,585	2,167,865	7,911,915
	6.8%	27.9%	1.0%	0.0%	36.9%	27.4%	100%
Jezzine	128,580	527,556	20,800	0	695,844	518,101	1,890,880
	6.8%	27.9%	1.0%	0.0%	36.9%	27.4%	100%
Marjeyoun	82,692	516,484	0	0	455,482	300,943	1,355,600
	6.1%	38.0%	0.0%	0.0%	33.6%	22.2%	100%
Hasbaya	42,599	266,069	0	0	234,643	155,032	698,343
	6.1%	38.0%	0.0%	0.0%	33.6%	22.2%	100%
Bent Jbeil	277,886	1,008,018	0	0	1,400,327	2,762,513	5,448,744
	5.1%	18.5%	0.0%	0.0%	25.7%	50.7%	100%
Total	**1,211,759**	**5,383,421**	**2,563,117**	**230,738**	**6,579,417**	**7,253,383**	**23,221,836**
	5.2%	**23.2%**	**11.0%**	**1.0%**	**28.3%**	**31.2%**	**100%**

As outlined above, the agricultural land can be further broken down based on the 1998 agricultural survey:

Table D4. Breakdown of agricultural land in suspect contaminated areas by crop type

Caza	Area	Olive groves	Fruit trees (citrus)	Fruit trees (other)	Banana	Tobacco	Cereals	Other field crop	Total
Sour	m²	838,665	1,872,248	528,070	225,572	273,191	422,282	166,328	4,326,355
	Hectares	83.9	187.2	52.8	22.6	27.3	42.2	16.6	432.6
Saida	m²	19,206	39,578	15,391	5,166	691	7,736	11,309	99,077
	Hectares	1.9	4.0	1.5	0.5	0.1	0.8	1.1	9.9
Jezzine	m²	527,556	2,080	18,720	0	49,405	349,314	297,125	1,244,199
	Hectares	52.8	0.2	1.9	0.0	4.9	34.9	29.7	124.4
Nabatieh	m²	2,207,424	40,905	46,126	0	768,658	1,636,311	506,616	5,206,040
	Hectares	220.7	4.1	4.6	0.0	76.9	163.6	50.7	520.6
Marjeyoun	m²	516,484	0	0	0	112,048	302,440	40,993	971,965
	Hectares	51.6	0.0	0.0	0.0	11.2	30.2	4.1	97.2
Hasbaya	m²	266,069	0	0	0	0	187,245	47,398	500,712
	Hectares	26.6	0.0	0.0	0.0	0.0	18.7	4.7	50.1
Bent Jbeil	m²	1,008,018	0	0	0	901,811	438,302	60,214	2,408,345
	Hectares	100.8	0.0	0.0	0.0	90.2	43.8	6.0	240.8
Total	**m²**	**5,383,421**	**1,954,810**	**608,307**	**230,738**	**2,105,804**	**3,343,631**	**1,129,983**	**14,756,694**
	Hectares	**538.3**	**195.5**	**60.8**	**23.1**	**210.6**	**334.4**	**113.0**	**1,475.7**

Annex E: The relationship between land contamination and land denial

E.1 Sources of information regarding land use

A number of sources have been identified in an effort to try and quantify the level of land use in cluster munition contaminated areas since August 2006. These are as follows:

a. UNMACC Post-Clearance Assessments

b. MAG Community Liaison Data

c. Direct Field Research

d. Analysis of Suspension/Completion Reports

e. Mine Action Operators

The information gathered from each of these sources, and the key observations and findings with regard to use of contaminated land, are presented below.

- *UNMACC Post-Clearance Assessment:* The UN coordination centre in southern Lebanon has recently commenced a project to assess the impact of cluster munition clearance activities. This has followed on from previous efforts to assess the impact of minefield clearance, and has adapted some of the same forms and methodology for conducting the assessment. By using a combination of village data and information regarding individual cleared areas, the assessment identifies issues such as key local development needs, confidence in the use of cleared land, change in the use of land from before and after clearance, and any reasons that people are choosing not to use cleared land. The assessment also attempts to determine if land was being used prior to clearance taking place.

  As of March 2008, the assessment process had interviewed 20 landowners whose land had been subject to clearance activities. Of those, only 2 had been using contaminated land prior to clearance taking place. It should be noted that the land belonging to these landowners had been cleared shortly after the end of hostilities.

- *MAG Community Liaison Data:* MAG is an international mine action agency and has been working in southern Lebanon since 2002. A key part of MAG's work is the assessment of contaminated areas prior to clearance by community liaison teams in order to prioritise according to needs.

  The MAG CL teams provided detailed information on two contaminated villages in Nabatieh (Zawtar West and Adhseet). Both of these locations had multiple cluster munition strikes, with 43 identified contaminated areas in total. Of these, only 11 have been cleared as of March 2008. Figures from MAG village assessments indicate the following with regards to 32 sites that have not yet been cleared:

  - In 16 of the suspect contaminated areas, only a small proportion of the area is being used. This almost certainly reflects local knowledge regarding the actual extent of the contaminated area;
  - Land use in is above 50% on 9 of the 32 sites, all but one of which are used for a variety of agricultural activities (tobacco, wheat, olives);
  - On all 26 sites where there is any land use at all, 17 are used for agriculture, 5 are used for a combination of agriculture and housing, and 3 are used for housing, and 1 is used for resource collection.

These figures indicate that land use in suspect areas is frequently based on a local assessment regarding the precise area contaminated by submunitions, and is driven by need. Where people are using only a small part of the land it is often for housing, with the remaining land that would normally be used for agricultural production remaining untouched. On sites where land is being used for agricultural activities, very few are using a large percentage of the suspect area, and are therefore almost certainly using a particular area that they have determined to be free of cluster munitions.

It should be noted that the initial suspect areas are very rough estimation based on the early emergency survey conducted immediately after the conflict in 2006. More precise boundaries of the suspect area are established following a comprehensive technical reconnaissance and subsequent development of a clearance plan. This often relies on information gathered from farmers regarding the locations in which they have seen cluster munitions. In areas where only part of the land is being used, it suggests very strongly that producers have assessed where they consider to be safe and have placed only this land in use.

Based on these figures, there are only 8 sites out of 32, or 25%, that show high levels of land use in suspect areas. It is likely that these producers have decided to taken the decision to use contaminated land and adopted one or more of the coping strategies identified above to mitigate and manage the risk.

- *Direct Research and Interviews:* The third source of information regarding land use in contaminated areas comes from interviews conducted with agricultural producers during field research conducted in March/April 2008. A total of 14 farmers whose land was suspected to be contaminated by cluster munitions were interviewed in a number of contaminated areas in Nabatieh, Sour and Bent Jbeil. Clearance was underway on 3 of these sites at the time of the interviews. The main findings from these interviews were as follows:
    - Four producers confirmed that they were using land prior to clearance being conducted;
    - Two other producers were using part of the land after identifying which areas contained submunitions and avoiding that part of land. One other had started using land after the LAF had removed some munitions, despite knowing that there could be more on the site;
    - The remaining seven farmers were not using the suspect land and were awaiting clearance.

The farmers that had decided not to use land all indicated an alternative source of income, whether it was remittances from close relatives, the availability of other land that was not contaminated or the ability to engage in other income generating activities, including working as labourers on other farms.

Although based on a limited sample, this research indicates that land use in known contaminated areas took place in 28% of cases. These farmers had engaged in a variety of methods to reduce the risk, including payment of labourers to remove munitions from orange groves and reporting munitions on a case-by-case basis as they were identified.

- *Analysis of Suspension / Completion Reports:* A fourth source of information regarding land use in contaminated areas is that contained in the Completion Reports used by the UNMACC to collect final data on clearance tasks. In these reports there are frequent indications as to whether some or all of the land was in use at the time of clearance, and for what purpose. On many of these tasks the owner indicates a refusal to allow clearance activities to take place, usually due to the damage that will be sustained to crops that have been planted, referred to as “disclaimed land”. In this case the owner will be required to sign a formal letter indicating they accept the risk of submunitions being found in that area. The area is mapped as part of the Completion Report using GPS and distance and bearing measurements, and entered into the GIS-IMSMA database.

  Of the 332 clearance sites that have been entered into the database, 5.8% contained areas of “disclaimed land”. This figure represents the minimum number of sites on which agricultural production was taking place either prior to or during clearance activities. It is very likely that other producers, particularly those with olive groves or orchards, would permit clearance as the clearance process would be unlikely to impact on these types of crops in the same way that it does on field crops such as tobacco or wheat.

- *Mine Action Operators:* A final source of information regarding land use in contaminated areas are the agencies involved in cluster munition clearance. A total of seven international agencies were conducting clearance at the time of the field research, and all indicated they had worked on sites where agricultural activities were taking place prior to and during clearance operations. It was reported that close coordination with farmers was required on these sites with regard to where clearance activities took place in relation to any specific agricultural activities, such as pruning, spraying, ploughing and so on, throughout the time spent on site. All clearance operators indicated that use of contaminated land had increased over time. There was some indication that use of contaminated land was more prevalent in the larger citrus orchards and banana plantations in the coastal area around Tyre. Estimates on how many sites had producers engaged in some form of activity at the time clearance started ranged from 30% to 60%.

E.2 Estimated rates of deliberate land use in contaminated areas

Based on the information identified above regarding land use in contaminated areas, it is possible to make two key assertions:

- Firstly, on many suspect contaminated sites that remain uncleared, land is in partial use based on a combination of need (particularly with reference to housing) and an assessment of the actual suspect area by the land user. This type of land use cannot be considered as use of contaminated land in the same way as land use across entire areas that are contaminated, and in which the user is required to adopt a method for dealing with unexploded munitions as they are encountered;
- Secondly, such land use, in confirmed contaminated areas, has increased over time for a variety of reasons.

Based on the information sources, it is possible to provide an estimate for deliberate use of contaminated land in southern Lebanon. For the purposes of this report land use in contaminated areas will be assumed to have taken place within the following ranges during each period:

Period	Estimated access of contaminated land – lower limit	Estimated access of contaminated land – upper limit
September 2006 – March 2007	5%	15%
March 2007 – June 2009	15%	30%

It is important to note that although cluster munitions do not always cause land denial, this is only because land users are prepared to accept risks in order to undertake agricultural activities. They are accepting these risks in part due to a lack of viable alternatives for income generation, and in doing so are living with far greater levels of psychological stress than would normally be the case. All know that any accidents that subsequently occur will have significant personal, financial and social implications for the victim and their families.

Annex F: Price and yield estimates for various crops

The output and price estimates for the primary crops produced in southern Lebanon are based on the publication Agricultural Statistics: Lebanon 2005, produced annually by the Ministry of Agriculture with the support of the FAO. Information has also been cross-referenced to other sources where appropriate and as indicated, as well as with information provided by producers and key informants during interviews.

F.1 Field crops

Table F1. Average yield and prices for main types of field crops (2005)

Field crops	Price (US$ / kg)	Tons produced	Hectares	Yield / hectare (kg)	Value / hectare
Wheat	0.26	143,700	49,543	2,901	US$754
Barley	0.17	29,000	14,524	1,997	US$339
Other cereals	0.34	1,600	1,102	1,452	US$494
Tobacco	6.80	9,000	9,000	1,000	US$6,800
Legumes	0.42	35,500	7,148	4,966	US$2,086
Root vegetables	0.15	586,300	23,512	24,936	US$3,740
Fruit bearing veg.	0.30	538,100	12,664	42,491	US$12,747
Leafy vegetables	0.19	159,900	5,902	27,093	US$5,148
Industrial crops	0.09	81,000	1,827	44,335	US$3,990

F.2 Olive groves

Olive production is widespread in southern Lebanon, and results in two products, olive oil and table olives. Actual yields can vary greatly depending on the age of the tree, with more mature trees (25 years or older) giving the greatest amount of produce. Yields are also cyclical, with output in odd years more than half that of output in even years.

The table below gives details for olive production. The information regarding total output, land under production and price per k.g. for table olives has been taken from the Agricultural Statistics of 2005. However the price for olive oil is based on figures indicated in a joint publication by Association for Forests, Development and Conservation (AFDC) and the UNDP, War Impact on Forest resources and olive groves in southern Lebanon. This indicates that value per hectare of olive production when pressed for oil is US$11,200 in high-yield years.

Table F2. Average yield and prices for olive groves (2005)

Olive groves	Price (US$ / kg)	Tons produced	Hectares	Yield / hectare (kg)	Value / hectare
Olives					
Low-yield years	0.99	76,500	58,750	1,302	US$1,289
High-yield years	0.99	167,300	58,750	2,848	US$2,819
Olive oil					
Low-yield years	3.93	76,500	58,750	1,302	US$5,117
High-yield years	3.93	167,300	58,750	2,848	US$11,191

The AFDC report estimates that 70% of all olive production is used for the production of olive oil, and the remainder for table olives.[59] Given this, we can estimate that the value per hectare of olive production is US$3,968 in low-yield years and US$8,694 in high-yield years. These figures regarding levels of olive oil production, total yields and estimated losses are in line with information obtained during interviews with olive producers conducted during field research.

F.3 Fruit trees (permanent crops)

Orchard-based production of a wide variety of fruits takes place in Lebanon. Southern Lebanon is dominated by production of citrus fruits and bananas, but other fruits area also produced in smaller quantities. The table below is taken from the Agricultural Statistics of 2005, and indicates aggregated outputs and land under production for various crops. As with field crops, these categories include a variety of specific fruits, the price of which can vary significantly. An average price has been calculated that reflects the total value of production in that category.

Table F3. Average yield and prices for fruit crops (2005)

Fruit trees	Price (US$ / kg)	Tons produced	Hectares	Yield / hectare (kg)	Value / hectare
Citrus fruits	US$0.28	392,000	16,488	23,775	US$6,657
Bananas	US$0.49	81,200	2,800	29,000	US$14,297
Other fruits	US$0.53	370,600	43,829	8,456	US$4,481

Unlike other crops, total yields and prices for citrus fruits are significantly lower than those indicated during interviews with citrus producers during the course of the research. For the purposes of this research, however, the figure above, based on official production statistics, has been retained when calculating total production and financial losses.

Annex G. Production losses due to cluster munition contamination by *caza*

As presented in the main body of the report, agricultural losses due to cluster munition contamination are estimated to range between US$22,602,221 and US$26,815,997. This figure represents losses that have been incurred since the conflict to date, and the projected losses that will continue to be incurred until the clearance process is completed.

In this section losses are presented broken down by *caza*, showing lost agricultural production in both areas that have been cleared, and in areas that are suspected of being contaminated and awaiting clearance.

G.1 Sour

Table G1. Estimated agricultural losses in confirmed and suspect contaminated areas in Sour (2006–2009)

Year	Status	Estimated loss – lower (US$)	Estimated loss – upper (US$)
2006	Cleared areas	2,888,021	3,261,158
	Suspected	2,173,003	2,454,330
	Subtotal	**5,061,024**	**5,715,489**
2007	Cleared areas	1,576,531	1,914,359
	Suspected	1,715,391	2,082,975
	Subtotal	**3,291,922**	**3,997,334**
2008	Suspected	1,371,064	1,664,864
2009	Suspected	36,814	44,703
	Total	**9,760,824**	**11,422,388**

G.2 Saida

Table G2. Estimated agricultural losses in suspect contaminated in Saida (2006–2009)

Year	Status	Estimated loss – lower (US$)	Estimated loss – upper (US$)
2006	Suspected	48,464	54,166
2007	Suspected	38,549	46,810
2008	Suspected	33,557	40,748
2009	Suspected	4,554	5,530
	Total	**125,125**	**147,254**

G.3 Jezzine

Table G3. Estimated agricultural losses in suspect contaminated areas in Jezzine (2006–2009)

Year	Status	Estimated loss – lower (US$)	Estimated loss – upper (US$)
2006	Suspected	401,517	453,361
2007	Suspected	315,644	383,282
2008	Suspected	355,962	432,240
2009	Suspected	27,233	33,068
	Total	**1,100,357**	**1,301,951**

G.4 Nabatieh

Table G4. Estimated agricultural losses in confirmed and suspect contaminated areas in Nabatieh (2006–2009)

Year	Status	Estimated loss – lower (US$)	Estimated loss – upper (US$)
2006	Cleared areas	397,826	487,305
	Suspected	1,723,963	1,999,068
	Subtotal	**2,121,789**	**2,486,373**
2007	Cleared areas	339,527	412,282
	Suspected	1,298,066	1,576,223
	Subtotal	**1,637,592**	**1,988,505**
2008	Suspected	1,468,484	1,783,159
2009	Suspected	110,802	134,545
	Total	**5,338,667**	**6,392,582**

G.5 Marjeyoun

Table G5. Estimated agricultural losses in confirmed and suspect contaminated areas in Marjeyoun (2006–2009)

Year	Status	Estimated loss – lower (US$)	Estimated loss – upper (US$)
2006	Cleared areas	554,777	635,084
	Suspected	388,935	445,220
	Subtotal	**943,711**	**1,080,304**
2007	Cleared areas	196,658	238,799
	Suspected	214,728	260,742
	Subtotal	**411,386**	**499,541**
2008	Suspected	319,209	387,611
2009	Suspected	11,400	13,843
	Total	**1,685,707**	**1,981,299**

G.6 Bent Jbeil

Table G6. Estimated agricultural losses in confirmed and suspect contaminated areas in Bent Jbeil (2006–2009)

Year	Status	Estimated loss – lower (US$)	Estimated loss – upper (US$)
2006	Cleared areas	983,772	1,201,782
	Suspected	806,238	985,877
	Subtotal	**1,790,010**	**2,187,659**
2007	Cleared Areas	721,955	876,660
	Suspected	754,408	916,067
	Subtotal	**1,476,364**	**1,792,727**
2008	Suspected	809,300	982,722
2009	Suspected	80,387	97,612
	Total	**4,156,060**	**5,060,720**

G.7 Hasbaya

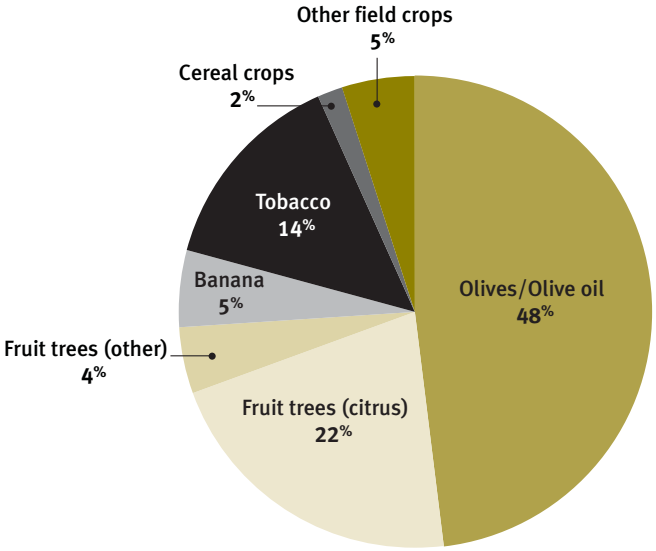
Table G7. Estimated agricultural losses in suspect contaminated areas in Hasbaya (2006–2009)

Year	Status	Estimated loss – lower (US$)	Estimated loss – upper (US$)
2006	Suspected	196,571	219,697
2007	Suspected	101,981	123,834
2008	Suspected	131,726	159,953
2009	Suspected	5,204	6,319
	Total	**435,482**	**509,803**

Annex H. Production losses due to cluster munition contamination by crop

This annex presents a detailed breakdown of the total estimated agricultural losses by main crop types produced in southern Lebanon. A key element in determining losses for any given crop is the time when land was or is projected to be cleared in relation to the agricultural season. For example, if an area of land used for tobacco production is cleared after April in any given year, the crop for that year cannot be planted. Based on dates on which cleared areas were completed, and on projected dates for clearance of suspect land, we can estimate how many seasons for any given crop have been lost.

Graph H1. Estimated distribution of agricultural production losses by crop type (2006–2009)



The breakdown of losses by crop in terms of year and whether losses have been assessed as being on land already subject to clearance, or on land awaiting clearance, is provided below.

H.1 Olive production

It is assumed that despite the rapid establishment of clearance operations, the entire olive harvest of 2006 was lost in contaminated areas, allowing for the percentage of producers who chose to access contaminated land. Olive yields vary from year to year, and 2006 was expected to be a high-yield year, 2007 a low-yield year, 2008 a high yield year and so on.

Table H1. Estimated losses in olive production due to cluster munition contamination (2006–2009)

Year	Status	Estimated loss – lower (US$)	Estimated loss – upper (US$)
2006	Cleared areas	2,630,065	2,939,485
	Suspected	3,977,736	4,445,705
	Subtotal	**6,607,801**	**7,385,189**
2007	Cleared areas	539,965	655,672
	Suspected	1,495,089	1,815,465
	Subtotal	**2,035,054**	**2,471,138**
2008	Suspected	2,195,148	2,665,537
2009	Suspected	0	0
	Total	**10,838,004**	**12,521,864**

H.2 Fruit trees (citrus)

The process for calculating losses in citrus fruit production is similar to that for olive production. It can be assumed that the total harvest of 2006 was lost due to cluster munition contamination, excluding those areas that were deliberately accessed. The total estimated losses for citrus fruits range from US$4.8 million to US$5.6 million, almost all of which were in Sour.

Although citrus fruits represent approximately 25% of total agricultural losses, in Sour they account for almost 50% of all lost production in the period 2006–2009.

Table H2. Estimated losses in citrus fruit production due to cluster munition contamination (2006–2009)

Year	Status	Estimated loss – lower (US$)	Estimated loss – upper (US$)
2006	Cleared areas	1,414,047	1,580,405
	Suspected	1,105,235	1,235,263
	Subtotal	**2,519,282**	**2,815,668**
2007	Cleared areas	832,258	1,010,599
	Suspected	910,078	1,105,095
	Subtotal	**1,742,337**	**2,115,694**
2008	Suspected	609,515	740,125
2009	Suspected	0	0
	Total	**4,871,134**	**5,671,488**

H.3 Fruit trees (other)

Fruits other than citrus fruits, such as apples, pears, pomegranates and so on represent only a small part of total losses in southern Lebanon. As with citrus fruits, the majority of these losses are concentrated in Sour.

Table H3. Estimated losses in other fruit production due to cluster munition contamination (2006-2009)

Year	Status	Estimated loss – lower (US$)	Estimated loss – upper (US$)
2006	Cleared areas	274,618	306,926
	Suspected	232,366	259,704
	Subtotal	**506,985**	**566,630**
2007	Cleared areas	164,677	199,965
	Suspected	191,339	232,340
	Subtotal	**356,015**	**432,304**
2008	Suspected	128,291	155,782
2009	Suspected	0	0
	Total	**991,291**	**1,154,716**

H.4 Banana plantations

Although the number of banana plantations confirmed as being contaminated by cluster munitions is low, it is included here for three reasons: firstly, unlike other fruit crops, it is relatively easy to distinguish banana plantations on satellite imagery from other types of crop; secondly, it represents a relatively high value crop and therefore total losses are estimated at more than for other non-citrus fruits together; thirdly, it is highly likely that a greater number of banana plantations were impacted than estimated due to the change in land use since the satellite imagery was produced These figures therefore represent a low-end estimate with regards to losses in banana production in 2006–2009.

Table H4. Estimated losses in banana production due to cluster munition contamination (2006–2009)

Year	Status	Estimated loss – lower (US$)	Estimated loss – upper (US$)
2006	Cleared areas	365,789	408,823
	Suspected	280,201	313,166
	Subtotal	**645,990**	**721,989**
2007	Cleared areas	164,130	199,300
	Suspected	231,182	280,722
	Subtotal	**395,312**	**480,022**
2008	Suspected	156,123	189,578
2009	Suspected	0	0
	Total	**1,197,425**	**1,391,589**

H.5 Field crops – tobacco

It is important to note that the 2006 crop of tobacco was due to be harvested at the time of the conflict. Lost tobacco production in that year is predominantly due to disruption caused by the conflict itself, as opposed to the subsequent post-conflict impact of cluster munitions. Many tobacco plants died in the heat at the time when they should have been collected and dried.

However a number of tobacco farmers indicated that they would have been able to harvest at least some of their crop in 2006 if cluster munitions had not been present. Given that for many tobacco farmers the harvesting is undertaken by the entire family, including children, there may have been an understandable reluctance to engage in this activity.

This report therefore considers that at least a proportion of the total contaminated tobacco land could have been harvested immediately following the conflict, were it not for the presence of cluster munitions. A minimum figure of 10% and a maximum of 25% have been used to as the proportion of the loss due to cluster munitions in 2006 as opposed to the conflict itself.

Table H5. Estimated losses in tobacco due to cluster munition contamination (2006-2009)

Year	Status	Estimated loss – lower (US$)	Estimated loss – upper (US$)
2006	Cleared areas	139,876	349,690
	Suspected	143,153	357,882
	Subtotal	**283,029**	**707,572**
2007	Cleared areas	892,500	1,083,750
	Suspected	1,001,980	1,216,690
	Subtotal	**1,894,480**	**2,300,440**
2008	Suspected	841,568	1,021,904
2009	Suspected	169,932	206,346
	Total	**3,189,009**	**4,236,262**

H.6 Field crops – cereal

The cereal crop in Lebanon is dominated by wheat, with barley also being grown in reasonable quantities. It is assumed that the majority of the 2006 crop had been harvested prior to the conflict and that there was no impact from either the war itself or cluster munition contamination. In 2007 to 2009, however, losses are estimated to range from US$377,000 to US$459,000.

Table H6. Estimated losses in cereal crop due to cluster munition contamination (2006–2009)

Year	Status	Estimated loss – lower (US$)	Estimated loss – upper (US$)
2006	Cleared areas	0	0
	Suspected	0	0
	Subtotal	**0**	**0**
2007	Cleared areas	67,683	82,187
	Suspected	154,413	187,502
	Subtotal	**222,096**	**269,689**
2008	Suspected	129,360	157,080
2009	Suspected	26,149	31,753
	Total	**377,606**	**458,521**

H.7 Field crops – other vegetables

The final field crop category represents a mixture of various root vegetables, fruit-bearing vegetables, legumes and so on. Although only a small proportion of production, it represents an important source of income for farmers as it diversifies agricultural products, and many of the crops produce have high sales values, such as beans, lentils, spinach and tomatoes. This type of production is also a common source of personal produce for household use.

Table H7. Estimated losses in other field crops due to cluster munition contamination (2006–2009)

Year	Status	Estimated loss – lower (US$)	Estimated loss – upper (US$)
2006	Cleared areas	0	0
	Suspected	0	0
	Subtotal	**0**	**0**
2007	Cleared areas	173,458	210,627
	Suspected	454,686	552,118
	Subtotal	**628,143**	**762,745**
2008	Suspected	429,297	521,290
2009	Suspected	80,312	97,522
	Total	**1,137,753**	**1,381,557**

Annex I. Economic losses due to cluster munition contamination for individual producers

Whilst the total scale of the financial losses can be assessed, it is important to remember the human dimension of this lost income. Based on the average size of land holdings in different *caza* as reported in the *Atlas Agricole du Liban* an estimate can be made of the number of producers affected, and of the scale of their losses.

The first table (I1) shows average losses for producers in areas where land has already been subject to clearance and handed over and the second table (I2) shows average losses for producers in areas still awaiting clearance.

In total, some 3,105 producers are estimated as having been affected at an average loss per producer of around US$8,000.

Table I1. Estimated losses by agricultural producer in cleared areas

Caza	Average land holding per user (hectares)	Estimated agricultural land contaminated (m²)	Agricultural producers affected	Total losses per producers – lower (US$)	Total losses per producers – upper (US$)
Sour	1	5,750,970	575	7,763	8,999
Saida	1.1	–	–	–	–
Jezzine	0.6	–	–	–	–
Nabatieh	0.7	1,143,800	163	4,513	5,505
Bent Jbeil	0.8	2,924,992	366	4,665	5,685
Marjeyoun	1	1,384,607	138	5,427	6,311
Hasbaya	0.7	–	–	–	–
	Total	**11,204,369**	**1,243**	**(Avg.) 6,164**	**(Avg.) 7,265**

Table I2. Estimated losses by agricultural producer in suspect contaminated areas

Caza	Average land holding per user (hectares)	Estimated agricultural land contaminated (m²)	Agricultural producers affected	Total losses per producers – lower (US$)	Total losses per producers – upper (US$)
Sour	1	4,326,355	433	12,242	14,439
Saida	1.1	99,077	9	13,892	16,349
Jezzine	0.6	1,244,199	207	5,306	6,279
Nabatieh	0.7	5,206,040	744	7,178	8,595
Bent Jbeil	0.8	2,408,345	301	5,666	6,904
Marjeyoun	1	971,965	97	7,731	8,991
Hasbaya	0.7	500,712	72	6,088	7,127
	Total	**14,756,694**	**1,862**	**(Avg.) 8,023**	**(Avg.) 9,551**

Clearly a wide range of factors will influence the actual losses sustained by any given agricultural producer, including size of holding, type of crop grown, the time the area is cleared and the willingness of the producer to engage in deliberate use of suspect land. For comparison, the average GDP per capita in Lebanon for 2006 was US5,300. These losses clearly represent a significant loss of income and livelihood for individual agricultural producers.

Annex J. Expended, allocated and required funding for cluster munition related activities

Based on a variety of sources, the following table identifies the funding provided by the international donor community in support of mine action operations in the period following the end of the conflict and 2007.

Table J1: Funds provided for mine action activities 2006–2007[60]

Donor	Amount (US$)	Activity
Belgium	954,788	Reconnaissance
EC	8,081,990	UXO clearance
France	158,540	Equipment, training, MRE
Norway	2,248,979	UXO clearance
Slovenia	88,920	Mine action, coordination
Spain	157,037	UXO clearance
Sweden	3,419,640	UXO clearance
UAE	19,881,982	CM clearance
USA	11,061,000	UXO clearance, MRE, MVA, mapping
Poland	1,270,000	Equipment
Australia	385,800	UXO clearance
Australia	814,400	UXO clearance
Austria	526,920	UXO clearance, MRE, MVA
Canada (CIDA)	1,123,192	Rapid response plan
Canada (DFAIT)	1,377,648	UXO clearance
Chile	50,000	Un-earmarked
Czech Republic	94,616	UXO clearance
Denmark	967,199	UXO clearance
Denmark	996,818	UXO clearance
Estonia	25,042	UXO clearance
Finland	1,323,500	UXO clearance
Germany	1,000,000	UXO clearance
Ireland	250,000	UNMAS mine action
Italy	2,625,600	Rapid Response Plan
Luxemburg	128,140	Rapid Response Plan
Netherlands	5,000,000	UXO clearance, QA coordination
New Zealand	661,863	UXO clearance
Spain	300,000	Un-earmarked
Switzerland	499,975	UXO clearance
UAE	1,500,000	QA, coordination
UK	468,075	Rapid response plan
UK	200,000	Rapid response plan
UK	1,910,100	Early recovery plan
UK	1,961,500	UXO clearance
USA	2,000,000	Rapid response plan
UNIFIL/DPKO	2,413,205	Coordination, Info management
UNIFIL/DPKO	2,644,575	Coordination, Info management
UNOCHA	100,000	Un-earmarked
HSTF/Japan	998,250	UXO clearance and post clearance development
HSTF/Japan	921,865	UXO clearance and post clearance development
Total	**80,591,159**	

Table J2: Funds requested for mine action activities 2008[61]

Requesting agency	Amount requested (US$)	Project reference	Project title
United Nations Mine Action Service (UNMAS)	1,822,792	PO6-LE03	Coordination, quality assurance of mine, and unexploded ordnance clearance, South Lebanon
UNMAS, Lebanese Mine Action Centre, Clearance Organisations	9,272,236	PO7-LE01	Continuation of operational clearance capacities in South Lebanon
Handicap International	2,600,000	PO8-LE01	Battle area clearance in South Lebanon
Norwegian Peoples Aid	2,003,097	PO8-LE02	Battle area clearance in South Lebanon
DanChurchAid	2,312,091	PO8-LE04	Humanitarian mine action in conflict-affected areas in southern Lebanon
Swiss Demining Federation	2,216,467	PO8-LE05	Integrated mine clearance and developmental activities in Lebanon
UN Mine Action Service (UNMAS)	739,156	PO6-LE04	Freedom from fear: Community empowerment to end the threat of cluster munitions
UNICEF	101,333	P07-LE03	Mine risk education and victim assistance programme in Lebanon
Norwegian Peoples Aid	153,846	PO7-LE06	Mine risk education and victim assistance programme in Lebanon
Mines Advisory Group	5,533,505	PO8-LE03	Conflict recovery programme for Lebanon
Philanthropic Association for Disabled Care (PADC)	57,000	P07-LE07	Mine risk advocacy and mine victims rehabilitation programme
Handicap International	450,000	P08-LE08	Support to people with disabilities in areas affected by the war
Total	**27,261,523**		

For projects covering victim assistance and mine risk education, a proportion of the total project value has been indicated in the table above to represent the approximate amount that may be required for activities specific to cluster munition contamination and victims of cluster munitions.

Finally, the following funds have been identified as having been provided for activities in 2008.

Table J3: Funds allocated for mine action activities 2008[62]

Donor	Amount (US$)	Activity
Australia	843,900	UXO clearance
UK	500,000	Un-earmarked
Canada (CIDA)	977,283	UXO clearance
Canada (DFAIT)	1,788,782	UXO clearance, coordination
Canada (DFAIT)	2,119,742	UXO clearance, coordination
Denmark	1,000,000	UXO clearance
South Korea	100,000	Un-earmarked
Italy	1,462,400	Un-earmarked
Kingdom of Saudi Arabia	500,000	UXO clearance
Netherlands	145,855	Chief of QA
Switzerland	256,410	UXO clearance
South Korea	100,000	Un-earmarked
Czech Republic	55,800	UXO clearance
Total	**9,850,172**	

It is assumed that these funds are allocated against projects listed in the 2008 portfolio above, leaving an additional US17,4113,351 in funding requirements. Assuming that these funds have been or will be secured, the total cost of cluster munition clearance, coordination, quality assurance and risk education activities for the period 2006–2008 will amount to US107,852,682. If, as has been predicted, clearance activities are required to continue until mid–2009 to be completed, a further US12,500,000 may be required. Total confirmed and projected expenditure on cluster munition clearance, not including expenditure allocated by the Government of Lebanon itself, is therefore estimated at just over US120 million.

Notes

1 See Annex A for a complete list of information sources regarding cluster munition use in Lebanon.

2 *Rebuilding Lebanon Together... 100 days after.* Government of Lebanon (2006) Presented by Prime Minister Siniora on 21 November 2006.

3 *"Rebuilding Lebanon Together...100 days after – Damage and Reconstruction Figures".* Government of Lebanon, October 2006. (GoL 2006b).

4 *Setting the Stage for long term reconstruction: The national early recovery process.* Stockholm Conference for Lebanon's Early Recovery, August 2006. Government of Lebanon (GoL 2006a)

5 EC (European Commission), 2006a. *Lebanon 34 Day War: Fact finding mission and preliminary damage assessment.* October 2006

6 World Bank, 2006a. *Lebanon. Economic and Social Impact Assessment from Recovery to Sustainable Growth.* Volume 2. Sectoral Analysis. Social and Economic Development Group. Middle East and North Africa Region. World Bank.

7 For an more information see Human Rights Watch, *Flooding South Lebanon: Israel's Use of Cluster Munitions in Lebanon in July and August 2006,* Human Rights Watch, New York. (2007)

8 See for general discussion Landmine Action (2006), *Failure to protect: A case for the prohibition of cluster munitions.*

9 In Lebanon the Lebanese Mine Action Centre estimates that between 2.6 and 4 million submunitions may have been utilised by both aerial bombing and ground-based artillery and rocket fire. In comparison, US and UK forces dropped approximately 234,000 submunitions on Kosovo in 1999. Southern Lebanon covers an area of approximately 2,020 km², equivalent to less than a fifth of the size of Kosovo.

10 pp.39-42, *Flooding South Lebanon: Israel's use of cluster munitions in Lebanon in July and August 2006,* Human Rights Watch (2007). It is noted in this report that olive groves and citrus orchards were deliberately targeted as they were frequently used as launch sites by Hezbollah.

11 155 out of the 197, or 79%, of confirmed victims of cluster munitions occurred in the initial five months following the end of hostilities according to information held on the UNMACC Mine Victim Database.

12 UNMACC Quarterly Report (January – March 2008). The UNMACC assumes an average area of approximately 40,000m² per confirmed strike location when estimating Total contaminated land.

13 Figures provided by Rana Elias, IMSMA Programme Officer, UNMACC South Lebanon, 1 May 2008

14 "Duplicated" refers to CBU strike sites that have been cleared as part of another clearance site. Some tasks comprised two or more CBU strike sites.

15 Interview with Tekimiti Gilbert, Chief of Operations, UNMACC. 14 April 2008.

16 *Lebanon: Post-conflict Environment Assessment,* United Nation Environment Programme (January 2007)

17 *Damage and Early Recovery Needs Assessment of Agriculture, Fisheries and Forestry,* Food and Agriculture Organisation (November 2006)

18 Now the Lebanese Mine Action Centre (LMAC)

19 Post-conflict Social and Livelihoods Assessment in Lebanon, World Bank /Ministry of Social Affairs (June 2007)

20 The authors of the report, along with many other observers, equate land contamination with land denial. However as identified in Section 2.3 of this report, a significant proportion of agricultural producers choose to enter and utilise suspect contaminated areas.

21 p.52. World Bank (2007)

22 For example, a UNDP report entitled *"CBU Contamination by Land Use",* current as of 29 November 2006, indicates that 4,700ha of olive land were affected, and more than 20,000ha of agricultural land in Total. The FAO quote LMAC sources in their damage assessment stating that 26% of all agricultural land was contaminated. UNOCHA in their report on the legacy of cluster munitions indicated that 10% of all land for field crops and 6% of all citrus fruit land was contaminated, noting that this was likley an underestimate. Based on the analysis of contaminated land and land use undertaken in the present report, all of these figures are substantially overestimated.

23 Many of the Dangerous Area reports examined contain little more than a coordinate and the name of the village.

24 Sites are classified as "suspended" for a variety of reasons, including the need for additional clearance, areas within the site that cannot be cleared without mechanical assistance and so on. It may be many months or years before these areas are cleared, but it has been assumed that for the 66 areas classified as "suspended" amongst the 332 areas assessed in Total, all of the usable and priority land has been cleared.

25 There is an option to tick the type of land that was cleared, but this is restricted to four categories – "Housing", "Agricultural", "Industrial" and "Other": Different agencies have interpreted this in different ways: some organisations tick multiple boxes when a clearance site encompasses more than one type of land use; other organisations will choose "other" when the land cleared is used for a variety of purposes

26 The sketch maps are provided along with the boundaries defined by both GPS readings and distance and bearing measurements. They do distinguish between areas cleared using different methods (e.g. visually, instrumentally, mechanically, and so on).

27 IMSMA, the Information Management System for Mine Action, is a piece of specialised software developed by the Geneva International Centre for Humanitarian Demining (GICHD) to assist coordination bodies manage information regarding the threat from mines and ordnance, and the mine action activities undertaken to mitigate and reduce this threat. It is used in conjunction with ArcView 3.2 in Lebanon, which allows the data to be represented over maps, including digitised satellite imagery.

28 The six land use categories were used at this stage of the analysis were housing, olive groves, fruit trees, field crops, pasture/ non-agricultural land and unidentified.

29 An interactive CD-ROM version of the *Atlas Agricole du Liban* was provided by Mr Hussein Nasrallah at the Ministry of Agriculture. However it can also be viewed online at the Ministry of Agriculture website.

30 The Total number of dangerous areas/tasks in each *caza* could only be estimated. This is because the UNMACC separates southern Lebanon into 8 Area of Operations, which do not match with administrative boundaries. However the majority could be clearly identified as lying within a specific *caza* based on the UTM reading.

31 For *caza* that had not yet received any clearance activities (Saida, Hasbaya and Jezzine) it was assumed that clearance tasks would be equivalent to the average size in the neighbouring *caza*.

32 In Bent Jbeil, however, the proportion of pasture/non-agricultural land was only increased by half for future clearance locations, from 33.8% to 50.7%. This was due to the already high proportion of pasture land cleared.

33 Interview with Rami Samain, Emergency Coordinator, Food and Agriculture Organisation, 13 March 2008

34 Many factors could influence the projected end date of June 2009, including a change in the number of operational BAC teams, identification of additional strike sites, cancellation of existing suspect contaminated sites, delays in clearance operations for reasons such as security restrictions and so on. These changes will affect the calculations with regards to the economic impact of contamination – if clearance takes longer, the economic impact increases, and if it is completed more rapidly than projected, the economic impact is lessened.

35 These comprised of one commercial organisation, BACTEC International, and six non-governmental organisations – Handicap International (France), Swedish Rescue Services Association (SRSA), Norwegian Peoples Aid (NPA), DanChurchAid (DCA), Swiss Demining Federation (FSD) and Mines Advisory Group (MAG). Another commercial clearance agency, ArmorGroup, was operational in the period October 2006 – December 2007. Several of these organisations had existing activities in Lebanon prior to the 2006 conflict.

36 Interview with Andy Gleeson, Technical Operations Manager, MAG Lebanon, 17 March 2006.

37 In fact in the first six weeks after the end of hostilities more submunitions were destroyed than in the entire 12-month period up to March 2008.

38 Although a substantial amount of clearance, this is lower than the amount of land indicated as cleared in the most recent UNMACC Quarterly Report, which states that 28,857,522m² of land has been cleared up to March 2008. This reflects variances between the amount of clearance activity reported each month by operators, and the actual final amount of cleared land handed over.

39 Information is not readily accessible or consistently recorded in terms of the quantities of munitions found on or below the surface during the clearance process. However in a sample of 27 clearance sites examined during the research, 39.1% of the Total munitions found were located below the surface in the case of M42, M77 and M85 type submunitions. For BLU-63 submunitions this proportion rose to 69.7% of submunitions found below the surface.

40 Different organisations choose to adopt different methodologies for levels of surface or sub-surface search. Some have conducted sub-surface search on all areas except artificial ground. Others have conducted only a minimum amount of sub-surface search. Clearly the levels of residual risk will differ between these locations.

41 Figures for confirmed funding are taken from *UNMACC Quarterly Report* (January – March 2008) and *Lebanon Country Report, Landmine Monitor 2007*. The outstanding amount for 2008 is based on figures in the UNMAS *2008 Portfolio of Mine Action Projects: Lebanon*. The figure for 2009 is estimated on a pro rata basis based on costs for 2008.

42 For more detailed analysis of these issues see R. Moyes (2004), *Tampering: the deliberate handling and use of live ordnance in Cambodia,* Handicap International Belgium, Mines Advisory Group, Norwegian People's Aid.

43 *Economic Assessment of Environmental Degradation Due to the July 2006 Hostilities,* Report No. 39787-LB, World Bank (October 2007). A similar system, Quality Adjusted Life Years (QALY) is used by the U.K government to calculate the economic cost of road accidents

44 Approximately translated to "Analysis of livelihoods and gender following war damage in poor rural areas"

45 Referred to as AAL 2004 from this point onwards.

46 Land in use is referred to as *Superficie Agriculture Utile* in the *Atlas Agricole du Liban 2004* and does not include land that has been out of use for more than five years or to pasture land in common ownership. The amount of land in use is estimated to have increased to approximately 270,000ha since the 1998 survey.

47 Carte S.2.2, AAL 2004

48 *Tableau 3: Superficie Agricole Utile et mode de faire valoir de l'exploitation,* AAL 2004

49 Carte S.2.4, AAL 2004.

50 *Tableau 1 : Répartition des exploitants par classe d'âge et par activité économique.* AAL 2004.

51 *Tableau 1 : Répartition des exploitants par classe d'âge et par activité économique.* AAL 2004.

52 *Tableau 2 : Le niveau d'instruction de l'exploitant et la destination principale de la production.* AAL 2004

53 *Tableau 3 : Superficie Agricole Utile et mode de faire valoir de l'exploitation.* AAL 2004

54 p.33. IFAD 2007

55 *Tableau 4: La main d'oeuvre salarieé permanente et la main d'œuvre occasionnelle.* AAL 2004

56 Based on data contained in the AAL 2004.

57 *UNMACC Monthly Report,* October 2006.

58 For *caza* that have not yet received clearance, the proportion of land in each land use category is based on the statistics from neighbouring *caza* – Saida is based on Sour, Hasbaya on Marjeyoun and Jezzine on Nabatieh.

59 p.44, *War Impact on Forest resources and olive groves in southern Lebanon.* Association for Forests, Development and Conservation / UNDP (2007)

60 Based on figures from *UNMACC Quarterly Report (January–March 2008) and Lebanon Country Report, Landmine Monitor 2007.*

61 Taken from the *2008 Portfolio of Mine Action Projects: Lebanon,* available at www.mineaction.org/projects.asp?c=16&pg=1

62 Based on figures from *UNMACC Quarterly Report (January–March 2008)* and specific donor websites.

landmine action

2nd floor
89 Albert Embankment
London SE1 7TP
Tel +44 (0)20 7820 0222
Fax +44 (0)20 7820 0057
Email info@landmineaction.org

www.landmineaction.org