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MERCY CORPS

Thematic Report

Assessment of Damages in the South

December 2024

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Credit: Reuters

The Lebanon Crisis Analytics Team (LCAT) provides reactive and in-depth context analysis to inform the aid community in Lebanon. The information and analysis contained in this report is therefore strictly to inform humanitarian and development actors and associated policymaking on Lebanon.

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Introduction

Israel's ground invasion along Lebanon's southern border has resulted in widespread property damage, much of it due to controlled demolitions, as part of an apparent attempt by Israel to establish a buffer zone. The ground campaign follows nearly one year of attritional fire targeting Lebanese villages and towns within five kilometers of the border. Israeli military action has precipitated mass displacement, and, despite a recently announced ceasefire, extensive property damage will continue to present a barrier to Lebanese internally displaced persons (IDPs) returning to their homes.

Notably, the recent damage resulting from the Israeli invasion has also sharply increased the already high reconstruction and compensation bill for the Lebanese state, potential donor countries, and implementing agencies. Understanding the trend of residential property destruction – including its scale, geographical focus, and costs – is essential for any response planning in southern Lebanon, the Bekaa, and the southern suburbs of Beirut when the conflict ends. This is in addition to the direct and ongoing costs associated with supporting displaced and affected populations with basic needs assistance. Timely and accurate information on the scale and ongoing cost of these damages is essential for response actors and supporting donors to adequately plan and implement recovery activities, with a high likelihood of additional costs stemming from insufficient, poorly managed, or overly delayed recovery and reconstruction efforts. Given the high likelihood that funding levels will be, at least initially, insufficient to meet needs, accurate data on damages will be essential for effective prioritization and coordination of response activities.

Taking this into account, the Mercy Corps Lebanon Crisis Analytics Team (LCAT) developed a satellite imagery analysis model to estimate property destruction levels in southern Lebanon, specifically in Bint Jbeil district. This district covers approximately one-third of the area to the south and east of the Litani river, where Israel is conducting heavy shelling and ground operations. At least 43.2% of the buildings in the district – which measures approximately 400 square kilometers – have been damaged or destroyed. LCAT also developed an approach to estimate compensation and reconstruction costs, which are projected to total at least USD 900 million for Bint Jbeil alone.

LCAT used the models to analyze damage in four southern Lebanon towns located in Bint Jbeil district that incurred heavy damage. To complement these models, LCAT identified key infrastructure in the four selected towns, including civilian infrastructure damaged by shelling such as schools, municipal buildings, and pharmacies.

In the coming weeks the LCAT aims to scale up these models to include all territory in southern Lebanon, Beirut, and the Bekaa that has been subject to heavy Israeli bombardment. The resulting estimates can then be combined with data on IDP movements in Lebanon, yielding a potentially valuable dataset to guide post-conflict reconstruction and returns.

Context

Worsening damage in southern Lebanon

From October 8, 2023 through September 23, 2024, LCAT logged some 7,390 rounds of Israeli airstrikes and artillery fire. During this period, 80% of Israel's fire in Lebanon was directed at Lebanese territory within five kilometers of the border. Israel has escalated its campaign since September 23, conducting 6,068 rounds of air and artillery strikes through November 12 in southern Lebanon, the Bekaa valley, and the southern suburbs of Beirut, with 21% of total fire directed within the five-kilometer zone. Approximately 18% of Israel's shelling since September 23 has been directed at Bint Jbeil district.

LCAT's conflict tracking logs Israeli strikes by location, including shelling on residential and commercial properties. LCAT also logs reported incidents of Israeli ground troops conducting controlled demolitions. Documented strike locations and controlled demolition sites offer insights into the pattern of building destruction. Although this dataset cannot comprehensively quantify shelling damage, it enables LCAT to identify and prioritize areas most severely impacted by Israel's military operations.

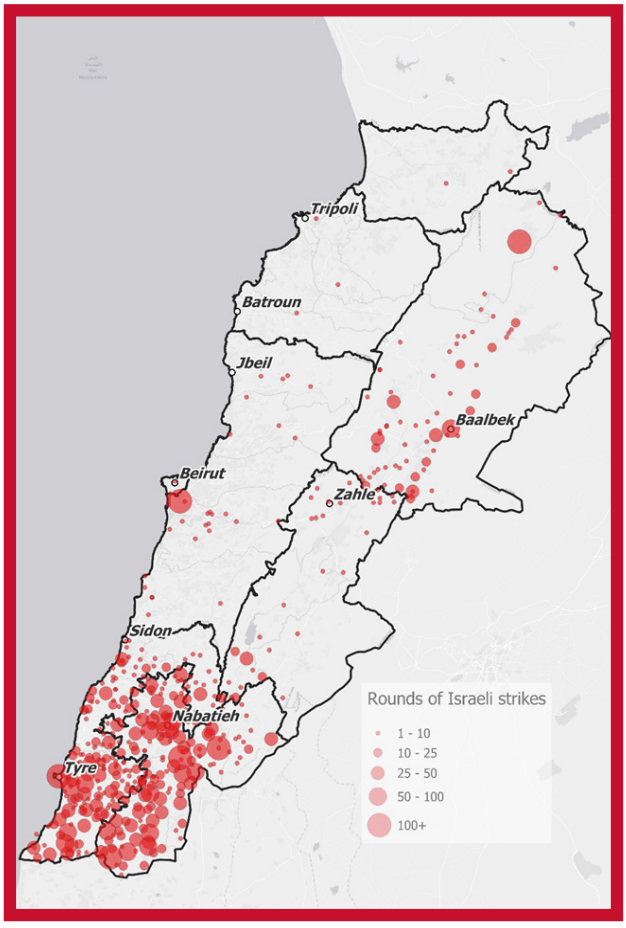

***Figure 1**: Rounds of Israeli airstrikes from September 23, 2024 through November 19, 2024.*

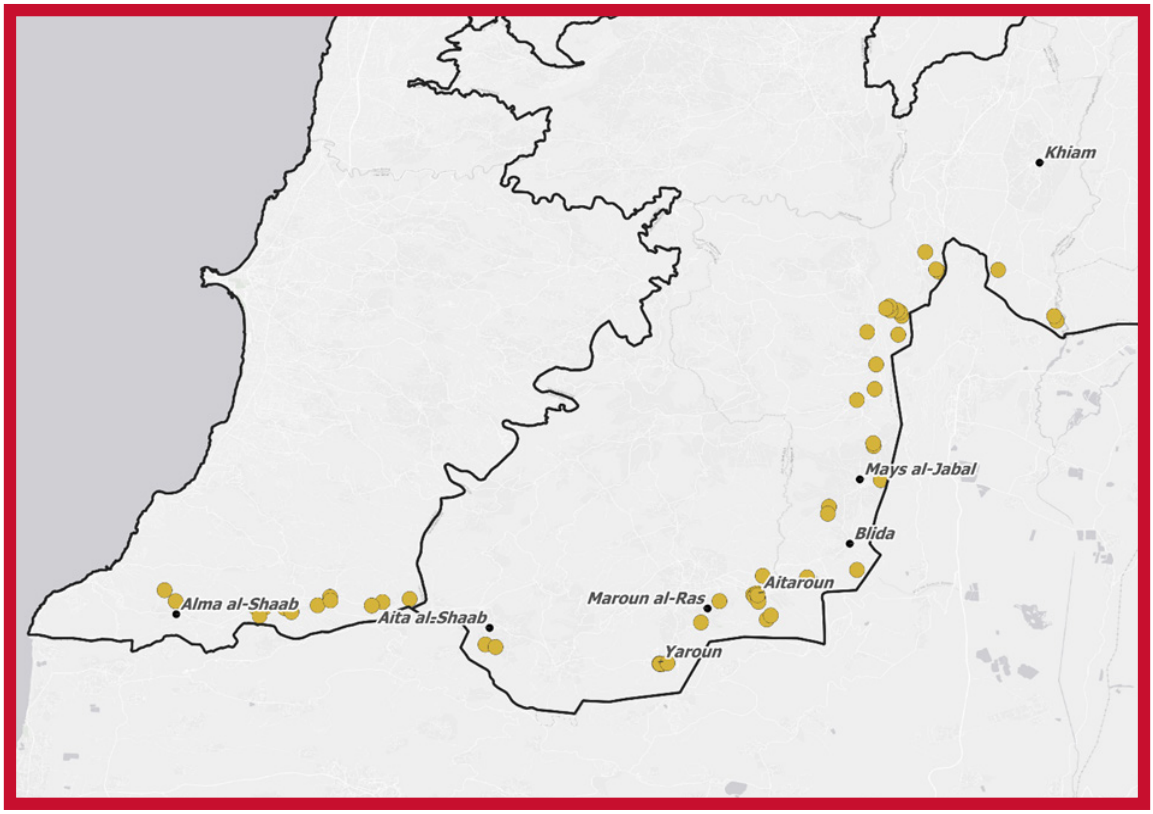

***Figure 2**: Sites of Israeli controlled demolitions through November 20, 2024.*

According to LCAT tracking logs, as of September 23, 2024, Khiam, Kfar Kila, Teir Harfa, and Aita al-Shaab were likely to have suffered the most property damage. Since then, Israel's ground invasion has caused more widescale damage in Kfar Kila, Khiam, Teir Harfa, and Aita al-Shaab, as well as nearly all other municipalities along the border. Southern Lebanese towns outside the immediate border area such as Nabatieh, Tyre, Yohmor, and Kfar Tebnit are also likely to have suffered extensive property damage.

Increasing displacement

As of November 10, 2024, Israel's bombardment of southern Lebanon since October 2023 had displaced 878,497 people, according to the UN's International Organization for Migration (IOM).[1] Approximately 13% of IDPs in Lebanon were displaced from Bint Jbeil district. Israel's destruction of property in Lebanese territory spanning approximately five kilometers from the border poses a severe barrier for return, which will persist after a ceasefire. Moreover, Israel's escalated bombing across broader swaths of southern Lebanon, the Bekaa Valley, and the southern suburbs of Beirut will add to property destruction and compound existing barriers of return.

[1] IOM, Lebanon - Mobility Snapshot - Round 61 - 11-11-2024 November 11, 2024

District	IDPs departing district as of November 10, 2024	Rounds of Israeli shelling from September 23, 2024 until November 13, 2024
Sour	190,808	1,352
Bint Jbeil	114,250	1,077
Nabatieh	144,550	921
Marjayoun	95,189	901
Baalbek	86,387	536
Baabda (includes southern suburbs of Beirut)	105,231	384
Saida	58,211	350
Jezzine	1,259	128
Hermel	26,832	109
West Bekaa	15,401	94
Hasbaya	12,120	76
Zahle	6,008	53
Beirut	21,175	4
Rachaya	1,076	4
Total	**878,497**	**5,989**

Table 1: *Lebanese IDPs by districts of origin compared to Israeli strikes on these districts.*

Reconstruction efforts made little headway in the year after the 2006 Lebanon War, as the Lebanese state struggled to provide compensation for widespread housing damage.[2] In Aita al-Shaab, one of the villages most damaged in the 2006 War, most of the 11,000 residents returned home immediately after the conflict and "endured hardships waiting for reconstruction."[3]

Compensation payments

Compared to the aftermath of the 2006 War, Lebanon's contemporary economy is in a far worse state. The country has been suffering from one of the worst economic collapses in modern history since 2019.[4] The Lebanese government has initiated discussions about how the state can compensate residents for property destruction,[5] though Lebanon's caretaker prime minister said in March that "it is impossible to take any step to count and determine the damage or its cost, as long as the fighting is still going on and the destruction of homes and infrastructure in the south continues."[6]

In August, reports emerged that the Lebanese government had run a budget surplus of at least USD 600 million – with a projected end-of-year figure of approximately USD 1.4 billion – which officials discussed possibly using for compensation payments.[7] However, this optimistic figure would be unable to cover current estimates for housing damage costs nationwide. Moreover, it is unclear whether the Lebanese state has managed to run a budget surplus since the significant escalation in Israel's war starting in mid-September. To put Lebanon's public finances in context, a draft budget for 2025 projects USD 4.8 billion of total spending,[8] while nationwide housing damage cost estimates are just shy of USD 3 billion.

[2] Al-Jazeera, Lebanon still struggling to rebuild July 13, 2007;
Bint Jbeil, الجنوب الجنوبيون بعد July 18, 2007
[3] Al-Akhbar, عيتا الشعب: ترميم الأيقونة July 31, 2010
[4] World Bank, Lebanon Sinking into One of the Most Severe Global Crises Episodes, amidst Deliberate Inaction June 1, 2021
[5] L'Orient Today, Is the Lebanese government ready to finance the south's reconstruction? August 7, 2024
[6] L'Orient Today, Is the Lebanese government ready to finance the south's reconstruction? August 7, 2024
[7] Ibid.
[8] L'Orient Today, Lebanese government faces 2025 budget proposal fraught with challenges September 9, 2024

As of May 8, 2024, the Lebanese state's Southern Council estimated that the conflict had caused "more than 1 billion US dollars" in damage to buildings and institutions.[9] A November 14 damage assessment by the World Bank estimated that approximately 99,000 housing units nationwide were partially or fully damaged. The World Bank assessed this damage at USD 2.8 billion. As of November 15, Hezbollah's Jihad al-Bina construction agency found that 45,000 housing units across Lebanon had been destroyed, with an estimated reconstruction cost of USD 2.9 billion. In the south, Jihad al-Bina found that 23,500 units had been destroyed, with an estimated reconstruction cost of USD 1.68 billion.

The 2006 War resulted in an estimated USD 2.4 to USD 2.8 billion in direct damages, with an estimated USD 1 billion to USD 1.8 billion of this figure attributed to damage to private housing.[10] Following the end of the 2006 War, the Lebanese government offered compensation for complete and partial destruction to housing units, excluding those in the highly urbanized southern suburbs of Beirut, which required a separate plan that was managed and funded by Hezbollah.[11]

Foreign donors also provided financial assistance, including Qatar, which funded compensation payments in Aita al-Shaab, Ainata, Bint Jbeil, and Khiam, some of the towns most heavily damaged in the 2006 War.[12] It is unclear which, if any, foreign states would offer such assistance following the end of the current conflict.

Identifying damaged and destroyed buildings

Currently, there are no publicly available assessments or datasets of damage and destruction to buildings caused by the current conflict in Lebanon. The United Nations Satellite Centre[13] (UNOSAT) typically provides spatial datasets of the location of damaged or destroyed buildings on a rolling basis in most active conflict zones, most recently several locations in Ukraine[14] and the entire Gaza Strip.[15] However, UNOSAT has yet to publish damage assessments covering Lebanon over the course of the current conflict.

LCAT is working to fill this critical information gap using an analytical approach that relies on Sentinel-1 satellite imagery, which uses a synthetic aperture radar (SAR) instrument that records backscatter intensity at a 10 meters squared spatial resolution every 12 days (for same orbit). The imagery is publicly available and can be obtained from Google Earth Engine.

Backscatter intensity recorded by Sentinel-1's SAR measures the strength of a radar wave after it is reflected from objects on the Earth's surface. Intensities vary by surface characteristic, such as surface type (e.g., water or land) and geometry (e.g. mountain peaks or steep mountain ridges). When analyzed over time, backscatter intensity can reveal changes in surface features. For example, backscatter intensities fluctuate in conjunction with plant growth cycles[16] and rapidly decrease when water covers the land due to flooding.[17]

[9] AFP, Lebanon body puts Israeli bombardment damage at $1.5 bln August 9, 2024
[10] World Bank, Republic of Lebanon: Economic Assessment of Environmental Degradation Due to July 2006 Hostilities October 11, 2007
[11] Presidency of the Council of Ministers, Lebanon: On the Road to Reconstruction and Recovery December 15, 2006
[12] Al-Akhbar, عيتا الشعب: ترميم الأيقونة July 31, 2010
[13] The United Nations Satellite Centre
[14] UNOSAT, Ukraine February 2022 - October 2023
[15] OCHA Humanitarian Data Exchange, UNOSAT Gaza Governorate Damage Assessment - Gaza Strip, Occupied Palestinian Territory October 18, 2024
[16] MDPI, Crop Monitoring Using Sentinel-1 Data: A Case Study from The Netherlands August 13, 2019
[17] MDPI, Satellite-Based Flood Mapping through Bayesian Inference from a Sentinel-1 SAR Datacube July 31, 2022

Shifts in backscatter intensities over buildings are caused by structural changes. Generally, backscatter intensities rapidly decrease when a building is destroyed and dramatically increase when a building is constructed. However, backscatter intensity over a damaged building increases or decreases depending on how a structure is damaged. For example, backscatter intensity increases if an SAR wave bounces off a newly exposed wall and decreases if the portion of the building angled toward the satellite is leveled while the remainder of the building is still standing.

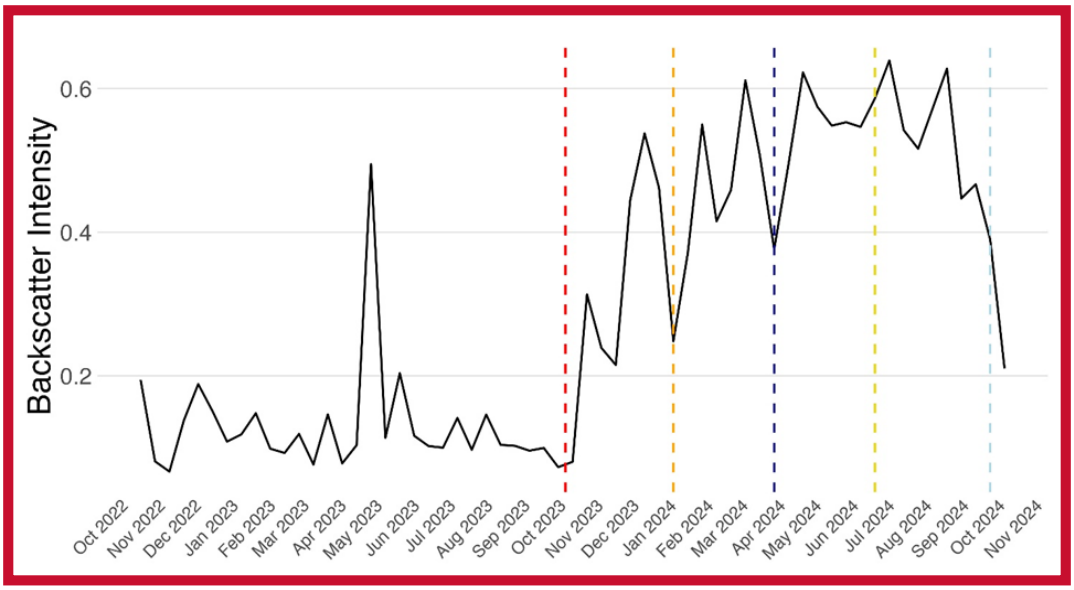

***Figure 3**: Backscatter intensities measured for a building in the Gaza Strip identified as "severely damaged" by UNOSAT in the October 15, 2023 damage assessment. The red dotted vertical line marks October 7, 2023. The orange and yellow dotted lines represent the beginning and end of the "middle" time period. The dark and light blue dotted lines represent the "end" time period. The building damage identification algorithm compares these values with those in the same time period the previous year.*

LCAT produced an algorithm that detects changes in the time series of Sentinel-1 readings[18] over building footprints in Bint Jbeil district that can be obtained from Microsoft.[19] Points spaced 10 meters apart were placed over the building footprint, where possible, to maximize the Sentnel-1 coverage and provide a more complete assessment of it.

LCAT obtained a time series of Sentinel-1 backscatter intensities for all the points covering building footprints from Google Earth Engine and then analyzed them in R. The algorithm gathers the backscatter intensities from October 8, 2023, three other dates,[20] and the latest available Sentinel-1 images,[21] and compares these intensities to those recorded during the same month-day range the previous year.[22] These "before-conflict" and "conflict" time series are compared using Welch's t-test. The t-statistics are recorded from tests calculated using data collected from Sentinel-1 ascending and descending orbits[23] and averaged[24] to calculate an aggregate t-statistic result and associated p-value. Damage is identified if the p-value of the t-tests comparing the middle or end periods of the time series to the pre-conflict period are statistically significant.[25]

[18] The algorithm measures changes in Sentinel-1's vertical-vertical (VV) band, which records the backscatter intensity of waves transmitted and received with a vertical polarization.
[19] Gee Community Catalog, Global ML Building Footprints May 30, 2022
[20] The "conflict" (post 7 October) time series is divided into three equal parts comprising the beginning, middle, and end of the time series. The length of each time period is defined as the number of days between the earliest and latest date, divided by two.
[21] The latest Sentinel-1 data in LCAT's extractions ranges from October 21, 2024 to October 31, 2024.
[22] Pixel-level time series obtained from the Sentinel-1 images with the same orbit number were used to ensure consistent backscatter intensity data. The orbit with the highest number of images in the past two years was selected, and if that number was tied, the orbit with the lowest incidence angle possible was selected.
[23] Images obtained from ascending and descending satellite passes were used to minimize the impact of distortions that affect Sentinel-1 images, such as foreshortening, shadowing, and layover. Using images from both ascending and descending orbits provides two distinct perspectives of the surface, which reduces distortions caused by the orientation of the building and steep geographies.
[24] The absolute value of the t-statistics were averaged.
[25] $p < 0.05$

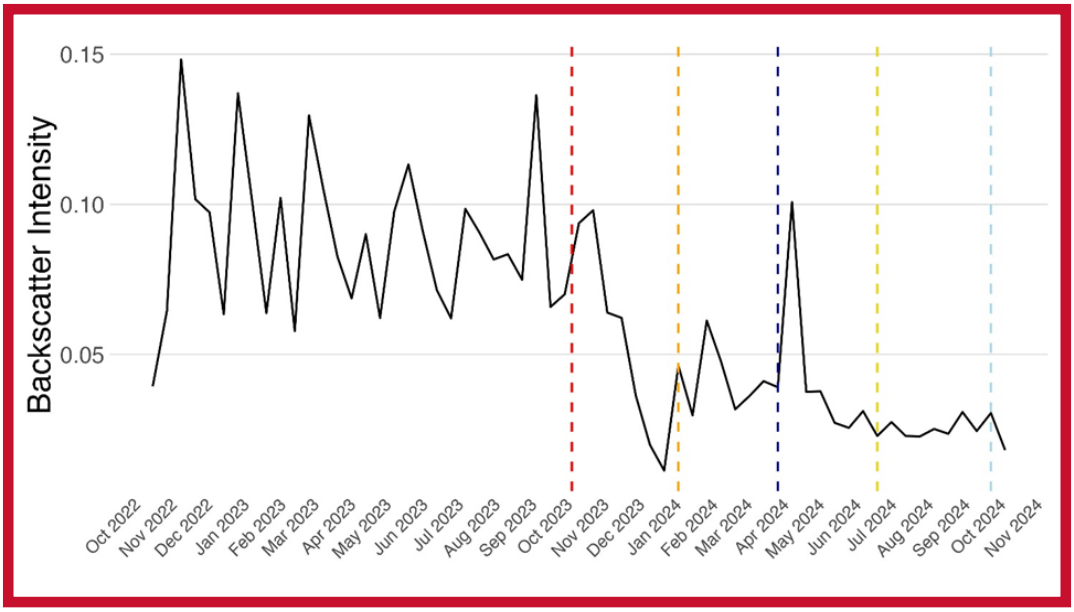

***Figure 4**: Backscatter intensities measured for a building in the Gaza Strip identified as "destroyed" by UNOSAT in the November 7, 2023 damage assessment. The red dotted vertical line marks October 7, 2023. The orange and yellow dotted lines represent the beginning and end of the "middle" time period. The dark and light blue dotted lines represent the "end" time period. The building damage identification algorithm compares these values with those in the same time period the previous year.*

LCAT carried out testing using 5,000 randomly selected damaged or destroyed buildings in the Gaza Strip identified by UNOSAT,[26] and a control group composed of a random sample of 5,000 building footprints[27] [28] from seven cadasters in Lebanon that have not been bombed during the current conflict: Bourj Hammoud, Halba, Kfar Abida, Jeita, Mazraat Es-Dahr, Qbaiyat Aakkar, and Zgharta. These locations represent a variety of population densities and physical geographies ranging from relatively flat (Bourj Hammoud) to mountainous (Jeita, Qbaiyat Aakkar).

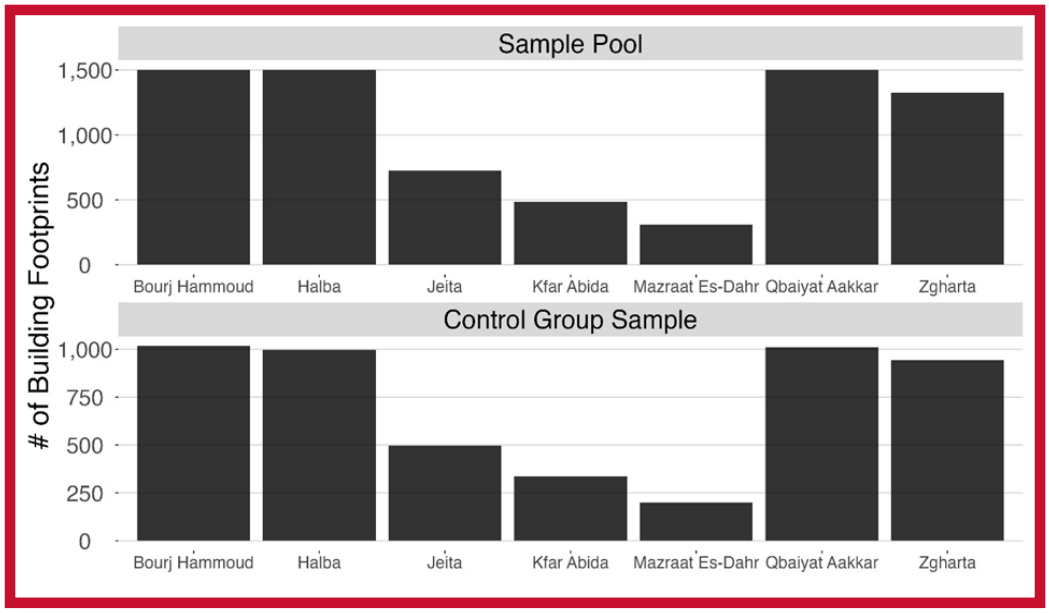

***Figure 5**: Distribution of building footprints among the seven locations in the sample pool and control group sample.*

[26] Only buildings that were assessed with "high confidence" by UNOSAT were included in the sample.
[27] If the total number of building footprints within a location was less than 1,500, then all building footprints were included in the sample pool. If the total number of building footprints within a location exceeded 1,500, then a random sample of 1,500 building footprints were added to the sample pool. There was a total of 7,347 building footprints in sample pool.
[28] The backscatter intensity was measured over the centroid of each building footprint in the control group to match the UNOSAT data.

The building damage detection algorithm correctly identified 81% (4,049/5,000) of destroyed or damaged buildings in Gaza (true positives) and incorrectly identified 26% (1,302/5,000) of buildings in the control group as damaged or destroyed (false positives).[29] Together this produced an F1 score of 78%, which should be considered respectable when compared to similar academic research that identified damaged and/or destroyed buildings using Sentinel-1 imagery.[30] [31] [32]

Location	Identified as damaged or destroyed	Total buildings	% identified as damaged or destroyed
Gaza Strip	4,049	5,000	81%
Control Group	1,302	5,000	26%

***Table 2**: Accuracy results from the building damage detection algorithm, which was tested on damaged or destroyed buildings in the Gaza Strip and a random sample of 5,000 buildings from seven municipalities in Lebanon that have not been bombed during the current conflict.*

LCAT measured damage over the entire building footprint. The proportion of observation points identified as damaged or destroyed were used to categorize each building's damage status. Buildings with more than 0% and under 100% of the points were identified as "damaged". Buildings with all points (100%) identified as damaged or destroyed were labeled as "destroyed". Buildings with no points (0%) were labeled as "not damaged".

Estimating damage cost methodology

LCAT uses the 2006 Lebanese state formula for war-related compensation payments as a basis for its estimate.[33]

- In 2006, the government offered USD 33,000 per housing unit that was completely destroyed.
- In 2006, the government offered USD 198 per square meter in damaged sections of partially demolished units, with a maximum payment of USD 26,402 for partially demolished units.
- In 2006, state compensation was based on a formula of approximately USD 200 per square meter, with an average housing unit's size set at approximately 165 square meters.
- In 2006, the government also provided USD 6,600 for the purchase of new furniture.
- As such, the baseline formula from 2006 for total compensation, including furniture, was approximately USD 240 per square meter.

The Southern Council's damage estimate for the ongoing conflict uses the state's formula from 2006, with a projected payment of USD 40,000 per destroyed unit (covering damage and furniture).[34] Hezbollah's Jihad al-Bina construction agency estimates a damage cost of USD 420 per square meter, with the average housing unit in southern Lebanon measuring 170 square meters.

[29] Upon inspection, several buildings in the control misidentified as damaged or destroyed had solar panels installed during the analysis period. Like building damage and (to a lesser extent) destruction, additions to a building causes noticeable changes (typically an increase) in the backscatter coefficient.
[30] IEEE Xplore, A New Method for the Identification of Earthquake-Damaged Buildings Using Sentinel-1 Multitemporal Coherence Optimized by Homogeneous SAR Pixels and Histogram Matching March 14, 2024
[31] MDPI, War Related Building Damage Assessment in Kyiv, Ukraine, Using Sentinel-1 Radar and Sentinel-2 Optical Images December 9, 2022
[32] Arxiv, Open Access Battle Damage Detection via Pixel-Wise T-Test on Sentinel-1 Imagery May 10, 2024
[33] Presidency of the Council of Ministers, Lebanon: On the Road to Reconstruction and Recovery December 15, 2006
[34] Independent Arabia, سجال لبناني – لبناني حول تعويضات الحرب April 4, 2024

LCAT conservatively adjusted the 2006 compensation payments for estimated inflation, to calculate costs incurred from the current conflict.

- LCAT used Lebanon's Consumer Price Index for the category of "furnishing and housing equipment" from January 2008 (earliest available) and October 2019 (latest available before Lebanese lira depreciation) from the Central Administration of Statistics to calculate an inflation rate of 18%.

- LCAT adjusted this figure upward to 25% to account for inflation between October 2019 and November 2024, as well as any immediate inflation affecting construction supplies following the end of the conflict due to heightened demand (as happened in 2006).

- In 2006, compensation payments reportedly did not cover total costs. As such, LCAT conservatively assumed the payments at the time covered 90% of reconstruction costs and adjusted the above figure upward to cover the full costs.[35]

Based on these conservative assumptions, LCAT developed an estimate of USD 55,000 payment per housing unit of 165 square meters, or approximately USD 333 per square meter. LCAT also developed a less-conservative estimate of USD 76,400 per housing unit, or USD 460 per square meter. This estimate assumes 35% inflation from 2006 through November 2024, and assumes that compensation payments would cover only 70% of total costs.[36] As such, LCAT provides an estimated damage range of USD 55,000 to USD 76,400 per housing unit of 165 square meters, or USD 333 to 460 per square meter.

The total rebuild cost is calculated by multiplying each value in a range of per-square meter rebuild costs (from USD 340 to USD 450 in increments of USD 10) by building volume.[37] [38] These costs are applied to the building damage results using the following two methods:

1. *Binary cost estimate:* This assumes a building needs to be either fully rebuilt or not rebuilt at all. If 50% or more of the building is assessed as damaged, LCAT multiplies the total square meters of the building by the rebuild costs. If less than half the building is assessed to be damaged, LCAT assumes no rebuilding cost.

2. *Proportional cost estimate:* This assumes the total rebuilding cost is weighed against the percentage of the assessed damage. For example, if 50% of the building is assessed as damaged, LCAT multiplies the total cost by 0.5.

The "Binary" cost estimation approach is less conservative than the more conservative "Proportional" cost estimation approach.

[35] LCAT reviewed media reports from 2006 through 2008 regarding reconstruction and compensation payments. According to two reports, compensation payments reportedly covered 80 percent of total costs due to inflation of reconstruction-related services and material. Other reports mentioned that compensation payments were adequate but were delayed. LCAT conservatively assumed compensation payments covered 90 percent of costs at the time.
[36] LCAT assumes the Lebanese government figure would intent to compensate the full costs of reconstructing a housing unit. However, spikes in demand for reconstruction-related services and material as well as the cash injections into the market in the form of compensation payments could cause further inflation in prices, as was reported in 2006. For the less conservative figure, LCAT assumed that the payments would cover 70 percent of the total costs, lower than the reported 90 percent figure in 2006.
[37] Building volume calculated by multiplying the size of the footprint (sqm) by the estimated number of stories of the building, which are derived from the Global Human Settlement Layer.
[38] Building heights <=3 meters were considered one-story; buildings >3 meters and <=6 meters were considered two-story; buildings >6 meters and <15 meters were considered three-story. No buildings in Bint Jbeil district. exceeded 15 meters in height, according to the Global Human Settlement Layer data.

Bint Jbeil district damage assessment

LCAT applied its building damage algorithm to all building footprints in Bint Jbeil district and estimated the cost of rebuilding, according to the level of damage. The algorithm identified 14,916 of 34,490 assessed buildings (43.2%) as damaged or destroyed. Furthermore, 8,838 buildings (25.6% of total) were identified as "damaged" and 6,078 (17.6% of total) were identified as "destroyed". It found that property damage estimates reach USD 909.6 million to USD 1.20 billion at a lower range and USD 1.64 billion to USD 2.17 billion at a higher range.

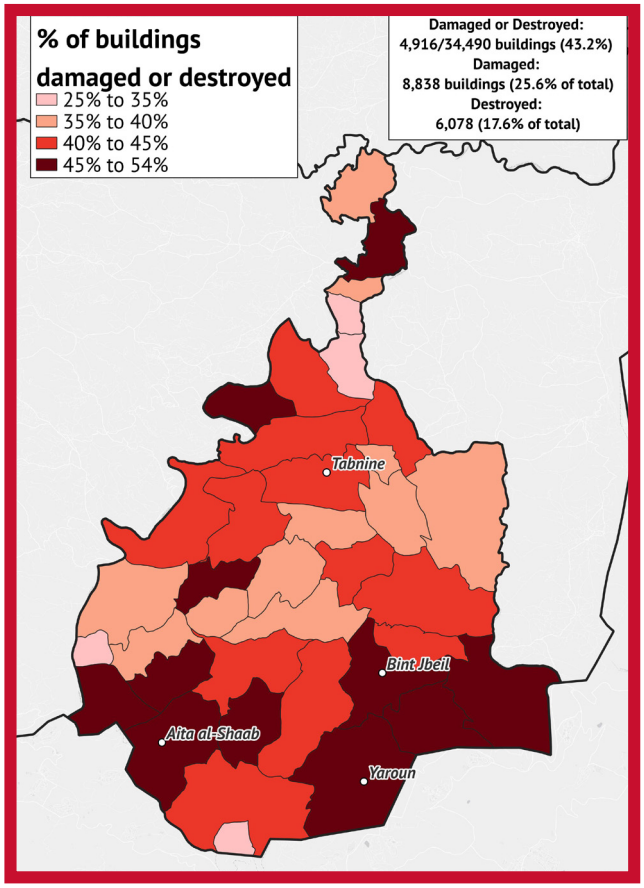

***Figure 6**: Proportion of buildings identified as damaged or destroyed in Bint Jbeil district.*

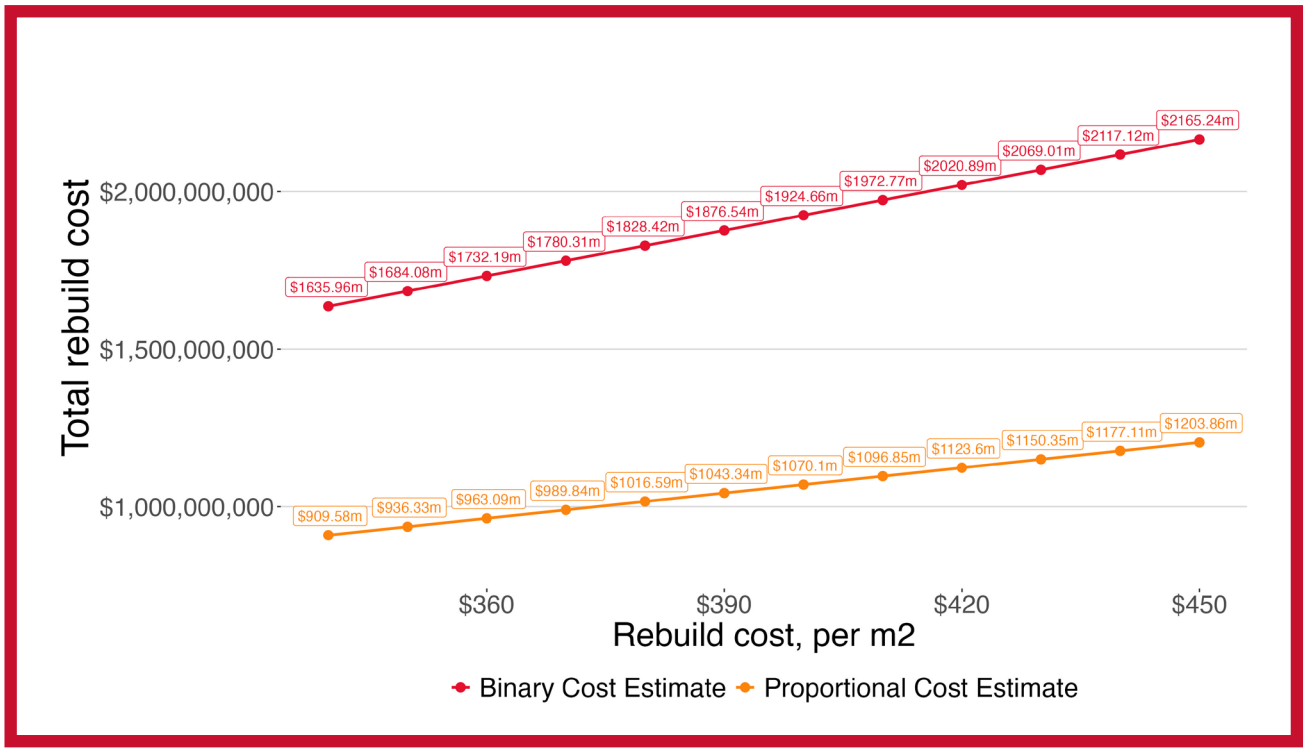

***Figure 7**: Estimated cost of rebuilding Bint Jbeil district.*

Aita al-Shaab

The town of Aita al-Shaab has been heavily bombed since the beginning of the conflict, with 998 of 1,889 buildings (52.8%) damaged or destroyed from October 8, 2023 to October 31, 2024; specifically, 514 buildings (27.2%) were damaged, and 484 buildings (25.6%) were destroyed. Israeli troops have conducted a series of controlled demolitions in Aita al-Shaab since the ground invasion began on September 30. Aita al-Shaab is third-most damaged municipality in Bint Jbeil, after Yaroun (54% of buildings) and Ramyeh (53.7% of buildings), where Israeli troops have also conducted demolitions. Figure 8 is a map of damaged buildings in Aita al-Shaab, where one diesel generator and one place of worship have been destroyed, and one petrol station, government building, medical center, pharmacy, place of worship, and school have been damaged.

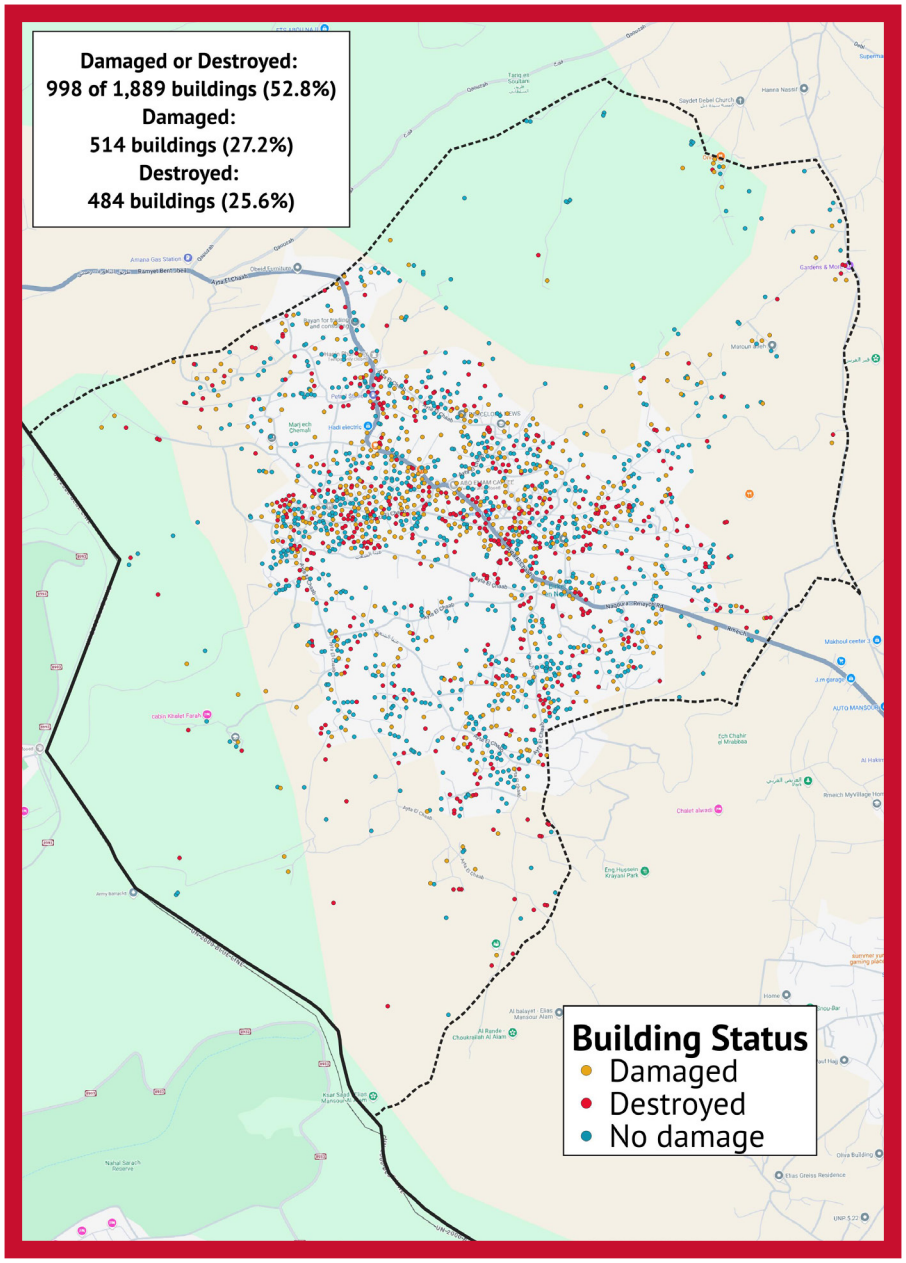

***Figure 8**: Building damage in Aita al-Shaab.*

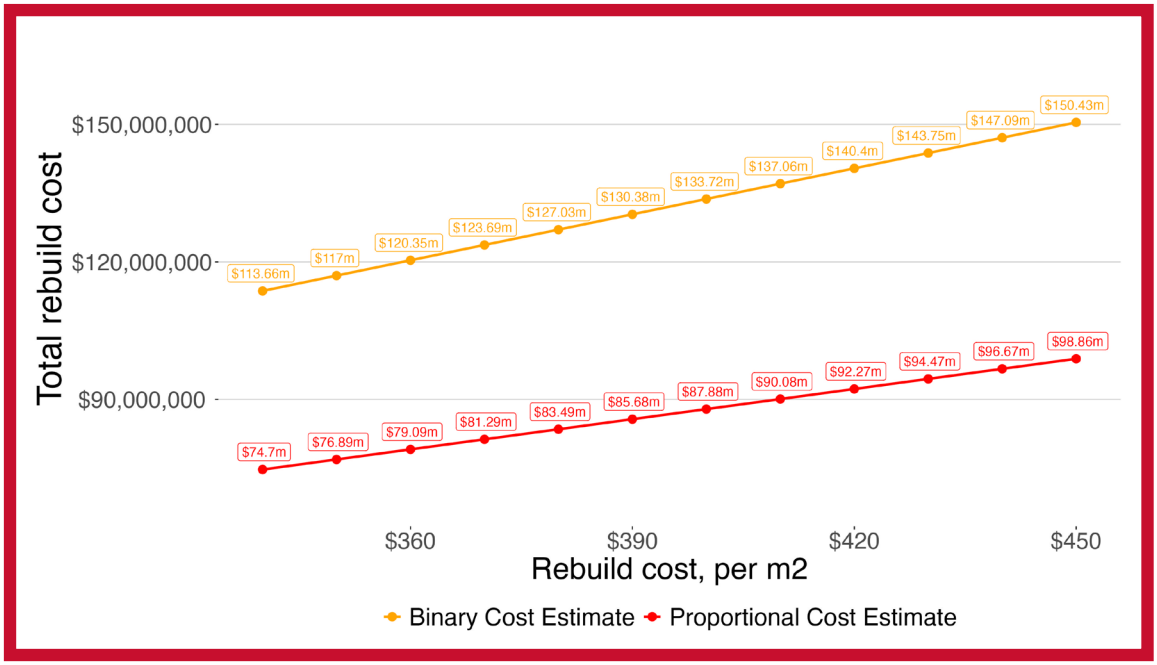

***Figure 9**: Estimated cost of rebuilding Aita al-Shaab.*

Yaroun

The town of Yaroun exhibited the most extensive building damage in Bint Jbeil district, with 626 of 1,159 buildings (54%) damaged or destroyed from October 8, 2023 to October 31, 2024; specifically, 315 buildings (27.2%) were damaged, and 311 buildings (26.8%) were destroyed. After launching its ground invasion on September 30, Israeli troops entered Yaroun, where they have conducted several controlled demolitions. Figure 10 is a map of the building damages in Yaroun, where two schools have been destroyed, and one school and four places of worship have been damaged.

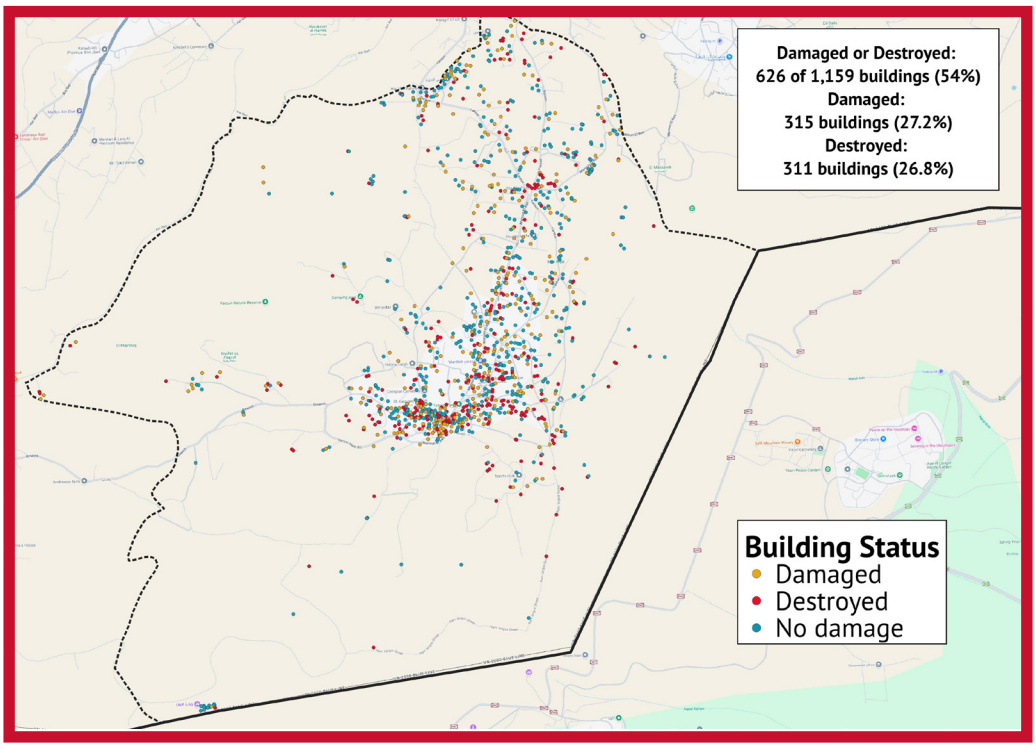

***Figure 10**: Building damage in Yaroun from October 8, 2023 to October 31, 2024.*

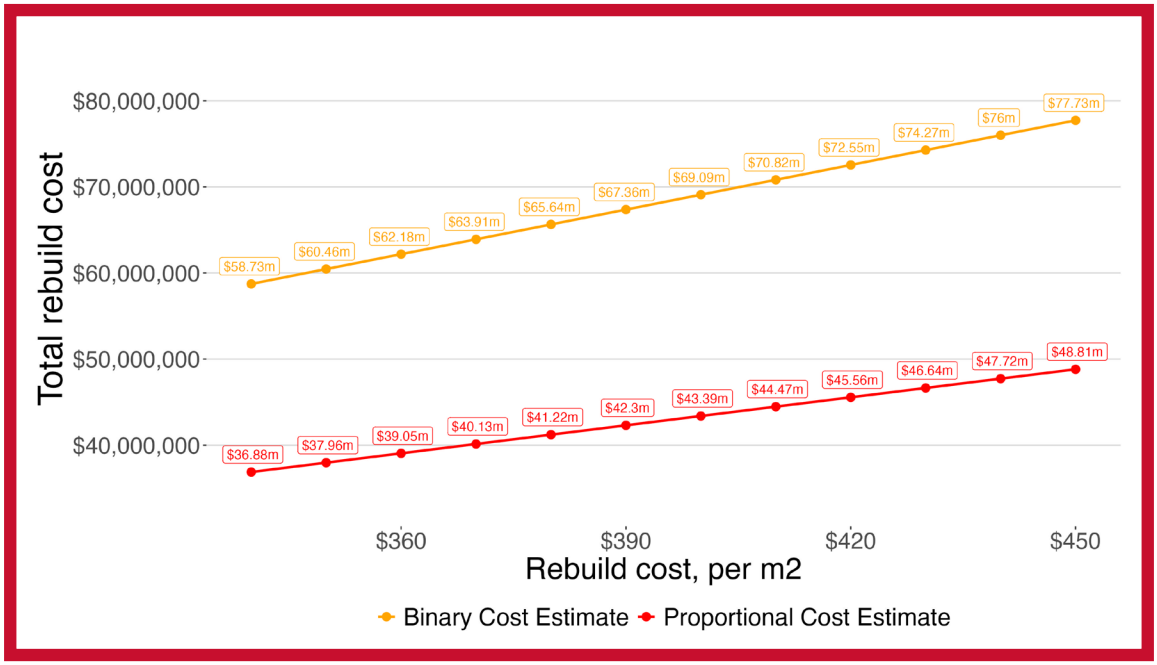

***Figure 11**: Estimated cost of rebuilding Yaroun.*

Aitaroun

In the town of Aitaroun, 854 of 1,770 (48.2%) buildings were damaged or destroyed from October 8, 2023 to October 31, 2024; specifically, 479 buildings (27%) were damaged and 375 buildings (21.1%) were destroyed. Figure 12 is a map displaying damage to buildings in Aitaroun, where one gas station, market, pharmacy, and place of worship have been destroyed, and one government building and market have been damaged. Since the start of the Israeli ground invasion on September 30, Israeli troops have operated along the outskirts of Aitaroun, but there have been no reports of controlled demolitions within the town itself.

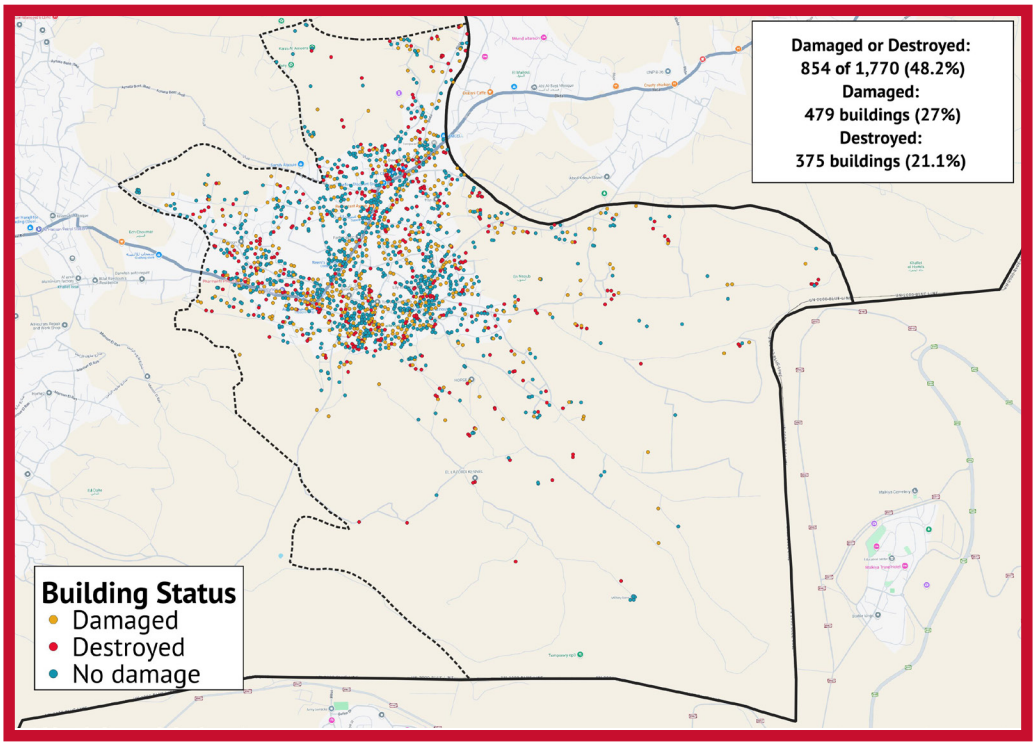

***Figure 12**: Building damage in Aitaroun from October 8, 2023 to October 31, 2024.*

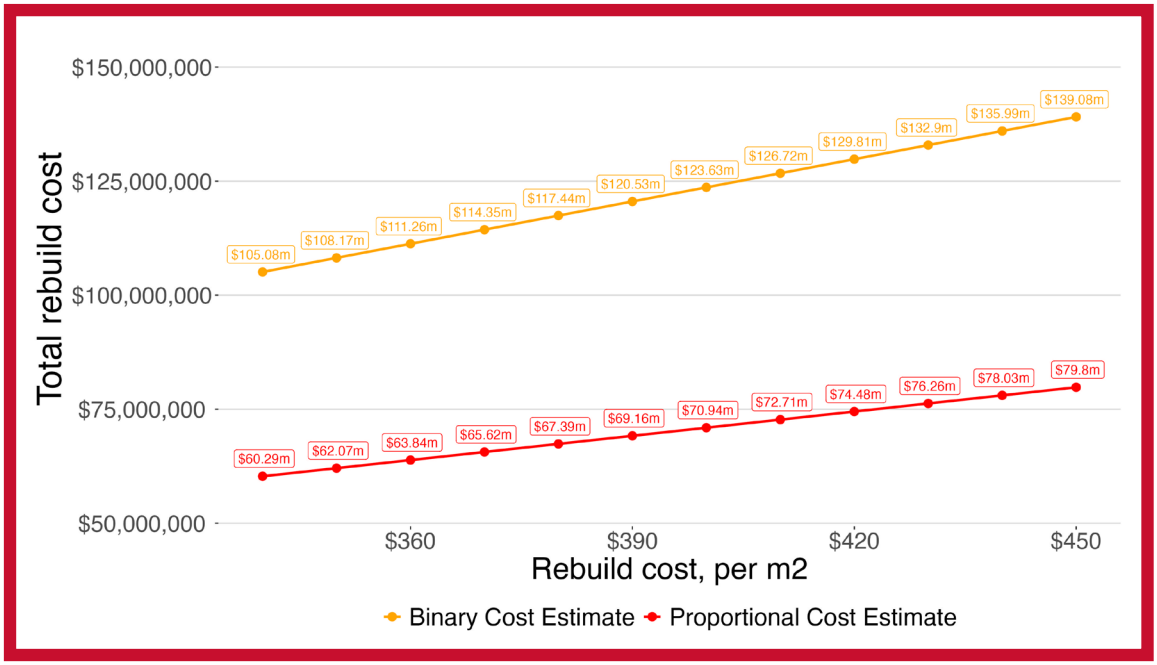

***Figure 13**: Estimated cost of rebuilding Aitaroun.*

Ramyeh

In the town of Ramyeh, 262 of 488 (53.7%) buildings were damaged or destroyed from October 8, 2023 to October 31, 2024; specifically, 110 buildings (22.5%) were damaged and 152 buildings (31.1%) were destroyed. After launching its ground invasion on September 30, Israeli troops entered Ramyeh, where they have conducted several controlled demolitions. Figure 14 is a map of building damage in Ramyeh, where one government building and place of worship has been destroyed, and one school has been damaged.

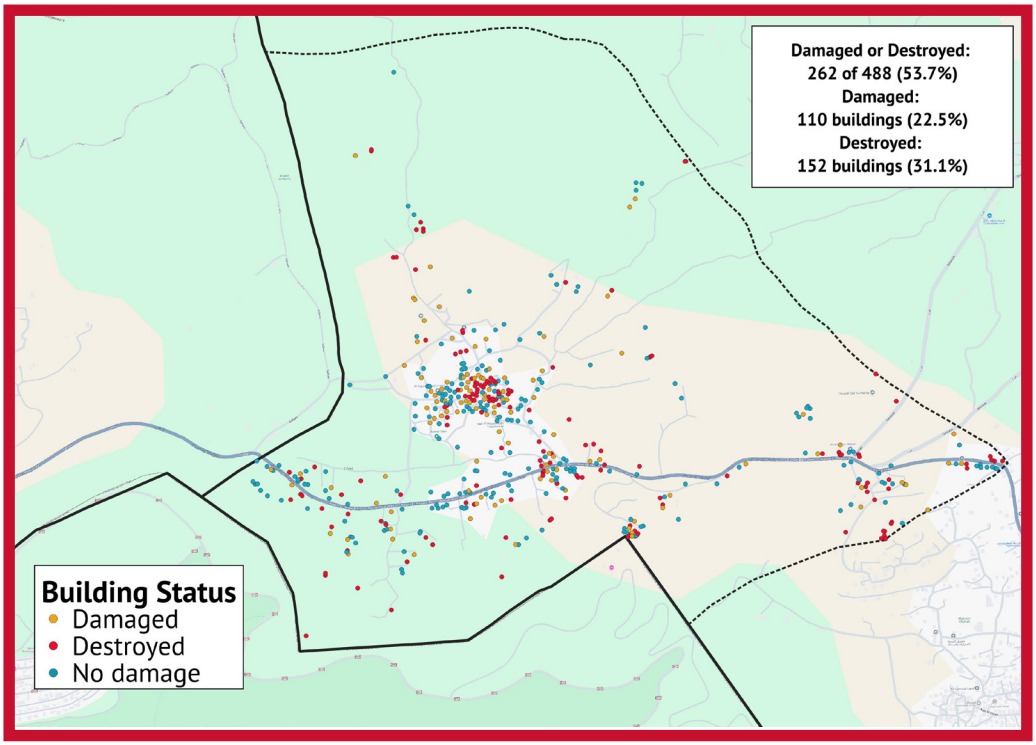

***Figure 14**: Building damage in Ramyeh from October 8, 2023 to October 31, 2024.*

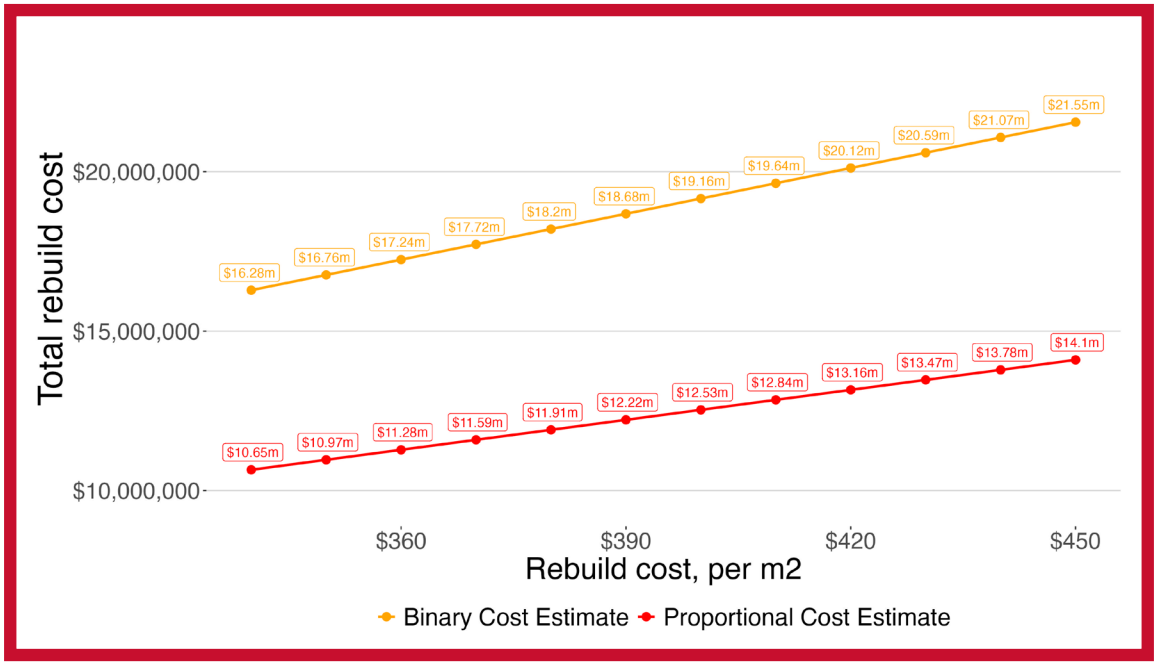

***Figure 15**: Estimated cost of rebuilding Ramyeh.*

Building damage and conflict

The estimated amount of building damage was overlaid with bombing and shelling incident data collected by LCAT[39] to assess how conflict intensity relates to on-the-ground damage. A scatter plot of the number of bombing/shelling incidents and proportion of buildings damaged or destroyed in Bint Jbeil per-municipality in Figure 16 produced moderate positive correlation.[40] Aita al-Shaab municipality was subject to the most bombing/shelling and had the third-most extensive level of building damage. Notably, Yaroun and Ramyeh had slightly more extensive building damage but noticeably less bombing/shelling incidents, which suggests that the per-attack intensity and geographic targeting of attacks have been more concentrated on population centers.

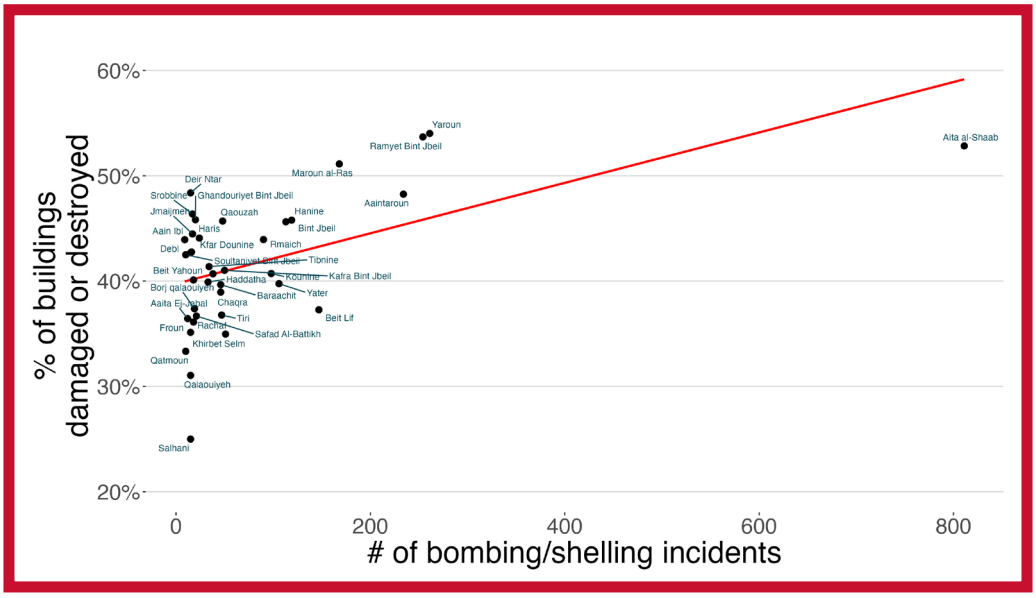

***Figure 16**: Number of bombing/shelling incidents and the percentage of buildings identified as damaged or destroyed in municipalities located in Bint Jbeil district as of October 31, 2024.*

[39] LCAT has tracked Israel's ground invasion by logging and analyzing all Hezbollah claims of responsibility for attacks against Israeli troops in Lebanon. LCAT also logs all incidents of clashes between Israeli troops and Hezbollah reported by Lebanon's state-run National News Agency. LCAT tracks NNA's reports of demolitions conducted by Israeli troops and geolocated sites of demolitions available on the geoconfirmed.org portal.
[40] Pearson's correlation (r) = 0.54 (p = 0.0005)

Moving Forward:

Expand the geographical coverage of damage assessments: In the coming weeks, LCAT plans to scale this analysis and identify building damage and estimate rebuild costs in other conflict-affected districts in Lebanon down to the municipal level. This information will be available on an interactive map hosted on the LCAT Data Analysis Hub that visualizes the location, height, and type of building in addition to summing the total rebuild costs estimates ranging from conservative to less conservative.[41]

Assessing returns dynamics as displaced families seek to return home: Assessing trends related to IDPs, including reported returns to date by level of damage and destruction in districts. This will also include time estimates for IDP returns based on analysis of post-2006 War IDP movements compared to current trends. Understanding these dynamics will be essential for response actors seeking to support displaced families effectively, as well as better understand and address the barriers to return over time (UXO, damaged buildings, and lost livelihoods.).

Produce more focused analysis of the types of damages, and broader economic impact: To better support targeted programming aimed at addressing sectoral impacts, such as market functionality or erosion of agricultural capacity, the LCAT will aim produce a series of focused assessments and datasets for response actors to be housed on an interactive dashboard. This will involve an assessment of types of building damaged in affected villages (state assets, shops, infrastructure, etc.).

Limitations:

LCAT's building identification analysis performed well according to test results, but is currently limited by the following:

- Building damage assessments conducted using synthetic aperture radar (SAR) data will practically always be less accurate than those conducted with very high resolution (VHR) satellite imagery. This analysis is meant to fill information gaps (geographic or temporal) about the extent and location of building damage and is not meant to replace assessments conducted using VHR satellite imagery.

- A sizable but unknown proportion of houses in the South are secondary residences for families, meaning owners may choose to prioritize rebuilding primary residences, if damaged, or wait longer to rebuild their secondary residence. Therefore, the estimated rebuilding costs may be realized over an extended time period, and noticeably lower in total cost if a significant number of owners choose not to rebuild.

- The cost to rebuild damaged and destroyed buildings is exacerbated by the decimation of livelihoods opportunities in the conflict-affected areas, in particular damage to agricultural land. This is examined in the World Bank's recent Interim Damage and Loss Assessment.

[41] Further, the LCAT is currently testing the utility of the algorithm to identify whether damaged or destroyed buildings are being or have been rebuilt, which can be used to monitor the recovery of the housing stock.

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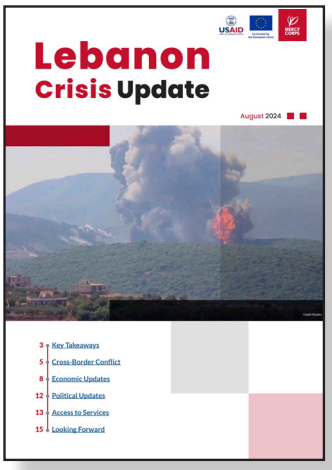

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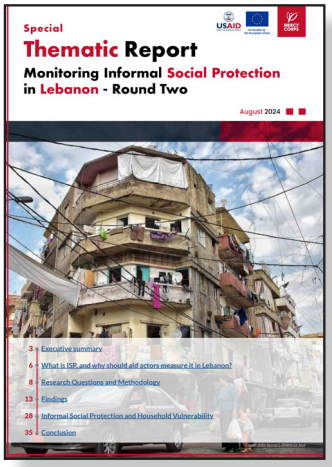

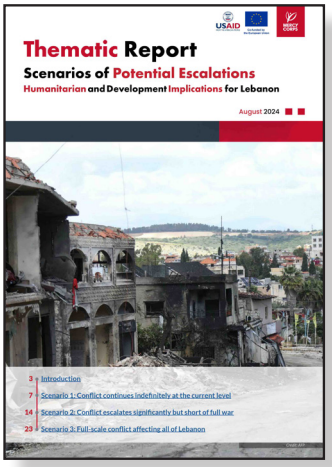

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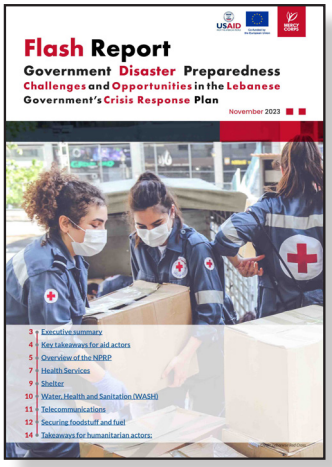

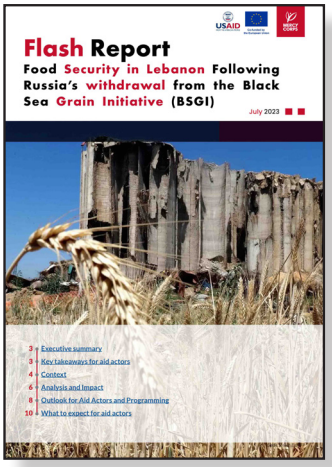

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ABOUT MERCY CORPS

Mercy Corps is a leading global organization powered by the belief that a better world is possible. In disaster, in hardship, in more than 40 countries around the world, we partner to put bold solutions into action — helping people triumph over adversity and build stronger communities from within. Now, and for the future.