

# War and Garbage in Gaza

The public health and environmental crisis  
from widespread solid waste pollution



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## **Colofon**

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Authors Wim Zwijnenburg, PAX and Marilena Zigka, Princeton University

Contact [zwijnenburg@paxforpeace.nl](mailto:zwijnenburg@paxforpeace.nl)

Graphic design Frans van der Vleuten

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*Cover photo* Children scavenging a smoldering solid waste mountain, Gaza. Via [@UNRWA](#), posted June 13, 2024

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# Introduction

Young children scavenging for food in hills of rotting waste. Once-buzzing markets and large agricultural fields turned into endless garbage lands. The waste is everywhere in Gaza with make-shift waste sites even becoming the target of airstrikes. Social media footage has revealed the scale of a threat that has largely remained unnoticed in the context of the Israel-Hamas conflict. The problem of solid waste is a slow but growing public health disaster amidst the explosive violence. Clear warnings from humanitarian agencies such as [UNICEF](#) and [UNRWA](#) demonstrate the scale, public health and environmental risks from the massive conflict-linked garbage crisis.

Currently, at least 225 large and smaller waste dumps exist across the Gaza Strip according to an analysis of open-source information including satellite imagery, social media posts, and official reports. Whether in non-evacuated urban areas in the North or makeshift camps for internally displaced people in the South, the problem of waste is pervasive. And though it might not seem like a priority in a conflict zone, the combination of high temperatures and a destroyed sanitary infrastructure with a population weakened by food insecurity and the lack of medical attention, this 'silent threat' is critical for the public health and the environment people are depending on.

"I survived the Israeli bombing, but I fear dying from the diseases this garbage leaves behind... We are dying slowly in Gaza, unnoticed,"

- Samah al Haijj, Rafa. Source: [Xinhua, April 18, 2024](#)

With the formal waste collection apparatus paralyzed and access to designated landfills blocked by the Israeli Defense Forces, hundreds of thousands of tons of solid waste are piling up in the streets, backyards, and fields of Gaza. The UNRWA reported on June 10, 2024, that more than [330,000 tons of solid waste](#), enough to fill over 150 football fields, have accumulated over the past six months. Though relief initiatives are already underway, only a small fraction of the waste has been disposed of. With 2,000 additional tons [generated](#) daily, restoring the environment and effectively shielding the population from disease remains a long, uphill battle.

The renewed movement of internally displaced people (IDPs) following the IDF May operations has created new dynamics on the ground. In Deir El Ballah, where millions have now fled, old waste dumps were quickly cleared out to make way for new camp settlements. Minor improvements have been noted thanks to the efforts of the UNRWA and the UNDP.

In the course of the Rafah operations by the IDF from May 2024 onwards, the forced movement of IDPs from the south coastal areas of Deir El Ballah created new dynamics around the informal garbage landfills, where some locations of waste dumps were cleared for camp settlements.

## Background

The Israeli offensive launched in response to the October 7<sup>th</sup> Hamas attacks has passed its half-year mark. Gaza, the main theatre of operations in this showdown, has evolved into a site of immense material destruction and human suffering on an unprecedented scale in a heavily urbanised region. Over 36,000 deaths have been [reported](#) by the Gaza Ministry of Health, while the United Nations Population Fund [estimates](#) that nearly 1.7 million civilians have been [displaced](#) by the fighting. At the same time, the ongoing bombing campaign has inadvertently altered Gaza's architectural profile with damage assessments showing that at [minimum](#) 55% to [over](#) 58% of all built-up areas have been reduced to rubble. Besides residential and commercial buildings, critical healthcare and hygiene facilities have collapsed, too, making access to water, sanitation, and medical treatment even more cumbersome. A tenet of this multilateral collapse, the constantly growing mountains of solid waste raise alarming implications for public health and the environment.

Though trash might not be the first issue one considers in a violent conflict zone with thousands of casualties, the issue of waste in conflict zones is hardly novel. International [guidelines](#) are already on file to shield against improperly treated waste's adverse public health and environmental consequences. Yet, the relevant directives have been shunned in the context of Gaza. Months of continuous bombing and Israel's [fuel blockade](#) have decimated the already limited and outdated waste collection infrastructure. Local authorities [report](#) that the Israeli Defense Forces are preventing access to Gaza's three official landfills, forcing the local authorities and people into improper disposal methods. For UNICEF, the lack of spare parts and tools to repair municipal vehicle fleets and disposal facilities caused by Israel's suspension of imports exacerbates the situation, while the long-standing cash blockade prohibits authorities from sustaining an active labor force.

*Children picking waste in Khan Younis, January 19, 2024 via @UNRWA*



[Iraq](#), [Syria](#), and [Yemen](#) have faced similar wartime issues and can function as a warning tale while also helping to identify, prevent, and minimize risks. Lebanon's solid waste crisis [demonstrated](#) the complex health and environmental risks and exposures from dumped and burned garbage. Gaza is the newest breeding ground for such disasters.

"If the issue of solid waste, including medical waste, is not adequately addressed and resolved, it will exacerbate the suffering of Palestinians in the Gaza Strip. It will severely impact public health, particularly with limited access to healthcare services. Moreover, it will contaminate agricultural lands and the aquifer as pollutants seep into the soil. We must take decisive steps to avert the long-term consequences, and we are committed to doing so."

[UNDP REPORT](#) - March 28, 2024

The United Nations keeps putting out [warnings](#) on the massive public health and environmental crisis from the widespread pollution caused by solid waste in Gaza. Their heeded calls echoes a long legacy of scientific studies documenting the risks of inadequate disposal practices. Open landfills lacking official oversight are [known](#) to be a breeding ground for disease-carrying [vectors](#), like rodents, flies, and mosquitoes. As their numbers increase, so do the chances that the already vulnerable, malnourished, and conflict-ridden population is exposed to communicable diseases [like](#) gastrointestinal infections, asthma, skin irritation, and cholera. At the same time, as an ever-growing

*Palestinian families forced to live in tents surrounded by piles of garbage, are viewed in Gaza City, Gaza on June 20, 2024.*



*Abed Rahim Khatib / Anadolu*

number of people resort to waste scavenging as a source of nutrition and income and come into contact with [hazardous substances](#), the instances of [respiratory problems](#) are likely to skyrocket. While the effects of the war on Gaza's health infrastructure have been widely televised, the lens failed to capture the situation unravelling just outside the region's remaining hospitals. With no proper disposal mechanisms, [medical products](#) are dumped in the open. When improperly treated, such waste can release chemicals and radioactive substances into the earth or underground water, [leading](#) to the spread of diseases like Hepatitis B and C.

These health risks are compounded by another potential conflict-linked medical threat, namely the emergence of antimicrobial resistance (AMR). Palestinian doctors have [warned](#) of this threat ever since the escalation of the conflict in October. [Health experts](#) cite the degradation and damage of the water and wastewater treatment infrastructure as the main reason why a growing number of patients in conflict areas [fail](#) to respond to [antibiotic treatments](#). Past research in other war zones has also connected AMR to [heavy-metal exposure](#), such as the exposure of the population to munition remnants.

## Environmental Consequences

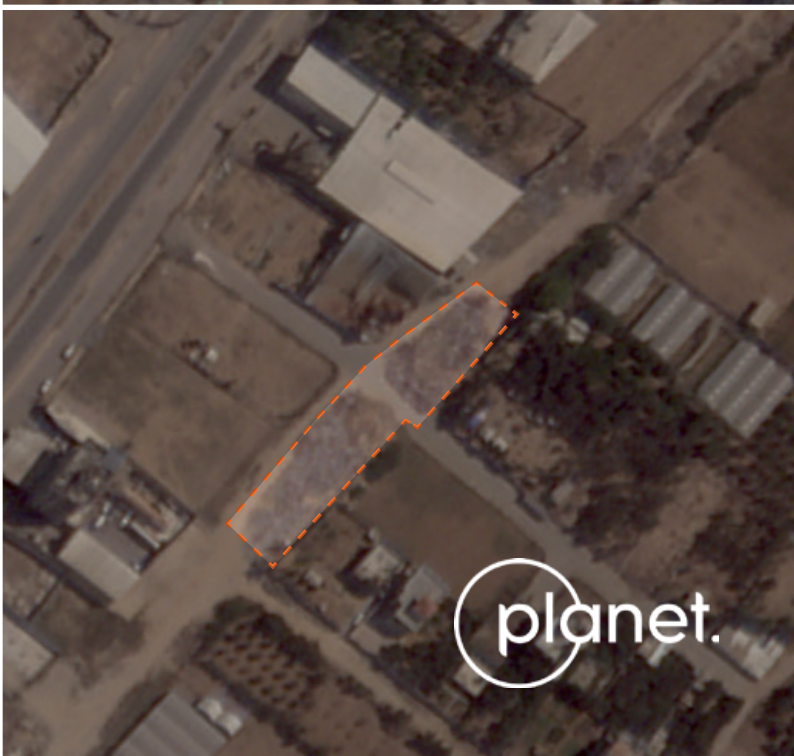
Besides the deadly consequences solid waste can pose to people, it can also render Gaza wholly uninhabitable. In unmonitored, make-shift landfills, leaking substances, called leachate, slowly seep into the soil. This chemical [soup](#), consisting of soluble organic matter, inorganic components, heavy metals, and xenobiotic organic compounds, [contaminates agricultural lands](#) and the [aquifer](#), while eventually [toxic substances](#) penetrate the food chain and find their way back to humans. Degraded soil and water supplies do not exclusively threaten the well-being of Gaza; owing to water's capacity to [migrate](#) over long distances, ecosystems and people not involved in the fighting could also be affected. So, while the danger for Gaza is imminent, the overall region could soon confront grave [ecosystem](#) and public health problems. With the waste collection apparatus in shambles, small communities resort to burning waste, a practice that [worsens](#) air conditions, and in return, public health near burn locations. Specifically, such practices have been [linked](#) with increased rates of childhood lymphoma and childhood lead poisoning.



Informal solid waste dump



Gaza



June 26-28, 2024





# Main Findings of Gaza's Waste Crisis

For the seven months between October 2023 and May 2024, our research identified at least **225 waste disposal sites and informal landfills** throughout Gaza, including **14 UN designated emergency landfills**. The majority of those locations are in the south, in and around IDP sites, or in the North in areas that people have remained in despite evacuation orders. The real number is likely much higher with smaller sites often not visible on satellite imagery and disposal of waste in open areas is an often occurring practice near all residential locations in absence of collection services or a designated landfill nearby. A substantial amount of waste seems to be small heaps near the roadside and in urban areas mixed with rubble.

***Based on the present findings four initial observations can be derived:***

The collapse of the waste management system has significantly increased the public health risks associated with solid waste exposure for tens or even hundreds of thousands of people displaced by the conflict. Satellite imagery and social media footage reveal that camps for internally displaced people (IDPs) and areas where civilians have sought refuge are situated near large volumes of waste, with small dump sites continually emerging. This already vulnerable population is now facing compounded health risks from solid waste. This includes the spread of communicable diseases, airborne illnesses caused by deteriorating air quality from waste burning and the odor of decomposing waste, and the exposure of waste-pickers to hazardous medical and industrial waste. Though the waste collection institutional ecosystem suffered from several deficiencies before the current conflict, the damage inflicted upon hundreds of municipal waste collection vehicles, processing facilities, and other tools deepened the solid waste crisis. The collection and safe disposal of waste were difficult tasks in the first six months of the war when support from the United Nations and humanitarian agencies was limited.

The closure of the three main landfills by the IDF forced local authorities and UN agencies' approaches to select local temporary dumpsites. These are often locations in back-alley or empty areas further away from populated areas to minimize civilian exposure. However, the locations often are not safe landfill sites with protective layers built in and are likely to contribute to contamination of soil and groundwater from leachate.

Initial clean-up and capacity-building efforts sponsored by local authorities, humanitarian organizations, and the United Nations are yielding small positive results. Yet, the removal of a few roadside dumps falls short of the herculean task ahead. With limited resources, the official landfills closed, and the fighting still underway, the widespread problem of solid waste will be on Gaza's agenda for many more months, even years, to come.

## Methodology: Identification of Solid Waste Dumps

Past work identifying solid waste landfills in Syria has established know-how in the recognition of solid waste dumps. Both satellite imagery and ground truthing are necessary tools in this process. Earth observation and optical imagery are useful for detecting changes or identifying specific types of land use. Satellites are designed to record light reflections; the way colors in the visible and near-infrared spectrums are absorbed or reflected could reveal information on the type of object observed, as is well explained in this [guide](#) on Remote Sensing and OSINT by Ollie Ballinger for Bellingcat. This method could [theoretically](#) also be applied to [identify](#) the grey scale or emissions in the light spectrum for solid waste landfills. However, this method was incompatible with the context of Gaza. Rubble, whose presence is extensive in the area, is likely to show similar visual signatures as waste, making it impossible to directly disambiguate between the two objects. Therefore, this research resorted to visual interpretation of high-resolution imagery.

### Use of earth observation for visual interpretation and mapping

Documentation of existing official landfills in Gaza and the work done to establish or remediate them has been helpful in visually identifying waste dumps, as it allows to look for similar patterns and colours throughout the region. For this research, access to Planet SkySat high-resolution optical imagery is a key tool for the identification of solid waste fills. With nearly weekly updates, depending on cloud cover and availability, locations could be identified throughout the start of the invasion after October 7.

*Several visual cues can assist in the identification of solid waste dumps, both official landfills and informal dumps:*

- ◆ Trash is a different spectrum of grey and black, the colour of most frequently used trash bags. This grey-black scale is apparent in this Google Earth image of the Juhr Al Deek field, one of the largest official waste landfills in Gaza, taken on July 5th 2022



But grey or black-coloured masses on satellite imagery do not *necessarily* equal trash. A lot of the grayscale features are likely to be rubble, especially given the months of intense bombardment in Gaza. That is why the use of pre-conflict imagery is necessary. For instance, in the following image from Khan Younis, a quite significant grey area is visible and at first sight, one could assume that it is waste. Checking pre-conflict imagery, however, one can see that there used to be a building in the now grey zone, which means that what we see in April is rubble and not waste.



Of course, context is also important. The grey-scale plot is found next to other buildings, so it is likely to also have been a building itself. Still, in the chaotic and ever-changing environment of wartime Gaza, empty land next to residential buildings is often converted into waste fields.

- The shape of the waste dumps is a second telling characteristic. Waste fields often have irregular shapes as can be seen in the following image of a former waste dump north of Nuseirat camp along the Wadi river of Gaza. UNDP [invested](#) in providing capacity and training for cleaning up this area in 2022 and the smaller patches of waste dumps along the river. The litter and different types of waste, and shapes of grey-scale colours are clearly identifiable and helpful for further visual identification on satellite imagery.



Hence, if the patches of grey appear to frame a more ordered polygon or square, even without comparing it with pre-conflict footage, we might already have suspicions that this used to be a building.

- Thirdly, location and contextual elements are also very helpful. Most dumps are relatively far from residential areas, as people do not want to live close to waste. Other possible locations are empty plots, river banks, or the outskirts of formal landfills. In urban environments where free land is not widely available, entire streets can be converted into landfills. This can be seen in the following image from the urban and more densely populated Northern Gaza, where a road is transformed into a makeshift dump site.



With Planet imagery, the larger and smaller pile of solid waste classification was conducted using the checklist provided above. For larger landfills, there were clear indicators that, on some occasions, could be corroborated with photos and videos shared by UN agencies, local authorities, journalists, and on social media.

## Use of open-source information to identify solid waste dumps

Social media posts and traditional journalistic reportages provide on-the-ground visuals of the solid waste crisis. Garbage was visible on street corners and squares in almost all videos. Though the piles were too small to be detected with satellite imagery, their constant presence corroborated that our count was an underestimate that only partially reflected the harsh reality. Social media discovery imagery was mainly based on imagery and videos shared by UN agencies, the Gaza Municipality's [Facebook](#) and [Twitter/X](#)-account, professional press agencies, as well as amateur videos retrieved from [Telegram](#) channels, Instagram, and X.



The examples that will be discussed below are cases in which waste sites seen in social media posts were geolocated and then observed in satellite imagery, too. In other words, we had visuals of specific garbage heaps both from the ground and from the sky. In other cases, however, even though research pinned certain pictures at specific locations in Gaza, the waste remained undetectable in satellite imagery.

For example, [a video](#) that made rounds in social media this February showed children picking through waste in an urban area of the Gaza Strip. The nearby store signage from the Telecom store and [pre-war social media footage](#) helped geolocate the video to a street in Gaza City. This shows the benefit of combining social media discovery and satellite imagery. Still, numeric estimates based on remote sensing grossly underestimate the extent of the situation on the ground. A February [WASH Cluster investigation](#), for instance, revealed that waste was present in more than 93% of both official and makeshift disposal sites.

The following map features all the waste sites that were identified in the Gaza Strip based on imagery dating to the end of June 2024. As the methodology section detailed, the number of waste sites presented in this report is most likely under-representative of the reality on the ground. The analysis of satellite imagery is limited and can only produce certainty for waste fields that are large enough to be detected.

# Conflict-linked solid waste crisis

Gaza

Beit Hanoun

Beit Lahiya

Jabalia

Gaza City

Juhr Al Deek

MEDITERRANEAN SEA

Wadi Gaza

Deir al-Balah

Deir al Balah

ISRAEL

PAX

Khan Younis

Al Fukhari

Rafah

EGYPT

**Legend**

- Pre 7 Oct. sites**
  - Informal solid waste landfills and processing facilities
  - Official solid waste landfills and processing facilities
  - ⊘ Closed landfill
- Post 7 Oct. sites**
  - Conflict-linked solid waste dumps
  - ▲ UN designated emergency waste dumps
- Urban areas
- Humanitarian zone July 2024

Analysis waste dumps by PAX and Marilena Zigka, Sources: UNOCHA, Openstreet Map, IDF.





## Case study Firas Market (Northern Gaza)

The area north of the Wadi Gaza riverbed was the main battlefield in the first acts of the war. Gaza City, considered a “[Hamás stronghold](#),” was one of the first areas to receive evacuation orders back in October. Though [more than 85%](#) of the population had fled the North in the first weeks of the conflict, approximately 300,000 people were [estimated](#) to have remained in the densely populated urban area. With [62% of the](#) area having been reduced to rubble and the blockade of aid delivery routes exacerbating conditions of famine, those who stayed in the North faced another threat: waste. At least 39 waste sites were identified above the Wadi River, and according to the Gaza Municipality, there have been over 100,000 tons of solid waste accumulated in the streets throughout the city since October 7.

A particular waste site consistently appeared on social media. The X and Facebook accounts of the [Municipality of Gaza](#) posted many images reporting the growing problem posed by waste. We geolocated the image to the Firas Market, one of Gaza City’s most historic and popular markets. The lack of proper waste management and treatment in the specific location can lead to great public health risks. The waste in Firas is not only piling up in huge mountains of garbage on the premises of the once buzzing market; it is also often burning, and the location has also been [bombed](#), causing [casualties](#), and further deteriorating the conditions of the site.



## Case study Rafah

During the first months of the Israeli offensive, people fled to the south, with over 1.5 million people spread out through Rafa in houses and IDP camps. This also resulted in a massive increase in waste accumulation, with a claimed rate of 350-400 tons being processed. The problems are worsened by the rapidly increasing temperatures that affect the waste and spread of diseases and bad smells, [warns](#) the UN. Specific sites are now allocated as temporarily ‘official’ landfills, though without any protective layers. Satellite imagery shows the massive piling up of solid waste near the wastewater treatment plant close to the border. Imagery [shared](#) by traditional media that is geolocated to Rafah, meters away from the Egyptian border.



## 📍 Case study Al-Aqsa University

Al-Aqsa University is one of the oldest educational institutions in Gaza with its first branch established in 1955. The university’s Khan Yunis campus was built in the past decade and the two campuses [reported](#) an enrollment of over 25,000 students. The UN has [expressed](#) concerns over a potentially ongoing “scholasticide” occurring in Gaza due to the destruction of all educational institutions in the conflict. Indeed, the university has been the [target](#) of [bombings](#) and raids and has long suspended its academic operations.

The premises now [house](#) displaced people with the university’s surroundings having ultimately been converted into a makeshift waste field seen in footage released by the [UNRWA](#) and [The National News](#). The waste dump stretches over 300 meter along the road, cover nearly 10,000m<sup>2</sup>, and is surrounded by hundreds of tents with thousands of displaced people living near the stench of rotting garbage.





## Yarmouk Waste Transfer Site site

Prior to the war, waste collection in Gaza city was coordinated through the Yarmouk Waste Transfer Site (TS), next to the city's stadium. The transfer station had a daily [processing](#) capacity of 350 tons, where the waste would be transported to the Juhor ad-Dik landfill in the east of Gaza. The facility hosted dozens of garbage trucks and other vehicles used in waste collection and had equipment for processing the waste for recycling.

The location itself soon became both a massive dump site and a target of bombing, going by satellite imagery that shows the destruction of the location, and [reports](#) by UN agencies. The Municipality of Gaza put out [warnings](#) of the dire state of the facility due to over 90,000 tons of solid waste spread in northern Gaza, accompanied by photos and [videos](#) that can be geolocated to the site of the Yarmouk TS, showing large piles of garbage in and around the facility. An Al Jazeera camera crew also visited the location in late April, with footage [showing](#) burning waste.



## Historical Challenges with Waste Management in Gaza

Though waste management has considerably worsened in recent months, Gaza has historically faced an unsustainable sanitary regime. Data from 2019 [shows](#) that 35% of all municipal waste was not being disposed of in controlled landfills, but in illegal dumping sites instead. Even the three operational landfills in Sofa/ Al-Fukhari, Deir al-Balah, and Juhor ad-Dik, however, have long surpassed their expected lifespan [according to](#) the Heinrich Böll Stiftung and had already been deemed unfit to correspond to the increasing demands of the region back in 2019. For example, at the Juhor ad-Dik landfill in the north, the piles of waste reached a [height](#) of more than 35 metres above the ground, making it one of the tallest landmarks in Gaza.

The COVID-19 pandemic was a critical point of deflection. To manage the demands of this health emergency, money was diverted away from waste management, ultimately decreasing the frequency and scope of waste collection. As a result, not only did the official waste dumps significantly expand, but also [more than 80](#) new unofficial dumps mushroomed around Gaza in just a year.

With only 500 donkey carts and 76 collection vehicles available, the almost 2,000 tons of waste produced by Gaza's 2.3 million inhabitants every day **exerted** even more pressure on Gaza's fragile environment. According to the **UNDP**, one collection vehicle served 21,000 inhabitants and one collection worker served 3,343 individuals.

Since 2011, the World Bank has spearheaded an **initiative** aimed at ameliorating the solid waste management system in Gaza through improvements in collection services and capacity building. A new landfill was supposed to be set up, while older ones were to be rehabilitated. Local authorities working through the Joint Council on Solid Waste Management worked on a **master plan** to close down informal waste sites and set up a broader network of waste collection, waste processing, and safe landfills to counter the wider environmental health issues linked with the garbage crisis. Progress on both the local and international funded projects however has been stalled during the current conflict.

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لجنة الطوارئ في بلدية خان يونس: جانب من أعمال طواقم صنّاع الجمال في بلدية خان يونس جنوب محافظات غزة أثناء جمع وتحويل النفايات من حي المواصي غرب خان يونس بالتعاون مع المجلس المشترك لإدارة النفايات الصلبة

Translated from Arabic by Google

The Emergency Committee in the Municipality of Khan Yunis: An aspect of the work of camel makers crews in the municipality of Khan Yunis, south of the Gaza governorates, while collecting and transporting waste from the Al-Mawasi neighborhood, west of Khan Yunis, in cooperation with the Joint Council for Solid Waste Management.

Was this translation accurate? Give us feedback so we can improve: 👍 👎



7:23 AM · Mar 15, 2024 · 120 Views

## Clean-up efforts

In central and southern Gaza, UN agencies and the International Committee of the Red Cross established 19 emergency dump sites, where collected waste could be temporarily stored before being later transported to official landfills. But with access to the latter still prohibited by the IDF, the removal of solid waste from temporary sites in populated areas to safe dumping locations remains elusive. In the north, the Municipality of Gaza has also struggled with the mounting waste crisis. The authorities have **cited** the destruction of waste collection vehicles and facilities as reasons for the downgrading of their collection mechanisms.

**Municipality of Gaza - بلدية غزة** May 16 · 🌐

سيتم جمع باقي الكمية وفق ما يتوفر للبلدية من مشاريع جديدة #بلدية\_غزة تجمع وترحل نحو 15 ألف طن من النفايات للتخفيف من الكارثة الصحية والبيئية

تمكنت بلدية غزة من جمع وترحيل نحو 15 ألف طن من النفايات ضمن مشاريع تنفذها البلدية على مراحل بالتعاون مع الهيئة العربية الدولية لإعادة إعمار فلسطين وهيئة الأعمال الخيرية إسترااليا ضمن جهود التخفيف من الكارثة الصحية والبيئية التي تعيشها المدينة.

وأوضحت البلدية أنه تم جمع وترحيل الكمية المذكورة من النفايات من أصل 100 ألف طن تتراكم في الشوارع منذ بدء العدوان، مؤكدة أنه سيتم جمع باقي الكمية وفق ما يتوفر للبلدية من مشاريع جديدة.

وأكدت البلدية أن عملية الجمع تستهدف المناطق الأكثر تكديسا للنفايات والتي يمكن الوصول إليها وتتواجد بها المواطنين.

ويمنع الاحتلال الإسرائيلي طواقم البلدية من الوصول مكب النفايات الصلبة الرئيس في منطقة جحر جنوب شرق المدينة وكذلك تعمد تدمير آليات جمع النفايات مما تسبب بكارثة كبيرة وتكدس النفايات في الشوارع.

وتناشد البلدية كافة المؤسسات والمنظمات الدولية والجهات المعنية بالتدخل العاجل لإنقاذ الأوضاع في المدينة وتمكين البلدية من توفير الخدمات الأساسية للمواطنين. #حرب\_غزة



13 comments 5 shares

Like Send Share

Throughout the war, UN agencies and local authorities have been [working](#) to mitigate the waste crisis. In recent months, small-scale clean-up initiatives sponsored by Australian charities have resumed. Those efforts have already [resulted](#) in the removal of 15,000 tons of waste. Since February, joint efforts led by UNDP resulted in [10,000 tons](#) of solid waste being collected by the Joint Service Council for Solid Waste Management, the UNRWA, and the UNDP. An example collection effort is seen in [images](#) coming out of Khan Yunis.

Still, [recent UNDP research](#) warns that such efforts are localized in the south, while only 600 to 700 tons of waste are collected daily. With more than 2,000 tons generated every day and roughly 200 vehicles and collection equipment [destroyed](#), the clean-up campaign is still in its infancy.

*Palestinians walk past piles of garbage left in the streets of Gaza City, May 20, 2024*



# Conclusions

Facing months of heavy bombing, destruction, and killing, the population of Gaza is also facing a myriad of cascading health risks from the war. This report aimed to visualize and quantify both the acute health risks from the war-caused waste crisis, and the 'slow violence' that is already emerging with limited ability for removal, remediation, and safe storage of the hundreds of thousands of tons of solid waste. The findings also show that there are more health and environmental risks that the eye can see in warzones, which can have profound implications for conflict-affected populations yet need to be addressed in the medium- and long-term. The use of earth observation and open-source investigative techniques is proven to be an essential instrument in the toolkit mapping the environmental dimensions of war.

The research undertaken for this report already proved useful for UN agencies on the ground who did not have the capacity and expertise to map the spread of informal solid waste dumps throughout Gaza. PAX shared the findings with relevant UN agencies on the ground who are using the data to set priorities for informal solid waste collection programs.

In the long term, additional remote sensing analysis is needed, in particular around the larger emergency dump locations, as the accumulation of waste risks contaminating soil and groundwater resources. This should include information on hydrology, land use, and broader geospatial analysis of atmospheric conditions that can help determine potential risks for nearby communities and their resources and the need for proper remediation efforts of emergency dump sites. The mapping should also be integrated into environmental health analyses concerning the spread of communicable diseases, potential connections with antimicrobial resistance, and other established health conditions related to exposure to solid waste. This includes considering air pollution from waste burning and diseases associated with waste picking.



# Recommendations

## Short Term

An immediate and permanent ceasefire is urgently needed to protect the civilian population in the Gaza Strip. In the absence thereof, the following actions should be undertaken to curb the looming health and environmental catastrophe caused by the solid waste management crisis.

- Facilitate remote sensing and open-source mapping to understand the extent of the conflict-linked solid waste crisis, a critical support for UN and humanitarian actors planning systematic clean-up efforts.
- Call for Israel to allow access to the designated safe landfill sites in Gaza. Proper disposal of solid waste is currently impossible, which exacerbates the humanitarian crisis by increasing environmental and health risks.
- Provide equipment, funding, and training for humanitarian organizations working on clean-up, remediation, and disposal efforts.
- Replicate [UNDP clean-up initiatives](#) using mobile crushers that can both collect and repurpose rubble and waste for use in future projects, like construction.
- Designate funding for post-conflict recovery initiatives aiming to restore existing waste transfer sites and construct new safe landfills.
- Conduct sampling of soil, air, and water sources around major informal solid waste dumps to evaluate potential public health and environmental risks.

## Long-term

The future outlook for Gaza's ability to cope with numerous challenges—such as rising sea levels, pressure on natural resources (including water), and the catastrophic level of destruction from the current conflict—will pose an existential challenge for Palestinians. Addressing this requires long-term investments and political stability to implement the necessary measures and policies. These include climate mitigation and resilience policies as part of sustainable reconstruction efforts that would also need the inclusion of local communities in both the research and implementation phases. A more strategic approach is therefore needed to ensure the sustainable recovery and future resilience of environmental infrastructure in Gaza. The following measures should be considered:

- Understanding the breadth and depth of damages is needed to work on remediation, clean-up, and restoration efforts. A coordinated effort with the help of the World Bank, UNDP, and UNEP is needed to conduct a full-scale post-conflict environmental assessment, including the mapping of hazardous facilities, water infrastructure damages, impact on groundwater sources and the marine environment, affected agricultural land, biodiversity and other relevant topics, in line with [UNEA Resolution 3.1](#) on conflict pollution.
- Conduct a full-scale post-conflict environmental assessment in line with [UNEA Resolution 3.1](#) on conflict pollution. This includes the mapping of hazardous facilities, water infrastructure damages, impact on groundwater sources and the marine environment, affected agricultural land, biodiversity, and other relevant topics.
- Introduce climate mitigation and resilience policies in the post-war reconstruction waste management regime.
- Foster the inclusion of local engineers, community workers, communication and reporting officers as well as a waste collection fleet in both the research and implementation phases by providing funding, training, and equipment to cultivate expertise and maintain a labor force.