

PEACE AND SECURITY

RECONSTRUCTION AND ENVIRONMENT

Palestinian Perspectives on the
Reconstruction of Gaza

Ahmed H. Hilles
November 2024



The blockade, economic hardship and repeated military attacks have left Gaza in a state of perpetual crisis. The ongoing war has worsened this crisis, causing severe and potentially irreversible damage to the environment, public health systems and infrastructure.



The war has led to soil contamination and the destruction of agricultural lands, the collapse of essential water and sanitation services and air pollution from toxic emissions.



An international environmental fact-finding committee is needed to assess the damage and lay the basis for environmental restoration and long-term recovery. Key priorities include a ceasefire, rehabilitating critical infrastructure, guaranteeing food and water security, and restoring environmental health and public health care, while ensuring community participation throughout.

RECONSTRUCTION AND ENVIRONMENT

Palestinian Perspectives on the Reconstruction of Gaza



The cumulative effects of the blockade, economic hardship and repeated military attacks on Gaza have left Gaza in a state of perpetual crisis and environmental degradation. Before 7 October 2023, Gaza was already suffering from high unemployment, widespread poverty and infrastructure deficits. The ongoing war has worsened these issues and the systematic destruction of Gaza's environment and infrastructure has led to severe and potentially irreversible damage.



Basic elements of the environment: soil contamination, water pollution and air quality deterioration. The destruction of agricultural lands, coupled with the burning and poisoning of the soil, has drastically reduced the region's capacity to ensure food security. The collapse of infrastructure and electricity shortages have led to the complete breakdown of water, sanitation and hygiene systems, significantly increasing the risk of communicable diseases and public health crises. Air pollution is widespread due to the release of toxic emissions from continuous bombardments.



The establishment of an international environmental fact-finding committee is crucial to document the war's environmental impacts. Key actions to mitigate the environmental and public health should must include a ceasefire and withdrawal of Israeli troops, environmental restoration, international support, long-term environmental management, and rehabilitation and reconstruction. Empowerment of marginalised groups and community participation and contributions are crucial in achieving these goals.

Further information on the topic can be found here:

<https://palestine.fes.de/topics/palestinian-perspectives-on-the-reconstruction-of-gaza>

PEACE AND SECURITY

RECONSTRUCTION AND ENVIRONMENT

Palestinian Perspectives on the
Reconstruction of Gaza

In cooperation with:



Stiftung Wissenschaft und Politik
German Institute for International
and Security Affairs

Content

1	BACKGROUND	2
2	THE CURRENT STATE OF GAZA	4
3	ENVIRONMENTAL IMPACT AND NATURAL RESOURCES	7
4	CONCLUSIONS	12
5	OBSTACLES AND RECOMMENDATIONS	13
	References	15

1

BACKGROUND

DEMOGRAPHICS AND SOCIAL CONDITIONS

Before the current war, the population of Gaza had grown to approximately 2.4 million people, with 45 per cent under the age of 15 and 65 per cent under 24. All of this within an area of just 365 square kilometres, making it one of the most densely populated areas in the world, with approximately 6,000 people per square kilometre (Hilles 2021). Unemployment rates had increased to 46 per cent as of 2021, with youth unemployment at 68 per cent. The economic blockade, in place since 2007, had driven more than 65 per cent of the population below the poverty line. Over 85 per cent of Gazans relied on international aid, and food insecurity affected 75 per cent of households. Mental health issues remained critical, with 58 per cent of children showing Post-Traumatic Stress Disorder (PTSD) symptoms (OCHA 2024).

INFRASTRUCTURE AND ENVIRONMENTAL CONDITIONS

Infrastructure in Gaza had been severely compromised by years of blockade and repeated military attacks on Gaza. The electricity supply was a significant issue, with Gaza receiving only about 120–180 megawatts (MW) against a daily demand of 450–500 MW. This resulted in power cuts lasting up to 20 hours a day. The energy crisis affected all aspects of life, from health care to education and daily living (Hilles 2021).

Water scarcity was another critical issue. Over 96 per cent of Gaza's water supply was deemed unsafe for human consumption due to high levels of salinity and contamination. Per capita water consumption was about 79 litres per day, significantly below the World Health Organization's (WHO) recommended minimum of 100 litres per day. Only about 10 per cent of the population had direct access to clean water (Hilles 2021).

Solid waste management was also problematic, with Gaza generating approximately 2,000 tons of waste per day. The majority of this waste was not properly managed due to a lack of resources, leading to environmental pollution and health hazards. Approximately 35 per cent of municipal

waste was disposed of at illegal dumping sites, and the three operational landfills were beyond capacity. The main landfill in Gaza City was near capacity, handling about 700 tonnes of waste daily from Gaza City and northern Gaza. Prior to the war, Gaza's waste management infrastructure was already under significant strain. This inadequate waste management system was further exacerbated by the blockade and recurring attacks on Gaza, leading to an accumulation of waste and insufficient disposal facilities (PAX 2024).

ECONOMIC IMPACT AND RESOURCE SCARCITY

The economic blockade on Gaza had crippled its economy. GDP per capita was estimated at around US\$ 1,000 in 2021, significantly lower than the US\$ 3,600 in the West Bank. The industrial sector operated at less than 20 per cent of capacity, primarily due to restrictions on the import of raw materials and exports of finished goods (Hilles 2021).

The labour force participation rate was low, at around 45 per cent, with female participation even lower at 20 per cent. Approximately 79 per cent of workers in the private sector earned less than the minimum wage of 1,450 shekels (approximately US\$ 439.3), with the average monthly wage only about 682 shekels (US\$ 206.6) in Gaza. These figures reflected the dire economic conditions and the significant income disparity between Gaza and the West Bank (Hilles 2021).

Agriculture, a vital sector in Gaza, was severely affected by the blockade and recurrent military operations. The agricultural sector employed about 6.6 per cent of the labour force, a significant portion of them women. However, the restrictions on the movement of goods and people, along with the destruction of agricultural lands, led to substantial economic losses. Annual agricultural output had decreased by over 50 per cent since 2000, exacerbating food insecurity in the region.

HEALTH AND ENVIRONMENTAL HEALTH

The environmental challenges in Gaza contributed to health issues, such as rising rates of cancer and kidney failure. Pollution of air, water and soil was prevalent due to inadequate

waste management, industrial emissions and the use of contaminated water for irrigation. Health services were critically impaired, with 60 per cent of essential drugs and 50 per cent of medical disposables unavailable. Waterborne diseases had increased significantly, with over 25 per cent of the population affected by related illnesses (Hilles 2021).

The health sector in Gaza was on the brink of collapse. Hospitals and clinics faced chronic shortages of medicines, medical supplies and equipment. As of 2021, about 46 per cent of essential drugs and 33 per cent of medical disposables were at zero stock. The health infrastructure had also been damaged in war, with over 50 per cent of primary health-care facilities partially or fully damaged during military operations (World Bank 2024). Waterborne diseases were prevalent due to the poor quality of water and inadequate sanitation facilities. Approximately 25 per cent of households were not connected to the sewage network, relying instead on cesspits that often overflowed and contaminated the groundwater. The incidence of diarrheal diseases, particularly among children, was alarmingly high.

The environmental impact of earlier Israeli military operations has been severe. The wars have left behind thousands of tonnes of rubble, hazardous waste and toxic substances. These pollutants have contaminated the soil, water and air, posing long-term health risks to the population. The cumulative effects of the blockade, economic hardship and repeated military attacks on Gaza have left Gaza in a state of perpetual crisis. The environmental degradation, coupled with the socio-economic challenges, has created a fragile and unsustainable living situation for the residents. The inability of local institutions to address these challenges, due to both resource constraints and external pressures, has further exacerbated the situation.

2

THE CURRENT STATE OF GAZA

WAR AND DISPLACEMENT

The ongoing conflict in Gaza has led to severe displacement and significant environmental impacts. Over 2 million people have been internally displaced within Gaza, particularly in the southern governorates where 70 per cent of buildings in Khan Younis and Rafah have been damaged or destroyed. This mass displacement has not only created a humanitarian crisis but has also strained the already fragile environmental resources and infrastructure.

Continuous bombardments have destroyed over 80 per cent of housing in southern Gaza, leading to dire living conditions and further exacerbating environmental health issues. The displacement of nearly the entire population has resulted in

overcrowded living conditions, particularly in makeshift shelters and tent groups, which lack proper sanitation and access to clean water. This has significantly increased the risk of communicable diseases and further strained the water and sanitation infrastructure (IPC Famine Review Committee 2024).

As of November 2024, cumulative fatalities among Palestinians were reported to be 43,665, with tens of thousands more injured. The destruction of buildings and infrastructure has led to widespread environmental degradation, including soil contamination, air pollution and hazardous waste accumulation. These environmental hazards pose ongoing health risks to the displaced population, who are already vulnerable due to limited access to health care and essential services (OCHA 2024c).

Figure 1
Cumulative Fatalities in Gaza from 7 October 2023 until 12 November 2024

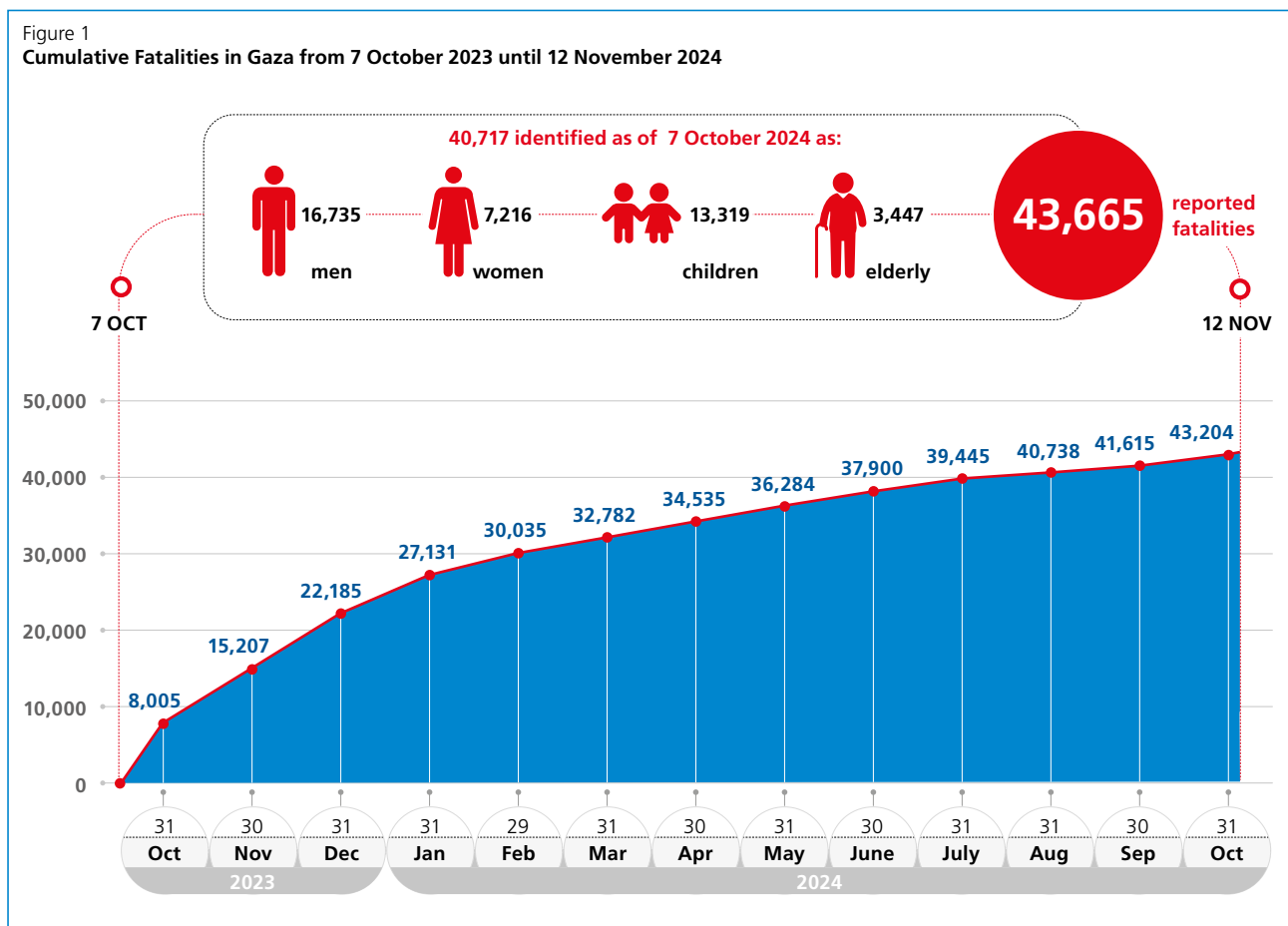


Table 1
Health sector capacity and impact

Indicator	Pre-war (2023)	Current (November 2024)
Hospitals (partially functioning)	36	17
Primary health-care facilities (partially functioning)	132	47
Field hospitals	–	11

Source: OCHA 2024c

FOOD SECURITY

The food security situation is dire, with 96 per cent of the analysed population projected to face crisis or worse levels of food insecurity. This includes 745,000 people facing emergency levels of food insecurity and 495,000 people facing catastrophic levels of food insecurity. Additionally, 60–70 per cent of meat and dairy-producing livestock have been killed or prematurely slaughtered, and 63 per cent of cropland and 33 per cent of greenhouse areas have been damaged.

In response to the crisis initially forecast as potential famine in the northern governorates in February, significant nutrition interventions were implemented during March and April. These included treatments for acute malnutrition (both outpatient and inpatient), blanket supplementary feeding, micronutrient supplementation, and support for Infant and Young Child Feeding (IYCF). However, access to and availability of these critical nutrition services declined in May 2024 (Global Nutrition Cluster 2024). By the end of April, approximately 259 nutrition service sites were operational, with 86 per cent concentrated in Rafah, Khan Younis and Deir Al Balah. Over 15,000 children underwent screening, and about 5,750 were admitted for treatment for severe acute malnutrition (SAM) and moderate acute malnutrition (MAM). The nutrition programmes in the northern governorates were hindered by the inability to secure authorisation for importing essential supplies during March and April (Global Nutrition Cluster 2024).

Following the military actions in Rafah, many partners suspended their operations and relocated from Rafah to cen-

tral areas. The number of Outpatient Therapeutic Feeding Program (OTPs) sites decreased from 102 in April to 66 in May. Moreover, several nutrition partners encountered challenges accessing warehouses and supplies, as well as difficulties in establishing new sites due to limited space (Global Nutrition Cluster 2024).

INFRASTRUCTURE AND UTILITIES

The infrastructure in Gaza has sustained extensive damage, with over 60 per cent of residential buildings and over 80 per cent of commercial facilities affected. Additionally, 65 per cent of the total road network has been damaged, as reported by UNOSAT (UNOSAT 2024a; WASH Cluster 2024).

UNRWA has reported damage to 189 of its installations, a total of 162 health institutions, including 34 hospitals, have been partially or totally destroyed, and 131 ambulances have been damaged. Hundreds of thousands of citizens are in desperate need of urgent health interventions and major surgeries, which the health sector is unable to provide under the current oppressive conditions and the destruction it has suffered (UNRWA 2024).

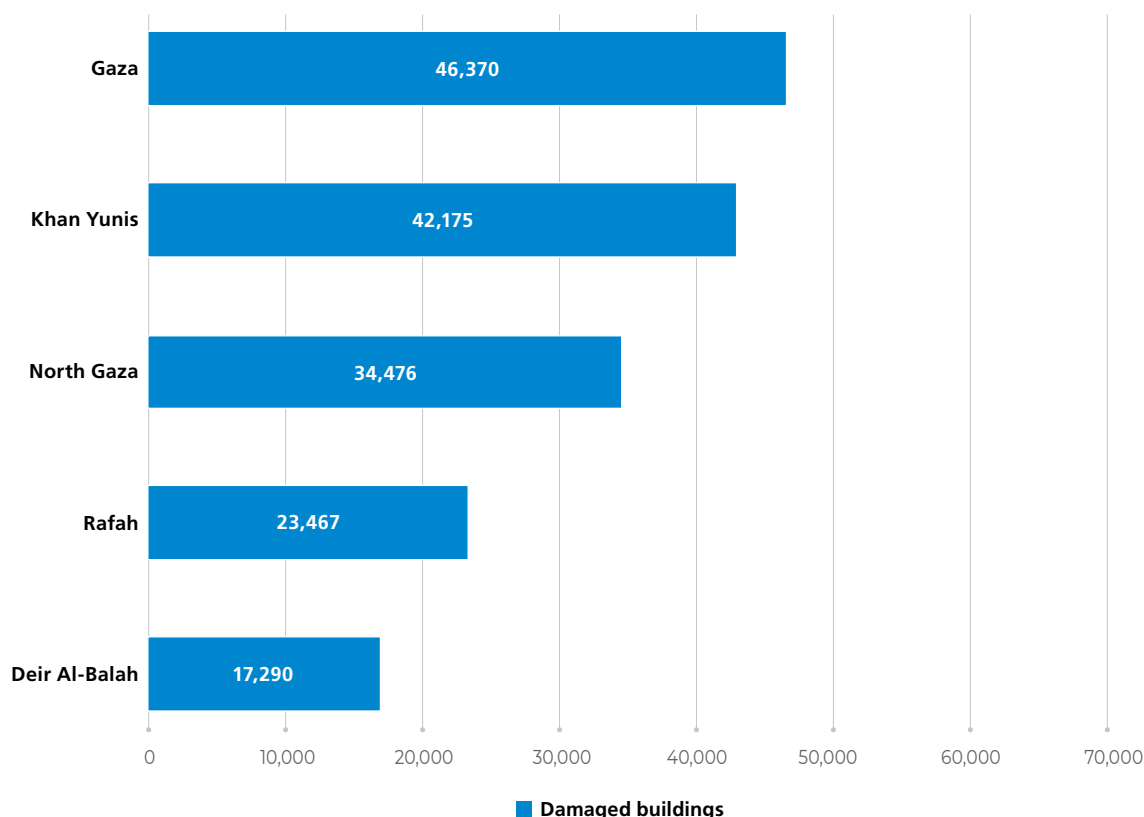
The electricity supply is critically inadequate, with most areas receiving less than two hours of electricity per day. This severe power shortage has crippled essential services, including health care and sanitation. Over 96 per cent of Gaza's population lacks access to safe water due to damaged infrastructure and contamination issues. Access

Table 2
Infrastructure and utilities impact

Indicator	Pre-War (2023)	Current (July 2024)
Hours of electricity per day	8–10	Less than 2
Population with access to safe water (%)	10%	4%
Population with access to sewage network (%)	70%	30%

Source: OCHA 2024a, Global Nutrition Cluster 2024

Figure 2
Housing damage across Gaza governorates as of September 2024



Source: UNOSAT 2024b

to safe water is now at 4 per cent, and only 30 per cent of households are connected to proper sewage systems. The water and sanitation infrastructure has suffered significant damage, with 135 water wells, 450 km of water networks, 150 km of sewage networks, 65 sewage pumping stations, and seven treatment plants all partially or completely destroyed due to the war (UNOSAT 2024a). Table 2 illustrates the stark contrast between pre-war and current conditions (OCHA 2024b; Global Nutrition Cluster 2024).

The destruction of critical infrastructure has also had a profound impact on health-care facilities. Furthermore, 163,778 buildings in the Gaza Strip have suffered damage, distributed across the governorates, as shown in Figure 2 (UNOSAT 2024b).

Environmental health concerns have intensified, with widespread contamination of soil, water and air due to war-related debris and pollutants. The use of hazardous substances in bombardments has increased the risk of chronic health conditions among the population. The economic impact of the war has been profound, plunging Gaza into severe economic hardship. Unemployment rates have soared to over 60 per cent, with female labour force participation plummeting to around 10 per cent. The industrial sector, which was already operating at less than 10 per cent capacity due to infrastructure damage and trade restrictions, has been severely crippled. Agricultural output, crucial for employ-

ment and food security, now operates at only 30 per cent of its pre-war capacity.

The health sector in Gaza is on the brink of collapse, struggling with critical shortages of medical supplies and facilities. Nearly 70 per cent of essential drugs and 50 per cent of medical disposables are out of stock, severely limiting the capacity to treat the wounded and sick. The destruction of health-care facilities during the war has exacerbated these challenges, leading to preventable deaths and a significant public health crisis. Out of the 36 hospitals, 21 are out of service. Additionally, there are eight functional field hospitals, with four fully operational and four partially operational. Approximately 43 per cent of primary health-care centres (45 out of 105) are partially functional, and 38 per cent (10 out of 26) of UNRWA health centres are operational (UNRWA 2024).

The current state of Gaza is characterised by a severe humanitarian, economic and environmental crisis of unprecedented proportions. The war has inflicted a devastating impact on civilian lives, infrastructure and essential services, exacerbating pre-existing vulnerabilities and setting back development efforts significantly. Immediate and sustained international intervention is imperative to address the urgent needs of the population, support recovery and facilitate long-term reconstruction efforts.

3

ENVIRONMENTAL IMPACT AND NATURAL RESOURCES

Gaza, akin to other Palestinian occupied territories, confronts significant environmental challenges exacerbated by fragile resources, constrained sovereignty and limited financial resources (OCHA 2024b). Key environmental sustainability issues in Gaza include water scarcity, soil degradation, pollution of air, water and soil, as well as desertification and unsustainable land management practices. These factors collectively impact the region's biodiversity and overall environmental health, suffering the consequences of Israeli actions during periods of both peace and Israeli military operations (UNEP 2020).

DESTRUCTION OF BUILDINGS AND INFRASTRUCTURE DAMAGE

As of the end of January, the Interim Damage Assessment reported that over 60 per cent of physical infrastructure across all sectors in Gaza, excluding water, sanitation and hygiene (WASH), had been either damaged or completely destroyed. This includes approximately 62 per cent of all residential homes in Gaza, totalling 290,820 housing units. The transport sector has incurred damages amounting to approximately US\$ 358 million, impacting 62 per cent of roads, including 92 per cent of primary roads, and a substantial number of vehicles (World Bank 2024).

UNEP has been regularly assessing the quantity of debris generated from the Gaza war since November 2023. The

destruction of buildings and infrastructure has resulted in a substantial volume: as of May 2024, estimates put it at over 39 million tonnes. This quantity of debris in Gaza is thirteen times greater than the combined total generated from all previous attacks on Gaza since 2008. Currently, there is over 107 kg of debris for every square metre in the Gaza Strip, potentially containing unexploded ordnance (UXO), hazardous materials and human remains. The total debris from the current war in Gaza exceeds by five times the amount generated during the 2017 ISIL conflict in Mosul (7.65 million tonnes) (UNEP 2018).

In Gaza, asbestos is present predominantly in older buildings and structures across its eight refugee camps, particularly in the asbestos cement sheets used for roofing. A preliminary assessment of the debris produced in these camps suggests that approximately 800,000 tonnes of debris could be contaminated with asbestos, requiring careful handling as hazardous waste. Therefore it is crucial to ensure that potentially contaminated debris from refugee camps is segregated and not mixed with debris from other locations.

PROHIBITED WEAPONS AND ENVIRONMENTAL IMPACT

The bombing of Gaza and subsequent destruction of buildings, roads and infrastructure had produced more than 39 million tonnes of debris by July 2024, some of which con-

Table 3
Debris generated in each governorate

Governorate	Tonnes of debris
North Gaza	8,134,416
Gaza	15,313,427
Deir AlBalah	2,448,472
Khan Younis	9,100,037
Rafah	604,626
Damaged Roads	3,600,000
Total	39,200,978

Source: UNEP 2018

tains hazardous substances such as unexploded ordnance (UXOs) and asbestos (World Bank 2024). This vast quantity of building debris also includes human remains (OCHA 2024a).

The probable deployment of internationally banned weapons during the recent war in Gaza in 2023 has inflicted severe damage on essential civilian infrastructure, including hospitals, water sources and sanitation facilities, which are vital to sustaining life. Israeli forces have employed large-scale bombing, probably white phosphorus, and other weapons that have polluted the fundamental elements of any present and future environment: water, air and soil. Statements from Israel, coupled with evidence of extensive damage and an unprecedented volume of debris, indicate that a notably large quantity of munitions has been employed in a densely populated region. According to reports from various media outlets and official statements, as of 10 December 2023, Israel Forces acknowledged hitting 22,000 targets in Gaza, averaging more than 300 strikes or bombings daily.

According to reports (MAG 2024; Sharp/Detsch 2023), prohibited weapons, such as white phosphorus, have been used. That has not been confirmed as of yet. UNEP has previously highlighted the challenge of differentiating between white phosphorus and legally permissible thermite-based ammunition based solely on photographic or video evidence (UNEP 2022).

The soil in Gaza has also suffered significant degradation due to the heavy metal contamination from munitions, making it less fertile and further undermining the region's agricultural capacity. This not only threatens food security but also leads to the bioaccumulation of toxic substances in crops, posing a health risk to the population that relies on locally grown food. Air pollution, intensified by the use of explosives, has led to a marked increase in respiratory conditions and has exacerbated the existing health crisis in Gaza.

These environmental and health impacts are not solely attributable to actions during armed attacks on Gaza but also reflect a longstanding policy of the Israeli occupation towards Palestinians in this region. The combined effects of these pollutants have created a hazardous living environment in Gaza, where the long-term consequences for public health and the ecosystem may persist for decades (CEOBS 2022).

WASH, WASTEWATER TREATMENT, AND SEWAGE SYSTEM

The WASH situation remains dire across the Gaza Strip, with ongoing significant damage to water and sanitation infrastructure. According to estimates from WASH Cluster partners over the past eight months, approximately 67 per cent of water and sanitation facilities have been destroyed or damaged (WASH Cluster 2024). Various challenges

such as insecurity, restricted access and fuel shortages have rendered many sites non-operational. Municipal water production is currently only at 28 per cent of pre-October 2023 levels, and distribution across production points is uneven. The water distribution network has experienced a 50 per cent loss due to extensive damage (OCHA 2024b). Recently, in July 2024, a major water treatment plant was blown up, further exacerbating the already critical situation. As a result, only one of the three desalination plants in Gaza is operational, and it functions only intermittently. This has significantly reduced the availability of potable water, with average daily water production between 7 and 14 July at only 86,000 m³.

The situation is expected to worsen rapidly in densely populated southern areas, where increasing competition for limited water access and use of sanitation facilities may impact the health and nutritional well-being of the population. Fuel scarcity remains a critical issue, particularly for operating water pumps and desalination plants (WASH Cluster 2024).

The war in Gaza has severely disrupted nearly all environmental management systems and services, including essential ecosystem services, while introducing new environmental hazards. The breakdown of sewage, wastewater and solid waste management facilities has had a significant impact on both the environment and the population. Sewage treatment plants have been damaged, leading to untreated sewage being discharged into the environment, contaminating water sources and creating significant public health risks. This has particularly affected densely populated areas, where overflowing sewage has increased the risk of waterborne diseases.

One notable consequence is the rising incidence of communicable diseases in Gaza: following the escalation of the war, the WHO reported in late 2023 that 179,000 cases of acute respiratory infections, 136,400 cases of diarrhoea among children under five, 55,400 cases of scabies and lice, and 4,600 cases of jaundice were recorded within a three-month period. The incidence of diarrhoea alone is 25 times higher than pre-war levels (WHO 2023).

Moreover, a recent outbreak of polio has been linked to the compromised sanitation and water conditions, further endangering the health of the population, particularly children. The spread of polio, a disease that had been nearly eradicated, highlights the severe impact of the breakdown in essential health and sanitation services in Gaza.

The interim assessment conducted by the World Bank, the European Union and the United Nations in 2024 reveals extensive damage to Gaza's water infrastructure and assets, with 57 per cent reported destroyed or partially damaged (World Bank 2024). This includes desalination plants in both the northern and central regions, along with 162 water wells and two of the three connections with Mekorot, Israel's national water company re-

sponsible for supplying water to Gaza, resulting in losses exceeding US\$ 503 million (World Bank 2024).

The collapse of infrastructure and electricity shortages have led to the complete breakdown of the water, sanitation and hygiene (WASH) system. As of March 2024, water production capacity was estimated to be below 5 per cent of its usual output. Additionally, Gaza's wastewater networks have suffered severe damage, with three out of six treatment facilities and five out of six waste management sites being either damaged or destroyed (World Bank 2024).

Displacement and restricted access hinder people from reaching water facilities and strain the capacities of facilities in densely populated areas. The movement of over a million people to southern Gaza has significantly stressed water and sanitation services there. Before 7 October 2023, Rafah's population was under 280,000. Since then, an estimated one million internally displaced persons (IDPs) have relocated or 'were forcibly displaced' to southern Gaza. A substantial amount of untreated sewage discharged into the environment in the Gaza Strip is likely concentrated in the south, where the largest concentration of people has been situated throughout much of the war (UNEP 2024).

In April 2024, the available water supply plummeted to between 2 and 8 litres per capita per day (lcd), a stark contrast with the pre-October 2023 level of nearly 70 l/c/d. The quantity varies depending on geographical location, water resource availability and the extent of damage to water infrastructure (WASH Cluster 2024). Since the onset of the war, small-scale private operators (short term low volume) have emerged as one of the primary sources of water supply, providing approximately 3,300 cubic metres per day, down from 11,000 cubic metres produced before the war began (WASH Cluster 2024). The cost of water from tanker deliveries to end users has surged significantly, soaring from 20 NIS before 7 October to 600 NIS by April 2024 (WASH Cluster 2024).

Households, humanitarian shelters and internally displaced persons (IDP) centres have reported resorting to rationing water supplies strictly for drinking and cooking purposes, often sacrificing personal hygiene and sanitation needs. People have been compelled to seek alternative water sources for drinking, such as traditional agricultural wells containing brackish water, which frequently contains saline levels exceeding 3,000 milligrams per litre. This practice exposes them to pesticides and other chemicals typically found in such wells (UNEP 2024).

SOLID WASTE

Extensive damage to Gaza's municipal infrastructure has been documented, with reports indicating that five out of six solid waste management facilities have been affected (World Bank 2024). The breakdown in managing solid

waste has had a profound impact on urban infrastructure and public health. Issues with waste systems were already evident by October 2023, and by November waste transport to landfills had stopped. This halt was due primarily to fuel shortages and security concerns that restricted access to waste disposal sites (UNDP 2024). As the war intensified around mid-November, reports indicated that approximately 400 tonnes of garbage were accumulating daily in IDP camps and shelters. This waste originated primarily from IDP sites located in schools, with additional waste generated by host communities, resulting in a daily waste generation estimated at between 1,100 and 1,200 tonnes. This surge in waste accumulation, along with the increasing problem of medical waste in hospitals, heightened health risks for the population. These conditions created a potential for disease outbreaks, exacerbating the public health crisis (UNDP 2024).

A report published by PAX emphasises the severe public health and environmental crisis caused by widespread solid waste pollution in Gaza. The accumulation of waste has exacerbated public health issues, with at least 225 waste disposal sites identified across the Gaza Strip, including 14 UN-designated emergency landfills. This widespread pollution poses significant risks to the health of the population, including increased incidence of diseases and contamination of water and soil (PAX 2024).

In December 2023 and January 2024, efforts were made to address the deteriorating waste management situation, including steps to increase solid waste collection operations, although these actions were hampered by the ongoing attacks on Gaza.

AIR POLLUTION

At present, there is no publicly accessible air quality data for Gaza. Numerous fires have been observed burning across Gaza since the outbreak of the ongoing war in October 2023. Sentinel satellite images, such as the one captured on 16 November 2024, clearly depict significant fires raging in Gaza. Residential buildings, schools, businesses and industrial facilities have been ablaze, with 19 fire alerts reported from the Gaza Industrial Estate between 7 October 2023, and 12 January 2024. These fires pose a significant risk of emitting hazardous chemicals, especially when they occur at locations known for storing chemicals (UNDP 2024). Additionally, people in Gaza are resorting to burning materials for cooking and heating purposes.

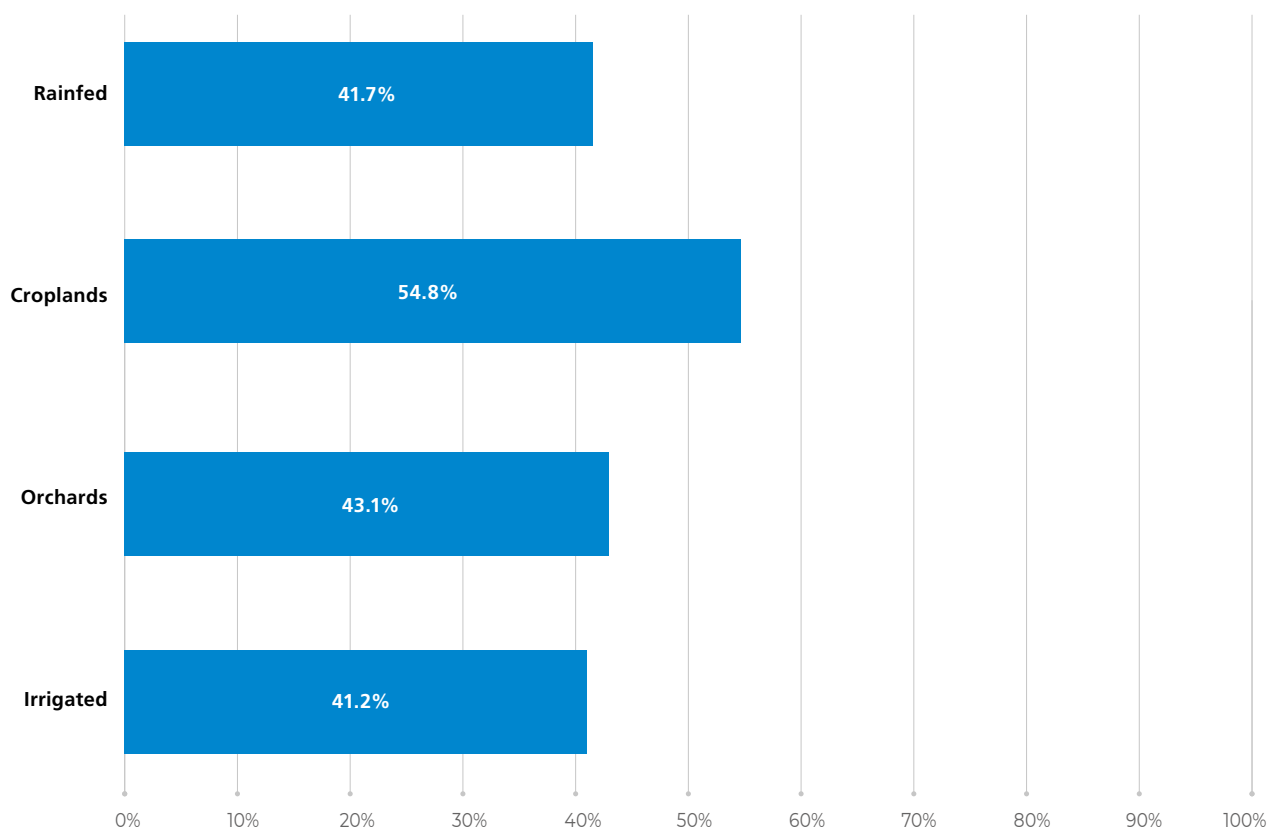
The burning of waste, a common practice in Gaza due to the lack of proper disposal facilities, exacerbates air pollution. The release of toxic fumes and particulate matter from burning waste contributes to respiratory issues, cardiovascular diseases and other health problems. Children and the elderly are particularly vulnerable to the adverse effects of air pollution (OCHA 2024a).

Figure 3
Gaza Strip, 16 November 2023



Source: Sentinel 2 [10 m resolution] retrieved by GRID Geneva, March 2024

Figure 4
Percentage of damage occurred to agricultural areas in Gaza from October 2023 to May 2024



Source: Personal research and collected data by the author

The deployment of explosive munitions generates significant quantities of dust, which presents hazards during war, as well as during subsequent clean-up and recovery efforts. Inhaling fine particulate matter from dust created during the bombing of buildings and infrastructure can be harmful, given potential contamination with asbestos, organic compounds, heavy metals from munitions and other hazardous substances (UNEP 2024).

and advanced equipment needed to diagnose and treat diseases such as cancer and kidney failure. Meanwhile, contaminated groundwater, polluted by seawater and sewage, poses health risks such as kidney disease and cancer due to a lack of clean drinking water (CEOBS 2022).

VEGETATION DAMAGE

According to February 2024 data from the UN Food and Agriculture Organization (FAO), extensive damage has been observed across agricultural lands in Gaza. As of mid-February, approximately 42.6 per cent of all cropland, totalling 6,694 hectares, has been reported damaged. Among the governorates, Gaza has suffered the most significant impact, with 1,941 hectares of cropland affected, representing 54.8 per cent of all cropland in the region (Yin 2024).

In addition to croplands, significant damage has also been documented in other agricultural sectors. Orchards have been particularly hard hit, with 5,027 hectares (43.1 per cent) affected by the war. Irrigated croplands and rainfed croplands have also seen substantial damage, with 887 hectares (41.2 per cent) and 780 hectares (41.7 per cent) affected, respectively. These figures, shown in Figure 4, underscore the widespread and severe impact of the war on Gaza's agricultural infrastructure, posing significant challenges to food security and livelihoods in the region (FAO 2024).

The Interim Damage Assessment reveals extensive devastation in Gaza's agriculture, estimating losses at around US\$ 629 million. This includes the destruction of trees, agricultural facilities, greenhouses, shops and irrigation systems (Yin 2024). Recent studies using remote sensing and on-site checks indicate that as of 3 April 2024, between 44 and 52 per cent of Gaza's tree crops are likely to have been damaged. Additionally, 42 per cent of greenhouses have suffered more than 10 per cent damage, with 23 per cent completely destroyed. The worst hit areas for tree crops are North Gaza (55–71 per cent) and Gaza City (58–80 per cent) (Yin 2024).

ENVIRONMENTAL IMPACT ON GAZANS' HEALTH

Even before the current war, the Gaza Strip faced significant environmental challenges that contribute to health issues such as rising rates of cancer and kidney failure. These challenges stem from a complex interplay of environmental pollution, lifestyle factors and socio-economic conditions. Pollution of air, water and soil is prevalent due to inadequate waste management, industrial emissions and the use of contaminated water for irrigation, compounded by the presence of pesticides and chemicals (CEOBS 2022). The blockade of Gaza severely limits access to medical supplies

4

CONCLUSIONS

The current environmental crisis in Gaza is the culmination of a prolonged siege lasting more than 17 years, compounded by the recent and ongoing Israeli military operations. The environmental devastation across the Gaza Strip is not only extensive but also reflects the direct consequences of prolonged conflict, repeated escalations and the intersection of complex political, socioeconomic and environmental factors.

As outlined in this report, the systematic destruction of Gaza's environment and infrastructure has led to severe and potentially irreversible damage. The indiscriminate bombardment of residential areas and critical facilities, including drinking water units, wastewater treatment plants and solid waste management systems, has resulted in widespread contamination and the collapse of essential environmental services. The targeted destruction of agricultural lands, coupled with the burning and poisoning of the soil, has drastically reduced the region's capacity to sustain its population, adding to food insecurity and the threat of starvation.

The accumulation of more than 40 tonnes of rubble and debris, coupled with the overcrowding of displaced populations in unsanitary conditions, has created an environment ripe for the spread of disease. The lack of access to clean water, proper sanitation and adequate waste management has exacerbated the public health crisis, particularly among vulnerable groups, such as children and pregnant women. The release of toxic emissions from continuous bombardments has contributed to widespread air pollution, further endangering the health of Gaza's residents.

The establishment of an international environmental fact-finding committee is crucial to accurately document the war's environmental impacts. Missiles and bombs containing harmful substances such as phosphorus and tungsten have caused widespread contamination, significantly raising health risks. The number of cancer cases in Gaza is expected to increase dramatically due to this toxicity. The large quantities of unexploded ordnance present significant dangers and require specialised handling. Furthermore, the prolonged nature of the conflict threatens to erase vital evidence of the use of internationally banned weapons, underscoring the urgency of immediate and thorough investigation.

To address these unprecedented challenges, a multifaceted and integrated approach is essential. Immediate and strategic interventions are required to mitigate the environmental and public health impacts. Key actions must include:

- Ceasefire and withdrawal: secure an immediate ceasefire and the complete withdrawal of Israeli military forces from Gaza, including key border areas, to facilitate the safe and unhindered delivery of humanitarian aid and environmental recovery efforts.
- Environmental restoration: prioritise the rehabilitation of water sources, soil remediation and the restoration of agricultural lands to prevent further environmental degradation and ensure food security.
- International support and access: guarantee international and local organisations' access to Gaza for the provision of humanitarian aid, environmental restoration and public health services. The lifting of the blockade and the opening of borders are crucial to allow the flow of necessary resources and personnel.
- Long-term environmental management: develop and implement integrated, long-term environmental management plans to ensure sustainable recovery and resilience. These plans must address the restoration of ecosystems, the rebuilding of infrastructure and the prevention of future environmental health crises.
- Rehabilitation and reconstruction: mobilise international financial support for the reconstruction of Gaza's infrastructure, with a focus on sustainable development and robust environmental safeguards. This will include securing funds for the rebuilding of public and private sectors, ensuring that recovery efforts contribute to long-term environmental and public health stability.
- By focusing on these critical areas, the path to recovery can be paved with measures that not only address the immediate crisis but also lay the foundation for a sustainable and resilient future for Gaza.

5

OBSTACLES AND RECOMMENDATIONS

MAIN OBSTACLES TO ADDRESSING THE ENVIRONMENTAL AND HEALTH IMPACTS OF THE WAR

- Safety and security status because of intense indiscriminate shelling and huge bombardments by the Israeli army along the Gaza Strip.
- Absence of interior safety/security chaos because of local security collapse and the targeting of the police.
- Crowding of displaced people in unhealthy areas away from their homes complicate environmental protection interventions and humanitarian relief.
- Restricted access to resources: the blockade and closure of the borders by the Israeli occupation severely limits the import of essential goods and humanitarian aid.
- Local political instability: ongoing conflict and political fragmentation hinder effective governance and coordination.
- Inadequate funding: limited financial resources constrain the ability to implement comprehensive recovery plans.
- Environmental degradation: the destruction of infrastructure has led to significant environmental health hazards and overexploitation of natural resources and concentrated pollution in all environmental elements.
- Scarcity/absence of cooking gas has pushed people to burn all combustible items such as plastic and rubber in addition to wood, resulting in huge indoor and outdoor ambient air pollution with toxic emissions very close to people's shelters. These routine practices affect their health; in particular, sensitive people who have respiratory problems will be severely affected.
- Most people in Gaza have lost relatives and friends. They are very angry, depressed and uncooperative. This complicates environmental protection interventions that could be implemented in addition to humanitarian relief and exposes staff to risk.
- Environmental reclamation and recovery require efforts and expertise in addition to tools and equipment, which are very scarce at the current time, and need to be handled well.
- The full consequences of the war are still unknown. This means that we are in dire need of implementing a comprehensive needs assessment and evaluation of all sectors to build up a real plan reflecting the situation in detail and determining the priorities that should be followed.

MAIN RECOMMENDATIONS

In addition to what has already been said, the following are important recommendations that should be taken into consideration in order to enhance the environmental situation in Gaza.

WATER AND INFRASTRUCTURE

- Water projects: implement decentralised water projects, including the enhancement of wells powered by solar energy. Focus on improving access to clean water through sustainable methods.
- Infrastructure restoration: rebuild critical infrastructure, such as roads and buildings. Prioritise the restoration of essential services such as electricity, water and sanitation to ensure a stable and functional living environment for residents.
- Sanitation systems: rebuild and enhance sanitation systems to prevent health hazards. Ensure proper waste management and disposal to improve public health and environmental conditions.

ENVIRONMENTAL RESTORATION

- Environmental institutions must redouble their efforts to restore the environmental health of Gaza after the war. Renew ideas and methods of achieving environmental peace and security for community members.

SOLID WASTE MANAGEMENT

- International bodies must establish a separate sector for recycling solid waste, which the Gaza Strip had initiated before the war. Enhance the system for disposing of hazardous and medical waste, ensuring sustainable and safe waste management practices.

HEALTH-CARE SYSTEM

- Medical supplies: ensure a consistent supply of essential drugs and medical equipment.
- Health-care facilities: rebuild and equip hospitals and clinics to provide adequate health-care services.
- Support services: provide targeted support to rebuild lives and livelihoods, ensuring inclusive recovery efforts.

FOOD SECURITY

- Agricultural support: provide resources and training to restore agricultural productivity and ensure food self-sufficiency.
- Humanitarian aid: increase the provision of food aid and nutritional support to vulnerable populations.

SUSTAINABLE ALTERNATIVE ENERGY

- Transform the Gaza Strip into a hub for sustainable alternative energy. Support every aspect of sustainability. Enhance the system of wells that operate on solar energy in local areas. Encourage community participation and contributions to achieve these goals.

FOSTER COLLABORATION AMONG KEY ACTORS

- International organisations: engage with UN agencies, NGOs and donor countries to secure funding and technical support.
- Local authorities: empower local governance structures to coordinate and implement recovery initiatives.
- Community groups: involve community-based organisations in planning and execution to ensure culturally appropriate and effective interventions.

EMPOWERMENT AND AWARENESS

- Civil society institutions and NGOs must work to raise awareness among community members. Focus on empowering and strengthening women, children and people with disabilities who have been particularly affected by the large-scale war that has destroyed their lives and livelihoods.

REFERENCES

- Conflict and Environment Observatory (CEOBS)** (2022): A framework for military greenhouse gas emissions reporting, <https://ceobs.org/report-a-framework-for-military-greenhouse-gas-emissions-reporting/>.
- Food and Agriculture Organization (FAO)** (2024): Overview of the Damage to Agricultural Land and Infrastructure due to the Conflict in the Gaza Strip as of 15 February 2024.
- Global Nutrition Cluster** (2024): Nutrition Vulnerability and Situation Analysis /Gaza, <https://www.nutritioncluster.net/resources/nutrition-vulnerability-and-situation-analysis-gaza>.
- Hilles, Ahmed** (2021): The Environmental Context in the Gaza Strip and the Role of NGOs, the Project of Palestinian CSOs Policies towards Community Issues, National Institute for Environment and Development (NIED), 2021.
- Integrated Food Security Phase Classification (IPC) Famine Review Committee** (2024): Famine Review Committee: Gaza Strip, June 2024. Conclusions and Recommendations, https://www.ipcinfo.org/fileadmin/user_upload/ipcinfo/docs/IPC_Famine_Review_Committee_Report_Gaza_June2024.pdf.
- Mines Advisory Group (MAG)** (2024): How MAG is responding to the crisis in Gaza, <https://www.maginternational.org/whats-happening/how-mag-is-responding-to-the-crisis-in-gaza/>, 05.02.2024.
- Pax For Peace (PAX)** (2024): War and Garbage in Gaza. The public health and environmental crisis from widespread solid waste pollution, https://paxforpeace.nl/wp-content/uploads/sites/2/2024/07/PAX_War_and_Garbage_in_Gaza.pdf.
- Sharp, Alexandra / Detsch, Jack** (2023): What the Use of White Phosphorus Means in Warfare, *Foreign Policy*, <https://foreignpolicy.com/2023/10/19/white-phosphorus-israel-gaza-human-rights-war-crimes-un-icc/>, 19.10.2023.
- UN Office for the Coordination of Humanitarian Affairs (OCHA)** (2024a): Hostilities in The Gaza Strip and Israel, Flash Update 177.
- UN Office for the Coordination of Humanitarian Affairs (OCHA)** (2024b): Hostilities in The Gaza Strip and Israel, Flash Update 179.
- UN Office for the Coordination of Humanitarian Affairs (OCHA)** (2024c): Reported impact snapshot | Gaza Strip (12 November 2024), <https://www.ochaopt.org/content/reported-impact-snapshot-gaza-strip-12-november-2024>
- United Nations Development Programme (UNDP)** (2024): A Silent Threat: Gaza's Struggle with Solid Waste Management.
- United Nations Environment Programme (UNEP)** (2020): State of Environment and Outlook Report for the Occupied Palestinian territory.
- United Nations Environment Programme (UNEP)** (2018): Mosul Debris Management Assessment.
- United Nations Environment Programme (UNEP)** (2022): The Environmental Impact of The Conflict in Ukraine: A Preliminary Review. Nairobi, Kenya.
- United Nations Environment Programme (UNEP)** (2024): Environmental Impact of the Conflict in Gaza: Preliminary Assessment of Environmental Impacts.
- United Nations Relief and Works Agency for Palestine Refugees (UNRWA)** (2024): Gaza Supplies and Dispatch Tracking, <https://www.unrwa.org/what-we-do/gaza-supplies-and-dispatch-tracking>.
- UNOSAT** (2024a): UNOSAT Gaza Strip Comprehensive Damage Assessment – January 2024, <https://unosat.org/products/3793>.
- UNOSAT** (2024b): Occupied Palestinian territories, Gaza Strip, Imagery Analysis: 06 September 2024 / Published : 27 September 2024 / V1, https://unosat.org/static/unosat_filesystem/3984/OCHA-OPT-017_UNO-SAT_A3_Gaza_Strip_OPT_CDA_06092024.pdf
- WASH Cluster** (2024): Emergency and Recovery Action Plan for the Water Sector in Gaza, WASH Cluster, April–May 2024.
- World Bank, European Union and United Nations** (2024): Gaza Strip Interim Damage Assessment Summary Note 29 March 2024, <https://thedocs.worldbank.org/en/doc/14e309cd34e04e40b90e-b19afa7b5d15-0280012024/original/Gaza-Interim-Damage-Assessment-032924-Final.pdf>.
- World Health Organization (WHO)** (2023): Lethal combination of hunger and disease to lead to more deaths in Gaza, <https://www.who.int/news/item/21-12-2023-lethal-combination-of-hunger-and-disease-to-lead-to-more-deaths-in-gaza>, 21.12.2023.
- Yin, He** (2024): Agricultural land in Gaza damaged until 18 January 2024. Kent State University.

ABOUT THE AUTHOR

Dr. Ahmed H. Hilles is an Assistant Professor of environmental sciences; he was awarded the VLIR-UOS Scholarship in Technology for Integrated Water Management from the University of Antwerp and Ghent University, Belgium, 2016. He holds a Ph.D. degree in environmental sciences from the Department of Environment Health at Alexandria University (2015). Dr. Hilles has worked as the Director of the Environmental Awareness Department at EQA from 2005 to 2017. In addition, he has worked as the Head of the National Institute for Environment and Development (NIED) from 2015 to now, and as a Lecturer with the Institute of Water and Environment at AL-Azhar University. Moreover, Dr. Hilles works as a consultant in the fields of water science, green economy, disaster risk reduction, emergency management, WASH issues, and public health topics. Dr. Hilles has published many refereed research papers, publications, and practical manuals. He also has conducted several projects in these fields. Dr. Hilles has executed more than 4100 training hours as a trainer for more than 19 years in his field of study and his work targeted different types of trainees and community levels.

ABOUT THE PROJECT

»Palestinian Perspectives on the Reconstruction of Gaza« is a joint project carried out by the Friedrich-Ebert-Stiftung (FES) and the Stiftung Wissenschaft und Politik (SWP), the German Institute for International and Security Affairs. The papers published within the framework of this project focus on Palestinian needs and priorities with regard to a range of topics linked to early recovery and reconstruction of Gaza after the 2023/2024 war.

In this context, they do not regard the Gaza Strip as a separate entity, but as part of the Palestinian territories occupied by Israel since 1967. They also hold that all approaches, be they short or long term, should be compatible with the principle of Palestinian self-determination. The objective is to highlight key insights from Palestinian experiences and expertise and introduce them into the international debate. Papers cover aspects such as security arrangements, governance, the role of women and urban planning for recovery and reconstruction. They reflect the author's views only.

Editorial team: Usama Antar, Friederike Stolleis and Konstantin Witschel (FES), Muriel Asseburg (SWP), Omar Shaban (PalThink)

IMPRINT

Published by:
Friedrich-Ebert-Stiftung e. V.
Godesberger Allee 149
53175 Bonn
Germany
Email: info@fes.de

Issuing Department:
Friedrich-Ebert-Stiftung | Department for Middle East and North Africa | Hiroshimastr. 28 | 10785 Berlin | Germany

Responsibility for content and editing:
Elisabeth Braune, Head of Department
for Middle East and North Africa

Contact/Order: info.nahost@fes.de

Copyediting: James Patterson
Design: perTEXT | www.perTEXT.de

The views expressed in this publication are not necessarily those of the Friedrich-Ebert-Stiftung (FES) or the Stiftung Wissenschaft und Politik (SWP), the German Institute for International and Security Affairs. Commercial use of media published by the FES is not permitted without the written consent of the FES. Publications by the FES may not be used for electioneering purposes.

ISBN 978-3-98628-601-9

© 2024



www.fes.de/bibliothek/fes-publikationen