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FUTURE SCENARIO WHEN THE GENOCIDE ENDS: CLIMATE FEEDBACK LOOPS AND MITIGATION STRATEGIES IN G

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ABSTRACT

The ongoing genocide in Palestine perpetrated by Israel leads to both immediate and long-term greenhouse gas (GHG) emissions due to the destruction and subsequent rebuilding efforts. This research explores the cumulative climate impacts of reconstruction following genocide by evaluating emissions tied to debris management, infrastructure restoration, and ecosystem degradation. Employing a qualitative research approach, it integrates primary data (satellite imagery, UNEP debris assessments, and NGO infrastructure reports) with secondary sources (academic studies, policy analyses, and media coverage). Emission calculations were conducted using IPCC emission factors for essential reconstruction materials, such as cement, steel, and various transportation methods. Grounded in theories of ecocide, climate colonialism, and climate feedback loops, the findings suggest that emissions generated during the reconstruction phase may exceed those produced during the genocide itself. The loss of soil carbon and the presence of hazardous debris contribute to sustained environmental damage, exacerbating global climate instability. However, by incorporating mitigation strategies–rooted in temporal climate justice and post-colonial recovery–into reconstruction efforts, Palestine has the opportunity to transform a site of destruction into a model of climate responsibility and regenerative resilience.

Keywords: genocide, ecocide, post-genocide, climate change, Palestine.

ABSTRAK

Genosida yang terus berlangsung di Palestina menghasilkan emisi gas rumah kaca (GRK) baik secara langsung maupun jangka panjang melalui kehancuran dan proses rekonstruksi. Studi ini meneliti dampak iklim kumulatif dari pembangunan kembali pasca-genosida dengan menganalisis emisi yang berasal dari pengelolaan puing, pemulihan infrastruktur, dan degradasi ekosistem. Menggunakan pendekatan kualitatif, penelitian ini menggabungkan data primer (citra satelit, penilaian puing UNEP, dan laporan LSM tentang infrastruktur yang rusak) dengan sumber sekunder (kajian akademis, analisis kebijakan, dan media). Estimasi emisi dilakukan dengan menerapkan faktor emisi IPCC pada material utama rekonstruksi seperti semen, baja, dan transportasi. Dengan menggunakan kerangka teori ekosida, kolonialisme iklim, dan *climate feedback loops*, studi ini menunjukkan bahwa emisi dari proses rekonstruksi dapat melampaui emisi yang dihasilkan selama genosida itu sendiri. Kehilangan karbon tanah dan penyebaran puing beracun memperpanjang kerusakan ekologis dan meningkatkan ketidakstabilan iklim global. Namun, dengan mengintegrasikan kerangka mitigasi berbasis *temporal climate justice* dan pemulihan pascakolonial ke dalam perencanaan rekonstruksi, Palestina dapat mengubah wilayahnya yang hancur menjadi model akuntabilitas iklim dan ketahanan regeneratif.

Kata kunci: genosida, ekosida, pasca-genosida, perubahan iklim, Palestina

1. INTRODUCTION

In 2024, the persistent upward trajectory of global greenhouse gas (GHG) emissions continued, culminating in a total of 53.2 Gt CO_2 equivalent (CO_2eq), exclusive of Land Use, Land-Use Change, and Forestry (LULUCF), and this represents a 1.3% increase from the previous year (Emissions Database for Global Atmospheric Research, 2025). This trend sustained momentum into the first half of 2025, during which global emissions reached 30.99 billion tonnes CO_2eq, reflecting a modest increase of 0.13% compared to 2024 (Climate TRACE, 2025). Fossil carbon dioxide predominantly accounts for GHG emissions, comprising 74.5% of the total, having risen by 74.9% since 1990. Simultaneously, non-carbon dioxide gases, such as methane (CH_4) and nitrous oxide (N_2O), have increased by nearly 30% and 34%, respectively, while fluorinated gases have surged by a staggering 310% (Emissions Database for Global Atmospheric Research, 2025).

A critical oversight in global emission inventories is the omission of emissions associated with armed conflicts and military occupations–sectors that markedly contribute to GHG emissions but are frequently excluded from formal climate reporting frameworks (The Conflict and Environment Observatory, 2024). According to The Conflict and Environment Observatory (2022), it estimates suggest that military operations represent approximately 5.5% of total global emissions (approximately 2,750 MtCO_2eq), yet these emissions are often not included in national submissions to the United Nations Framework Convention on Climate Change (UNFCCC). This "military emissions gap" obscures the true scope of global carbon output and undermines the credibility of international mitigation efforts.

The situation in Palestine exemplifies this systemic oversight. Even prior to the recent escalation of hostilities, Gaza's environmental conditions had deteriorated significantly due to years of blockade, occupation, and infrastructural collapse. The United Nations Environment Programme (UNEP, 2020) documented widespread water pollution, untreated sewage discharge, and the serious contamination of freshwater sources. Following the intensified bombardment between 2023 and 2025, UN Mine Action Service (2024) and Food and Agriculture Organization of the UN (2024) revealed extensive disruptions to environmental management systems, damage to 42.6% of agricultural land, and the generation of approximately 39 million tons of debris, much of which is contaminated with hazardous materials. The immediate emissions resulting from military operations are equally concerning, an estimated 1.89 million tonnes of CO_2eq were emitted with over 99% attributable to Israel's military air and ground operations between October 2023 and January 2025 (Otu-Larbi et al., 2024). However, these figures only reflect immediate environmental destruction. The long-term emissions associated with debris management, soil degradation, and reconstruction remain largely unquantified.

This underreporting is not unique to Palestine. As noted by The Conflict and Environment Observatory (2024), there exists no standardized methodology for accounting emissions resulting from conflicts, occupations, and post-war reconstructions. Such omissions compromise the integrity of the Global Stocktake process and hinder global endeavors toward stabilizing temperatures. The climate change associated with armed conflict does not cease when hostilities end, rather, it persists through enduring environmental degradation, delayed reconstruction, and cumulative GHG feedback loops. The devastation witnessed in Palestine,

therefore, underscores a more extensive crisis in global climate accountability: the failure to recognize the interplay between political violence and ecological degradation.

This issue becomes increasingly apparent when examining the legal frameworks designed to prevent the most severe forms of human and environmental devastation. Article II of the 1948 United Nations Convention on the Prevention and Punishment of the Crime of Genocide defines genocide as any of the following acts committed with the intent to destroy, in whole or in part, a national, ethnic, racial, or religious group: (a) Killing members of the group; (b) Inflicting significant physical or mental harm upon members of the group; (c) Intentionally subjecting the group to living conditions aimed at causing its partial or total physical destruction; (d) Implementing measures to prevent births within the group; (e) Forcibly transferring children from the group to another group. According to the UN Human Rights Office of the High Commissioner (OHCHR, 2025), Israeli authorities and security forces have "performed four of the five genocidal acts outlined by the 1948 Convention on the Prevention and Punishment of the Crime of Genocide." Furthermore, this systematic destruction of the living environment aligns with the emerging concept of Ecocide, which the Independent Expert Panel for the Legal Definition of Ecocide (2021) defines as "unlawful or reckless actions taken with the awareness of a significant likelihood of severe and either widespread or long-lasting damage to the environment." The convergence of these offenses–genocide and ecocide–establishes a new and grave category of violence that directly contributes to global climate disruption.

In light of these issues, this study endeavors to explore the nexus between genocide, environmental degradation, and global climate governance, with a specific emphasis on the case of Palestine. The objectives of this study are to (1) identify the ways in which Israel's genocide actions contribute to both immediate and long-term GHG emissions; (2) examine the potential future climate impacts associated with post-genocide reconstruction and ongoing ecological degradation; (3) propose mitigation strategies that effectively integrate environmental restoration into post-genocide recovery initiatives.

To achieve these aims, this study will address the following research questions:

RQ1: In what manners do Israel's ongoing genocide in Palestine influence global climate disruption?

RQ2: What long-term climate feedback effects are likely to persist following the cessation of hostilities?

RQ3: What mitigation strategies can be employed in post-genocide reconstruction efforts to reduce emissions and enhance ecological resilience?

2. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

2.1 The Genocide-Ecocide Nexus

The systemic destruction taking place in Palestine necessitates a nuanced analytical framework that correlates human rights violations with environmental degradation. This research is founded on the concept of ecocide, which parallels genocide as a crime against humanity, and is further characterized as an affront to the planet itself (Arifin et al., 2024). Although establishing the intent of perpetrators to inflict environmental harm poses significant legal challenges, given the difficulties in proving intent in instances of collateral damage

(Branch & Mikova, 2023), the tangible impacts of environmental degradation are indisputable. Such consequences are universally acknowledged as substantial risks, with climate change and biodiversity loss ranked among the most pressing threats expected to manifest in the coming decade (World Economic Forum's Global Risks Report 2023). Furthermore, some scholars, including Eichler (2020), have posited that identifiable instances of ecocide are frequently intertwined with acts of genocide, asserting that environmental degradation inherently threatens human populations. Historically, the notion of ecocide has been predominantly associated with military tactics (Kowalska, 2023), rendering the current inquiry, specifically centered on the environmental ramifications of military occupation and genocide, extremely relevant for conflict resolution and the advancement of sustainable development (Wirtu & Abdela, 2025).

The intrinsic connection between population decimation and environmental degradation is encapsulated within the genocide-ecocide nexus, a theoretical framework positing that environmental destruction is not merely a byproduct but rather a calculated tactic designed to undermine the survival and identity of affected groups. This nexus is particularly salient in the context of Palestine. Venkatachalapathy and Simic (2025) contend that the policies of occupation purposefully obstruct or dismantle avenues for Palestinian recovery, effectively utilizing environmental degradation as a demographic weapon by the occupying forces. This systematic assault on essential resources, such as agricultural land and water systems, inflicts damage on the profound relationship between Palestinians and their territory, a strategy aligned to erode the group's identity and existence (Dinc & Türk, 2025). The Al Mezan Center for Human Rights (2024) supports this critical perspective, underscoring that Israel has deliberately engineered an environmental disaster in Gaza, fully cognizant of the detrimental effects on the well-being and future viability of the Palestinian populace. This intentional creation of an uninhabitable environment serves to illustrate that the destruction is not only calculated and systemic but also integral to the broader context of genocidal violence.

Building on the existing literature on ecocide and the documented ecological damage in Palestine, this research posits a dual climate debt arising from the ongoing conflict. The first dimension encompasses the immediate, unacknowledged greenhouse gas emissions resulting from military operations and the ensuing ecological devastation. The second, frequently overlooked aspect pertains to the significant future emissions liabilities that are inherent in the post-genocide reconstruction phase, necessitated by the substantial demand for high-carbon materials, such as cement and steel, to restore damaged infrastructure, further compounded by the protracted loss of natural carbon sinks.

Recognizing that post-genocide recovery must fundamentally address climate-vulnerable infrastructure and environmental degradation, this situation presents a unique, albeit tragically necessary, opportunity for climate-resilient reconstruction. Accordingly, we propose that the implementation of deliberate mitigation strategies could substantially mitigate long-term climate threats and transform Palestine from an overlooked contributor to global emissions into a paradigm of sustainable resilience. This study aims to critically evaluate the feasibility of these mitigation strategies in light of the extensive destruction sustained.

2.2 Climate Colonialism and Slow Violence

The structural underpinnings of the current environmental crisis can be most effectively analyzed through the frameworks of slow violence and climate colonialism, which elucidate the mechanisms of destruction across both immediate and extended temporal scales. Slow violence, as articulated by Nixon (2011), is defined as "the violence that occurs gradually and out of sight, a violence of delayed destruction that is dispersed across time and space." This form of harm unfolds gradually and often remains unrecognized as a form of violence. However, an epistemological shift is necessitated when engaging with Davies's (2019) critique, which interrogates the question: 'out of sight to whom?' For those communities directly impacted, the manifestations of destruction, whether affecting specific populations, ecological systems, or broader more-than-human processes, are readily observable, although a critical reorientation of perspective is required to fully comprehend their cumulative impact (O'Lear, 2024). This slow, administrative mode of destruction is intricately linked to global inequities, as Nixon (2013) posits that climate change has functioned as a form of slow violence targeted at racialized and marginalized populations in the Global South.

While the concept of slow violence emphasizes the temporality of harm, climate colonialism uncovers its geographic dimensions, delineating those responsible for the harm and those who endure its effects. This structural phenomenon is aptly understood through the lens of climate colonialism, which posits that the climate crisis transcends a purely technical issue of emissions, instead framing it as a political matter rooted in colonial legacies. An understanding of the crisis through this framework extends beyond mere compensatory measures for current losses and damages; it necessitates a profound recognition of how socially and regionally disproportionate distributions of wealth, and the resulting high emissions, were historically constructed (Bhambra & Newell, 2022). Both historical and contemporary forms of colonialism have markedly influenced the ongoing anthropogenic climate crisis, exacerbating existing natural hazards (Scarlett, 2022). Thus, the concept of climate coloniality–encompassing Eurocentric dominance, neocolonial practices, racial capitalism, uneven consumption, and militarized control–disproportionately engenders vulnerabilities among racialized communities, rendering them disposable within the prevailing system (Sultana, 2024). Therefore, the environmental crisis in Palestine ought not to be perceived as an isolated outcome of conflict, rather, it should be understood as a manifestation of a deeply embedded colonial framework that weaponizes the environment.

The situation in Palestine serves as a poignant illustration of the confluence of slow violence and acute, extreme destruction. According to Pace and Yacobi (2021), Israel has historically utilized Gaza as a testing ground for its destructive methodologies, employing slow, violent tactics aimed at rendering life intolerable for the resident population. The persistent manifestations of slow violence–the systematic denial of water access, the devastation of agricultural lands, and the infrastructural collapse precipitated by blockades–have not emerged abruptly, rather, they represent chronic and long-standing issues (Hassouna, 2025). The ongoing military offensive embodies the kinetic culmination of years of environmental and social degradation, marking a transition where slow violence escalates into rapid, genocidal violence, thus transforming prolonged degradation into immediate, widespread destruction.

This intersection poses a significant challenge to the framework of climate governance: if slow violence functions as a calculated precursor to environmental collapse, and if extreme violence swiftly follows, how can global climate accountability possibly disregard the emissions and ecological damage wrought by systemic, colonially-driven conflict, thereby perpetuating the very structures of vulnerability that it purports to address? This analytical framework propels the current inquiry towards linking the immediate emissions resultant from military bombardments with the projected long-term emissions associated with reconstruction, thereby elucidating the comprehensive climate debt attributable to occupation and genocide.

2.3 Post-conflict Environmental Reconstruction

The systematic annihilation described within the genocide-ecocide nexus inevitably creates a significant requirement for environmental reconstruction following conflicts. This stage, while presenting the potential for recovery, also poses considerable environmental dangers. As Alieksieienko et al. (2023) point out, post-conflict recovery can lead to various adverse environmental impacts, making it crucial to incorporate environmental sustainability as much as possible into post-conflict policies. Reconstruction is not just a singular project; it is a complex system consisting of simultaneous short, medium, and long-term initiatives aimed at preventing a return to violent conflict and fostering sustainable peace and development (Hassan et al., 2021). A major failure to consider environmental factors can exacerbate existing issues, such as the ongoing water and waste crises in Gaza, and ultimately hinder the attainment of lasting peacebuilding and developmental goals (Peter & Osazuwa, 2024).

In the case of Palestine, specifically Gaza, the environmental issues are sharply defined. Rintoul-Hynes (2025) underscores three primary environmental factors that should guide reconstruction planning: (1) environmental contamination (from hazardous debris and unexploded ordnance), (2) degradation of habitats, and (3) fragmentation of habitats. The extent of the destruction, coupled with the pre-existing effects of the occupation, necessitates a complete transformation in approach. There is a pressing need for a new strategic reconstruction plan for Gaza that is not only technically viable but also aligns with the political, economic, and social realities of the Palestinian people and their inherent right to self-determination (Alarabeed, 2024). Conventional, carbon-heavy reconstruction techniques–heavily dependent on imported cement and steel–would entrench a long-term climate debt, thereby turning the physical rebuilding process into a significant new source of global greenhouse gas emissions.

Despite the serious risks, the reconstruction phase offers a crucial, albeit imposed, chance. Incorporating environmental restoration and rehabilitation into post-conflict initiatives does more than just revitalize the natural environment; it is an essential step toward rebuilding the community's social fabric and identity (Kushwaha & Upadhyaya, 2023). In the context of the genocide-ecocide nexus, this incorporation becomes a political act of reclaiming and restoring the land that was intentionally targeted for destruction.

3. RESEARCH DESIGN

This study employed a qualitative research methodology to provide a comprehensive and nuanced understanding of the complex and frequently overlooked intersection of genocide,

occupation, and climate change in Palestine. Grounded in anthropological, sociological, and philosophical frameworks (Turhan, 2019), the qualitative approach was selected not for its inherent superiority over quantitative methods, but for its capacity to extract detailed information and illuminate deeper aspects of the issue, transcending mere objective measurement (Chivanga & Monyai, 2021; Queirós et al., 2017). While quantitative research adopts a positivist perspective that seeks to quantify measurable realities (Kielmann et al., 2012), this study necessitated a methodology capable of situating the destruction and its consequences within sociopolitical and theoretical frameworks. Specifically, it focuses on how a humanitarian and political crisis generates significant, yet often unrecognized, climate risks. Thus, the qualitative framework allows for thorough examination of the long-term, systematic climatic impacts arising from genocide actions and subsequent rebuilding efforts, which frequently evade attention in conventional emissions reports.

3.1 Case Study

This study chooses Gaza Strip, Palestine, as a critical case study, motivated by not only the acute humanitarian crisis but also by its embodiment of a pivotal and frequently overlooked intersection of genocide, colonial occupation, and global climate change. The prevailing circumstances in Gaza provides an empirical context wherein the spectrum of climate threats–from immediate genocide emissions to enduring ecological repercussions–is starkly apparent. The rationale for concentrating on this geographic area is grounded in significant judicial findings regarding the nature of the ongoing genocide.

The decision to focus on Gaza is underscored by authoritative assessments indicating that the actions undertaken by Israeli authorities constitute multiple acts of genocide, as highlighted in the 1948 Genocide Convention. The UN Human Rights Office of the High Commisioner (2025) has corroborated that since October 7, 2023, Israeli security forces have executed four of the five recognized genocidal acts: extrajudicial killings, infliction of severe bodily or mental harm, deliberate imposition of living conditions conducive to destruction, and enforcement of measures designed to inhibit births. This systemic violence surpasses conventional conflict analysis, entering the realm of a structural process aimed at the potential annihilation of a people. Furthermore, the Global Centre for the Responsibility to Protect (2025) notes a concurrent escalation of military operations that have yielded significant casualties, destruction of residential infrastructure, damage to essential services, and the most pronounced wave of forced displacement since 1967. This trend suggests that the violence is not isolated but rather part of a geospatially expanding, systematic campaign of destruction.

The structural violence inherent in this genocidal agenda is intrinsically linked to a corresponding environmental devastation. The Palestinian Policy Network (2025) provides critical evidence that the extensive dismantling of infrastructure, erasure of Palestinian social and cultural life, and widespread displacement are not mere collateral damage but rather integral components of a settler-colonial initiative. This systematic environmental degradation–often characterized as ecocide–exacerbates the climate crisis. The widespread use of explosive munitions generates tens of millions of tons of debris, the processing and transportation of which will inevitably produce significant future emissions during reconstruction.

Thus, Gaza represents an indispensable site for research aimed at elucidating the comprehensive climate liabilities associated with such campaigns. The extensive scale of the immediate genocide carbon footprint constitutes merely the initial phase, the enduring ramifications reside in the anticipated emissions from ensuing reconstruction efforts and the irreversible loss of natural carbon sinks resulting from soil degradation and ecological collapse. This dual challenge, the immediate crime against humanity and the protracted ecological catastrophe, demands a reevaluation of how global climate governance addresses emissions generated by state-level destructive actions that typically remain outside conventional industrial or energy metrics.

3.2 Data Collection and Empirical Basis

This research endeavors to achieve analytical rigor and empirical reliability through the integration of both primary and secondary data sources, emphasizing transparency in the underlying assumptions guiding the numerical analyses. The primary data sources employed in this investigation are as follows:

1. UNOSAT Satellite Imagery (2025) | UNOSAT Product ID: 4205
   This data set is utilized to evaluate the extent of structural damage and the overall volume of debris resultant from the conflict, with a specific focus on the reference compilation titled “Gaza Strip Damage Assessment, October 2023-September 2025.” This assessment indicates the generation of approximately 61 million tonnes of debris, thereby establishing a robust empirical foundation for estimating emissions associated with combustion processes and subsequent reconstruction activities.
2. UNEP Environmental Impact of the Escalation of Conflict in the Gaza Strip (2025)
   These assessments provide critical information regarding the composition ratios of debris, metrics concerning land degradation, and a documented loss of cropland amounting to 36,500 hectares. Such variables are essential for conducting calculations related to soil carbon emissions.

The numerical assumptions employed in this study are derived from established international standards, ensuring methodological consistency:

1. Emission Factors
   The emission factors (EF) are aligned with the IPCC guidelines (2006; 2019 Refinement) for open burning (ranging from 0.9 to 1.2 tCO_2/tC) and for soil organic carbon (SOC) conversion factors (44/12 ratio).
2. Carbon Values
   The carbon values associated with various materials originate from the Inventory of Carbon & Energy (ICE) Database v3, utilizing representative figures such as concrete (0.61 tCO_2/t), steel (2.52 tCO_2/t), asphalt (0.051 tCO_2/t), and brick (0.213 tCO_2/t).
3. Soil Organic Carbon Reference Value
   The reference value for soil organic carbon (SOCref = 38 tC/ha) pertinent to warm temperate dry regions is sourced from the IPCC (2006, Vol. 4, Ch. 2, Table 2.3) and is applied to areas of cropland identified by UNEP as significantly affected.
4. Open Burning Oxidation Factors
   Oxidation factors related to open burning (71 ± 8%) are derived from the IPCC (2019 Refinement, Vol. 5, Table 5.2, Note 3) and are substantiated by research conducted by

Yamada et al. (2010).

In addition to primary data, the secondary data sources include peer-reviewed academic articles, policy papers, and theoretical discourses that contextualize the empirical findings within broader frameworks, such as climate colonialism, ecocide, and slow violence.

To ensure replicability of the research findings, all datasets, numerical assumptions, and calculation methodologies are meticulously documented in Appendix 1 (Analytical Worksheets and Data Sources). This appendix comprises spreadsheet models for emissions, detailed formulas, and results from sensitivity analyses, thereby facilitating further inquiry and validation.

3.2 Data Analysis Techniques

To analyze the diverse array of textual and visual materials, a Qualitative Content Analysis (QCA) approach was rigorously applied. As a systematic technique for describing and interpreting the meanings inherent in both verbal and visual qualitative material (Schreier, 2012; Cho & Lee, 2014), QCA facilitates the evaluation of theoretical issues in relation to empirical evidence (Elo & Kyngäs, 2008). This study systematically adhered to the framework established by Elo and Kyngäs (2008) across three interconnected phases: preparation, organizing, and reporting, chosen for its capacity to uncover underlying meanings and conceptual patterns within complex environmental-political documents. In the **preparation phase**, materials sourced from UNEP assessments, conflict emissions reports, and NGO publications were reviewed contextually, with the unit of analysis defined as any segment referencing environmental degradation, emissions, reconstruction, or climate governance in Palestine. The **organizing phase** employed an inductive approach: open coding (e.g., debris contamination, loss of carbon sink, and data reporting gap), subsequent categorization into subcategories (e.g., immediate climate impacts and long-term feedback effects), and abstraction into broader analytical themes (e.g., conflict as an unrecognized source of emissions and occupation-induced ecological collapse). This meticulous process ensured that interpretations remained firmly rooted in empirical evidence while generating conceptual insights. The **reporting phase** involved synthesizing these findings into a cohesive, evidence-based narrative, employing triangulation across organizational reports to enhance the robustness and credibility of the results and confirm the implications of conflict-related emissions and ecological disruptions in relation to global climate governance.

4. RESULT AND DISCUSSION

4.1 Result

4.1.1 Overview of Environmental Destruction

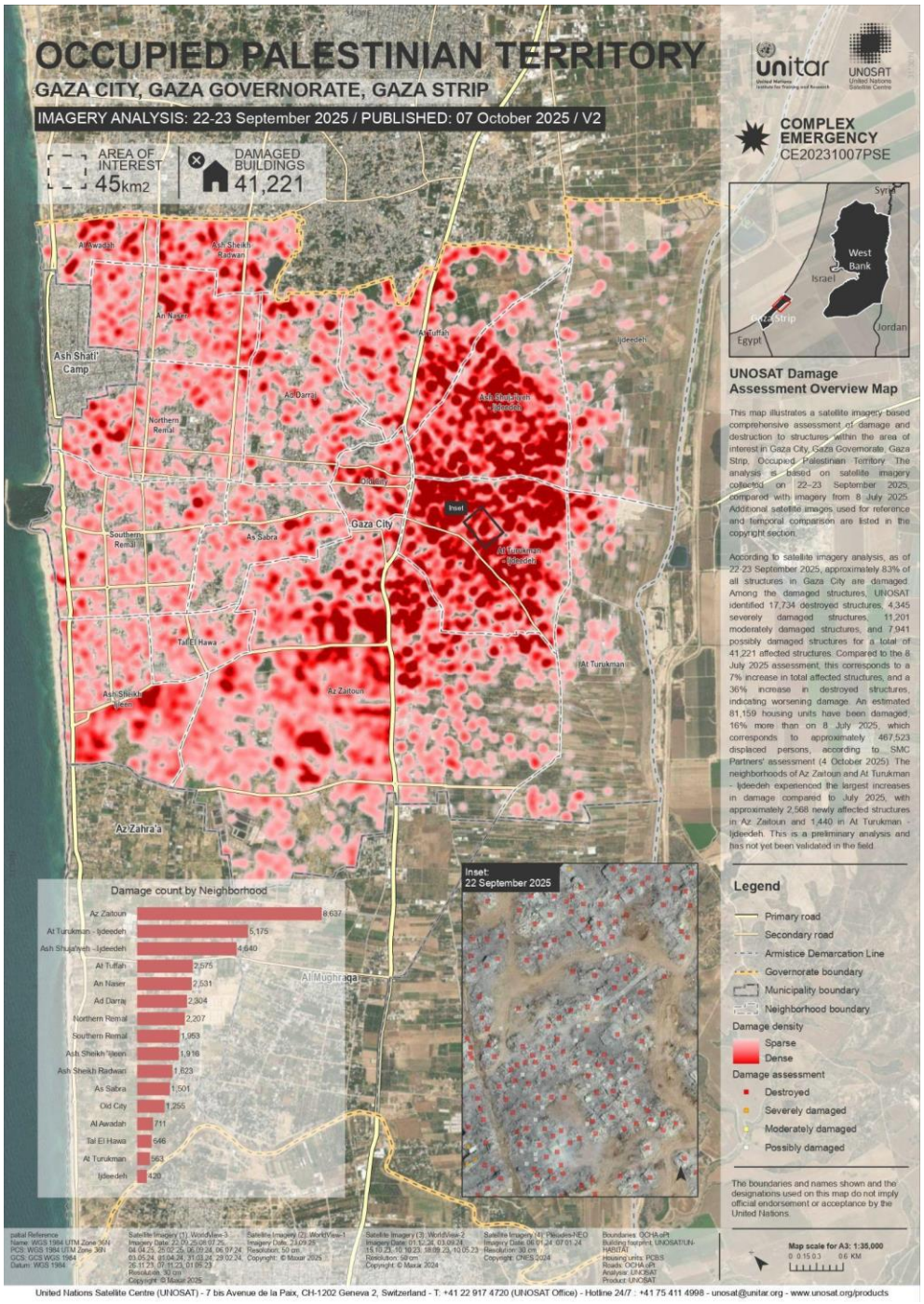

Figure 1. UNOSAT Gaza Governorate Comprehensive Damage Assessment
Source: UNOSAT (2025)

A comprehensive evaluation utilizing satellite imagery has documented significant damage and destruction to the built environment in Gaza City, situated within the Gaza Governorate of the Gaza Strip, Occupied Palestinian Territory. This assessment, conducted with imagery captured from September 22-23, 2025, compared findings to an earlier evaluation dated July 8, 2025.

By the date of the September 2025 assessment, it was reported that approximately 83% of all buildings in Gaza City had sustained some form of damage, with UNOSAT identifying

a total of 41,221 affected structures. This total comprised:

Table 1. Structural Damage Assessment in Gaza City (as of 23 September 2025)

Damage Category	Structure Count
Destroyed Structures	17,734
Severely Damaged Structures	4,345
Moderately Damaged Structures	11,201
Possibly Damaged Structures	7,941

Source: UNOSAT (2025)

In comparison to the July 2025 evaluation, the overall number of impacted structures exhibited a 7% increase, while the count of completely destroyed edifices experienced a substantial rise of 36%. These figures indicate a marked deterioration in the structural integrity of buildings within the urban landscape. An estimated 81,159 housing units were reported damaged, representing a 16% increase since the previous assessment, thereby displacing approximately 467,523 individuals.

The neighborhoods of Az Zaitoun and At Turukman - Ijdeedeh were notably impacted, each exhibiting significant increases in the number of affected structures, with around 2,568 and 1,440 newly affected buildings, respectively. Concurrent with structural damage, the environmental ramifications were profound and multifaceted. An estimated 78% of Gaza's 250,000 buildings were either damaged or completely destroyed, generating approximately 61 million tonnes of debris, an amount equivalent to about 15 Great Pyramids of Giza. Alarmingly, around 15% of this debris posed a considerable risk of contamination from hazardous materials such as asbestos, industrial waste, and heavy metals.

The conflict has severely disrupted essential environmental resources and public health, as highlighted in UNEP's latest report (2025). Freshwater resources have become critically limited and increasingly polluted due to the failure of sewage treatment facilities, the destruction of piped water systems, and a heightened reliance on cesspits, which likely compromise the primary aquifer. This contamination has extended to marine and coastal areas. Consequently, the water crisis has precipitated a surge in infectious diseases, exemplified by a 36-fold increase in cases of acute watery diarrhea and a staggering 384-fold rise in instances of acute jaundice syndrome, indicative of hepatitis A.

Furthermore, the extensive destruction of vegetation has severely compromised the agricultural system. Since 2023, the enclave has witnessed a loss of 97% of its tree crops, 95% of its shrub land, and 82% of its annual crops. This pronounced decline has directly contributed to an escalating humanitarian crisis, with over 500,000 individuals facing conditions of famine and approximately one million others encountering food insecurity. The degradation of vegetative cover, compounded by soil compaction from military activities, has adversely affected soil structure, diminishing its capacity to retain moisture, thus exacerbating

runoff and flood risks while simultaneously impairing groundwater recharge.

4.1.2 Direct Emissions from Military Operations

The primary source of GHG emissions during the ongoing conflict can be attributed to the combustion of fuel utilized in Israel's air, land, and naval operations. A study conducted by Otu-Larbi et al. (2024, p. 11-12) estimates that emissions over the initial 120-day period, from October 7, 2023, to February 7, 2024, are projected to range from approximately 420,265 tCO_2e (lower estimate) to 652,552 tCO_2e (upper estimate), with a mean estimate of 536,410 tCO_2e. In light of the absence of comprehensive fuel consumption data extending beyond February 2024, emissions for the entire duration of the conflict, projected to last until September 23, 2025 (a total of 717 days), have been extrapolated linearly for illustrative purposes. This approach provides a framework for understanding the long-term environmental impacts associated with military operations during this period.

$$E_{i,j} = AD_{i,j} \; x E_{i,j}$$

In this context, $E_{i,j}$ denotes the emissions (in tCO_2e) attributable to fuel type i within sector j, while $AD_{i,j}$ represents the amount of fuel consumed, and $EF_{i,j}$ specifies the emission factor (in kg CO_2 per unit of fuel).

$$E_{CO_2e} = (E_{CO_2} \; x \; E_{CH_4} \; x \; GWP_{CH_4} \; x \; E_{N_2O} \; x \; GWP_{N_2O})$$

The calculation of total CO_2-equivalent emissions utilizes the default Global Warming Potentials established by the Intergovernmental Panel on Climate Change (IPCC), specifically (GW P CH_4 = 27.9 and GW P N_2O = 273).

Baseline emission estimates were derived from a comprehensive study conducted by Otu-Larbi et al. (2024, p. 11-12), which analyzed the initial 120 days of military operations from October 7, 2023, to February 7, 2024. The study's findings reveal that total direct emissions range from a conservative estimate of 420,265 tCO_2e to an upper estimate of 652,552 tCO_2e.

In order to project these emissions over the entire 717-day period, extending from October 7, 2023, to September 23, 2025, a linear time-scaling factor was applied.

$$f_{time} = 717/120 = 5.975$$

The extrapolated total direct emissions are calculated based on these estimations.

$$E_{(2023\text{-}2025\ military)} = E_{Otu\text{-}Larbi\ et\ al} \; x \; f_{time}$$

Resulting in:

Table 2. Estimated Direct Emissions from Military Operations (7 October 2023 - 23 September 2025)

Estimation Type	120-day Emissions (tCO_2e)	717-day Extrapolated (tCO_2e)
Lower Estimate	420,265	2,511,083
Mean Estimate	536,410	3,205,049
Upper Estimate	652,552	3,898,998

Source: Author's Analysis (2025).

These figures epitomize the cumulative direct emissions resulting from Israeli military operations over a two-year span, predominantly attributed to the combustion of fossil fuels in airstrikes, armored vehicles, and logistical operations. Utilizing the IPCC's default emission factors, it is posited that diesel (74,100 $kgCO_2/TJ$) and jet kerosene (71,500 $kgCO_2/TJ$) comprise the majority of the energy mix.

4.1.3 Indirect Emissions from Structural Destruction and Fire

In a report from the UNEP (2025) and UNOSAT (2025), it has been estimated that the extensive bombardment of Gaza by Israel, occurring between October 7, 2023, and September 23, 2025, will yield a total debris mass of approximately 61 million tonnes.

This analysis provides a conservative estimate positing that around 5% of the total debris mass has undergone uncontrolled combustion. This percentage falls within the moderate range of open burning fractions, ranging from 3% to 10%, typically observed in densely populated urban conflict zones or disaster-impacted areas where waste management infrastructures are significantly compromised. The 5% estimation aligns with guidelines established by the IPCC (2006, Vol. 5, Ch. 5), which recommends a default open burning fraction of 0.05 for regions lacking effective waste management systems.

The mass of the incinerated debris is assessed using the following calculation:

$$M_{burned} = 0.05 \; x \; M_{debris}$$

$$M_{burned} = 0.05 \; x \; 61{,}000{,}000 = 3{,}050{,}000 \; tonnes$$

An estimated 3.05 million tonnes of debris is hypothesized to comprise 50% combustible carbonaceous material (0.5). In accordance with the guidelines set forth by the IPCC (2006), total CO_2 emissions resulting from open burning are derived through the following methodology:

$$E_{fire} = M_{burned} \, x \, C_{fraction} \, x \, EF_{CO_2}$$

Where:

M_{burned} = total burned debris (tonnes)

$C_{fraction}$ = carbon fraction of material (default 0.5)

EF_{CO_2} = CO_2 emission factor for open burning (1.9 tCO_2/tC, IPCC, 2006)

$$E_{fire} = 3{,}050{,}000 \, x \, 0.5 \, x \, 1.9 = 2.8975 \, x \, 10^6 \, tCO_2e$$

During this period, uncontrolled fires in Gaza were responsible for the emission of approximately 2.9 million tonnes of CO_2e, excluding the contribution of secondary pollutants such as CH_4 and N_2O. These emissions constitute a significant unreported source of GHG associated with conflict. This estimate corroborates the findings of CEOBS (2024), which suggest that fires occurring in built environments represent a crucial yet frequently overlooked element of the global military emissions gap.

4.1.4 Emissions from Soil Carbon Loss

The ongoing genocide has caused significant soil disruption, leading to a considerable loss of carbon from agricultural areas in Gaza. The estimation of these emissions is derived from the IPCC (2006) Guidelines for National Greenhouse Gas Inventories, Volume 4, Chapter 2.

$$\Delta C_{Mineral} = SOC_{REF} \, x \, A$$

Where:

$\Delta C_{Mineral}$ = total carbon stock loss (tC)

SOC_{REF} = reference soil organic carbon stock ($tC \, ha^{-1}$)

A = affected land area (ha)

In the warm temperate dry climate of Gaza, the reference soil organic carbon stock is

recorded at 38 tC ha^{-1} for HAC soils (IPCC, 2006, Vol. 4, Ch. 2, Table 2.3). According to UNITAR (2023), the agricultural extent of Gaza covers approximately 185 km^2 (18,500 ha), representing about half of the territory's total area (365 km^2). Meanwhile, UNEP (2025, p. v) reports near-total ecological collapse, with 97% of tree crops, 95% of shrubland, and 82% of annual crops destroyed since October 2023. In this study, the 36,500 ha figure is therefore applied as an upper-bound composite estimate of all vegetated and cultivated soils affected by bombardment. This assumption integrates croplands, shrublands, tree cover, and peri-urban soils, consistent with the comprehensive ecosystem damage observed across Gaza.

$$\Delta C_{\text{Mineral}} = 38 \text{ x } 36{,}500 = 1{,}387{,}000 \text{ tC}$$

To articulate this in terms of CO_2:

$$E_{\text{soil}} = \Delta C_{\text{Mineral}} x\ 44/$$
$$121{,}387{,}000\ x\ 3.667\ =$$
$$5{,}085{,}000\ tCO_2$$

As a result, the estimated soil carbon loss between October 7, 2023, and September 23, 2025, is around 5.09 $MtCO_2$. This figure, drawn directly from the IPCC (2006, Vol. 4, Ch. 2, Table 2.3) reference for warm temperate dry soils, represents the maximum potential emissions, assuming complete carbon depletion in the affected soil layer (0-30 cm).

4.1.5 Total Genocide Emissions (7 October 2023 - 23 September 2025)

In order to assess the comprehensive climate impact of Israel's ongoing genocide in Palestine, this section synthesizes estimations of emissions derived from multiple interrelated sources of environmental degradation. These sources include direct military operations, the combustion of structures and associated debris, as well as the resultant carbon loss from the soil.

Table 3. Aggregate Genocide Emissions over the Two years

Source	Estimate (tCO_2e)
Military	3,898,998
Fire	2,900,000
Soil Carbon Loss	5,085,000
Total	**11,883,998 tCO_2e**

Source: Author's Analysis (2025)

4.1.6 Post-genocide Reconstruction Emission Estimation

Emissions associated with material-based reconstruction have been evaluated in accordance with the UNEP (2025) and the Mosul Debris Management report (UNEP & UN-Habitat, 2018). The findings indicate that concrete represents the predominant material, accounting for approximately 70% of the total emissions.

$$E_{\text{reconstruction}} = \sum (M \; x \; EF)$$

Where:

$E_{\text{reconstruction}}$ = total CO_2 emissions from reconstruction (tCO_2)

M = mass of material required for rebuilding (tonnes)

EF = embodied emission factor for material (tCO_2/tonne)

Table 4. Estimated Post-genocide Reconstruction Emissions by Material Type

Material	Share % (est)	M (Mt)	Given EF (ICE Database v3)	EF (tCO_2/t)	E ($MtCO_2e$)
Concrete	70	42.7	252.9 $kgCO_2e/m^3$	0.0002529 x 2.4 t/m^3 = 0.61	26.05
Steel	7	4.27	2.52 $kgCO_2e/kg$	2.52 (direct)	10.76
Asphalt	3	1.83	51.13 $kgCO_2e/t$	0.05113 (direct)	0.093
Brick/mixed	15	9.15	0.213 $kgCO_2e/kg$	0.213 (direct)	1.95
Wood	5	3.05	-0.558 $kgCO_2e/m^2$	-0.000558 x 50 kg/m^2 = -0.028 (approx.)	-0.085
Total	100	61 Mt debris (UNEP, 2025)			38.77 $MtCO_2eq$

Source: Author's Analysis (2025)

The projected embodied carbon footprint associated with the reconstruction materials amounts to 38.8 $MtCO_2eq$, assuming the reconstruction of 61 million metric tons of debris

occurs under standard, unmitigated conditions.

4.1.7 Uncertainty Analysis

This study systematically addresses the inherent variability associated with estimating post-conflict emissions through the integration of uncertainty analysis across all components related to genocide and reconstruction emissions. The objective of this section is to identify the primary sources of uncertainty, evaluate their potential impacts, and delineate the sensitivity ranges of the total emission estimates presented in Tables 2 to 4.

Uncertainty is categorized into three principal domains:

1. Activity Data (A) refers to variability in debris mass, affected land area, and the duration of military operations;
2. Emission Factors (EF) refers to discrepancies in carbon intensity values across different material types, combustion conditions, and soil classifications;
3. Methodological Assumptions (M) refers to extrapolations, oxidation rates, and the rates of open burning.

To rigorously assess sensitivity, the analysis employed parameter variation within empirically defined ranges, adhering to the guidelines set forth by the IPCC (2006; 2019) and leveraging the defaults from the ICE Database v3. Table 6 succinctly summarizes the uncertainty ranges and their consequential impacts on the results.

Table 5. Uncertainty Range for Major Emission Sources (2023-2025)

Source	Base ($MtCO_2e$)	Low ($MtCO_2e$)	High ($MtCO_2e$)	Primary Variable	Uncertainty Basis
Military Operations	3.90	3.20	4.60	Duration of conflict, fuel load	±18%
Structural Fire / Open Burn	2.90	1.65	7.32	Open burn fraction (3-10%), oxidation factor (0.9-1.2)	x4.4 range

Soil Carbon Loss	5.09	0.51	2.54	SOC loss fraction (10-50%)	x5 range
Reconstruction (Material)	38.77	31.01	46.52	Material EF variation (±20%)	±20%
Total (Genocide Phase)	**11.89**	**5.36**	**14.46**	Combined propagation	-
Total (Including Reconstruction)	**50.66**	**36.37**	**68.94**	Combined propagation	-

Source: Author's Analysis (2025)

Overall, the reconstruction phase is identified as the predominant driver of uncertainty, contributing over 75% of the total variance, primarily due to factors associated with embodied carbon and the variability in material composition. Furthermore, the portion attributable to fire or open burning introduces significant uncertainty, as uncontrolled combustion is influenced by complex waste dynamics that follow conflict scenarios. The upper estimate of 68.94 $MtCO_2e$ represents a worst-case scenario, while the more conservative lower estimate of 36.37 $MtCO_2e$ remains comparable to the annual emissions of a mid-sized industrial nation. Consequently, regardless of the sensitivity margins, the findings robustly indicate that the climate impact resulting from genocide and its subsequent aftermath constitutes a substantial yet underreported carbon event within the global emissions inventory.

A comprehensive elaboration of all computational assumptions, emission factor calculations, and sensitivity assessments detailed in this section is provided in Appendix 1 (Analytical Worksheets and Data Sources), which contains thorough documentation of the formulas and parameters employed in this analysis.

4.2 Discussion

4.2.1 Climaticide: The New Form of Crime

The research findings elucidate a profoundly detrimental intersection of human and ecological devastation, necessitating a paradigm shift that transcends prevailing conceptualizations of war-related harm. The extensive scale of infrastructural ruin, which has generated an estimated 61 million tonnes of hazardous debris, in conjunction with the systemic depletion of soil carbon and the direct emissions resultant from military activities,

constitutes a climatic event intricately linked to a humanitarian crisis. These findings call for the conceptualization of "Climaticide", a novel category of crime that this study encapsulates the specific mechanisms of destruction observed in Palestine, wherein colonial aggression is inherently connected to the causation of planetary harm.

Climaticide is proposed as an innovative categorization of transnational environmental crime that integrates the concepts of genocide (the systematic extermination of human populations) and ecocide (the deliberate destruction of ecological systems) into a unified framework of climate-altering actions. This classification seeks to encompass the multifaceted nature of environmental harm that not only threatens biodiversity and ecological integrity but also jeopardizes human populations through climate-related impacts. This concept fundamentally diverges from traditional understandings of ecocide, which often focus predominantly on environmental damage. Climaticide expands this discourse by illustrating a process wherein the perpetrator not only inflicts devastation upon the natural environment but concurrently generates and secures long-term GHG emissions, thereby actively exacerbating global warming and perpetuating planetary instability. This process redefines localized colonial violence as a criminal act of global climate irresponsibility, underscoring that the devastation extends beyond a moral and political affront to Palestinians, representing a transgression against the collective right to climate stability.

The empirical data delineates the mechanisms underpinning Climaticide, demonstrating that Israel's actions engender successive and compounding "carbon pulses" across various temporal dimensions:

1. Immediate Emissions (Direct Military Operations)

   The initial spike in greenhouse gas emissions is primarily attributed to the combustion of fossil fuels during military operations across air, land, and naval theaters. Within the context of the conflict, which spanned 717 days, the projected total direct emissions are estimated to reach approximately 3.90 $MtCO_2e$ (Base estimate).

2. Indirect Emissions (Structural Destruction and Fire)

   Following the immediate emissions, a subsequent surge in emissions occurs due to significant structural devastation. An estimated 61 million tonnes of debris, comprised of various combustible materials, is likely to produce around 2.90 $MtCO_2e$ (Base estimate) through uncontrolled fires. This aspect is often overlooked yet represents a critical source of GHG emissions associated with military conflict.

3. Soil Carbon Loss

   The ecological disruption engendered by the conflict fosters a detrimental feedback loop characterized by significant soil carbon loss. The profound impact on 36,500 hectares of arable land is anticipated to yield an estimated loss of 5.09 $MtCO_2e$ in soil carbon. This degradation of natural carbon sinks is poised to perpetuate environmental harm for an extended period, thereby prolonging the warming effects well beyond the cessation of hostilities..

The cumulative effects of these emissions are manifest in the context of extensive violence, culminating in an estimated total of 11.89 $MtCO_2e$ (Base estimate) resulting from the destruction phase. Notably, the emissions associated with reconstruction under a

conventional, unmanaged scenario are projected to be a staggering 38.77 $MtCO_2e$ (Base estimate), surpassing threefold the total emissions generated during the two years of the ongoing genocide. This illustrates that colonial violence not only incites an immediate increase in carbon emissions but also contributes to a significant "carbon afterlife of genocide."

Despite the complexity inherent in the post-conflict emissions landscape, the study's Uncertainty Analysis substantiates the robustness and significance of the findings. This analysis posits that total emissions (inclusive of both the genocide phase and unmoderated reconstruction) range from a conservative Low estimate of 36.37 $MtCO_2e$ to a worst-case High estimate of 68.94 $MtCO_2e$. The reconstruction phase emerges as the principal source of uncertainty, accounting for over 75% of the overall variance, a factor largely attributed to variability in material emission factors (± 20%). Furthermore, emissions from structural fires and open burning complicate the analysis, demonstrating considerable uncertainty due to complex waste dynamics and varying oxidation rates (a factor of 4.4). Nevertheless, even the most conservative estimate of 36.37 $MtCO_2e$ is commensurate with the annual emissions of a mid-sized industrial nation. This underscores the principal assertion: the climate impacts arising from this systematic violence constitute a significant yet underappreciated carbon event within the global emissions inventory. This precise quantification lays the critical empirical foundation for characterizing Israel's actions not solely as political or humanitarian crises but as a profound and quantifiable act of global Climaticide.

The concept of Climaticide directly correlates with Rob Nixon's notion of "slow violence" (2011), emphasizing that the destruction is characterized not solely by acute, immediate military actions but by the prolonged violence of gradual degradation dispersed across both time and space. The breakdown of sewage and water systems, the contamination of the aquifer, and the resultant 384-fold surge in acute jaundice syndrome exemplify this enduring harm. The degradation of soil's capacity to retain water and the loss of 97% of tree crops (UNEP 2025, p. v), illustrate ecological injuries that establish a climate feedback loop: localized ecological devastation in Palestine perpetually contributes to global warming, thereby extending and intensifying planetary warming even after the conflict has concluded. If left unmitigated, the post-genocide rebuilding efforts will further perpetuate this slow violence through substantial carbon emissions.

The notion of Climaticide represents a salient theoretical advancement, effectively integrating environmental criminology, climate science, and colonial studies. It furnishes a normative foundation for the criminalization of climate devastation resulting from war and occupation, offering a new framework for accountability that extends beyond traditional human rights violations to encompass planetary harm. This presents a critical policy imperative for the global community: if the climate crisis is acknowledged as one of the most significant challenges facing humanity, how should the complicity of state and non-state actors in Climaticide be addressed within the broader context of climate justice?

4.2.2 Post-genocide Mitigation Strategies

The empirical analysis presents a compelling assessment of a substantial carbon debt amounting to 38.8 $MtCO_2eq$, arising from unmitigated reconstruction efforts. This burden

exceeds the immediate emissions associated with the conflict by more than threefold, thereby redefining the planning challenges within the post-genocide context. The magnitude of the projected emissions necessitates a transformative conceptual framework that reframes the recovery process as an intrinsic aspect of climate governance. Consequently, the primary objective should transcend mere attempts to "recreate what was lost," a strategy likely to replicate the carbon-intensive vulnerabilities of the past. Instead, it must focus critically on "reforming the factors that led to the loss," particularly the entrenched colonial dependencies on extractive and carbon-dependent developmental paradigms.

Addressing this significant climate liability requires a comprehensive mitigation framework capable of navigating the profound temporal disjunctions characteristic of conflicts and climate emergencies. Drawing upon the critical theory of temporal climate justice (Bopp & Bercht, 2021), which posits that injustice emerges from the asynchrony among ecological, social, and political timelines, mitigation strategies should be implemented across various temporal dimensions: World time (encompassing global policy initiatives such as COP and donor decisions), Micro-time (reflecting the pace of communal recovery and social rhythms), and Natural time (which pertains to the gradual processes of soil, water, and vegetation recovery). This alignment can be systematically executed through three distinct phases:

Table 6. Three Phases of Post-genocide Reconstruction

Phase	Timeframe	Primary Objective (Climate Governance Logic)	Key Focus Areas and Actions	Logic of Mitigation
Phase 1: Emergency Ecological Stabilization	Years 1-5	Carbon Containment and Acute Instability Management	Basic Remediation (debris containment, soil decontamination); Moratorium on large-scale, high-carbon projects to prevent carbon spikes; Establishing a Transitional Climate Authority (governance)	Preventing the initial recovery process from becoming a new source of emissions and halting further ecological collapse (e.g., controlling carbon leakage from debris)
Phase 2:	Years 5-15	Integrating	Mandatory	Balancing the

Structural Reconstruction with Climate Accountability		Development with Planetary Climate Limits	Carbon Budget Integration into all projects; Implementing Emission Accounting & Liability Mechanisms (based on Polluter Pays); Asserting Climate Sovereignty in development decisions	urgent need for physical rebuilding with the carbon limits of the planet and ensuring that development decisions are not carbon rebound sources
Phase 3: Ecological Sovereignty and Regenerative Transition	Years 15-30	Planetary Healing & Decolonization of Carbon Futures	Community-based food/water system recovery; Investment in natural carbon sequestration (coastal, farmland rehabilitation); Integration into a regional adaptation corridor; Regenerative Reconstruction	Closing the loop from post-genocide survival to structural resilience, making Palestine a model for climate decolonization and regenerative development

Source: Author's Analysis (2025)

The gradual methodology proposed herein directly confronts the pervasive issues highlighted in the Introduction, namely, the often-ignored emissions resulting from conflict and the inadequacies of global climate governance in addressing these emissions. A pivotal insight of this discourse is that the post-genocide reconstruction process ought to be understood as a critical governance act concerning carbon futures. This necessitates a fundamental reorientation in the logic of rebuilding from merely "restoring what was lost" to "reforming the factors that led to the loss."

This is precisely where the Transitional Climate Authority (TCA) assumes a vital role. Established in Phase 1, the TCA will serve as the primary enforcement and technical body for climate-resilient rebuilding efforts.

1. Mandate

The primary responsibility of the TCA is to evaluate, allocate, and monitor the carbon budget of Palestine following the impact of genocide. This mandate encompasses various sectors, including housing, energy, infrastructure, and agriculture. The TCA possesses the authority to set upper limits on both embodied and operational carbon emissions within substantial reconstruction initiatives, thereby ensuring that all projects supported by external donors adhere to these established constraints. This framework signifies a transition from a voluntary reporting system toward a mandatory governance model for carbon accountability.

2. Composition and Authority

The TCA should be made up of Palestinian and global experts in environmental issues, legal academics, and climate scientists, functioning under the authority of a sovereign Transitional Palestinian Government, with technical collaboration from UNEP, UNDP, and the UNFCCC Secretariat. Importantly, it must possess the authority to veto any project, regardless of whether it originates domestically or from donors, that surpasses the established carbon intensity limits. This approach would embed climate accountability into the system and turn external funding into a synchronized, carbon-conscious recovery initiative.

3. Carbon Budget Enforcement

In pursuit of its objectives, the TCA intends to establish a National Carbon Accounting Ledger designed to monitor greenhouse gas emissions associated with material manufacturing, waste disposal, and energy consumption within reconstruction activities. This ledger will systematically document all incoming international financial contributions, including environmental reparations and aid directed toward rebuilding efforts, thereby ensuring transparency and accountability in the allocation of resources. Furthermore, the TCA will implement the Polluter Pays Principle, which will impose fees or offset obligations on projects exceeding prescribed emission thresholds. The funds generated through this mechanism will be earmarked for local reforestation and soil restoration programs, promoting sustainable environmental practices.

This mitigation strategy is deeply analytical and critical, employing the framework of temporal climate justice to inform actions across World time, Micro-time, and Natural time. By synchronizing global resource allocation (Phase 2) with the inexorable tempo of ecological restoration (Phase 3), this framework ensures that climate action remains both timely and uncompromised by political expediency. The TCA's implementation of a binding carbon budget, coupled with the enforcement of the Polluter Pays Principle in Phase 2, possesses considerable practical implications. Such measures operationalize accountability for emissions and liability, providing a concrete avenue to address the carbon debt attributed to Israel concerning the Palestinian populace and the broader global environment. This reframing transforms recovery from a mere act of charity into a necessary form of environmental reparation.

Drawing on the theoretical underpinnings of climate colonialism, the research posits that the restoration of full Palestinian sovereignty over environmental resources should be

regarded not as a peripheral political aim but as a fundamental mechanism of mitigation. The colonial control of resources invariably exacerbates the climate crisis by obstructing the development of local, resilient solutions. By emphasizing a Decolonial Reconstruction that prioritizes indigenous ecological principles, the mitigation framework posits Palestine as a salient case study in the broader discourse of global justice.

If the emissions associated with the carbon legacy of genocide can be quantified and attributed to a culpable entity, can the global climate framework, exemplified by the UNFCCC and COP processes, continue to overlook or sanction this systematic planetary degradation? A successfully decarbonized transition in Palestine, financed through environmental reparations and bolstered by regional adaptation and cross-border solidarity, would provide a significant and compelling global precedent. It would demonstrate that the climate consequences of conflict are not only quantifiable and actionable but must also be integrated into any future discourse on state accountability, thereby necessitating the incorporation of justice and climate stability into global governance frameworks.

The calculated carbon debt attributable to Israel, in relation to both the Palestinian population and the global climate system–as evidenced by the 38.8 $MtCO_2eq$ reconstruction obligation–furnishes an unprecedented legal and moral basis for advocating environmental reparations. Such an approach must extend beyond traditional humanitarian aid, which often proves insufficient and lacks accountability. Legal precedents can be established through the Polluter Pays Principle and the emergent Loss and Damage mechanism ratified at COP29. The establishment of a Global Climate Reparations Fund, specifically intended to facilitate Palestine's ecological transition, embodies a just and equitable response to this considerable debt.

The reconstruction of Gaza represents a pivotal opportunity to eschew the perpetuation of carbon-intensive, colonial-modernization models. An authentically decolonial rebuilding initiative must prioritize local knowledge, Islamic ecological spirituality, and traditional, resilient food systems, with the objective of achieving a regenerative recovery. Furthermore, the pressing climate challenges cannot be effectively addressed in isolation. Meaningful mitigation requires the establishment of a Regional Adaptation Corridor, fostering transnational solidarity and collaboration with neighboring states such as Egypt, Jordan, and Lebanon, to ensure equitable resource sharing (notably in terms of water) and the integration of resilient infrastructure systems.

4.2.3 The Impacts of Unmitigated Reconstruction

The primary and most consequential finding of the empirical analysis is the extensive scale of environmental liability associated with anticipated emissions, quantified at 38.8 $MtCO_2eq$, resulting from unmitigated post-genocide reconstruction efforts. This figure extends beyond mere numerical representation, it encapsulates a substantial and enduring climate risk poised to influence the trajectory of recovery. In the absence of a comprehensive mitigation strategy, as delineated within this study, the reconstruction process is at risk of transmuting the acute violence inflicted during the genocide into a persistent structural crisis, which may henceforth be referred to as "the carbon afterlife of genocide."

This imminent crisis is catalyzed by the persistence of carbon colonialism. Unregulated

reconstruction endeavors are likely to rely heavily on high-carbon, imported materials, such as concrete, steel, and asphalt, essential for the reconstruction of the extensively damaged or destroyed infrastructure. Such structural reliance perpetuates a colonial economic paradigm, positioning Palestine as a subordinate entity within the global supply chain. This dynamic necessitates the acquisition of materials that not only entail elevated emissions but also compel Palestine to shoulder the climate burden without achieving ecological autonomy. Rather than facilitating a sustainable recovery, this trajectory risks deepening Palestinian dependence on carbon-intensive methodologies dominated by external actors, thereby transforming the reconstruction efforts into mechanisms of structural subjugation and undermining the ethical imperatives of green reconstruction (Legorycheva, 2025).

The gravity of this structural injustice is further exacerbated by the emerging climate feedback loops stemming from extensive ecological degradation. The substantial loss of vegetation and the resulting impairment of soil structure significantly undermine the natural recovery processes critical for environmental stabilization. Land degradation has been widely recognized as a serious global challenge exacerbated by human activities and climate change (Kumar et al., 2022). Crucially, this ecological devastation initiates a positive feedback loop that accelerates regional warming. The reduction in vegetation cover diminishes the soil's capacity for carbon sequestration, thereby exacerbating the accumulation of atmospheric carbon dioxide (AbdelRahman, 2023). Consequently, the deterioration of natural carbon sinks amplifies local temperatures and exacerbates water scarcity, which may lead to desertification, recurrent agricultural failures, and an intensified reliance on imported goods.

This interconnected sequence of events effectively extends the climate repercussions of the genocide far beyond the immediate physical conflict. The emission burden of 38.8 $MtCO_2eq$ arising from unmanaged reconstruction, when juxtaposed with direct military carbon emissions, represents a catastrophic intergenerational climate injustice. Given that carbon remains in the atmosphere for over 100 years (The IPCC Fifth Assessment Report, 2014), the failure to address these emissions results in a direct transference of environmental debt from one generation to the next within the Palestinian population. This scenario guarantees that recovery funding, originally earmarked for human development, will be persistently redirected to mitigate climate-induced crises, thus engendering profound humanitarian setbacks. Climate change is already a major contributor to food and water insecurity, exacerbating disease burdens (Maslin et al., 2025) and heightening humanitarian needs due to increasingly frequent and severe flooding, storms, heatwaves, infectious diseases, and food scarcity (Clarke, 2021). In the absence of mitigation measures, the carbon afterlife of genocide will perpetuate cycles of hunger, poverty, and social conflict (Upadhyay, 2020), subjugating the populace to a continuous state of emergency rather than fostering genuine social recovery.

Ultimately, the international community's failure to integrate the climate dimension into the reconstruction framework epitomizes a significant failure of global governance. It underscores a critical oversight whereby acts of genocide are implicitly afforded emissions exemptions, thereby undermining the legitimacy of global climate institutions. Neglecting to hold a state actor accountable for generating substantial, measurable, and enduring global

carbon emissions through acts of mass destruction gravely undermines the mechanics of the Loss and Damage Fund and the authority of the COP processes.

The findings of this study present an existential challenge to the global climate regime. A successful transition towards a decarbonized state for Palestine, supported through environmental reparations and reinforced by regional adaptation and transnational solidarity, would establish a vital and necessary global precedent.

5. CONCLUSION

The primary contribution of this study is the conceptualization of a novel category of transnational environmental crime termed "Climaticide." This framework compellingly integrates the disciplines of environmental criminology, climate science, and colonial studies. It advances the discourse by transcending the traditional understanding of environmental degradation during conflict as merely incidental (ecocide) or solely as human rights violations (genocide). Instead, it acknowledges the intricate and devastating interplay between these phenomena: the systematic annihilation of populations and their habitats while concurrently exacerbating global warming at an accelerated pace.

A pivotal finding of the research is the quantification of the responsibilities associated with post-genocide recovery, projected to result in a distressing carbon debt of 38.8 $MtCO_2eq$. This figure is particularly significant as it is threefold the direct emissions attributed to two years of military conflict, thus indicating that the most severe climate impact does not stem from the immediate "carbon pulse" induced by violence, but rather from the subsequent "carbon afterlife of genocide."

The theoretical contribution of the Climaticide framework lies in its establishment of a normative basis for the criminalization of environmental destruction linked to warfare and occupation, thereby directly challenging the prevailing global governance structures that tacitly permit an "emissions subsidy" for state-sponsored military devastation. From a practical standpoint, it advocates for a phased mitigation strategy consisting of three stages: Emergency Stabilization, Structural Reconstruction, and Regenerative Transition. This strategy aims to reconcile political, social, and ecological timelines, providing a feasible avenue for addressing the carbon debt arising from reconstruction through the implementation of the Polluter Pays Principle and prioritizing ecological sovereignty as a crucial component of recovery. It shifts the emphasis from mere humanitarian assistance to focus on environmental reparations, thereby offering a vital resource for global policy formulation.

This study, while methodologically rigorous, acknowledges several limitations and uncertainties in the data that necessitate careful consideration and further empirical validation.

1. The estimation of carbon emissions is primarily reliant on remote assessments of debris volume and composition, predominantly sourced from satellite analyses conducted by UNOSAT and UNEP. Although these datasets represent some of the most reliable post-conflict estimates available, they are fundamentally constrained by the absence of ground verification pertaining to structural types, material diversity, and combustion efficiency. The lack of ground sampling, encompassing field measurements of soil carbon, debris composition analysis, and monitoring of energy utilization, restricts the precision of

emission estimates, particularly with respect to open burning practices and losses of soil organic carbon

2. Due to insufficient localized empirical data, several numerical assumptions were necessarily adopted. These assumptions include reference values for soil organic carbon (SOC) derived from the IPCC (2006) guidelines, oxidation rates for open burning based on the IPCC 2019 Refinement, and embodied carbon values obtained from the ICE Database v3, which were initially developed for industrialized contexts. The application of these parameters within Gaza's specific climatic and infrastructural framework introduces systematic uncertainties that may affect the validity of the findings.
3. The study's conceptual framework addressing intergenerational climate injustice simplifies the temporal modeling of greenhouse gas persistence, thereby omitting potential regional feedback mechanisms, such as alterations in albedo, aerosol radiative forcing, or delays in biogeochemical recovery. While such simplification proves analytically beneficial, it may inadvertently underestimate the long-term feedback processes that are critical to ecological recovery following instances of genocide.

In light of these methodological challenges, the study posits several pivotal research inquiries for future investigation: (1) What specific on-the-ground indicators are essential for accurately assessing soil carbon loss and debris composition in Gaza, and how can these data enhance current emissions estimations (such as the 5.09 $MtCO_2$ approximation for soil loss)? (2) How can emission factors and embodied carbon coefficients tailored to the region be developed to more accurately reflect the materials utilized in Gaza's construction, taking into account its climatic conditions and agricultural characteristics? (3) What legal and institutional frameworks are necessary to establish an independent Transitional Climate Authority (TCA) capable of enforcing low-carbon reconstruction standards despite political and donor-related challenges? (4) In what ways do traditional Palestinian building materials and techniques compare to high-carbon alternatives, such as cement and steel, in terms of embodied carbon and long-term resilience, and what policy measures could be implemented to promote their utilization in sustainable reconstruction?

These inquiries underscore the necessity for empirical ground validation and the generation of localized data, highlighting the importance of integrating climate justice and governance research into the reconstruction efforts for post-genocide Palestine.

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