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Making War Emissions Visible: Accounting Boundaries, Inventory Attribution and Climate Transparency in the Russia–Ukraine War

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Abstract

War-related greenhouse gas estimates are increasingly visible in climate diplomacy, yet their relationship to national emissions inventories remains unclear. This article asks how accounting boundaries and reporting rules shape the visibility and accountability of emissions associated with the Russia–Ukraine war. It combines a structured comparison of four successive published assessment vintages (18, 24, 36 and 48 months) with a source-category crosswalk between six conflict-related emission groups and the 2006 IPCC inventory architecture, as refined in 2019. The most recent assessment reports 311.4 $MtCO_2e$, including 73.3 $MtCO_2e$ in projected reconstruction. The remaining 238.1 $MtCO_2e$ is a reconstruction-excluded subtotal, not a verified inventory of exclusively realised emissions. Between the 36 -and 48-month assessments, the reported balance increased by 74.6 $MtCO_2e$, although updated estimates cannot be treated uncritically as independently observed annual flows. The crosswalk finds that the main reporting problem is fragmented attribution across source codes, jurisdictions, temporal horizons and international transport exclusions, rather than the complete absence of relevant inventory categories. The article develops a feasible voluntary, evidence-linked disclosure protocol alongside existing Paris Agreement reporting, without conflating event estimates with national totals or legal responsibility. It contributes a replicable comparative accounting framework and a politically bounded approach to conflict-related climate transparency.

1 Introduction

War is a major source of environmental damage, yet the international climate regime largely assesses that damage through national and sectoral emissions inventories. This creates a mismatch between the question asked in climate diplomacy, what emissions are attributable to a particular armed conflict?, and the question answered by a national inventory, what emissions occurred within specified reporting boundaries during a given year? The distinction matters because a military fuel purchase, an aircraft detour, a damaged pipeline and the future manufacture of reconstruction materials need not be recorded by the same country, in the same year or in the same source category. The reporting system can register some physical emissions without identifying them as consequences of the war (IPCC, 2006; UNFCCC, 2018).

The Russia–Ukraine war provides an unusually well-documented test of this problem. An independent accounting initiative has issued successive assessments of its greenhouse gas consequences. Its 48-month assessment reports 311.4 million tonnes of carbon dioxide equivalent ($MtCO_2e$) across warfare, landscape fires, energy infrastructure, population displacement, civil aviation and reconstruction (Initiative on GHG Accounting of War, 2026). The same report associates these emissions with an announced Ukrainian claim for climate-related damages. The quantity therefore circulates simultaneously as an estimate of physical environmental impact, a diplomatic signal and a potential input to claims-making. Those functions should be distinguished rather than treated as interchangeable.

Existing scholarship illustrates why a single total does not settle the issue. The first peer-reviewed estimate of previously unaccounted war-related emissions identifies serious coverage and uncertainty problems in the national reporting system (Bun et al., 2024). Research on international trade, food systems and transport shows that the conflict can also alter emissions through economic adjustments outside the battlefield, sometimes in directions opposite to direct warfare emissions (van Meijl et al., 2024; Huang et al., 2024; Xu et al., 2025). Security scholarship places military fuel dependence and logistics in the wider politics of decarbonisation (Belcher et al., 2020; Depledge, 2023). These approaches have different estimation targets and cannot be combined by merely summing their headline figures.

A second line of literature asks what transparency arrangements actually make accountable. Rules specifying who may report, which information must be supplied and what reviewers may assess reflect institutional compromise. More information does not automatically mean greater clarity about political responsibility (Gupta & van Asselt, 2019; Bergsvik et al., 2024). The enhanced transparency framework (ETF) under Article 13 of the Paris Agreement seeks consistent national reporting. It does not establish a mandatory register for emissions attributable to individual wars (UNFCCC, 2018, 2021). This is a governance design question as much as an emissions-measurement question.

This article asks: How do accounting boundaries and institutional reporting rules shape the visibility and accountability of greenhouse gas emissions associated with the Russia–Ukraine war? It makes three contributions. First, it compares sequential report vintages without mistaking revisions in estimated stocks for measured annual emission flows. Second, it maps six conflict-related source groups onto identifiable IPCC inventory pathways and likely reporting jurisdictions. Third, it specifies an implementable supplementary disclosure protocol whose authority, evidence standard and limits are explicit. The article is a comparative document and accounting-design study; it does not claim to measure primary emissions independently.

The argument proceeds from a conceptual distinction between measurement, attribution and accountability to a transparent research design. The findings examine temporal estimates, inventory intersections and politically constrained disclosure. The conclusion identifies the institutional change achievable under existing arrangements and the more demanding reforms that would require new agreement among states.

2 Theoretical Framework: Security, Transparency and Institutional Visibility

The politics of conflict-related emissions begins with the difference between a measurable event and a reportable national category. Physical measurement concerns fuel burned, methane released, biomass combusted or industrial inputs produced. Causal attribution asks whether an increment would have occurred without the war, which requires a baseline and defensible counterfactual assumptions. Institutional accountability concerns whether evidence is supplied in a form that a legally or politically

authorised body can review and what conclusions that body is entitled to draw. The three operations are connected but do not imply one another. In particular, identifying an emissions source cannot itself establish an internationally wrongful act or a monetary compensation obligation.

The regime-politics literature helps explain why these distinctions matter. Transparency rules are negotiated institutions, not neutral pipelines from measurement to responsibility. States have incentives to disclose comparable information that signals compliance, but also to limit reporting where disclosure imposes political, administrative or security costs. Such tensions persist even in mature transparency systems: differences in definitions and negotiated review limits can preserve ambiguity after formal reporting has expanded (Gupta & van Asselt, 2019; Bergsvik et al., 2024). In conflict settings, operational secrecy, contested territorial control and the political uses of emissions evidence intensify those tensions.

Military emissions demonstrate the institutional distinction between invisibility and incompleteness. The IPCC Guidelines contain categories for military fuel combustion under 1.A.5, with mobile and stationary subcategories. Some fuel associated with international aviation and shipping is reported as separate information items rather than included in national totals, and fuel supplied for specific United Nations multilateral operations is treated separately (IPCC, 2006, 2019). Thus, it is imprecise to assert that military activity is categorically absent from the inventory architecture. The gap lies in the degree of disaggregation, the availability of sensitive records, and whether a reported energy total can be transparently reconciled with a conflict-specific activity estimate.

From a security perspective, military decarbonisation is constrained by readiness, operational resilience and logistical dependence on liquid fuels. These are strategic choices with environmental consequences rather than simply failures of technical accounting. The material supply chains of warfare also extend beyond the territory in which equipment is deployed. This is the central insight of geopolitical-ecology approaches to military carbon accounting and of the debate over low-carbon warfare (Belcher et al., 2020; Depledge, 2023). The present study uses these contributions to identify incentives and reporting boundaries; it does not assume that all military activities are driven by one general theory of securitisation.

The Initiative on GHG Accounting of War occupies a distinctive epistemic position. Its published calculations use activity models, satellite observations and scenario assumptions, while its results also enter Ukrainian climate-damage diplomacy. The four-year report explicitly notes Ukraine's intention, announced at COP30, to pursue a climate-related claim through the Register of Damage for Ukraine (Initiative on GHG Accounting of War, 2026). This dual scientific and policy role does not invalidate the evidence. It does require the analysis to separate assumptions and observable sources from advocacy and institutional claims. Non-state expertise may improve visibility without replacing the responsibilities of states under the Paris Agreement.

The resulting theoretical proposition is narrower and more useful than a claim that more measurement invariably produces more accountability. Transparency can increase the *traceability* of conflict-related

emissions only when numerical estimates, inventory source categories, reporting jurisdictions and evidentiary qualifications are linked. A conflict-specific total may otherwise become more politically salient while remaining weakly connected to the records and procedures through which the climate regime evaluates national emissions.

3 Research Design and Sources

This is a structured single-case study with two complementary components. The first is a documentary comparison of sequential assessments issued by the Initiative on GHG Accounting of War for the first 18, 24, 36 and 48 months following 24 February 2022 (Initiative on GHG Accounting of War, 2023, 2024, 2025, 2026). The second is an analytical crosswalk between the six categories used in the latest assessment and the source/sink categories specified by the 2006 IPCC Guidelines and their 2019 Refinement (IPCC, 2006, 2019). UNFCCC decisions 18/CMA.1 and 5/CMA.3 define the institutional benchmark for evaluating what can be reported and reviewed under the ETF (UNFCCC, 2018, 2021).

The assessment *vintage* is the unit for comparisons across time. Each headline amount is a cumulative estimate published at a specific date. Subtracting two vintages therefore measures a difference between reported cumulative estimates, not necessarily the physical emissions occurring between publication dates. The distinction is especially important where later reports revise earlier assumptions, add new evidence or introduce methodological improvements. The 2026 report indicates that its methods are largely consistent with the October 2025 assessment while acknowledging that some input data are incomplete and may be updated. The language of 'change between assessments' is used rather than unqualified claims about new annual emission flows.

The crosswalk's unit is the physical emission-generating process, not the label attached to a war report category. One war category can span several IPCC codes, whereas one IPCC code can include both conflict-related and ordinary activities. For each category, the analysis records indicative inventory pathways, the likely territorial or fuel-sales reporting rule, and the information needed to detect overlap or omission. These are possible classifications under the IPCC architecture, not a claim that the reported estimate has been verified against submitted country-level inventory datasets. National reconciliation would require activity-level records and actual BTR/CRT line items, which cannot be inferred from aggregate totals.

Four safeguards guide interpretation. A gross event-accounting total is not the same estimand as a counterfactual net change in global emissions. Forecast reconstruction is separated from historical activity. A report-vintage difference is labelled as an estimate revision plus period expansion, not a causal annual measurement. Finally, the proposed reporting framework does not add the event total to national inventories or pretend that an independent estimate is automatically subject to the Paris Agreement's technical expert review. These restrictions are part of the research design, not qualifications repeated after every finding.

Table 1
Published assessment vintages and the temporal scope of war-related greenhouse gas estimates

Cumulative period	Report released	Published total ($MtCO_2e$)	Comparability caution
18 months	December 2023	150 (rounded)	Includes prospective reconstruction; older category grouping differs
24 months	June 2024	175 (rounded)	Updated assessment; rounded headline
36 months	October 2025	236.8	Detailed category definitions; forecasts included
48 months	February 2026	311.4	Method largely continued; updated and partly incomplete inputs

Sources: Initiative on GHG Accounting of War (2023, 2024, 2025, 2026). This table describes published estimates, not a harmonised emissions time series.

The 18-month and later category structures are not entirely identical. The December 2023 report identifies Nord Stream 1 and 2 releases as a separate category, whereas the 36- and 48-month assessments aggregate gas-related infrastructure impacts under energy infrastructure. A direct subtraction of such category values across all vintages would confound category redesign with changes in the assessed emissions. This is a concrete reason for restricting the six-category comparison to the two most recent detailed reports, while still reporting the earlier headline vintages for documentary context (Initiative on GHG Accounting of War, 2023, 2025, 2026).

The sources disclose an additional source-comparison difficulty. The 18-month initiative assessment reports approximately 150 $MtCO_2e$, whereas a peer-reviewed study discussing the first 18 months reports 77 $MtCO_2e$ with an estimated relative uncertainty of 22% (Bun et al., 2024). These figures should not be presented as mutually exclusive observations of the same quantity. The underlying accounting scopes and methods must be harmonised before their difference can be assigned to a particular component. For the present analysis, the initiative's own vintages form the descriptive series, while the peer-reviewed estimate is used to demonstrate the sensitivity of aggregate claims to estimator design.

4 Findings: Assessment Vintages and Inventory Intersections

The findings move from published emissions quantities to the institutions through which they may become visible. The first comparison shows how reported category totals change between two sufficiently detailed assessment vintages. The second traces these categories into conventional inventory classifications. Taken together, the exercises demonstrate that uncertainty about wartime emissions is generated at several stages: activity estimation, category aggregation, national allocation and institutional disclosure.

4.1 What the sequential assessments can and cannot show

The 36-month assessment reports a total of 236.8 $MtCO_2e$, and the 48-month assessment reports 311.4 $MtCO_2e$. The difference of 74.6 $MtCO_2e$ corresponds to the later report's rounded statement of an increase of about 75 $MtCO_2e$. More informative than the headline change is its composition: warfare estimates rose from 81.7 to 114.1 $MtCO_2e$ and landscape fires from 49.4 to 70.3 $MtCO_2e$. Together, these two categories account for 53.3 of the 74.6 $MtCO_2e$ difference between the two published balances (Initiative on GHG Accounting of War, 2025, 2026). This concentration indicates where the updated assessment allocates the largest additional carbon cost. It cannot by itself prove that those emissions were all newly released in the fourth year.

Sources: Initiative on GHG Accounting of War (2025, 2026); author-generated comparison of reported category values. *Reconstruction is modelled as future emissions; category estimates are not directly equivalent to realised annual flows.

Figure 1 highlights two forms of heterogeneity masked by the aggregate. Warfare dominates the most recent balance, but the projected reconstruction category is nearly as large as the landscape-fire estimate. Categories also expand at different rates across successive assessments. The figure compares values as published and does not partition changes into newly observed events, data revisions and altered modelling choices. That partition cannot be recovered from six cumulative totals alone.

Table 2
Category estimates at 36 and 48 months and changes between assessment vintages

Event-accounting category	36 months ($MtCO_2e$)	48 months ($MtCO_2e$)	Difference ($MtCO_2e$)	Reporting interpretation
Warfare	81.7	114.1	+ 32.4	Fuel and military supply-chain mix
Landscape fires	49.4	70.3	+ 20.9	Fire events, carbon stock effects, later decay
Reconstruction	64.2	73.3	+ 9.1	Prospective manufacturing and rebuilding
Civil aviation	20.3	29.8	+ 9.5	Rerouting relative to flight baselines
Energy infrastructure	17.0	18.6	+ 1.6	Leakage, fires, replacement power
Refugees / IDPs	4.2	5.3	+ 1.1	Transport and accommodation assumptions
Total	236.8	311.4	+ 74.6	Published aggregate difference

Sources: Initiative on GHG Accounting of War (2025, 2026). Differences computed from the published rounded values; they are not a causal estimate of fourth-year emissions.

The reconstruction-excluded subtotal is 238.1 $MtCO_2e$ (311.4 minus 73.3). Its correct label is important. The 36-month methodology also anticipates future emissions from the decay of dead forest biomass within its landscape-fire accounting, with a reported 32.37 $MtCO_2e$ future component (Initiative on GHG Accounting of War, 2025). Accordingly, omitting reconstruction does not produce an independently verified total of emissions already physically realised by February 2026. It merely removes one clearly identified prospective category. Other forward-looking assumptions may remain embedded in event-specific estimates. This more demanding temporal distinction substantially changes how the headline figure should be communicated.

The methodological implications are illustrated by the relationship between gross and counterfactual totals. A war increases fuel consumption by armed forces and may increase fires, but can suppress industrial production, reroute trade or change agricultural demand. The global *net* effect depends on the emissions that would have occurred without the war and on spillovers outside the combat zone. Economic modelling therefore can report a potential reduction in particular global emissions components while a gross activity account reports large war-related emissions (van Meijl et al., 2024; Huang et al., 2024). Such results do not cancel one another because they estimate different quantities.

4.2 Crosswalking conflict emissions into national inventory categories

A more consequential governance test asks whether a physical activity reported as war-related has a plausible counterpart in national inventories. Table 3 maps the six source groups to indicative IPCC categories and reporting boundaries. This replaces a generic matrix of unexplained 'Undetermined' overlaps with a traceable set of accounting pathways. The proposed mappings are conditional on the physical activity and fuel-supply location. They should not be interpreted as a numerical estimate of emissions missing from any country's inventory.

Table 3
Illustrative IPCC–UNFCCC inventory crosswalk for six conflict-related emissions groups

Event category	Relevant 2006 IPCC pathways (indicative)	Potential reporting jurisdiction / boundary	Verification and double-counting test
Military operations	1.A.5 (military fuel, mobile and stationary); 1.A.2 (industrial production); 2.C.1 (steel) as relevant	Fuel-delivering country; manufacturing country; separate treatment of specified UN multilateral operations	Match fuel quantities and supply-chain production to national totals; avoid counting embedded manufacture twice
Landscape fires	3.B.1 (forest carbon-stock change); 3.C.1.a (biomass burning in forest land); 3.C.1.b (cropland), where applicable	Territory / managed-land accounting of Ukraine; fire location and land-use class	Separate direct combustion, post-fire stock change, later decay and climate/baseline attribution
Reconstruction	2.A.1 (cement process); 2.C.1 (iron and steel); 1.A.2 (industrial fuel); 1.A.3 (transport)	Country and future year where materials are produced, fuel sold and construction occurs	Identify forecast rather than historical activities; link material origin and time to avoid cross-border duplication
Civil aviation	1.A.3.a.ii domestic aviation; 1.A.3.a.i international aviation as a separately reported memo item	Fuel-sales / domestic-versus-international flight classification across third countries	Flight-level route counterfactual; separate international bunker fuel from national totals
Energy infrastructure	1.B.2 (oil and gas fugitive releases); 1.A.1–1.A.4 (combustion); 2.G.1 if SF_6 electrical equipment is involved	Territory and facility location (Ukraine, Russia and others)	Attribute pipeline and facility leakage to specific events, avoiding duplication with energy-sector totals
Displacement	1.A.3.b road fuel; 1.A.4 residential / services energy; international aviation memo when relevant	Fuel-sales or building country, often outside Ukraine	Estimate incremental travel and housing relative to counterfactual baseline

Sources: Author-developed process-level mapping informed by IPCC (2006, 2019) and the activity definitions in Initiative on GHG Accounting of War (2025, 2026). Codes are indicative, not a verified correspondence to Ukraine's or Russia's submitted CRT line items.

The military category reveals why simple claims of inventory omission are misleading. IPCC 1.A.5 covers non-specified fuel combustion, including military fuel delivered within the reporting country, and distinguishes mobile from stationary uses. However, the conflict report also includes ammunition, manufacturing and fortifications. These embedded emissions may have been physically emitted in industrial sectors abroad rather than within Ukraine's military fuel account. A reconciliation exercise

must distinguish direct battlefield combustion from upstream material production and avoid allocating the same physical activity twice.

The aviation category presents a different boundary problem. Commercial rerouting caused by airspace closure can generate additional kerosene combustion outside Ukrainian territory. Depending on the route and fuel-sales classification, the relevant source may appear in a national domestic aviation account or in separately reported international aviation fuel. A war-related estimate of the *incremental* effect requires a counterfactual route and traffic baseline, but a national fuel-sales inventory generally records actual fuel supplied, not the reason a flight took a longer path. The issue is therefore absent conflict attribution rather than automatic absence from climate reporting (IPCC, 2006, 2019).

Landscape fires straddle more than one inventory mechanism. Land carbon-stock changes, direct biomass-burning emissions and later decomposition are linked but not identical processes. Differentiating managed from unmanaged land and forests from cropland matters to the applicable IPCC treatment. Satellite fire detection, changes in firefighting access and meteorological controls support attribution but do not resolve by themselves the correct division of emissions between immediate combustion and delayed biogenic processes. Research on Ukrainian landscape fires underscores both the importance of war-related ignition and the need to account for changing ecological and atmospheric conditions (Matsala et al., 2024; Vasylyshyn et al., 2025).

Reconstruction is the clearest illustration of geographical and temporal displacement. Cement-process emissions and steelmaking emissions belong to the producing country's industrial inventory, while related electricity and transport emissions appear in the corresponding energy sources. If materials are imported into Ukraine, an event-accounting estimate may attribute embodied emissions to rebuilding the country even though the national inventory responsibility follows production and fuel-use conventions elsewhere. Moreover, a forecast in 2026 can materialise over several subsequent years or never occur in the assumed form. A transparent account must distinguish scenario baselines, realised purchases and anticipated manufacturing emissions.

The crosswalk yields a concrete finding: none of the six event categories maps one-to-one onto one national source code and one reporting Party. Its purpose is not to prove that inventories exclude all conflict emissions. It identifies exactly what supporting records would be needed to demonstrate coverage or overlap at the process level. For this reason, the analysis neither subtracts estimated 'double counting' from 311.4 $MtCO_2e$ nor asserts an unsupported missing-emissions quantity. Both operations would require a much more disaggregated, harmonised dataset.

4.3 Source uncertainty, political claims and evidentiary standing

Independent estimation is valuable precisely because militaries and authorities do not necessarily disclose the activity records needed for complete modelling. Fuel logs may be classified, access to occupied areas is restricted, and fire-based estimates depend on remotely sensed observations and

ecological assumptions. Evidence quality therefore varies by category. A satellite-detected landscape fire may have strong locational evidence but weaker evidence of cause. A modelled military fuel balance may have plausible equipment and logistics assumptions but weak primary verification. Reconstruction forecasts depend on scenarios, material intensity and the timing of investment.

The difference between evidence and political framing is especially salient where estimated emissions are used to support compensation claims. The four-year report associates its estimates with a projected climate-damage claim based on an applied social cost of carbon, and records Ukraine's declared intention to advance a claim via the Register of Damage for Ukraine (Initiative on GHG Accounting of War, 2026). Such use demonstrates political salience, not automatically the legal admissibility of each category, the amount of recoverable damage or proof of state responsibility. These questions depend on separate legal standards, causal evidence and the design of any claims mechanism.

Transparency should thus be evaluated across a chain of evidentiary status: observed event, modelled activity, counterfactual attribution, inventory linkage and institutional review. A quantity can be credible at one stage but still too aggregated to answer questions at the next. The relevant research output is a documented trace from physical activities to accounting boundaries, not a claim that a headline estimate provides an all-purpose measure of guilt, cost or treaty non-compliance.

5 Institutional Implications: A Feasible Path under Article 13

The enhanced transparency framework under Article 13 is built around Party reporting. Biennial transparency reports contain national greenhouse gas inventories and information required to track progress under nationally determined contributions. The technical expert review is facilitative, non-intrusive and respectful of national sovereignty. Its mandate is defined in decision 18/CMA.1 and operationalised through decision 5/CMA.3. These rules do not give expert review teams general authority to compel disclosure of military operational data or to adjudicate responsibility for war damages (UNFCCC, 2018, 2021). An ambitious new mandatory conflict-emissions inventory cannot therefore be presented as a reform already authorised by the ETF.

A more credible response is a staged voluntary disclosure pathway. At stage one, researchers compile an event-level evidence register with dates, geolocation where safe, activity type, national inventory category, estimated gas, method and uncertainty range. Sources can include satellites, published government energy data and peer-reviewed studies. Independent bodies may publish this information without implying that they file an official BTR. At stage two, Parties choose whether to contextualise some of those activities in their domestic inventory narratives or voluntary supporting documentation. The information must remain supplementary to, and clearly reconciled with, reported national totals. At stage three, public methodological scrutiny can identify gaps and conflicting estimates outside the formal technical expert review mandate.

This model does not depend on cooperation from an alleged aggressor as its only source of information. It accepts that missing operational records and territorial access can make particular estimates

provisional. It also avoids claiming that Ukraine can fully report activities occurring on Russian territory or that a third country automatically assigns its industrial emissions to the conflict simply because it supplied materials. In that sense the model is feasible as a voluntary knowledge and disclosure practice while more compulsory disclosure would require a new negotiated institutional basis.

There are clear limits to verification. A future reviewer could compare a Party-submitted narrative against the Party's reported fuel or industrial information where appropriate, but formal TER procedures remain bounded by the information and objectives specified in the ETF. Non-state analytical peer review is not equivalent to UNFCCC technical expert review. The register could publicly display separate confidence ratings for geolocated events, activity-based estimates and scenario forecasts, and flag unresolved jurisdictional conflicts without requiring release of classified information. The proposed safeguard is disclosure of evidentiary limits, not an assumption that every wartime observation can become an auditable official inventory entry.

Table 4
Proposed voluntary disclosure pathway and institutional safeguards

Stage / actor	Deliverable	Existing institutional position	Safeguard
Independent researchers	Event records and methodology	External to Party BTR/TER obligations	Source audit, uncertainty, temporal labels
Reporting Party (optional)	Explanatory annex or contextual narrative	Does not change CRT national totals	Source-code crosswalk, no numerical addition
Independent academic review	Method checks and competing estimates	Not UNFCCC TER	Public review protocol; identify non-verifiable claims
CMA / Parties (future reform)	Negotiated standard if desired	Would need political agreement for new obligations	Respect sovereignty, data security and jurisdiction

Source: Author-developed institutional proposal based on UNFCCC (2018, 2021) and the mandate described by UNFCCC technical expert review guidance. It is a proposed mechanism, not an existing ETF reporting requirement.

Table 4 exposes the political trade-off. A voluntary layer may be methodologically informative without giving states incentives to share operationally sensitive data. A mandatory system might generate greater comparability in principle but would face sovereignty objections, bargaining costs and the absence of a simple rule allocating cross-border conflict emissions to one Party. The design therefore privileges information that can improve public traceability under existing rules, while admitting the limits of formal accountability. This approach follows a wider finding in climate governance: transparency arrangements have value only if their categories and review mandates can sustain the claims made from the data (Gupta & van Asselt, 2019; Bergsvik et al., 2024; Kamil & Karlsson-Vinkhuyzen, 2023).

Source: Author-developed conceptual model based on IPCC (2006, 2019) and UNFCCC (2018, 2021). The diagram illustrates a voluntary proposal, not an existing mandatory Article 13 procedure.

Figure 2 makes the institutional boundary explicit. Event-accounting evidence can be mapped to inventory codes and contextualised by a reporting Party; this may increase transparency without creating a second set of national emissions totals. The safeguards matter as much as the arrows. They prevent a conflict-specific estimate from being mistaken for a verified national inventory or a legally binding attribution of blame.

6 Conclusion

The Russia–Ukraine war reveals a climate-accounting problem that is not solved by a larger headline emissions estimate. The 48-month assessment reports 311.4 $MtCO_2e$, but its categories include activities generated in different jurisdictions and years, and some estimates concern future consequences. Even after removing the 73.3 $MtCO_2e$ reconstruction scenario, the remainder cannot be described without qualification as exclusively realised wartime emissions. A transparent account must declare its temporal and causal assumptions before its number can carry institutional meaning.

The article has moved beyond a simple percentage distribution in two respects. The comparison of assessment vintages demonstrates how the published aggregate changed from 236.8 to 311.4 $MtCO_2e$ and locates most of the change in warfare and landscape fires. It also makes explicit why this 74.6 $MtCO_2e$ assessment difference is not a separately observed annual flow. The IPCC crosswalk then shows that six conflict-accounting categories potentially intersect with different sectors, reporting territories and exclusions. This is a more precise understanding of the transparency gap than asserting that all military or war emissions are missing from national inventories.

The institutional implication is a constrained proposal for supplementary event-based evidence disclosure. Under the existing ETF, Parties submit national information and technical reviews have a limited mandate. Independent estimates may assist public scrutiny and voluntary contextualisation, but cannot simply become mandatory BTR data, compel the disclosure of military secrets or establish damages liability. A transparent source register, process-level code mapping, jurisdictional labels and separate uncertainty disclosures offer a practicable first step. Stronger obligations would require new political agreement and a defensible legal basis.

The case has limits. This study does not harmonise underlying activity-level datasets across all vintages, re-estimate their emission factors or calculate actual missing emissions from country inventories. Its crosswalk shows possible allocation routes, not observed line-by-line overlap in submitted CRTs. Further research should collect disclosed national inventory entries and activity records and test specific reconciliations for aviation fuel, pipeline methane, fires and cement production. These studies would make it possible to assess which visibility problems are solved by existing classifications and which persist because of incentives, contested jurisdiction or inaccessible evidence.

The general contribution is to show that the climate visibility of armed conflict depends on the relationship between measurement and rules of disclosure. Where causal attribution and jurisdiction cross national reporting boundaries, even credible physical estimates can support incompatible political interpretations. A transparent account of war therefore requires institutions to specify what is measured, which Party reports it, and what form of accountability the evidence can legitimately support.

Declarations

Data Availability and Reproducibility

All numerical inputs reported in Tables 1 and 2 are taken from the four public assessment vintages listed in the References. The calculations use only published rounded values: 36- to 48-month differences equal the 48-month value minus the 36-month value, and the reconstruction-excluded subtotal is 311.4 − 73.3 = 238.1 $MtCO_2e$. Table 3 is an original illustrative process-to-inventory crosswalk based on the cited IPCC guidelines. No source-level microdata were available to independently reconstruct category totals or confirm overlap with national CRT submissions.

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Figures

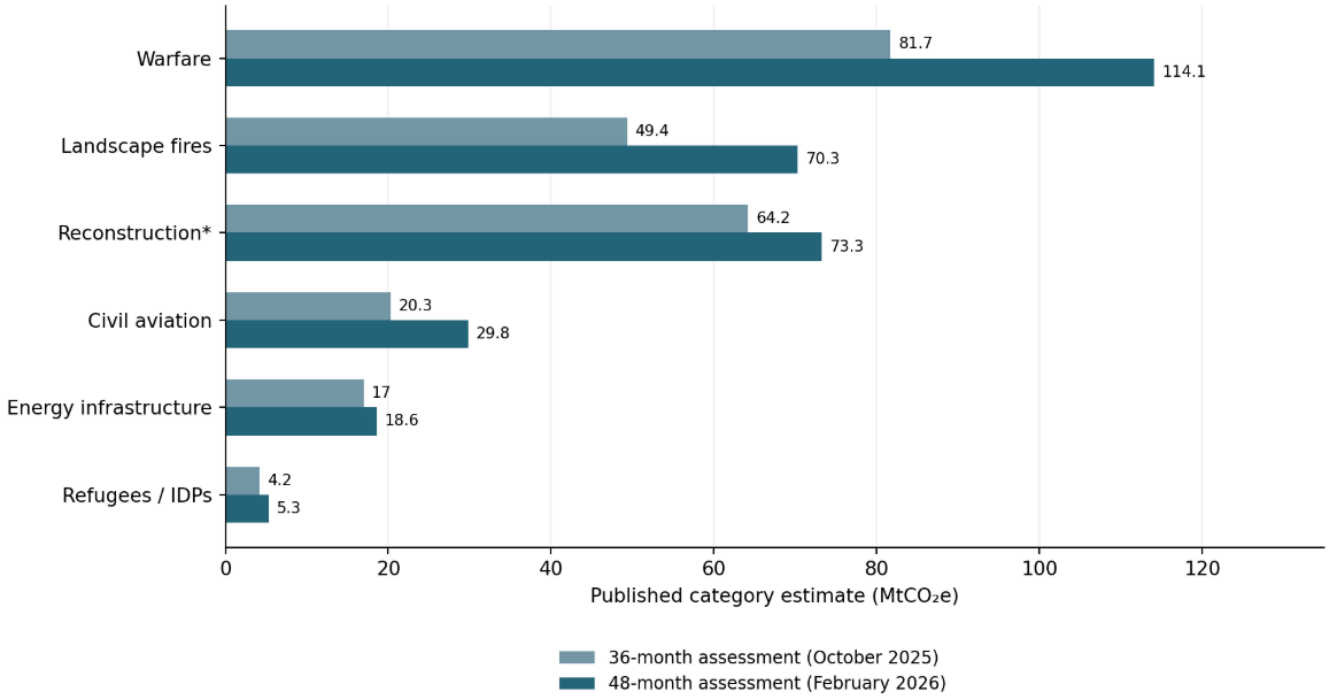


Figure 1

Published war-emissions category estimates in the 36- and 48-month assessments

Sources: Initiative on GHG Accounting of War (2025, 2026); author-generated comparison of reported category values. *Reconstruction is modelled as future emissions; category estimates are not directly equivalent to realised annual flows.

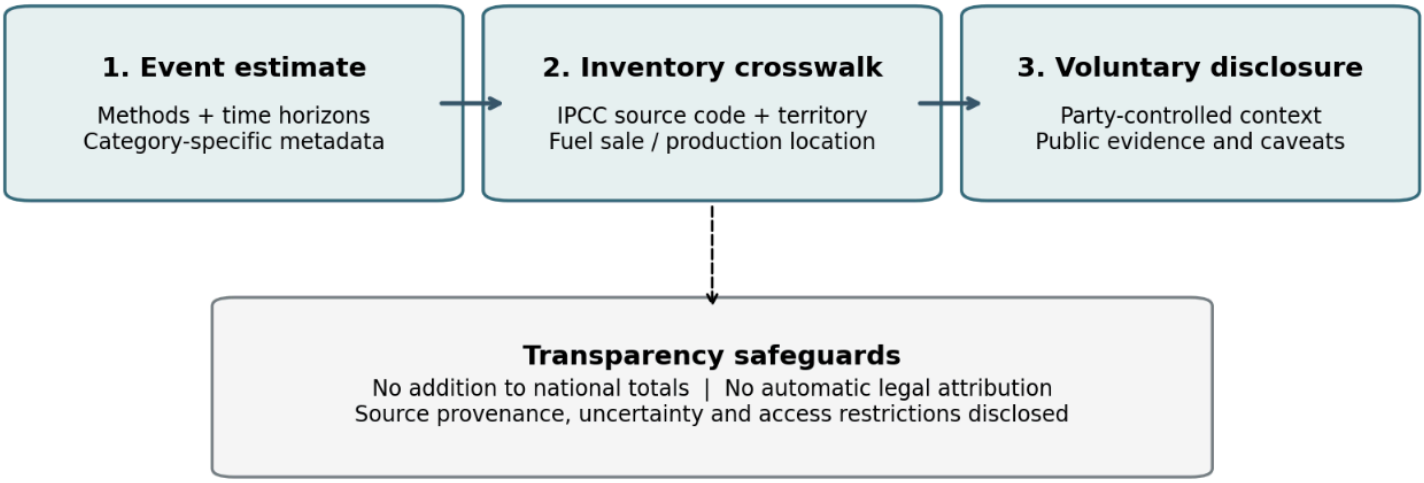


Figure 2

Proposed sequence linking conflict-event estimates to voluntary climate disclosure

Source: Author-developed conceptual model based on IPCC (2006, 2019) and UNFCCC (2018, 2021). The diagram illustrates a voluntary proposal, not an existing mandatory Article 13 procedure.