

Unpacking plastic credits: Challenges to effective and just global plastics governance

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Abstract

Amid growing concerns over plastic pollution and ongoing efforts to develop a global plastics treaty, this paper critically examines plastic credits as a compensatory measure for addressing plastic pollution. Despite claims of being a novel financing and control measure, plastic credits mirror the shortcomings of carbon credits and fail to account for the material complexities and varied impacts of different types of plastics. If linked to public policy, plastic credits risk creating regulatory loopholes and delaying more effective measures like sector-specific plastic reduction. We argue that plastic credits do not represent an innovative approach to genuine plastic pollution reduction or its financing; instead, they could exacerbate fragmented plastics governance and reinforce legitimization of waste colonialism.

INTRODUCTION

The increasing political and environmental salience of plastic pollution has prompted the international community to explore various governance options. Since 2018, a UN-level consensus has emerged that the existing fragmented, downstream-focused patchwork of regulations has major gaps to address plastic pollution (UNEP/EA.3/INF/5), spurring concerted efforts to devise a new global governance architecture. However, ongoing negotiations to develop a global plastics treaty, initiated in 2022 under the United Nations Environment

Assembly (UNEA) resolution 5/14 (UNEP/EA.5/Res.14), have unveiled deep stakeholder divergences on key areas, including the treaty's scope, provisions for primary plastic polymers, extended producer responsibility (EPR), and financing mechanisms.

Amid these divergences, plastic credits, considered part of “outcome-based financing mechanisms” have gained attention as a potential instrument to address plastic pollution. Despite lacking a formal definition, plastic credits, modeled on carbon credits, are broadly defined as *measurable, transferable assets representing 1 tonne of plastic waste diverted or recovered from the environment*.¹ Currently, two types of downstream activities are credited: collection (removal) and recycling (recovery). Collection involves removing plastic waste from the environment, including dumpsites, while recycling encompasses both mechanical and chemical recycling to convert plastic waste into secondary materials. Upstream activities, such as plastic production reduction, are not eligible for credits under existing standards, nor is the reuse of plastic waste. Companies can offset their plastic waste generation by funding plastic credit projects elsewhere as a compensatory measure. Several organizations and registries, including those active in carbon credit markets, are developing plastic crediting mechanisms and promoting their standards—both on the negotiation floor and in behind-the-scenes discussions during plastics treaty negotiations—as 'innovative' approaches.² However, the effectiveness of plastic credits as a compensatory measure in delivering real environmental and social improvements remains contested. Here we outline the technical problems embedded in plastic credits, parallel to those in carbon credits, concerning their scientific credibility and integrity. We also raise critical questions about whose interests these credits ultimately serve, whether they could contribute to meeting the estimated \$240 bn per year funding needs for downstream measures by 2040² compared to alternative instruments, or they might instead lead to further fragmented regulation and environmental degradation.

DESIGN FLAWS IN PLASTIC CREDITS

At bottom, a serious challenge to plastic credit mechanisms lies in the lack of standardized plastics accounting at international, national, and corporate levels. This critically undermines the credibility of any efforts to measure and track both the plastic waste of crediting projects and the plastic footprints of participating organizations. Inconsistent scopes and metrics for plastics accounting limits comparability, fungibility, and transparency across different plastic credit programs. On top of that, plastic credits face significant issues in meeting key criteria for quality offsets—namely additionality, permanence, and the ‘no-harm’ principle—further compromising the integrity essential for a market-based governance mechanism.

Non-additional crediting in plastic credit standards

The central premise of crediting as a compensatory measure is 'additionality', whereby polluters, instead of reducing their own pollution, invest in crediting projects that represent genuine reductions beyond business-as-usual (BAU) conditions. Ensuring additionality is critical, as making offsetting claims is the main economic driver for private actors to invest in credits. However, existing plastic credit standards diverge significantly on how to address additionality and lack rigorous methodologies for calculating baselines with scientific and market integrity. Some standards rely on positive lists that include ongoing activities, implying non-additional

crediting. As demonstrated in carbon credits, projecting counterfactual baselines is fraught with significant uncertainties, including adverse selection risks, making ex-ante precision scientifically unattainable.^{3,4} This often leads to an overestimation of the BAU scenario, artificially maximizing the creditable reductions. Plastic credits face similar challenges, with existing standards failing to dynamically adjust baselines in response to particularly fluid regulatory, technological, and normative landscape surrounding plastic waste management activities. Compounding this, the informal nature of a large portion of waste management activities—often undocumented but highly effective in practice—further complicates the writing of robust additionality criteria. More fundamentally, credits can create disincentives for adopting binding regulations. Since any pollution reductions that are required by regulation are non-additional and thus do not qualify for offset credits, credit revenues serve as a financial incentive for those benefiting from credit projects to resist direct pollution reduction regulations.³

The failure to discount for non-permanent removal

The science is clear: plastics are materials composed of thousands of chemicals and polymers derived almost exclusively from fossil fuels, and remain persistent in both ecosystems and socio-economic systems.^{5,6} To counterbalance this persistence, plastic credits must guarantee equivalently permanent removal. However, existing plastic credit standards allow various end-of-life pathways—such as recycling, waste-to-energy, and even landfilling—raising critical concerns about the ‘permanence’ criterion as different pathways entail varying degrees of reversal risks. For example, recycling, despite its alluring circular claims of looping plastic waste back into the value chain, operates at a dismal 9% globally⁵, suffers from significant process losses of micro- and nano-plastics⁷, and cannot prevent future waste. Even well-sorted, non-contaminated plastic waste shows significant degradation in thermal-mechanical properties, such as tensile strength, during recycling, limiting it to just one or a few cycles—far from achieving true closed-loop recycling.⁸ Thousands of different chemical additives present an additional barrier to recycling.⁶ Once plastics reach their recycling limits, they ultimately re-enter the waste stream. None of the existing plastic credit standards provide rigorous counterfactual baselines to measure the permanence of a project’s impacts or account for reversal risks; they assume 100% permanent removal without applying discounts or buffer pools, resulting in significant over-crediting.

Perfunctory safeguard mechanisms

Safeguards in credit standards, intended to protect local communities and ecosystems, are often perfunctory despite claims of meeting 'no-harm' criteria. Numerous failures in carbon credit projects show that stakeholder consultations and feedback mechanisms do not ensure genuine engagement, particularly given literacy barriers in many local contexts.⁹ Similarly, plastic credits, while claiming to provide new revenue streams for waste management communities, are prone to failure in preventing, mitigating, and redressing harm. For example, the Reciki project in Indonesia, a plastic waste collection credit project, began in May 2020 but has been on hold since May 2023, primarily due to severe health impacts on neighboring residents, who were poorly informed through indirect channels in English.¹⁰ The validation and verification report cited only two corrective actions—non-compliant working hours and inadequate safety

equipment for high-risk workers—without addressing consultation appropriateness.¹⁰ Public comments included just three superficial remarks¹⁰, reflecting the broader, inherent conflict in credit mechanisms where financial returns are prioritized over environmental and social outcomes. Auditors lack the power to sanction violators or mandate remedies for affected communities and have implicit incentives to judge leniently, as they are hired by project developers and motivated by the need to secure future work.⁹ These dynamics often cause auditors to fail in ensuring reliable, independent impact assessments or preventing harmful projects.

BEYOND TECHNICALITIES: FUNDAMENTAL ISSUES AND DISTRIBUTIVE CONCERNS

The devil is not just in the technical details. A series of more fundamental, plastic-specific challenges prompts questions regarding the suitability of crediting mechanisms for governing plastic pollution.

The fallacy of ‘tonne to tonne’ equivalence in plastic credits

The ‘tonne to tonne’ equivalence in plastic credits fails to capture the complexities of plastics from the perspectives of chemistry, material science, and environmental toxicology.^{6,11} Plastic offset credits operate on the premise of equating one tonne of plastic footprint with one tonne of plastics diverted from the environment. However, this approach overlooks the tremendous variability in plastic composition and its consequential environmental and health impacts.⁶ Unlike GHG emissions, where one tonne of CO_{2eq} represents virtually the same global warming potential (GWP) regardless of source or location, plastic pollution is not only a global commons issue but also a transboundary environmental problem and a local-cumulative issue with highly localized spillover impacts.¹² The harmful effects of different plastics cannot be equated by a single global metric. For example, one tonne of highly recyclable transparent PET bottles cannot be equated with one tonne of non-recyclable composite packaging or phthalate-heavy polyvinyl chloride (PVC) materials. Due to significant differences in characteristics such as toxicity and recyclability, a universal metric akin to the GWP for emissions does not currently exist, and may be scientifically untenable for plastics.

The pitfalls of linking plastic credits to EPR schemes

Plastic credits, initially voluntary initiatives by private actors, are now being integrated into public policies as a compliance instrument under EPR, particularly in developing countries.² While EPR typically mandates specific fee schemes for obligated organizations, some emerging EPR regulations on plastic packaging, such as those in the Philippines, require meeting offset targets with plastic credits instead of EPR fees. This shift, which dramatically expands the reach and impact of plastic credits, risks creating loopholes in national policies, representing a serious regression in EPR regulations. EPR can only be effective with advanced fee modulation that provides meaningful incentives for producers to adopt Design for Environment (DfE) practices.¹³ However, integrating plastic credits undermines these incentives in two significant ways. First, plastic credit prices are often low and volatile, set through various opaque ways across projects,

making them unreliable as a stable funding source for waste management and resulting in a loss of public control over pricing and revenue management. Such weak price signals that lack eco-modulation and public oversight entice polluters to invest in plastic credits rather than in more effective DfE technologies or new business models, thereby continuing BAU practices. Second, the material-specific scope of plastic credits is incompatible with the product- or sector-specific scope of EPR, which targets specific products like plastic packaging. Plastic credit standards cover a broader range of plastic products, including not only packaging but also items like auto parts and construction materials. This incompatibility further complicates the effectiveness of EPR regulations on plastic packaging, as it dilutes the targeted focus and undermines the primary objective of EPR regulations—namely, incentivizing DfE practices within the packaging sector and ultimately reducing packaging waste generation.

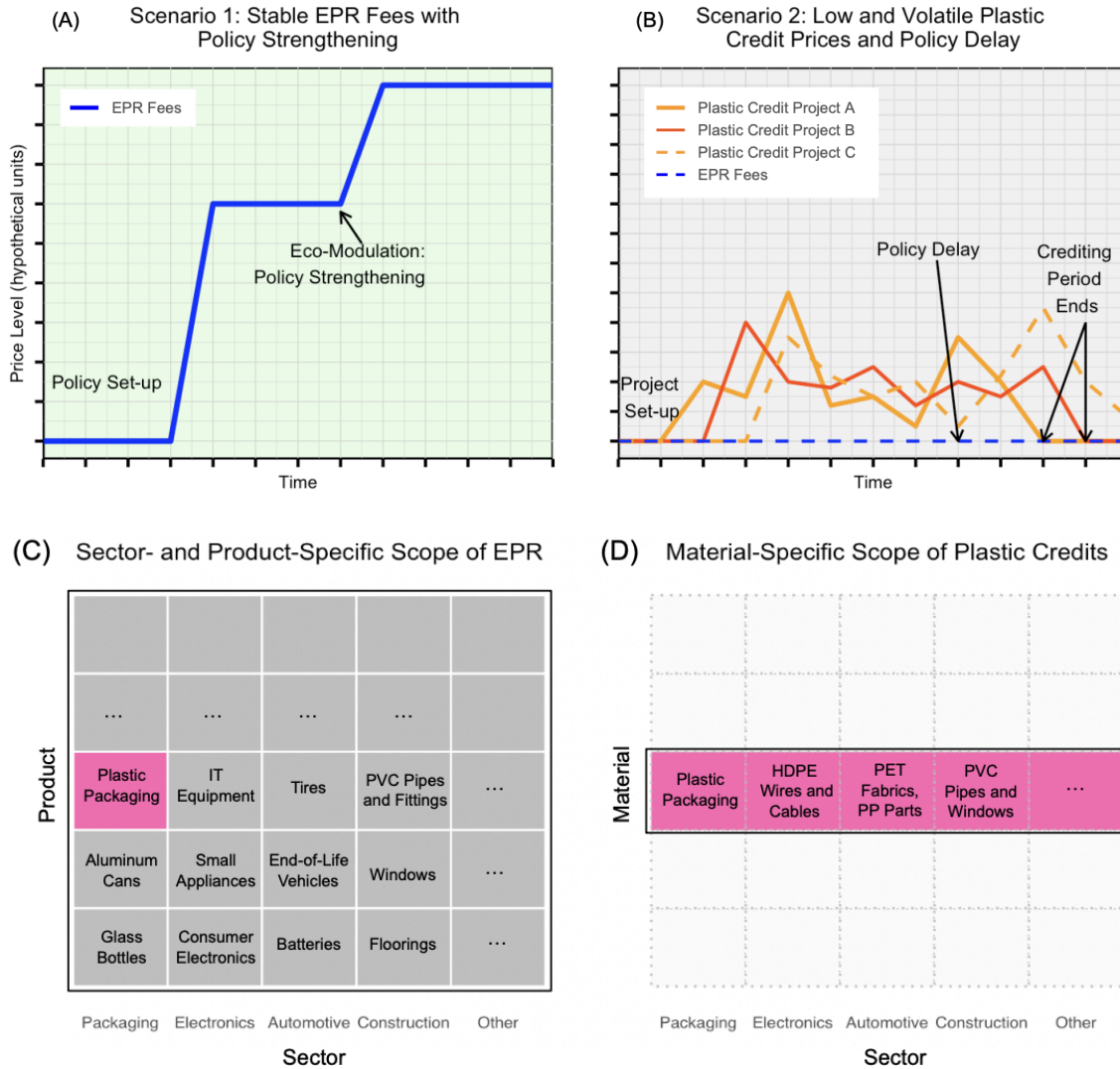
Legitimation of waste colonialism through plastic credits

From a socio-economic perspective, plastic credits epitomize the institutionalization of waste-based commodity frontiers, complicating equitable global governance for plastics. Plastic credits accelerate the integration of waste pickers into global waste-to-resource frontiers by codifying informal waste work into a structured market activity through standards or blockchain-based tracking. This leads to accumulation by inclusion,¹⁴ where informal labor is absorbed into neoliberal systems through the exploitation and financialization of their labor, often at the cost of reducing their autonomy. Crediting organizations and registries act as brokers, linking informal waste workers with global brands keen to make ‘plastic neutrality’ claims or meet EPR obligations at lower costs, while also facilitating de-risking of investments for private and institutional investors by serving as de facto regulatory powers in signaling what is deemed worthy of a plastic-related investment. By instrumentalizing the labor and tacit experiential knowledge of waste pickers and incentivizing activities at lower levels of the waste hierarchy, plastic credits risk creating a systemic lock-in. This lock-in allows credit-purchasing actors to financially benefit from externalizing pollution reduction activities and resist environmentally preferable interventions, such as plastic production reduction or alternative business models that could optimize plastic demand. This not only legitimizes ongoing waste generation but also institutionalizes exploitative practices, posing significant challenges to ending plastic pollution and to achieving a just transition.¹⁵

Figure 1. Can Plastic credits serve as a compliance instrument for EPR regulations?

Unstable funding: EPR fees are set at a stable level and adjusted over time through mechanisms like eco-modulation, serving as a stable funding source with public oversight over pricing mechanisms for waste management (A). In contrast, plastic credit prices, set through opaque mechanisms, are low and volatile, lacking the stability needed for sustainable waste management funding (B). **Incompatible scopes:** EPR regulations are designed with a product- or sector-specific focus to promote DfE practices and reduce waste generation (C). Plastic credit standards operate with material-specific scope, covering a broad range of plastic products across different sectors (D). Meeting EPR obligations for plastic packaging with plastic credits that are incompatible by definition complicates the effectiveness of EPR regulations, diluting

their targeted focus and undermining the regulatory objectives of EPR. Relying on plastic credits can delay policy implementation, perpetuate business-as-usual practices, and ultimately lead to further fragmented plastics governance.



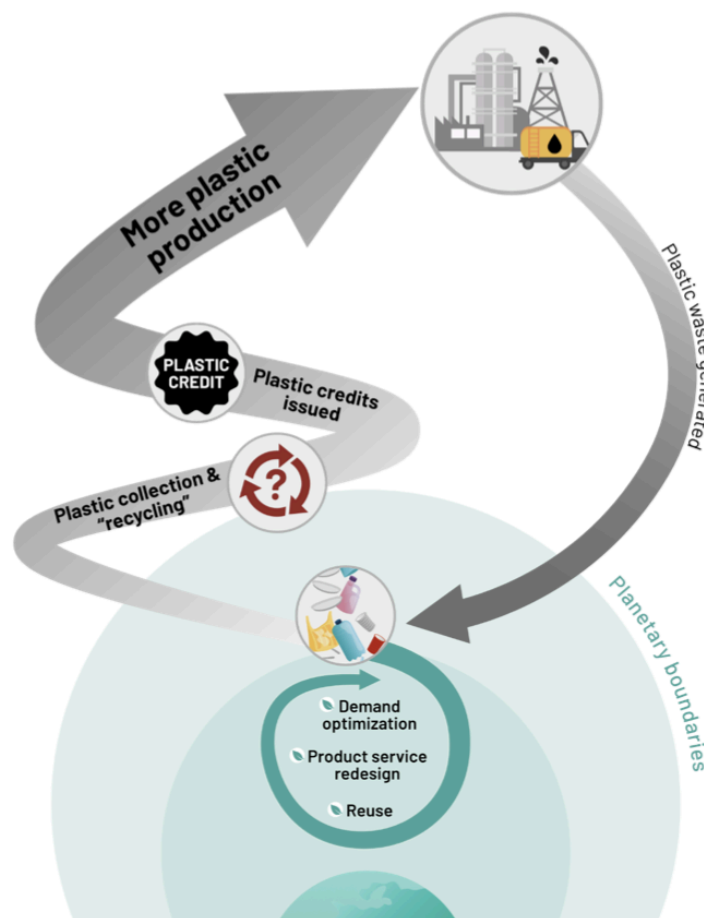
FROM CARBON TO PLASTIC: THE TROUBLING LEGACY OF CREDITS

History shows that carbon credits, while politically convenient, fail to deliver substantial environmental benefits or generate meaningful revenue to finance climate solutions.^{16,17} The assessment that “nearly everything about carbon credits must change”¹⁷ serves as a cautionary lesson. We argue that plastic credits do not represent an innovative approach; instead, they risk repeating the same old mistakes in climate governance, potentially diverting efforts into perpetual attempts to fix crediting methodologies.

While it is undeniable that there is a critical need for financial inflows to support the severely underfunded plastic waste management sector, and that grassroots contributions to plastic waste management can be highly effective, plastic offset credits are not the right instrument to achieve these goals. Private actors promoting plastic credits have fundamental financial incentives to overstate environmental outcomes and to avoid stringent regulation or asset-repricing risks. It is time to revisit the lessons from carbon credits, where prices have consistently failed to reflect the true social cost of carbon and significant transaction costs have been channeled into private intermediaries.

The risk of plastic credits mirroring the compromises of the Kyoto Protocol is real, potentially leading to a diluted global plastics treaty. Integration of plastic credits into the treaty as a regulatory and financing instrument presents significant challenges to implementing effective and justice-oriented solutions for ending plastic pollution. To ensure the treaty's success, it is crucial to prioritize sector-specific plastic reduction strategies and establish stable funding sources that effectively narrow financing gaps (e.g., through polymer fees and the reorientation of perverse fossil fuel-related subsidies). Directing financial flows to developing countries and waste workers through microfinancing or crediting as a contribution measure¹⁸ will uphold the polluter pays principle, rather than accommodating polluters.

Figure 2. Deep-Seated Problems in Plastic Credits: A counter-productive approach to effective and justice-oriented governance to end plastic pollution.



Resource availability

Lead contact

Further information and requests for resources and code should be directed to and will be fulfilled by the lead contact, Sangcheol Moon (sangcheol_moon@berkeley.edu).

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Declaration of interests

The authors declare no competing interests.

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