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Essay

Grassroots-Led Democratized Plastic Governance as a Pathway to Advancing Planetary Health

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Abstract

Plastic pollution constitutes a critical planetary health challenge, undermining the integrity of Earth systems while generating cascading harms to human health, livelihoods, and social equity particularly in low- and middle-income countries. Conventional top-down regulatory and technological responses have proven insufficient to address the complexity of plastic pollution, often excluding those most affected from decision-making and solution design. This paper examines how democratizing plastic governance through grassroots leadership can advance planetary health by simultaneously protecting ecosystems, improving human well-being, and strengthening socio-ecological resilience. Drawing on empirical evidence from the #RestorationX10000 initiative led by Community Action Against Plastic Waste (CAPws), this paper documents implementation processes and outcomes achieved between 2021 and 2025 across 71 impacted communities in 21 countries spanning Africa, Asia-Pacific, and Latin America. The initiative was designed to empower 10,000 youths and women as community leaders, practitioners, and advocates by equipping them with leadership, technical, and policy engagement skills to drive systemic change in plastic governance and circular economy practice. Using a trans-disciplinary, community-based action research approach aligned with planetary health principles, the initiative integrates capacity building, citizen science, circular economy interventions (collection, sorting, repair, reuse, repurposing, and recycling), and policy advocacy. Quantitative and qualitative evidence demonstrates that grassroots-led interventions can simultaneously reduce plastic leakage, create decent green livelihoods, and strengthen environmental governance. We argue that inclusive, community-centered plastic governance is not only an environmental intervention but a planetary health strategy, offering policy-relevant insights for national plastic action plans, extended producer responsibility frameworks, and global negotiations toward a legally binding instrument on plastic pollution.

Keywords: plastic pollution; grassroots communities; democratized governance; circular economy; community leadership; environmental justice; environmental health

1. Introduction

Plastic pollution emerges from interconnected stages of production, consumption, and waste management, with multiple points of leakage into terrestrial, aquatic, and atmospheric systems. As illustrated in Figure 1, plastics and associated chemical additives escape formal management pathways and are transported through the environment, generating diverse exposure routes for humans and ecosystems [1]. These pathways link plastic pollution directly to planetary health outcomes, including impacts on human health, biodiversity, food and water security, climate, air quality, and social equity [2]. The framework also identifies governance and intervention points where preventive, circular, and equity-centred strategies can disrupt pollution pathways and reduce cumulative harms.

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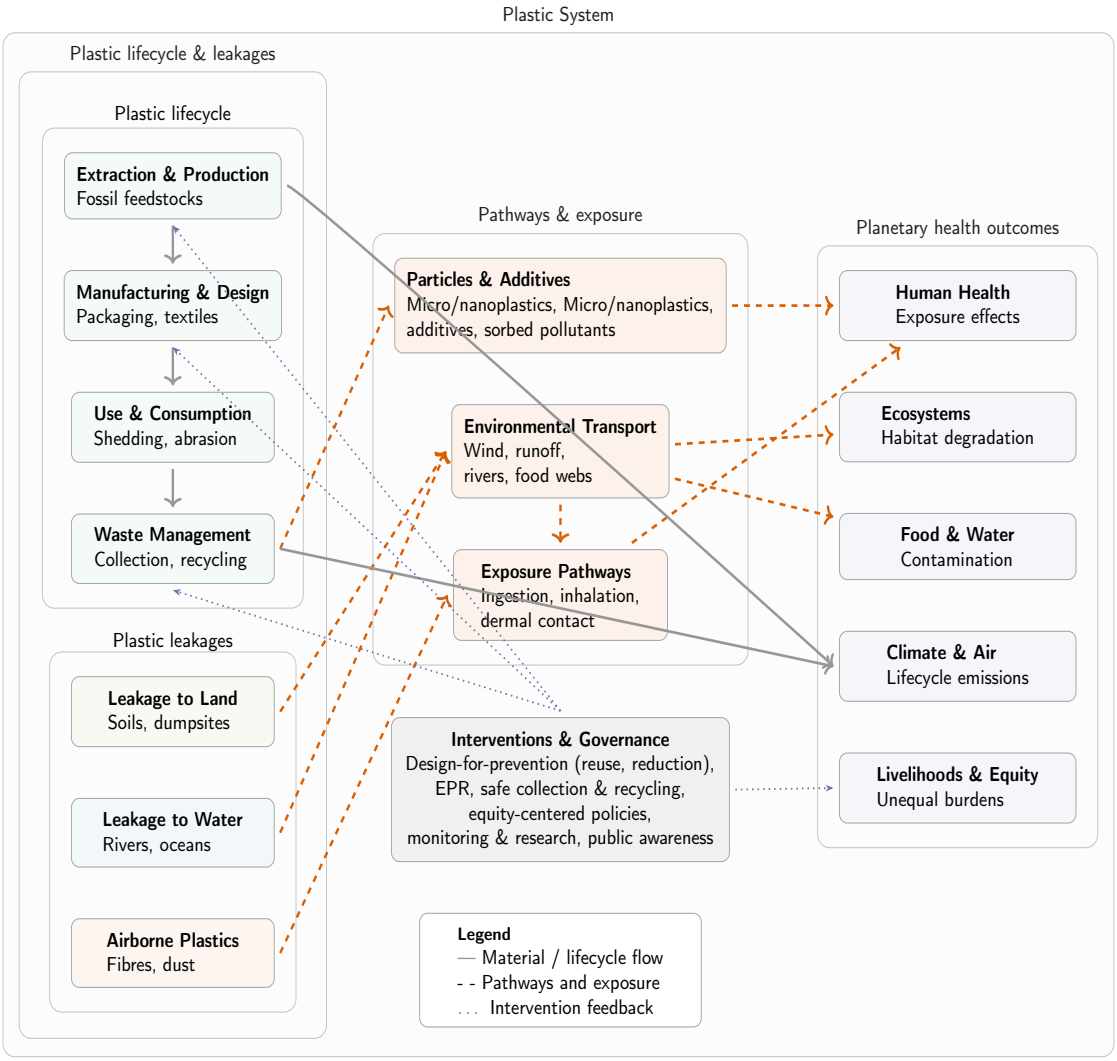

Figure 1. Plastic pollution pathways connected to planetary health.

1.1. Global Plastic Pollution Crisis and Governance Gaps

Plastic pollution has emerged as one of the most pressing global environmental challenges of the 21st century. Annual plastic production has exceeded 400 million tonnes, with a significant proportion designed for short-term use and disposed of within months of production [3]. An estimated 11 million tonnes of plastic enter aquatic ecosystems each year, with projections indicating a near tripling by 2040 under business-as-usual scenarios [4]. Despite the proliferation of international agreements, national regulations, and voluntary corporate commitments, plastic leakage continues to rise, revealing profound gaps in global, regional, and local governance frameworks. Fragmented policy regimes, weak enforcement, limited financial mechanisms, and insufficient attention to the full life cycle of plastics, particularly upstream production and toxic additives, have constrained effective responses.

1.2. Disproportionate Impacts on Grassroots and Vulnerable Communities

The environmental and health burdens of plastic pollution are unevenly distributed. Grassroots communities, especially in coastal, riverine, and informal urban settlements across low- and middle-income countries, bear the brunt of plastic waste mismanagement [5]. These communities experience heightened exposure to plastic-associated chemicals through open dumping, burning, contaminated food systems, and degraded water sources, with documented implications for respiratory health, endocrine disruption, and ecosystem integrity [6,7]. Informal waste workers, women, and youth are simultaneously exposed to occupational risks while remaining marginalized from decision-making processes that shape plastic policy and waste management systems.

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1.3. Limitations of Top-Down Plastic Governance Approaches

Prevailing plastic governance models are predominantly top-down, technocratic, and market-oriented, emphasizing recycling targets, waste infrastructure, and extended producer responsibility schemes with limited local participation. While necessary, these approaches often overlook social equity, informal systems, and contextual realities, leading to policy misalignment and implementation failures [8]. Furthermore, global policy processes have historically underrepresented grassroots knowledge and lived experience, reinforcing power asymmetries and limiting the legitimacy and effectiveness of interventions [9].

1.4. Rationale for Community-Led, Inclusive Governance Models

Community-led and inclusive governance models offer a critical pathway to address these shortcomings. Democratic environmental governance emphasizes participation, transparency, and justice, recognizing communities not merely as beneficiaries but as co-creators of solutions [10]. Grassroots engagement enables locally appropriate circular economy practices such as reuse, repair, and material recovery while generating data, accountability, and social ownership essential for sustained impact. Integrating community knowledge with scientific research and policy advocacy strengthens both environmental outcomes and institutional resilience.

This paper responds directly to planetary health challenges arising from plastic pollution governance failures, arguing that inclusive, grassroots-led governance is essential to protecting ecosystem integrity, reducing health risks, and strengthening socio-ecological resilience in vulnerable contexts by examining the #RestorationX10000 initiative implemented by Community Action Against Plastic Waste (CAPws) (https://www.capws.org/, https://www.un.org/en/civil-society/community-action-against-plastic-waste-capws, https://www.unccd.int/cso/community-action-against-plastic-waste) between 2021 and 2025. Specifically, it (i) demonstrates how grassroots-led interventions contribute to plastic pollution reduction, livelihood creation, and policy influence; (ii) discusses the role of transdisciplinary, community-based approaches in strengthening governance outcomes; and (iii) contributes to the evidence on ongoing debates on equitable and effective pathways for addressing plastic pollution within national contexts and global policy processes, including the emerging international legally binding instrument on plastics.

2. Conceptual Framework: Democratizing Plastic Governance

2.1. Democratic Environmental Governance

Democratic environmental governance refers to decision-making systems that are participatory, transparent, inclusive, and accountable, ensuring that those affected by environmental harms have meaningful influence over policies and practices that shape their lives [11]. This idea of inclusion was explored in [12] which identified lobbying and litigation by interest groups as the primary tools for environmental action. In contrast to centralized or technocratic governance models, democratic governance emphasizes plural knowledge systems, shared authority, and deliberative processes across scales. Within the context of plastic pollution, this framework challenges linear, top-down regulatory approaches by foregrounding community agency, social legitimacy, and contextual adaptation. Scholars argue that environmental governance is most effective when it reflects local realities and incorporates diverse stakeholders, including marginalized groups and informal sectors [10,11,13]. Democratic environmental governance thus functions not only as a normative ideal but as a practical mechanism for improving policy effectiveness, compliance, and long-term sustainability.

2.2. Participation, Equity, and Justice in Plastic Policy

Plastic pollution governance intersects with broader questions of environmental justice, as the burdens of production, consumption, and disposal are unevenly distributed along socio-economic, geographic, and gender lines [9]. Equity in plastic policy requires recognition of differentiated exposure, vulnerability, and capacity, particularly among low-income communities, informal waste workers, women, and youth. Meaningful participation enables these groups to articulate priorities, co-design

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interventions, and influence regulatory outcomes, moving beyond superficial consultation toward shared decision-making. Justice-oriented plastic governance also addresses intergenerational and trans-boundary impacts, acknowledging that plastics and associated chemicals undermine human health, ecosystems, and climate stability across borders and over time [7]. Embedding justice in plastic policy, therefore, demands participatory processes that connect local experience with national and global regulatory frameworks.

2.3. Grassroots Engagement as a Governance Innovation

Grassroots engagement represents a critical governance innovation in addressing plastic pollution. Community-led initiatives generate localized solutions such as reuse systems, informal collection networks, and repair economies that complement formal infrastructure while reducing plastic leakage at source. Importantly, grassroots communities also produce experiential data through citizen science, community monitoring, and lived testimony that can inform evidence-based policymaking [14]. By mobilizing social capital and trust, grassroots engagement enhances policy legitimacy and accountability, enabling adaptive governance that responds to evolving environmental and social conditions. Such approaches have been shown to improve environmental outcomes while strengthening community resilience and institutional learning [15].

2.4. Alignment with Circular Economy, Human Rights, and Public Health Frameworks

Democratized plastic governance aligns closely with circular economy principles that prioritize waste prevention, reuse, repair, and material recirculation over end-of-pipe solutions [16]. When implemented through inclusive governance models, circular economy strategies can deliver both environmental benefits and social value, particularly through decent work and livelihood creation. Additionally, plastic governance increasingly intersects with human rights and public health frameworks. Exposure to plastic-associated chemicals has been linked to endocrine disruption, respiratory disease, and broader health risks, raising concerns under the right to health and a healthy environment [17]. Integrating grassroots participation ensures that governance responses address real exposure pathways and health priorities, reinforcing precautionary and preventive approaches. Together, these frameworks position democratized plastic governance as a holistic, justice-centered approach capable of addressing plastic pollution as both an environmental and socio-political challenge.

3. Program Overview: The #RestorationX10000 Initiative

3.1. Origin and Vision of the Initiative

Persistent gaps in plastic governance systems tend to marginalize frontline communities while failing to curb plastic pollution [18,19]. In response to this, CAPws launched the #RestorationX10000 initiative in 2021. The initiative is grounded in the recognition that effective plastic solutions must address both environmental degradation and socio-economic exclusion [20]. Its long-term vision is to empower at least 10,000 youths, women, informal waste workers, and people living with disabilities (PLWD) with skills, assets, and leadership opportunities to access decent green jobs — jobs that provide fair wages, safety and social protection [21,22] and drive circular economy solutions by 2030. The initiative positions community members not as passive beneficiaries but as environmental stewards, innovators, and policy advocates capable of influencing plastic governance across local, national, and global scales. This vision aligns with calls in the literature for socially inclusive environmental transitions that integrate justice, livelihoods, and sustainability [23].

3.2. Target Groups and Social Inclusion

#RestorationX10000 deliberately prioritizes youth, women, informal waste workers, PLWD, and frontline communities that experience disproportionate exposure to plastic pollution and limited access to formal economic opportunities. These groups are often the most affected by global challenges like climate change and poverty and their participation ensures that solutions are designed by those who understand the problems most intimately [24]. Furthermore, women-led initiatives [25] and

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youth-led social enterprises [26] are more likely to prioritize community well-being, environmental stewardship, and social justice over pure profit while youths tend to lead through digital fluency and innovation [27,28].

Youth and women are engaged as change agents and entrepreneurs in reuse, repair, and recycling systems, while informal waste workers are supported to transition into safer, better-recognized roles within circular value chains. The inclusion of PLWD reflects an explicit commitment to equity and universal access, challenging structural barriers to participation in green economies. This inclusive targeting responds to evidence that environmental interventions are more effective and sustainable when they address social vulnerability and build local capacity [29,30].

3.3. Geographic Scope and Transregional Learning

The initiative operates across 71 communities in 21 countries in Africa, Asia-Pacific, and Latin America, regions that account for a significant share of global plastic leakage due to rapid urbanization, inadequate waste infrastructure, and high dependence on informal systems [31]. Operating across diverse socio-ecological contexts enables comparative learning and the exchange of locally adapted solutions. Cross-regional peer learning strengthens scalability while respecting contextual differences in governance, culture, and resource availability.

3.4. Theory of Change and Intended Impacts

The #RestorationX10000 theory of change is premised on the assumption that empowered communities with access to skills, data, and policy channels can drive systemic change in plastic governance. The initiative integrates four mutually reinforcing pathways:

- Capacity building in leadership, technical skills, and occupational safety for circular economy activities;
- Community-led circular interventions including collection, sorting, reuse, repair, repurposing, and recycling;
- Evidence generation through citizen science and participatory monitoring to inform policy and planning; and
- Policy engagement and advocacy linking grassroots data to decision-making processes.

The intended impacts include reduced plastic leakage and exposure, improved ecosystem health, creation of inclusive green livelihoods, enhanced recognition of informal waste pickers, and strengthened democratic governance. This approach reflects broader scholarship emphasizing transformative, people-centered sustainability transitions that integrate environmental, social, and economic objectives [32,33].

4. Approach

Understanding the impacts and effectiveness of grassroots-led plastic governance requires a research approach that is both rigorous and participatory. This section details the methodological framework adopted to operationalize the #RestorationX10000 initiative, emphasizing its transdisciplinary and action-oriented design.

4.1. Transdisciplinary and Participatory Approach

This study adopts a transdisciplinary and participatory action research (PAR) approach to examine the implementation and outcomes of the #RestorationX10000 initiative. Transdisciplinarity integrates knowledge from environmental science, public health, social sciences, policy studies, and community practice to address complex sustainability challenges such as plastic pollution [34]. Participatory action research emphasizes co-production of knowledge with community members, ensuring that research processes are responsive to local priorities and capable of generating actionable outcomes [35]. This combined approach allows for iterative learning, adaptive implementation, and reflexive analysis across diverse socio-ecological contexts.

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4.2. Community-Based Data Collection and Documentation

Data collection was grounded in community-based and citizen science methodologies, enabling grassroots campaigners to document plastic pollution sources, exposure pathways, and intervention outcomes. Trained community members collected quantitative data on waste volumes, material types, and recovery rates, alongside qualitative documentation of lived experiences, occupational risks, and environmental change. Methods included waste audits, shoreline and community clean-up records, participatory mapping, focus group discussions, and narrative reporting. Such approaches are increasingly recognized for their ability to democratize data production while enhancing policy relevance and social legitimacy [14,36].

4.3. Capacity-Building and Action-Research Methods

Capacity building was embedded as both an intervention and a research method. Participants received training in circular economy practices (collection, sorting, reuse, repair, and recycling), occupational health and safety, leadership, and policy engagement. Action-research cycles, comprising planning, action, observation, and reflection, enabled communities to test solutions, assess outcomes, and refine strategies in real time [37]. This iterative process strengthened local ownership, adaptive capacity, and the generation of context-specific evidence.

4.4. Monitoring Indicators

The initiative employed a mixed set of social, environmental, and economic indicators to track outcomes and impacts. Social indicators included number of participants trained, gender and disability inclusion, leadership roles assumed, and changes in awareness and participation. Environmental indicators captured volumes of plastic collected, reused, or recycled; reduction in visible pollution; and restoration of local ecosystems. Economic indicators assessed job creation, income changes, enterprise formation, and integration of informal workers into circular value chains. Triangulation of data sources enhanced validity and enabled cross-site comparison [38].

4.5. Ethical Considerations and Community Consent

Ethical integrity was central to the research design. The study adhered to principles of "free, prior, and informed consent (FPIC)", transparency, and data ownership. Communities were informed of research objectives, methods, and potential risks, with consent obtained through collective and individual processes. Safeguards were implemented to protect vulnerable groups, including women, informal workers, and PLWD. Findings were shared with communities to support accountability and mutual learning, consistent with ethical standards for participatory research [39].

5. Implementation

5.1. Leadership and Technical Training Models

The #RestorationX10000 initiative employs a blended leadership and technical training model designed to strengthen grassroots capacity for environmental governance and circular economy practice as shown in Figure 2. Training modules combine environmental leadership, systems thinking, occupational health and safety, and entrepreneurship with hands-on technical skills in plastic collection, sorting, reuse, repair, and recycling. Youth, women, informal waste workers, and PLWD are trained as community facilitators and peer educators, enabling knowledge diffusion and local institutionalization. This approach aligns with evidence that leadership development and skills training are critical enablers of sustainable community-led environmental interventions [30,33].

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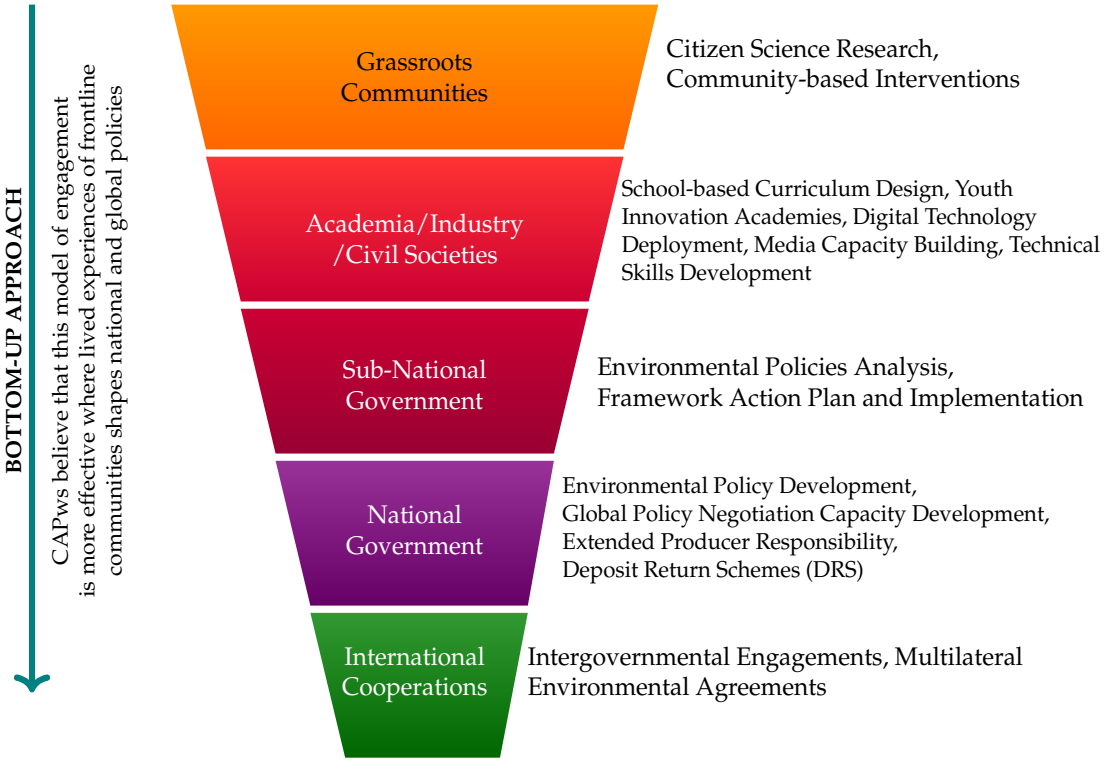

Figure 2. Stakeholder Engagement Approach.

5.2. Plastic Collection, Sorting, Reuse, Repair, and Recycling Systems

Implementation emphasizes waste prevention and value retention, prioritizing reuse and repair before recycling in line with circular economy hierarchies [16]. Community-led collection systems are established through organized clean-ups, door-to-door recovery, and integration of informal waste pickers. Sorting hubs enable material separation and quality control, while reuse and repair initiatives such as upcycling fishing nets and household plastics extend product lifecycles and reduce leakage. Recycling partnerships ensure that residual materials enter environmentally sound processing streams. These localized systems complement formal infrastructure and enhance material recovery efficiency, particularly in contexts with limited municipal services [40,41]. We have led several innovative community-based interventions to improve plastic waste collection, sorting, reuse, repair and recycling by establishing Material Recovery Facilities (MRFs), and reuse and refill cooperatives for local women and youth groups in line with zero-waste strategies [42].

5.3. Policy Advocacy and Stakeholder Engagement

Policy engagement is a core strategy, translating community action and evidence into governance influence. CAPws brings together community groups, local authorities, national agencies, and regional bodies to co-develop policy recommendations on plastic management, extended producer responsibility, and just transition strategies. Community-generated data and lived experience are leveraged to strengthen accountability and align policies with on-the-ground realities as described in Section 5.4. This participatory advocacy model reflects scholarship emphasizing the importance of multi-level governance and stakeholder engagement in environmental policy effectiveness [43].

CAPws serves as an accredited observer across several multilateral environmental processes and have contributed significantly to key Multilateral Environmental Agreements (MEAs) through oral presentations, written submissions, and capacity-building support for Member States. The organization's accreditations include the United Nations Environment Programme (UNEP); the Minamata Convention; the Basel, Rotterdam and Stockholm (BRS) Conventions; the Global Framework on Chemicals (GFC); the Intergovernmental Negotiating Committee (INC) for the Global Plastics Treaty; and the United Nations Convention to Combat Desertification (UNCCD). CAPws also hold special

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accreditations to the United Nations Ocean Conference, United Nations Water Conference, United Nations World Summit for Social Development, United Nations Financing for Development (FfD), and the World Bank/IMF Civil Society Policy Forum.

From 2023 to 2024, CAPws also hosted the Nigeria Plastic Treaty Preparatory Sessions in collaboration with the Nigeria Federal Ministry of Environment. This initiative convened stakeholders across the entire plastic value-chain in Nigeria to ensure that Nigeria's submissions and negotiating positions at the Intergovernmental Negotiating Committee (INC) for the development of a legally binding instrument on plastic pollution, including pollution in the marine environment, were comprehensively informed by all relevant actors—particularly those whose voices are often marginalized in such processes.

5.4. Integration of Citizen Science and Digital Tools

The use of digital citizen science has been shown to improve environmental decision-making while empowering participants and increasing policy salience [14,36]. Citizen participation, scientific expertise, and digital platforms are integrated to enhance data collection, improve coordination, and strengthen transparency. Community members use standardized tools to document waste flows, pollution hotspots, and intervention outcomes, contributing to locally relevant evidence bases. Digital applications enhance communication, market linkages, and monitoring, enabling adaptive management and cross-community learning.

5.5. Partnerships with Governments, Civil Society, and the Private Sector

Consistent with the literature on collaborative governance for complex sustainability challenges [44,45], the initiative is implemented through multi-stakeholder partnerships that leverage complementary strengths. Governments provide policy alignment and institutional support; civil society organizations contribute to mobilization, advocacy, and technical assistance; and private sector partners offer market access, logistics, and innovation. Such partnerships enhance scalability, financial sustainability, and policy coherence.

6. Results and Outcomes (2021–2025)

The #RestorationX10000 initiative has demonstrated substantial and measurable impact, underscoring its role as a catalyst for systemic change in plastic governance. As illustrated in Figure 3, the programme achieved rapid traction within a few months, gaining acceptance across multiple countries and attracting interests from like-minded leaders who voluntarily drove the initiative at country-level as "Country Directors". This early adoption reflects the initiative's alignment with global sustainability priorities and its capacity to mobilise diverse stakeholders.

Beyond its swift diffusion, #RestorationX10000 delivered quantifiable outcomes, including significant collection metrics that validate its operational effectiveness. Furthermore, the initiative has stimulated interest among key ecosystem actors such as recyclers and innovators in waste management systems, signaling its potential to foster collaborative models for circular economy practices. This is evidenced by increased participation from youths from other communities and countries including Burundi, Rwanda, South Sudan, Cote d'Ivoire, Fiji, Pakistan and Venezuela to mention a few. The organization also received more partnership engagements from recyclers and innovators in waste management systems including Pakam (https://www.pakam.ng/) and WasteBanc (https://wastebancng.com/).

Collectively, these developments position #RestorationX10000 as a net-positive intervention in the broader fight against climate change, while advancing a bottom-up governance framework that empowers local communities and decentralizes decision-making in plastic waste management.

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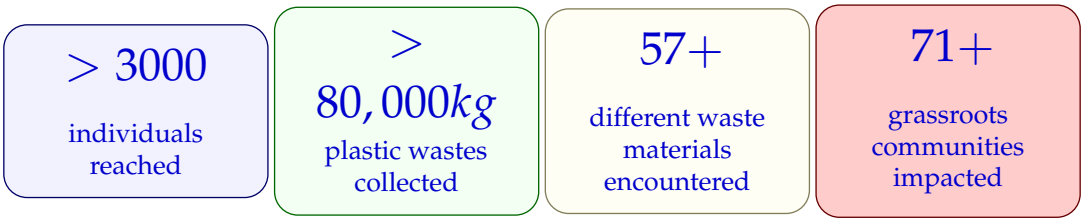

Figure 3. #RestorationX10000 Key Outputs: 2021–2025.

6.1. Reach and Participatory Engagement

Between 2021 and 2025, the #RestorationX10000 initiative directly reached over 3000 beneficiaries across 71 impacted communities in 21 countries spanning Africa, Asia-Pacific, and Latin America. Participants included youth, women, informal waste workers, community leaders, educators, and PLWD. Beyond individual beneficiaries, the program engaged community-based organizations, market associations, schools, and local authorities, creating multi-actor participation platforms.

Furthermore, in 2023, CAPws undertook a project inspired by Break Free From Plastic (BFFP)-*#BreakFreeFromPlastic* to understudy the exposure of the local population in Obajana, Kogi State, Nigeria, an area which hosts Africa's largest cement factory, to cement-Kiln co-processing with plastic waste. The campaign culminated in the development of a Grassroots-Informed Risk Assessment Framework (GIRAF) designed for low-resources settings often lacking formal bio-monitoring and epidemiological data. The outcome of this campaign are planned for a separate publication and is out of the scope of this paper.

This scale demonstrates the feasibility of grassroots-led interventions operating across diverse socio-economic and governance contexts, consistent with evidence that community-based environmental programs can achieve wide geographic diffusion when supported by networks and partnerships [10,46].

6.2. Environmental Outcomes: Plastic Diversion and Ecosystem Restoration

Environmentally, the initiative contributed to measurable reductions in plastic leakage through organized collection, sorting, reuse, repair, and recycling activities. Community-led clean-ups and recovery systems diverted significant quantities of post-consumer plastics from waterways, informal dumpsites, and sensitive ecosystems, including rivers, creeks, and coastal zones. In several locations, restoration activities such as mangrove clean-ups and lagoon remediation improved local environmental quality and reduced exposure pathways for wildlife and human populations.

In September 2022, CAPws launched Africa-Asia Youth Ocean Drive across 17 countries to advance ocean governance and literacy among young people and coastal communities through citizen science and participatory engagement. This drive reached about 1300 participants and diverted over 50 tonnes of plastic waste from the Indian Ocean, Atlantic Ocean, and Pacific Ocean combined. Overall, CAPws recovered over 80 tonnes (80,000 kg) of plastic waste. Although modest relative to global volumes, this quantity is meaningful at the local scale: globally, an estimated 350 million tonnes of plastic waste are generated each year [47], and about 3–11 million tonnes enter into the oceans annually [48]. CAPws documented its collection activities and gathered data for assessing plastic waste streams and characterization across its various collection points on Empower.eco platform (now defunct), which provided a readily available documentation tool. Since the activities of #RestorationX10000 had diversified beyond cleanups, the cessation of Empower.eco's operations had no impact on the CAPws' implementation strategy.

These outcomes align with studies showing that community-based waste management and ecosystem restoration can deliver tangible environmental benefits, particularly in data-poor and infrastructure-limited settings [49,50].

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6.3. Social Outcomes: Skills Development, Inclusion, and Leadership

Socially, #RestorationX10000 strengthened environmental leadership, technical skills, and health awareness among participants. Beneficiaries reported increased knowledge of plastic risks, chemicals exposure, and waste management practices, contributing to improved community-level environmental health literacy. The deliberate inclusion of women, youth, informal waste workers, and PLWD enhanced social equity and representation in local decision-making processes. Graduates of the program assumed roles as community facilitators, advocates, and peer educators, reinforcing local ownership and leadership. These findings are consistent with literature linking participatory environmental programs to empowerment, social inclusion, and improved governance outcomes [51,52].

6.4. Economic Outcomes: Green Jobs, Enterprises, and Income Generation

Economically, the initiative supported the creation of decent green livelihood opportunities through reuse, repair, recycling, and circular micro-enterprises. Participants accessed income-generating activities within community recovery systems, while some groups established cooperatives and small enterprises linked to local and regional value chains. By integrating informal waste workers into organized systems, the program improved income stability and occupational recognition, addressing long-standing precarity within the sector.

Because waste pickers' earnings depend on the volume of waste they collect, the collection exercises substantially increased both the quantity and quality of plastic recovered from land and water bodies, resulting in higher income for participating waste pickers. To strengthen these gains, CAPws facilitated connections between waste pickers and high-quality off-takers, who typically offer better prices, thereby helping to close the loop in the value chain. In addition, new entrants into the waste management sector—selected from CAPws' volunteer pool—were compensated to attend training on organizational development, and several have since established collection, aggregation, and processing hubs along the plastic value chain.

These outcomes reflect broader evidence that inclusive circular economy interventions can generate employment, enhance livelihoods, and support poverty reduction when social safeguards are embedded [53,54]. While also receiving several interests from various waste management innovation ideas, CAPws embarked on its own digital technology solution, Seikula (https://seikula.useinviteam.com/), in collaboration with two technology partners, Ainnov8 Technologies Ltd. (https://www.ainnov8.com/) and JustWeb (https://justwebtech.com/) to create a plastic circular economy bringing together households & businesses, informal waste collectors and recyclers.

6.5. Policy and Institutional Influence

At the governance level, #RestorationX10000 contributed to policy dialogue and institutional learning by translating community-generated evidence into advocacy and engagement processes. Community data, testimonies, and pilot interventions informed discussions on plastic management, extended producer responsibility, and just transition frameworks at local, national and international levels. Partnerships with government agencies and civil society organizations strengthened institutional capacity and fostered alignment between grassroots realities and formal policy instruments.

Through the work with Ondo State Government, Ondo State Environmental Protection Agency (OSEPA), Olusegun Agagu University of Science and Technology (OAUSTECH), Bank of Industry (BOI), and BFFP, CAPws established the Ondo State Reuse Economy Working Group, a multi-stakeholder platform advancing reuse and refill economy to address plastic pollution and local economic development in Ondo State. The Working Group connects local businesses such as restaurants, hotels and supermarkets with trained youths and women who provide them with reuse and refill solutions to replace single-use plastic products.

In 2025, CAPws partnered with PETpro Tanzania (PET Recycle Company (T) Limited) (https://petpro.co.tz/), which is constituted by the industry as a Producer Responsibility Organisation (PRO) that voluntarily pursues Extended Producer Responsibility (EPR) in Tanzania, and Emerging

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Generation Initiative (EGI) Tanzania (https://www.linkedin.com/company/emerging-generation-initiative-egi-tanzania (accessed on 30 December 2025)) to develop *"Taka Biashara Youth Innovation Academy (TBYIA)"* a training program aimed at empowering youth, women, and PLWD to create sustainable businesses from the circular economy. This call welcomed more than 200 entries, from which a first cohort of 25 participants have been selected to begin the academy in 2026.

This outcome supports scholarship emphasizing that participatory, evidence-informed engagement enhances policy legitimacy, responsiveness, and implementation effectiveness in environmental governance [13,55–57].

7. Discussion

7.1. Effectiveness of Grassroots-Led Plastic Governance

Findings from the #RestorationX10000 initiative demonstrate that grassroots-led plastic governance can be both effective and scalable when supported by enabling institutional and knowledge frameworks. Community-driven interventions proved capable of addressing plastic pollution at its sources by combining waste recovery, circular livelihoods, and behavior change with policy engagement. Unlike conventional top-down approaches that often suffer from weak local ownership and implementation gaps, the #RestorationX10000 model anchored governance in lived experience, local knowledge, and trust. Here, trust refers to the demonstrated willingness of local actors to engage, comply, and co-produce governance outcomes, grounded in perceived legitimacy, epistemic recognition, and consistent delivery. This aligns with extensive evidence that polycentric and participatory governance systems enhance environmental performance by improving compliance, innovation, and contextual relevance [10,58].

7.2. Comparative Insights Across Regions

Across Africa, Asia-Pacific, and Latin America, the initiative revealed context-specific pathways but convergent outcomes. While governance capacities, infrastructure, and policy maturity varied significantly, common challenges such as plastic leakage into waterways, reliance on informal waste systems, and limited regulatory enforcement were observed across regions. Grassroots engagement provided a unifying mechanism to adapt solutions to local socio-economic realities, whether in coastal fishing communities, urban informal settlements, or peri-urban markets. Lessons from #RestorationX10000 align with existing literature that participatory governance systems that engage grassroots communities effectively, draw interest from local community members [59,60]. Furthermore, in the Global South context, which is characterized by institutional fragmentation and resource constraints insights reinforce that community-based environmental governance is particularly effective [61].

7.3. Equity, Gender, and Informal Sector Inclusion

Equity and inclusion emerged as central strengths of the #RestorationX10000 approach. Women, youth, informal waste workers, and PLWD were not treated merely as beneficiaries but as co-producers of governance outcomes. Gender-responsive training and leadership pathways enhanced women's participation in decision-making and enterprise development, addressing structural exclusions common in environmental governance systems. Formal recognition and integration of informal waste workers contributed to improved livelihoods, dignity, and occupational safety. These themes support the successes of the #RestorationX10000 initiative as were previously identified through Sections 6.1–6.4. These outcomes resonate with feminist political ecology and just transition literature, which emphasize that environmental sustainability and social justice are mutually reinforcing when power asymmetries are addressed [51,53,62].

7.4. Challenges, Trade-Offs, and Adaptive Strategies

Despite its successes, the initiative faced notable challenges. These included limited access to sustained financing, policy inertia at higher governance levels, digital access constraints, and the precarity of informal livelihoods. Trade-offs arose between rapid scaling and the depth of commu-

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nity engagement, as well as between market-driven recycling solutions and higher-value reuse and repair systems. CAPws addressed these challenges through adaptive strategies such as phased implementation, blended financing approaches, cooperative models, and iterative learning informed by community feedback. Adaptive governance literature underscores the importance of flexibility, learning, and reflexivity in managing complex socio-environmental systems such as plastic pollution [63,64].

7.5. Implications for National and Global Plastic Policy

The results have significant implications for national and global plastic governance, including ongoing negotiations on a global plastics treaty. First, they highlight the necessity of embedding community participation, equity safeguards, and informal sector integration into policy design and implementation. Second, they demonstrate the value of community-generated data and citizen science in informing evidence-based decision-making, particularly in contexts where official data are limited. Finally, the initiative underscores that achieving a just and effective transition to a circular plastic economy requires aligning environmental objectives with livelihoods, public health, and human rights considerations. These insights support growing calls for inclusive, bottom-up approaches in global environmental governance frameworks [56,65].

7.6. Linkages of #RestorationX10000 to Planetary Health Concerns

Actions against plastic pollution have been central to the design and outcomes of the #RestorationX10000 initiative, particularly through community-led plastic collection, reuse, recovery, and advocacy strategies. Within a planetary health framework, plastics are increasingly recognized as a class of "novel entities", synthetic materials and associated chemical additives that exceed the Earth system's capacity for safe assimilation and regulation [66], as such, plastic pollution constitutes a systemic planetary health risk, destabilizing ecological processes, disrupting biogeochemical cycles, and generating direct and indirect impacts on human health, impacting human biology at a cellular level, and exacerbates every other planetary boundary threat, including climate change, biodiversity loss, and pollution.

#RestorationX10000 explicitly situates localized plastic collection and circular economy interventions within this broader planetary health context by linking waste recovery to ecosystem restoration, exposure reduction, and livelihood security. By integrating citizen science, community monitoring, and policy advocacy, the initiative connects grassroots action to global planetary health objectives, demonstrating how local governance innovations can contribute to reducing novel entity pressures while strengthening social resilience. In this way, plastic collection is not treated as an isolated waste management activity, but as a preventive planetary health intervention that addresses interconnected environmental, climatic, and public health risks through inclusive, community-centered governance.

Plastic collection efforts, for instance, through organized beach cleanups, act as immediate interventions to prevent "environmental leakage" that triggers cascading planetary failures [67] and deliver measurable benefits across ecosystems. By removing macro-plastics from marine environments, collection efforts reduce entanglement and ingestion risks for keystone sentinel species such as whales, helping sustain biodiversity, nutrient cycling, and oceanic carbon sequestration. Similarly, preventing plastics from fragmenting into microplastics also protects the biological carbon pump, supporting marine microorganisms' ability to absorb and regulate atmospheric CO_2. Furthermore, on land and in freshwater systems, plastic collection improves soil structure and water infiltration, safeguards soil microbiomes, and strengthens agricultural productivity and food security.

The advocacy efforts on the other hand, link to the "Cradle-to-Grave" impact. They shift the focus from individual behavior to structural change, targeting the full lifecycle of plastic which drives the planetary health crisis [68]. For example, by calling for caps on plastic production, advocacy addresses plastics' deep reliance on fossil fuel feedstocks and curbs a rapidly growing source of greenhouse gas emissions [69]. Demands for chemical transparency and regulation reduce exposure to toxicity [70], helping preserve humanity's safe operating space by preventing irreversible harm to

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human and ecological health. Grassroots-led action also advances environmental justice by challenging the unequal global trade in plastic waste, which disproportionately burdens low-income communities with pollution-related disease, environmental degradation, and human rights violations.

8. Policy and Practice Implications

8.1. Lessons for Governments and Multilateral Processes

The #RestorationX10000 initiative offers important lessons for governments and multilateral institutions seeking effective responses to plastic pollution. First, it demonstrates that policy effectiveness is strengthened when grassroots right holders and interest groups are treated as governance partners rather than implementation targets. Community-led systems improved compliance, legitimacy, and contextual fit, addressing persistent implementation gaps associated with centralized waste management policies. Governments can enhance policy outcomes by institutionalizing participatory mechanisms, supporting community enterprises, and aligning environmental regulation with social protection measures. These insights are consistent with evidence that inclusive, multi-level governance arrangements improve environmental performance and policy durability [10,71].

8.2. Relevance to Global Plastics Treaty Negotiations

The initiative's findings are highly relevant to ongoing negotiations toward a legally binding Global Plastics Treaty. Current debates emphasize lifecycle approaches, extended producer responsibility, and waste management, yet often under-address social equity and informal sector integration [72,73]. Evidence from #RestorationX10000 underscores the necessity of embedding just transition principles, community participation, and safeguards for vulnerable groups within treaty provisions. Incorporating community-based implementation pathways can enhance treaty feasibility and legitimacy, particularly in low- and middle-income countries where informal systems dominate plastic recovery. This aligns with increasing scholastic advocacy for socially inclusive global environmental agreements [65,74].

8.3. Scaling Community-Driven Circular Economy Models

Scaling community-driven circular economy models requires moving beyond pilot projects toward systemic support structures, including access to finance, markets, and policy recognition. The CAPws experience suggests that cooperative enterprises, blended finance mechanisms, and public–private partnerships can facilitate scale while preserving social inclusion. Importantly, scaling should prioritize reuse, repair, and reduction alongside recycling to avoid reinforcing extractive or low-value recovery pathways. These lessons support critiques of narrow recycling-focused circular economy models and reinforce calls for socially embedded circular transitions [54,75].

8.4. Integrating Grassroots Data into Formal Governance Systems

A critical implication is the value of grassroots-generated data for strengthening formal governance systems. Community documentation, citizen science, and participatory monitoring provided timely, context-rich evidence on plastic leakage, health risks, and intervention effectiveness. When integrated into official reporting, planning, and evaluation processes, such data can complement national statistics and improve policy responsiveness. Institutionalizing data-sharing frameworks and recognizing community knowledge as legitimate evidence are essential steps toward more democratic and adaptive plastic governance. This approach aligns with literature on knowledge co-production and the democratization of environmental decision-making [60,76].

9. Conclusions

This paper set out to examine how democratizing plastic governance through effective grassroots engagement can deliver equitable, scalable, and impactful responses to plastic pollution as a planetary health challenge. Drawing on practice-based evidence from the #RestorationX10000 initiative

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implemented between 2021 and 2025, the study demonstrates that community-led governance models can simultaneously reduce plastic leakage, generate decent green livelihoods, and strengthen policy relevance across diverse socio-economic and geographic contexts.

By reaching over 3000 beneficiaries across 71 communities in 21 countries, the initiative provides concrete evidence that locally anchored interventions can operate at meaningful scale while maintaining social inclusion and environmental integrity. From a scholarly perspective, this paper contributes to planetary health and plastic governance literature by advancing an empirically grounded model of democratic and polycentric governance that integrates participation, equity, and justice into circular economy practice. It responds to critiques of technocratic and top-down approaches by showing how grassroots knowledge, citizen science, and lived experience can enhance policy design, implementation, and legitimacy particularly in addressing the intertwined ecological degradation, public health risks, and social inequities associated with plastic pollution. In doing so, it bridges gaps between environmental governance theory, circular economy debates, planetary health frameworks, and human rights-based approaches to waste and pollution management [10,56,65].

Looking forward, the findings underscore the importance of embedding inclusive governance principles into national policies and global frameworks, including the emerging Global Plastics Treaty, to advance planetary health objectives. Achieving a toxic-free and socially just circular economy will require sustained investment in community leadership, recognition of informal systems, and institutionalization of participatory data and decision-making processes. As plastic pollution continues to threaten ecosystems, public health, and livelihoods, especially in frontline communities, grassroots-led governance offers a viable pathway toward long-term environmental restoration, planetary health protection, social equity, and sustainable development.

10. Limitations and Future Directions

Despite the demonstrated impacts of the #RestorationX10000 initiative, several limitations should be acknowledged. First, data gaps and contextual variability constrained the comparability of outcomes across regions. Operating in 21 countries with diverse governance systems, infrastructure levels, and socio-cultural dynamics meant that data collection relied heavily on community-based documentation and self-reported indicators. While this approach enhances relevance and inclusivity, it may introduce variability in data quality and limit standardization. Similar challenges are widely noted in participatory and community-based environmental research, particularly in Global South contexts where official data systems are weak or fragmented [71,76].

Second, the approach is limited by the absence of longitudinal impact assessments extending beyond the 2021–2025 implementation period. Many environmental, health, and socio-economic outcomes associated with plastic pollution such as ecosystem recovery, chronic exposure to hazardous chemicals, and intergenerational livelihood effects manifest over longer time horizons. Future research should employ longitudinal and mixed-methods designs to assess the durability of behavior change, enterprise viability, policy influence, and ecological restoration outcomes over time. Long-term evaluation is critical for understanding whether grassroots-led governance can sustain impacts at scale [63,64].

Finally, there are significant opportunities for deeper investigation into chemical exposure and public health impacts associated with plastic pollution. Although the initiative incorporated environmental health awareness and precautionary approaches, systematic bio-monitoring and exposure assessment were beyond its scope. Future studies could integrate toxicological analysis, epidemiological methods, and citizen science to examine exposure pathways to plastic-associated chemicals such as endocrine disruptors, particularly among vulnerable populations and informal waste workers. Strengthening this evidence base would enhance the integration of public health considerations into plastic governance and circular economy policy [3,77].

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