WIEGO
Women in Informal Employment: Globalizing and Organizing

INTERNATIONAL ALLIANCE OF WASTE PICKERS

WIEGO Technical Brief Nº 18
February 2026

# Mitigating from the Margins:

## Waste Picker Impact on Greenhouse Gas Emissions

Ed Cook and
Taylor Cass Talbott

**Technical Briefs**

WIEGO Technical Briefs provide guides for both specialized and non-specialized audiences. These are designed to strengthen understanding and analysis of the situation of those working in the informal economy as well as of the policy environment and policy options.

**About the authors**

**Ed Cook** is a waste management and plastic pollution researcher, focusing on the contribution of the informal sector to the circular economy. Contact: ed@edcook.org.uk.

**Taylor Cass Talbott** is the Advocacy Coordinator for the International Alliance of Waste Pickers and a member of the US-based waste picker organization Ground Score Association.
Contact: taylor.casstalbott@wiego.org.

**Acknowledgements**

Thank you to the following organizations and waste pickers leaders for supporting local data collection efforts: Amanecer Cooperative, FACCyR, Bokk Diom, Stree Mukti Sanghatana, SWaCH Cooperative, Hasiru Dala, Amelior, Ground Score Association, Movimiento Nacional de los Recicladores de República Dominicana, Cooperativas Dos Catadores de Belo Horizonte (ASMARE, ASSOCIRECICLE, COOMARP Pampulha, COOPEMAR Oeste, COOPESOL Leste, COOPERSOLI Barreiro, CATAUNIDOS, REDESOL), Cantinho do Reciclo, Arofuturo, Barrio Colombia, Puerta de Oro, Coemprender, Aremarpo, Asociacion de los Recicladores de Bogotá, Planeta Verde, Kpone Landfill Waste Pickers Association, Green Waste Pickers Cooperative, ANARCH, Johnson Doe, Robinson García Silfa, Fundación Fundazurza, Asociación César Sánchez, Martha Elena Iglesias, José Luis Torres Rivas, Kris Brown, Katherine Lindsay, Comprender Cooperative, María Eugenia Duque, Alejandro Mena, Soledad Mella, Ana Luisa Jaque Campos, Regina Agbeko, Wisdom Pinantaba, Saleh Mohammed, Devine Dekonor, Emelia Agbozo, David Halm, Julianna Mawuworde, Abdul Kadiri, Mary Amegashie, Musah Doe, more than 70 waste pickers and organizers associated with the SWaCH Cooperative and Hasiru Dala, Franklin Combriza, Federico Parra, Katherine Lindsey, Jane Kalpakis, Nate Lindsay, Owusu Boampong, Karim Saagbul, Maguette Diop, Adama Soumare, Papa Sakho, waste pickers of Bokk Diom, Juliana Gonçalves, the Public Prosecutor of Minas Gerais State (MPMG), and The Superintendency of Urban Cleaning (SLU) of Belo Horizonte.

Thank you to Lucia Fernandez Gabard for her instrumental role in the development of this report, and to Reka Soos, Vlad Muresan, Eva Incze, and Green Partners, Sonia Dias, and Amira El Halabi for their review and feedback.

Thank you to the Swedish International Development Cooperation Agency (Sida) for their support for WIEGO's Reducing Waste in Coastal Cities project and for supporting the development of the Waste Picker Greenhouse Gas Calculator.

**Publication date:** January 2026

**ISBN:** 978-92-95122-64-2

**Please cite this publication as:** Cook, Ed and Taylor Cass Talbott. 2026. Mitigating from the Margins: Waste Picker Impact on Greenhouse Gas Emissions. WIEGO Technical Brief No. 18. Manchester, UK: WIEGO

Published by Women in Informal Employment: Globalizing and Organizing (WIEGO)
A Charitable Company Limited by Guarantee – Company No. 6273538,
Registered Charity No. 1143510

**WIEGO Limited**
521 Royal Exchange
Manchester, M2 7EN
United Kingdom
www.wiego.org

**Series editors:** Ana Carolina Ogando and Caroline Skinner
**Copy editor**: Bronwen Dachs Muller
**Layout:** Julian Luckham

**Cover Photograph:** Waste pickers and researchers weigh materials to provide data for the Waste Picker Greenhouse Gas Calculator in Ghana. Photo credit: Karim Saagbul



# Table of Contents

## Key Findings

This report is a quantitative appraisal and evaluation of the Waste Picker Greenhouse Gas Calculator and presents the findings of 20 case studies from cities around the world where the Calculator has been used. The studies were done to assess the impact that waste pickers have on reducing greenhouse gas emissions. Our findings include:

- Waste pickers have a substantial impact on global greenhouse gas emissions mitigation. Our tentative estimates suggest that the activities of waste pickers help avoid:
  - Between 0.17 and 0.39 billion tonnes of $CO_2$eq each year: 0.3-0.7 per cent of global emissions (59 billion tonnes $CO_2$eq per annum).
  - Between 7 and 17 per cent of the 2.3 billion tonnes generated by the waste sector.
  - Approximately 44 tonnes of $CO_2$eq per waste picker per year (interquartile range: 15-82), equivalent to the annual greenhouse gases emitted by 6.5 people (range: 2-12).
- We find that the Calculator has been successfully used to provide evidence to justify the integration of waste pickers into formal waste management systems. In one example, in Accra, Ghana, advocacy for a contract with the municipal authority succeeded after the tool was used to show the impact that informal waste collectors have on greenhouse gas mitigation.
- Results from the Calculator demonstrate that the prevention of open burning by waste picker activity considerably reduces greenhouse gas emissions. We highlight the need for more work to improve the measurement of greenhouse gas emissions from open burning in dumpsites and in communities that lack waste collection services.
- Even in high-income countries with well-developed management systems, waste pickers are making an active contribution to the circular economy. Evidence from the Calculator in France and the USA demonstrates the greenhouse gas mitigation potential of informal waste collectors in unique market conditions. By ensuring continued access to materials and materials markets, waste pickers can be supported to fulfil niche roles in these systems and improve environmental outcomes.
- The collection of textiles for recovery or reuse has a substantial impact on greenhouse gas emissions mitigation. However, it is one of the least collected streams by waste pickers. We propose a market assessment to identify the drivers and barriers that affect the collection and marketability of secondary textiles by waste pickers. This could encourage the recovery of this important stream and improve climate mitigation outcomes.
- As the circular economy develops, interventions in the waste system, such as extended producer responsibility and increased formalization, could have a profound effect on the activities of waste pickers. The ability to demonstrate the value of their work, by collecting and presenting evidence on their contribution to greenhouse gas emission mitigation, can help waste pickers stand up to growing competition, demonstrate professionalism, and better negotiate for contracts and improved working conditions.
- We urgently need better data on the informal sector to strengthen the reliability of a global estimate for the impact of waste pickers on greenhouse gas emissions. This means more statistically reliable sampling that includes sufficient metadata such as location of work, activity type, transport mode, productivity rate, and degree of organization and formality.



## 1. Introduction

Solid waste management was responsible for an estimated 2.3 billion tonnes $CO_2$eq (carbon dioxide equivalent) (IPCC, 2018)[1] emissions in 2019 (Minx et al. 2022), 3.8 per cent (2.3 billion tonnes $CO_2$eq) of the 59 billion tonnes $CO_2$eq emitted worldwide (Minx et al. 2021). More than 90 per cent of these emissions are from methane generation, primarily when waste undergoes anaerobic decomposition in landfills and dumpsites, while the remainder is a result of transport and processing. In addition, the material system itself is a huge contributor to climate change, with production, manufacturing and resource extraction generating 11 billion tonnes $CO_2$eq in 2015 (23% of the global total) (Hertwich 2021).

Formal waste management systems have made considerable efforts in recent decades towards mitigating greenhouse gas emissions, mainly through the capture and use of methane generated by landfills; reducing the amount of biodegradable waste sent to landfill; and by promoting and facilitating reuse and recycling (Bogner et al. 2008; Oo et al. 2024). Alongside these efforts, at least 10 million full-time-equivalent waste pickers[2] collectively recover more than 100 million tonnes of waste worldwide every year (Cook et al. 2024b). Their work reduces the amount of waste that has to be managed by the formal authorities, often in contexts where monetary resources are already scarce (Wilson et al. 2006). The activities of waste pickers also mitigate greenhouse gas emissions in the following ways:

- They divert biodegradable material from land disposal, which mitigates methane generation (Chen n.d.).
- They return material resources back into the system through collection for recycling and reuse of engineered materials ("dry recyclates", "recycling"); displacing emissions from primary production (Gutberlet 2023).
- They divert combustible materials that would otherwise be burned in open uncontrolled fires, which are commonplace across much of the Global South (Velis 2022).

Despite the size of the informal waste sector and its substantial activities, work to assess the impact that waste pickers have on greenhouse gas emissions mitigation has been scarce. The impact of waste pickers on greenhouse gas reduction has been studied specifically in only a handful of publications. Vergara et al. (2016) found that the activities of waste pickers in Bogota, Colombia, resulted in avoided burdens of approximately 6.5 million tonnes $CO_2$eq each year. Other research includes a study on a recycling cooperative in São Paulo, Brazil (King and Gutberlet 2013) and other topics related to the informal waste sector (Brazil: Instituto Atmos & Instituto Pragma 2023; Reis-Filho et al. 2025; Delhi, India: Chintan 2009; Brasilia, Brazil: Mesquita et al. 2023; and Buenos Aires, Argentina: Fundación Avina 2024).

In response to this research gap, WIEGO partnered in 2018 with consulting firm Green Partners (a member of the Resources Waste Advisory Group) and organizations now affiliated with the International Alliance of Waste Pickers (IAWP) to develop a greenhouse gas calculator to quantify

1 Carbon dioxide equivalent ($CO_2$eq) is a standard metric that expresses the combined climate-warming effect of different greenhouse gases as the amount of carbon dioxide ($CO_2$) that would produce the same radiative forcing over a specified time horizon (commonly 100 years). Each gas is converted to $CO_2$eq using its global warming potential (GWP), a factor published by the Intergovernmental Panel on Climate Change (IPCC).

2 We define waste pickers according to the International Alliance of Waste Pickers definition, see: https://globalrec.org/constitution/

the mitigation impacts of waste pickers. The Waste Pickers Greenhouse Gas Calculator was designed to be both user-friendly and accessible to waste picker organizations and was originally tested on 12 organizations in different contexts. The methodology that explains the underlying science (Green Partners Ltd. 2019) can be found on WIEGO's website alongside the Calculator, which is freely accessible. The Waste Pickers Greenhouse Gas Calculator is the first of its kind to be tailored to inclusive waste management. This means that it was developed to be straightforward and useful to waste picker groups, and at the same time to measure the impact of waste management practices found in low-barrier, inclusive systems. These systems include the manual transport and processing of materials, as well as waste collection services that are expanding in underserved communities where waste would otherwise be burned.

This brief documents key findings from the implementation of the methodology between 2019 and 2025 and draws on data collection to present estimates of the greenhouse gas mitigation impact of waste pickers at the global level. The data provide useful evidence to demonstrate the substantial contributions made by waste pickers to greenhouse gas mitigation. This can, in turn, lead to a more inclusive waste management system that integrates waste pickers in planning and operations. The findings of this report are also of use to parties to the forthcoming international legally binding instrument on plastic pollution (United Nations Environment Assembly of the United Nations Environment Programme 2022).

## 2. Method

### 2.1 How the Calculator works

The Waste Pickers Greenhouse Gas Calculator is an Excel tool used to estimate the greenhouse gas emissions avoided by waste picker activity. It has been under continuous development since its creation in 2019 to improve its functionality and widen its scope. The Calculator follows a generic method (Green Partners Ltd. 2019), which was adapted from the Intergovernmental Panel on Climate Change (IPCC ) method for calculating methane emissions from waste management activities (IPCC 2006). It is also loosely based on a model developed by GIZ (ifeu 2022). Five main components calculate the emissions avoided (simplified "avoided emissions categories" are shown in brackets):

1. Biodegradable waste is recovered by waste pickers that would otherwise generate methane in landfills and dumpsites (avoided anaerobic decomposition).
2. Engineered materials are recovered for recycling by waste pickers, reducing the need to produce virgin material (avoided material production).
3. Waste pickers use manual power to collect materials that would otherwise be transported using fossil-fuel-powered vehicles (avoided fossil-fuel-powered collection).
4. Waste pickers sort materials manually that would otherwise be sorted using fossil-fuel-powered systems (avoided mechanical sorting).
5. Waste is recovered by waste pickers that would otherwise be burned in open, uncontrolled fires (avoided open burning).



WIEGO Technical Brief No 18

For each component, the Calculator requests a range of data inputs from users related to the baseline conditions in the country or locale in which waste pickers are operating. It then compares this counterfactual with the case where the waste pickers operate and collect materials for recycling. The basic operational process flow is illustrated in **Figure 1**.

### 2.2 Adjustments to the Calculator

In conducting the analysis, we identified several areas within the Calculator that needed adjusting. These changes, noted in **Table 1**, were implemented and each of the 26 case studies considered in our analysis was updated accordingly.

### 2.3 Analysis of case study data

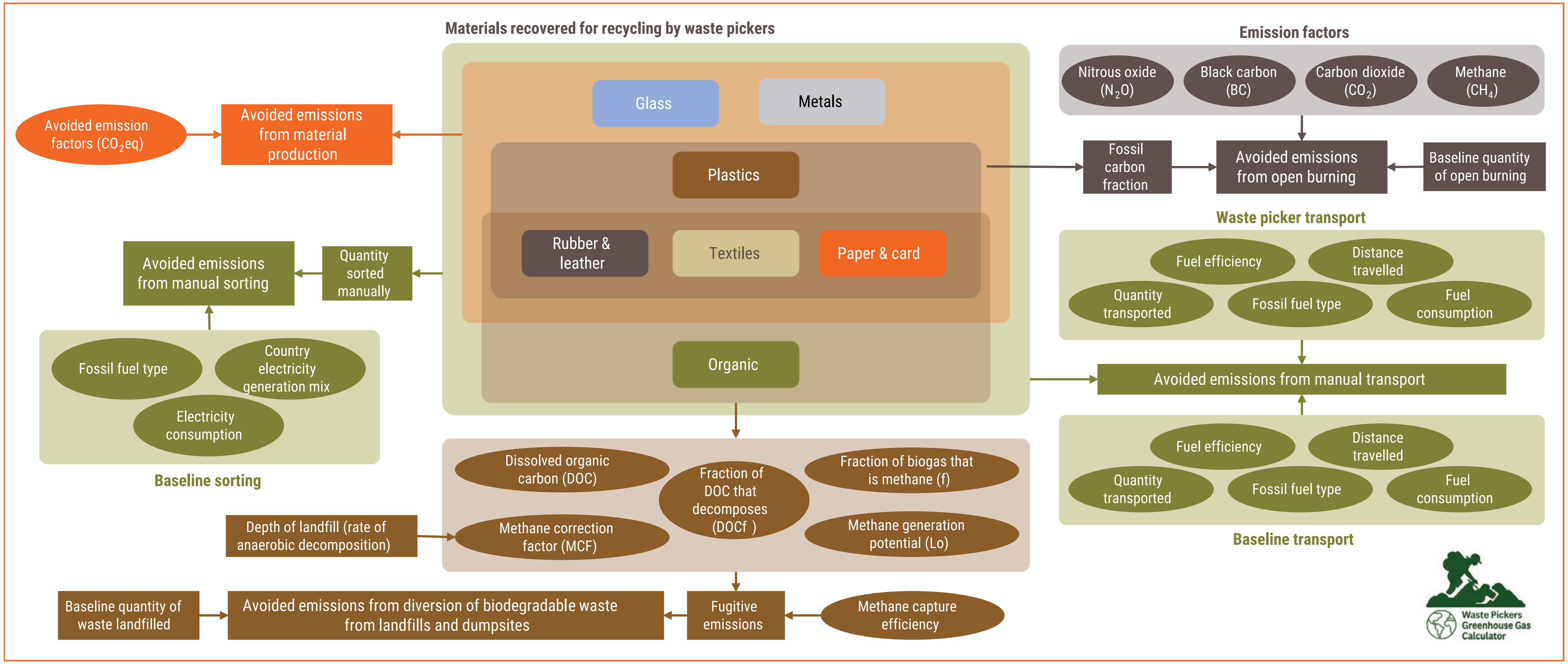
We assessed 26 case studies that calculated greenhouse gas emissions using the Waste Pickers Greenhouse Gas Calculator. Of these, six were excluded because aspects of the data, or associated metadata, could either not be verified or were not collected in a way that harmonized with the majority. The results of the remaining 20 case studies were consolidated for analysis. Metadata were obtained for each case as follows:

- Operational context: where materials were obtained (e.g. dumpsite, streets, households) and whether it was a sorting operation.
- Number of waste pickers who collected and/or processed the waste.
- Waste pickers' organizational status (organized/non-organized).

**Table 1: Summary of changes made to this version of the Waste Picker Greenhouse Gas Calculator**

| Topic | Issue | Shortcoming | Solution |
|---|---|---|---|
| Methane capture | The original version of the Calculator assumed that land disposal sites with methane capture systems emitted zero methane | This approach did not consider inevitable fugitive emissions, which are often between 30-60% (weight) of the methane generated (Duan et al., 2022) | New functionality was added to the Calculator, which enables users to select the type of landfill used and then grade the methane capture according to whether it is low, medium or high efficiency for methane capture |
| Landfill type | Managed semi-aerobic landfills were not included as a category | This means that one of the five landfill types specified by the IP CC was not included among the categories of landfills that could be selected | Added the category for managed semi-aerobic and associated emission factors |
| Textiles | Methane mitigation potential from the biogenic fraction of textile waste collected by waste pickers and thus prevented from decomposing in landfill was not calculated | This underestimated the mitigation efforts for waste pickers collecting textiles | Added functionality to include the impact of textile waste on methane mitigation in landfill using IPCC metric |
| Plastics | The emission factor for the "mixed plastics" category was much lower than for the "single polymer" categories | If the "mixed plastic" category was chosen by users, it resulted in approximately half the avoided emissions of single-polymer plastics. However, in reality, waste pickers almost always segregate mixed plastics into single polymers anyway. The "mixed plastic" category was being used by calculator users when they did not know the proportions of single polymers, rather than to describe activity where mixed plastic waste was the outcome of waste pickers' processing | The "mixed plastic" category was updated with a more recent emissions factor that is approximately double that which was previously used |

**Figure 1:** Waste Pickers Greenhouse Gas Calculator basic functionality and inputs




Waste picker productivity, defined here as the quantity of waste recovered for recycling by waste pickers, and the composition of waste collected for recycling, were expressed in tonnes per year per waste picker so that results could be compared on an equivalent basis. Likewise, the $CO_2eq$ mitigated by informal waste sector activity in each case study was expressed as a $CO_2eq$ per waste picker and also $CO_2eq$ per tonne of material "recovered for recycling". We reported greenhouse gas emissions mitigated according to three "avoided emissions" categories: (1) Avoided anaerobic decomposition; (2) Avoided material production; and (3) Avoided open burning. Emissions mitigated by transport and sorting were excluded because they were negligible in all cases.

## 2.4 Global estimate

We have attempted a tentative estimate of greenhouse gas emissions from waste pickers worldwide to demonstrate the magnitude of waste pickers' contribution to the fight against anthropogenic climate change. To do this, we created two models based on prevalence (number of waste pickers) and productivity (amount of waste recovered for recycling). We have been deliberately conservative with our assumptions because of the high level of uncertainty associated with this type of estimate.

### Prevalence-based model

The prevalence-based model uses the number of waste pickers in each income group and multiplies it by their potential to mitigate greenhouse gas emissions (tonnes of $CO_2eq$ avoided per waste picker). A full list of assumptions and calculation steps is shown in **Appendix B, Table 5**.

Our greenhouse gas emissions dataset consists mostly of data from organized waste pickers who use powered transport or who sort materials delivered to them. This type of operation has a high weight-based productivity rate and subsequently high rate of greenhouse gas emissions avoidance. We needed to model greenhouse gas emission mitigation for this high weight-based productivity group and also for waste pickers who do not use powered transport or organized sorting.

There are no aggregated global data on the proportion of waste pickers with high weight-based productivity as represented in our dataset but, based on sources that report how many waste pickers are organized, it is likely to be a small proportion overall. A few sources provide estimates on the number of waste pickers in organizations, for example: 5.5 per cent in Brazil (Bouvier and Dias 2021), 10 per cent in Colombia (Swiss Contact 2024 ), and 7 per cent in Delhi, India (Chintan 2024). These estimates indicate organization without necessarily representing all waste pickers using mechanical powered transport and organized sorting of concentrated materials. However, they provided us with a ballpark from which to make an assumption and we tentatively assumed that 15 per cent of waste pickers had a generally high weight-based productivity rate (broadly using powered transport or sorting concentrated materials) and 85 per cent had generally lower productivity (broadly using non-powered transport – bicycles or pedestrian transport).

We used the median greenhouse gas emissions avoided per waste picker (**Figure 3C**) to represent the high weight-based productivity waste pickers (15% of waste picker population) and the lower quartile greenhouse gas emissions avoided per waste picker to represent the lower weight-based productivity waste pickers (85 per cent of waste picker population).

We then used the 85:15 ratio to subdivide the global waste picker population and multiplied the respective populations by the lower quartile and median respectively. There was also some uncertainty about how many waste pickers are operating worldwide. Therefore, we used a lower estimate (circa 10 million full-time-equivalent waste pickers) provided by Cook et al. (2024b) and a higher estimate (circa 20 million full-time-equivalent waste pickers) from the International Labour Organization (ILO) (2013).

### Weight-based model

We based this estimate on the estimated global productivity of the informal waste sector reported by Cook et al. (2024b), which estimates approximately 100 million tonnes recovered for recycling by the informal waste sector each year (**Appendix B, Table 6**). To give us a range of estimates (uncertainty), we multiplied this weight to the upper and lower quartiles of the greenhouse gas emissions avoided by waste pickers per tonne of waste recovered for recycling (**Figure 3D**).

> **Productivity is related to transport, business model and access to materials**
>
> The most productive groups (mostly in Colombia and Chile) use larger, powered vehicles to collect materials, often vans or trucks that enable them to reach annual productivity rates of 25-55 tonnes per waste picker per year. They also have considerable access to materials and the markets that purchase them.
>
> Conversely, waste collectors who are members of SWaCH (Pune, India) use manually powered wheeled vehicles to collect materials. However, the distances are relatively short between their long-established collection points and, coupled with longer hours at work, they are able to collect approximately 7.4 tonnes per year.
>
> In the USA, waste pickers working in Portland, Oregon (Ground Score), primarily focus on collecting glass bottles, cans and plastic bottles to capitalize on return deposits as part of the deposit return system. The business model is unit-based rather than weight-based and collectors travel long distances (mean 13 miles per day in 2022); on foot, by bicycle, skateboard and wheelchair (Ground Score Association 2025). Only 15 per cent of waste pickers coming to Ground Score's depot reported using trucks or cars to collect materials. Furthermore, because the formal recycling system is already highly developed, waste pickers in Oregon have limited access to recyclables that can be commercialized in small quantities, and are thus primarily limited to cans and bottles. Their ability to access materials and small-scale commercialization points for cans and bottles, though, enables them to increase recycling rates in Oregon and prevent more greenhouse gas emissions than would have otherwise been possible.





## 3. Results

### 3.1 Productivity and materials collected

Waste pickers in the 20 case studies collected or sorted between 1 and 53 tonnes per worker per year (**Figure 2A**). Detailed operational data were not available, but the main differences in productivity are likely to be a result of the different business models used. Some organizations are highly mechanized and able to obtain large quantities of material in bulk, which are then sorted, whereas other organizations obtain smaller quantities of source-segregated materials on bicycles or on foot. There is also likely to be incongruity between the numbers of waste pickers reported to be working within different organizations. It is not clear whether these numbers relate to full-time-equivalent workers, how long they work each day or week, and whether they work all year round. These factors can have a huge impact on the reported productivity.

The median quantity of waste collected was 22 tonnes per waste picker per year (interquartile range 9-31) (**Figure 2B**). On the basis of a 260-day year, this is approximately 84 kg per waste picker per day (interquartile range 35-111), within range of sorting operation productivity reported elsewhere as 100 kg per waste picker per day (interquartile range 50-130), but much higher than for those working in other contexts and modalities (for example, on foot or bicycle) who collect in the range of 20-70 kg per day (Cook et al. 2024a).

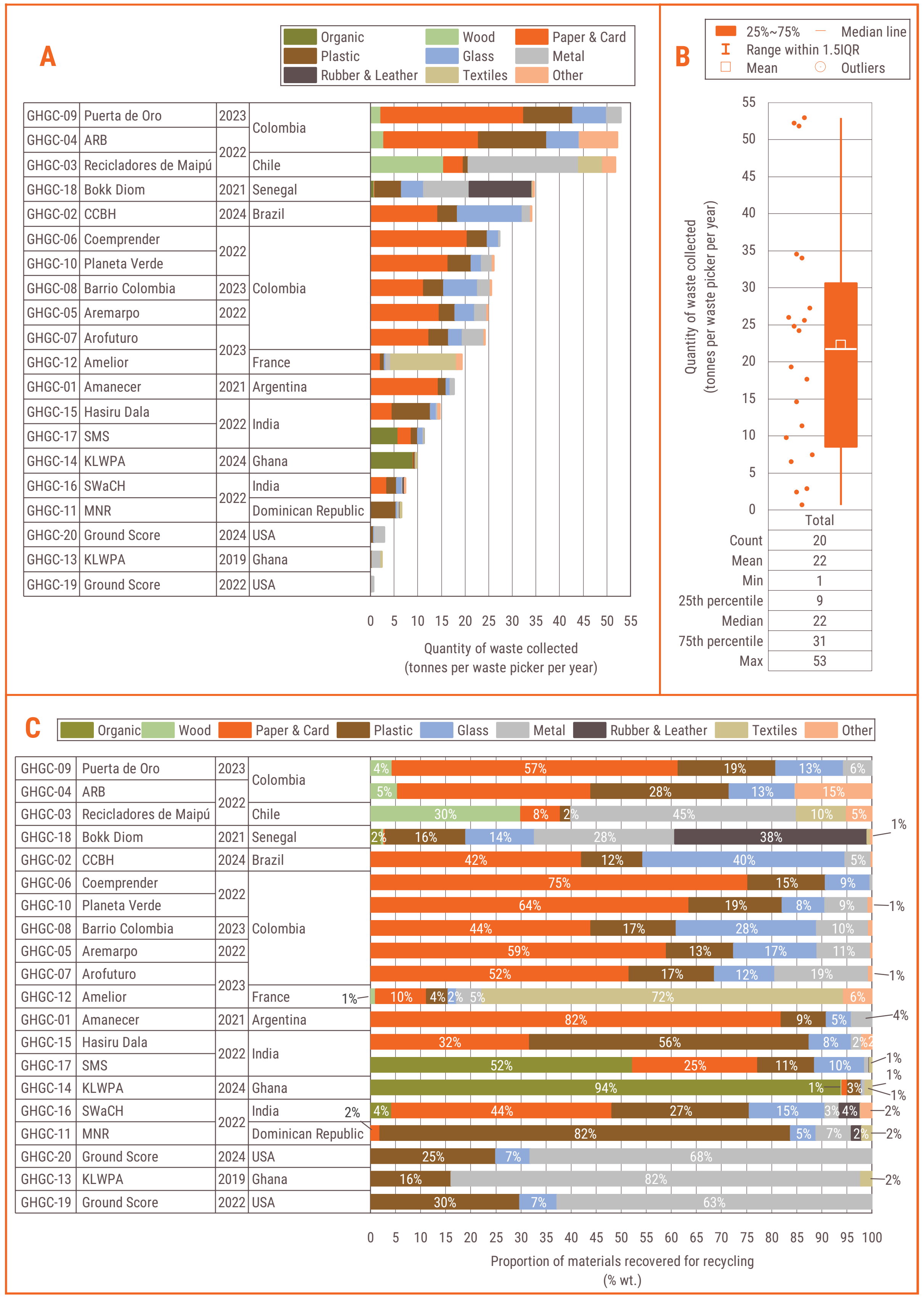
All waste picker groups collect metals and plastics, 17/20 collect paper and card, 17/20 collect plastics, and 18/20 collect glass (**Figure 2C**). Only three associations (Puerta de Oro and ARB in Colombia and Recicladores de Maipu in Chile) collect wood in substantial quantities. Rubber, leather and textiles are not commonly collected, except by Bokk Diom (Senegal), where rubber and leather make up 38 per cent (weight) of materials collected, and Amelior in France, where textiles account for 78 per cent (weight) of collections.

Collection and processing of organic waste is also rare, with just four groups engaged in the activity. Two of these, SMS (India) and KLWPA (Ghana) specialize in food waste collection, which makes up 52 per cent (weight) and 94 per cent (weight) of the materials basket.

### 3.2 Greenhouse gas emissions mitigation

In general, highly productive waste picker groups also mitigate the highest quantity of greenhouse gases from the system (**Figure 3A**). For example, the seven groups from Chile and Colombia that have the highest greenhouse gas emission mitigation per waste picker are in the top ten most productive. The recovery of biodegradable materials for recycling (avoided anaerobic decomposition) by waste pickers has a considerable impact on their greenhouse gas mitigation potential, making up over half of emissions mitigated in seven cases and at least a third in a further four cases. This is partly linked to the quantities of paper, cardboard, wood and food waste collected but also the type of land disposal site that operates in the area and whether it incorporates landfill gas capture systems. Though it may be counter-intuitive, a well-managed landfill without a system for capturing landfill gas will result in high methane emissions due to the largely anaerobic conditions. On the other

**Figure 2:** Materials recovered for recycling by waste pickers in 20 locations by: (**A**) Quantity and composition of materials; (**B**) Productivity; and (**C**) Proportion (% wt.) waste recovered for recycling (collected and/or sorted). Abbreviations and acronyms: CCBH=Cooperativas dos Catadores de Belo Horizonte; MNR; Movimiento Nacional de los Recicladores de República Dominicana; KLWPA=Kpone Landfill Waste Pickers Association; SWaCH=Solid Waste Collection and Handling (cooperative – Pune City); and SMS=Street Mukti Sanghatana (women's liberation organization)




hand, a poorly managed shallow site will emit less methane because the conditions are likely to be semi-aerobic.

Of the three "avoided emissions" categories, avoided open burning resulted in the highest avoided emissions per waste picker, with a median of approximately 30 tonnes of $CO_2$eq mitigated per waste picker per year (**Figure 3B**). Only four groups calculated avoided emissions from open burning due to the complexity of collecting data under this category, meaning that there is less certainty about mitigation potential under this category.

The median contribution to overall greenhouse gas emissions mitigated is highest for open burning, which has approximately 30 tonnes of $CO_2$eq mitigated per waste picker per year (**Figure 2B**). Though likely true for other waste picking groups as well, this data from the open burning category is limited because only four groups reported the metric, due to the complexity of collecting data under this category. The range of values obtained for both land disposal mitigation and engineered materials was large: 0-120 tonnes of $CO_2$eq mitigated per waste picker per year with medians of 16 tonnes of $CO_2$eq mitigated per waste picker per year and 214 tonnes of $CO_2$eq mitigated per waste picker per year respectively.

The combined median avoided emissions from anaerobic decomposition and material production was 44 tonnes of $CO_2$eq per waste picker per year (interquartile range: 15-82 tonnes of $CO_2$eq per waste picker per year) (**Figure 3C**). According to Crippa et al. (2023), global mean greenhouse gas emissions were 6.8 tonnes $CO_2$eq per person per year in 2022. This means that each waste picker mitigates the equivalent greenhouse gas emissions of 6.5 people every year through their activities (range 2-12 people).

The median greenhouse gas emissions mitigated by waste pickers per unit of productivity was 2.6 tonnes $CO_2$eq avoided per tonne of material recovered for recycling (**Figure 3D**).

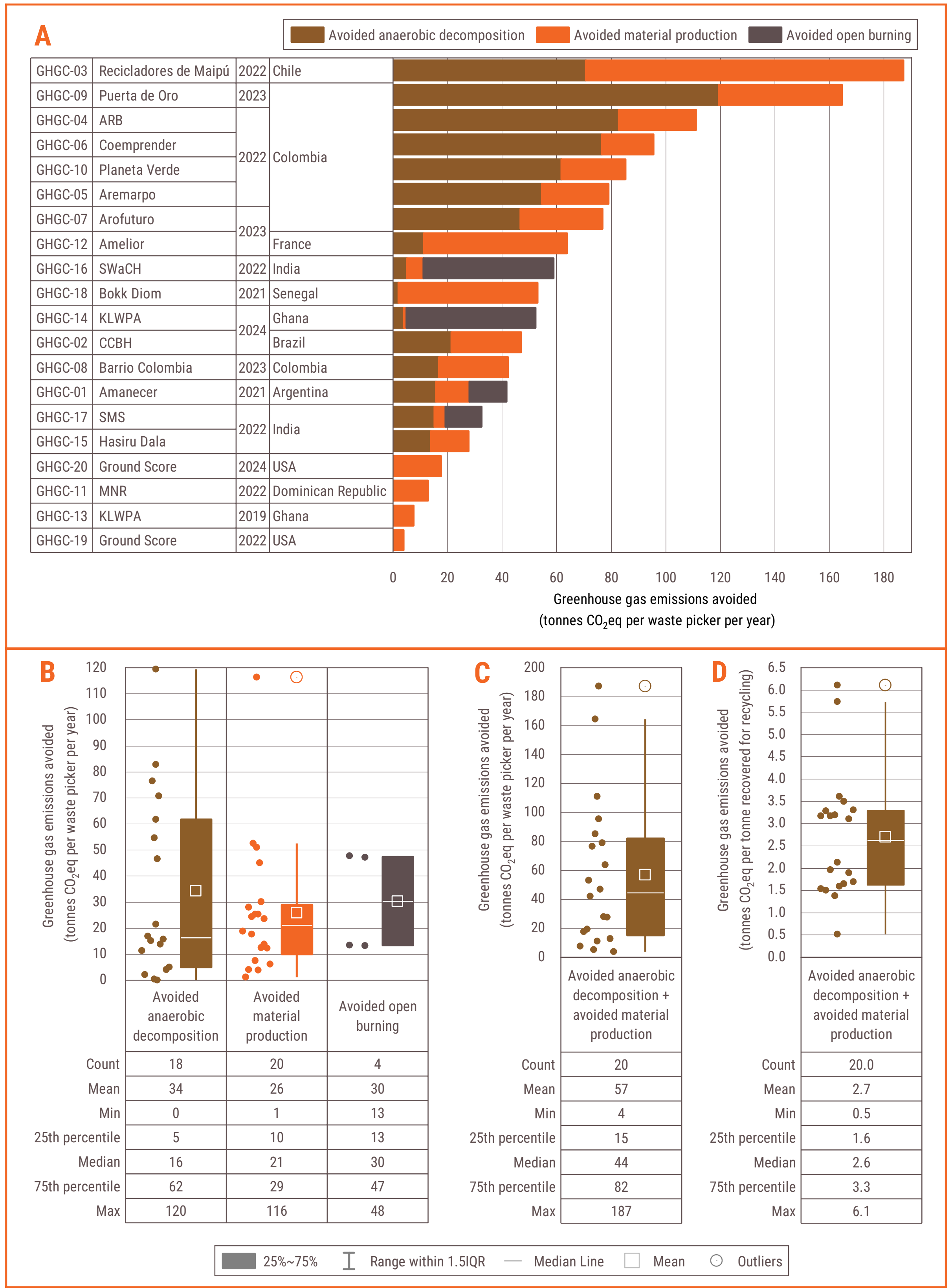
## 3.3 Global estimate

Both our weight-based and prevalence-based models resulted in a similar range of greenhouse gas emissions mitigated by waste pickers worldwide. Based on the lowest and highest results of the two models, we estimate that waste pickers mitigate between 170 million and 390 million tonnes of $CO_2$eq emissions each year from their activities (**Figure 4**). Our estimate is based on the avoided anaerobic decomposition and avoided material production only. We excluded avoided emissions from open burning because we had insufficient coverage in our case study samples. Consequently, our estimate should be regarded as conservative. Given the widespread occurrence of open waste burning in many low- and middle-income countries, it is likely that the true mitigation potential of waste pickers is substantially higher than our modelled range.

Taken in the context of global anthropogenic greenhouse gas emissions, the impact that waste pickers have on climate change mitigation is considerable. Based on the 59 billion anthropogenic $CO_2$eq tonnes per year estimated to be emitted worldwide in 2019 (IPCC 2022), the activities of waste pickers could contribute at least to mitigating 0.3 per cent of global emissions. When compared to the global emissions from the waste sector, these results are even more notable. Of the 2.3 billion tonnes $CO_2$eq tonnes per year estimated to be emitted from the waste sector (IPCC 2018), waste pickers could be responsible for mitigating between 7 per cent and 17 per cent of global emissions from the waste sector.

WIEGO Technical Brief No 18

**Figure 3:** Greenhouse gas emissions avoided by waste picker activity in 20 locations worldwide. (**A**) Emissions per waste picker per year for each case study; (**B**) Central tendency and spread of emissions avoided by waste pickers by "avoided emissions category"; (**C**) Central tendency and spread of emissions avoided by waste pickers from avoided material production and avoided anaerobic decomposition per waste picker; and (**D**) per tonne of material recovered for recycling. Abbreviations and acronyms: CCBH=Cooperativas dos Catadores de Belo Horizonte; MNR; Movimiento Nacional de los Recicladores de República Dominicana; KLWPA=Kpone Landfill Waste Pickers Association; SWaCH=Solid Waste Collection and Handling (cooperative – Pune City); and SMS=Street Mukti Sanghatana (women's liberation organization)




**B**

| | Avoided anaerobic decomposition | Avoided material production | Avoided open burning |
|---|---|---|---|
| Count | 18 | 20 | 4 |
| Mean | 34 | 26 | 30 |
| Min | 0 | 1 | 13 |
| 25th percentile | 5 | 10 | 13 |
| Median | 16 | 21 | 30 |
| 75th percentile | 62 | 29 | 47 |
| Max | 120 | 116 | 48 |

**C**

| | Avoided anaerobic decomposition + avoided material production |
|---|---|
| Count | 20 |
| Mean | 57 |
| Min | 4 |
| 25th percentile | 15 |
| Median | 44 |
| 75th percentile | 82 |
| Max | 187 |

**D**

| | Avoided anaerobic decomposition + avoided material production |
|---|---|
| Count | 20.0 |
| Mean | 2.7 |
| Min | 0.5 |
| 25th percentile | 1.6 |
| Median | 2.6 |
| 75th percentile | 3.3 |
| Max | 6.1 |





*In Accra, Ghana, waste pickers and researchers weigh materials to provide data for the Waste Picker Greenhouse Gas Calculator. Photo credit: Karim Saagbul*

Only four organizations were able to obtain sufficient data to calculate avoided emissions from open burning. Three of these were organizations that provided doorstep waste collection services in informal settlements. In both Mumbai and Pune, India, waste pickers work in semi-formalized cooperative organizations and have municipal contracts to provide waste collection services in informal settlements. In those contexts, the prevention of open burning represented 41 per cent and 81 per cent (weight) respectively, of avoided emissions.

In Accra, Ghana, waste pickers worked with WIEGO and New York University's Applied Global Public Health Initiative to use the calculator to estimate the amount of emissions they could avoid from the prevention of open burning. They used those results to advocate for contracts with the Kpone Municipal Assembly to provide waste collection services in the Kpone Coastal Community. This projection is not included in the comparative data analysis for this study, but it is worth reporting as an example of the ways that the tool can be used for proposal development. The group demonstrated that if they were contracted to provide services to the community's 18,000 residents (1,463 households), they could employ 330 waste pickers and reduce the following emissions per annum through the prevention of open burning (excluding emissions avoided through material production and anaerobic decomposition):

$CO_2$: 37,002 tonnes per year
$CH_4$: 7.34 tonnes per year
$N_2O$: 0.17 tonnes per year
Black Carbon: 0.73 tonnes per year

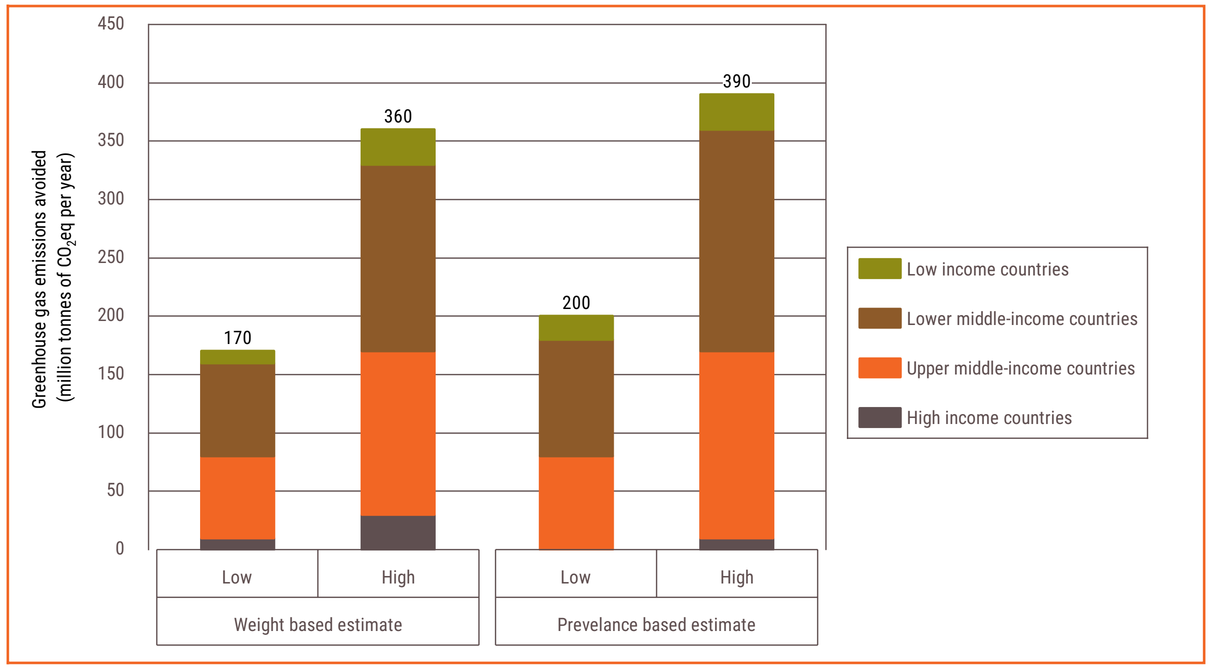
Though the Kpone waste pickers have not received funding to initiate waste collection services in the entire Kpone Coastal Community, they were awarded a grant to initiate collection in a portion of the community, providing work for 35 waste pickers, serving about 1,300 households, and mitigating 2,132 tonnes of $CO_2$eq per year, 76 per cent (weight) of which comes from the prevention of open burning. Compared to their greenhouse gas mitigation impact from 2019, when they were working on a dumpsite, their current work providing doorstep waste collection services in an underserved community is almost eight times more impactful.

Tonnes of $CO_2$eq mitigated per year per waste picker; two scenarios:
Picking informally on the Kpone landfill (2019): 7
Informal doorstep collection (2024): 52

## 4. Discussion

The informal waste sector continues to be a major driver of the circular economy across the world. It is undoubtedly the main supplier of secondary materials to the resource recovery system in the Global South (Lau et al. 2020). The sector's activities have also supplemented formal waste collection services for decades, in most cases with no recognition for this (Velis et al. 2012). In fact, waste pickers have carried out this function at great cost to their personal safety and psychosocial well-being. They have suffered social ostracization and, in some cases, persecution (Morais et al. 2022).

**Figure 4:** Estimated greenhouse gas emissions mitigated by waste pickers worldwide. Two models were explored which use weight- or prevalence-based assumptions to extrapolate to global level. See Method (Section 2.4) and Appendix B, Tables 5 and 6 for detailed steps used to calculate estimates.




There has, however, been progress with a recent focus on the impact that waste pickers have on mitigating plastic pollution (IAWP 2023; Cook et al. 2024a; O'Hare and Nøklebye 2024). This has led to their recognition and inclusion in the draft of an international legally binding instrument on plastic pollution (UN Environment Assembly of the UN Environment Programme 2022).

The Waste Pickers Greenhouse Gas Calculator has enabled quantification of yet another benefit to society from the activities of the informal waste sector: namely its substantial impact on the mitigation of greenhouse gas emissions. Our review has compared and analyzed data collected over the last five years, finding large variation in productivity and greenhouse gas emissions mitigated among 20 case studies in a variety of contexts worldwide. Although there is still some uncertainty in the data collected, it is clear from our review here that the sector has been insufficiently recognized for its contribution to anthropogenic climate change mitigation.

## 4.1 Comparison with other work

We compared the results of the 20 case studies with seven other studies that also estimated greenhouse gas emissions mitigated by waste pickers (**Table 2**). Our results fell within a range of 4-187 tonnes of $CO_2$eq mitigated per waste picker per year, while other studies reported between 6 and 90 tonnes of $CO_2$eq mitigated per waste picker per year. One exception is the study by Vergara et al. (2016), which found nearly 340 tonnes of $CO_2$eq mitigated per waste picker per year, which is an outlier in the review. All studies had a similar scope and took a broadly similar approach to assessing the scale of emissions mitigation.

As with the studies assessed in the present review, other published studies also lack specific information about how productivity, and hence emissions mitigation, is linked to the hours worked. This is likely to result in variation between results when reported on a per-waste-picker basis. We have made a recommendation in Section 6 that a





harmonized metric be used in future iterations of the tool.

## 4.2 Open burning

Users of the tool reported challenges with assessing the magnitude of open burning in the contexts that the groups assessed were operating in. This meant that the impact of waste picker activities on the mitigation of greenhouse gas emissions from open burning was only quantified in four of the 20 case studies. We believe that this has resulted in the underestimation of the impact of waste picker activity.

## 4.3 Textiles

The production of textiles results in considerable emission of greenhouse gases, with approximately 20 tonnes of $CO_2$eq emitted per tonne of material produced (Zero Waste Scotland 2022). This means that any activity carried out that displaces primary production will have a substantial impact on climate change mitigation. The evidence suggests that recycling or reusing a tonne of textiles will displace 3.4 tonnes of $CO_2$eq (Turner et al. 2015).

Textiles are not usually the main material of focus for many waste pickers, though evidence suggests that they are collected in multiple locations worldwide (Cook et al. 2024a). In this review of the Waste Pickers Greenhouse Gas Calculator, eight groups collected textiles but mostly in small quantities, with the exception of Amelior in France, where textiles made up the majority of the material basket.

It is not clear why textiles are not the main focus of waste picker activity. It is possible that clothing is not discarded at the same rates in the Global South as in many high-income countries, which could explain why textiles are targeted by Amelior in France. We speculate that in some contexts there may be limited market access for secondary textiles, especially in countries that import textile waste from the Global North, for example, Ghana.

Nonetheless, the Calculator demonstrates the substantial impact that the collection of textile waste for recycling and reuse can have on the climate change mitigation potential of waste pickers.

## 4.4 The global estimate

As far as we are aware, this is the first time that anyone has attempted to assess the impact of waste picker activities on greenhouse gas mitigation at a global level. We have already noted that, while we have made a pragmatic estimate of global emissions mitigated, our estimate is both conservative and highly speculative, with the variable conditions under which waste pickers operate worldwide. Also, greenhouse gas emission mitigation calculations are influenced by factors including:

- Technological advancement of the sorting and reprocessing system.
- Proximity to manufacturing of products using secondary materials.
- Quality and type of land disposal activities.
- Prevalence of the informal waste sector and its productivity – partially determined by the socioeconomic conditions, by the market for secondary materials, as well as the degree of access that waste pickers have to both materials and their commercialization.

To improve the accuracy of a global estimate, we make several recommendations that could improve the generalizability of data collected and processed using the Waste Pickers Greenhouse Gas Calculator.

WIEGO Technical Brief No 18

**Table 2: Summary of greenhouse gas emissions mitigated by waste pickers calculated in other studies**

| Source | Country | City | Organization (if relevant) | Year of functional unit | Categories in scope | Material throughput (tonnes per year) | Materials recovered (tonnes per year) | GHG emissions avoided (tonnes of $CO_2$eq per year) | Number of waste pickers | GHG emissions avoided (tonnes of $CO_2$eq per waste picker per year) | GHG emissions avoided (tonnes of $CO_2$eq per tonne recovered) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Chintan (2009) | India | Delhi | - | 2009 | Materials [b] | 397,120 | 352,712 | 962,133 | 160,000[a] | 6 | 2.7 |
| King and Gutberlet (2013) | Brazil | Ribeirão Pires, São Paulo | Cooperpires | 2010 | Materials, disposal | 3,503 | 2,733 | 1,443 to 2,720 | 30 | 48-91 | 0.1-0.5 |
| Vergara et al. (2016) | Colombia | Bogota | - | 2010 | Materials, disposal, transport, composting | | 438,000 | 7,800,000 | 23,000[c] | 339 | 17.8 |
| | | | Coopere | | | | 1,238 | 1,267 | 65 | 20 | 1.0 |
| | | | Plasferro | | | | 1,309 | 1,064 | 100 | 11 | 0.8 |
| Mesquita et al. (2023) | Brazil | Brasília | Recicle a Vida | 2019 | Materials, disposal | | 327 | 305 | 85 | 4 | 0.9 |
| Instituto Atmos & Instituto Pragma (2023) | Brazil | National (organized) | 2,941 organizations | 2023 | Materials, disposal | | 1,770,000 | 876,318 | 86,878 | 10 | 0.5 |
| Reis-Filho et al. (2025) | Brazil | National (organized) | 2,707 organizations | 2022 | Materials, disposal | 2,339,173 | 1,717,603 | 1,084,749 | 94,966 | 11 | 0.6 |

a=original report did not state how many waste pickers mitigated the emissions. But the same author reported 160,000 elsewhere (Chintan n.d.).
b=Avoided disposal not accounted for
c=20,000 collectors and 3,000 sorters.

## 5. Conclusion

The Waste Pickers Greenhouse Gas Calculator has proved to be a useful tool for assessing the greenhouse gas emissions mitigated by waste picker activity and has been successfully implemented in more than 26 case studies worldwide (20 included here). In this study, we have improved its functionality to increase the accuracy of its predictions for greenhouse gas emissions mitigated through avoided disposal and material substitution. We have compared its findings when applied to different contexts worldwide and made a tentative and conservative estimate of the quantity of greenhouse gas emissions mitigated by waste pickers worldwide.

As circular economy policies around the world integrate more stringent requirements for traceability and data transparency, the ability to demonstrate data management capacity, and measure impact – productivity and greenhouse gas emissions avoided – is becoming increasingly important for staying relevant in the world of recycling and reuse. The growing formalization and modernization of materials management systems across the globe makes it increasingly important for waste pickers, whose livelihoods are precarious, to be able to demonstrate their impact. User-friendly, open-source methodologies like the Calculator described in this report are essential for waste pickers and other groups who face barriers to accessing data processing tools. Tools like this are also subject to change as energy production and recycling methods shift, and as countries transition, which requires investment in their development and updating so that they can be accessed and used by those who most need to advocate for their place in the economy.



## 6. Recommendations

The Waste Pickers Greenhouse Gas Calculator provides robust evidence that quantifies waste pickers' impact on climate change mitigation.

Data reported by the tool could be used by grass-roots groups such as waste picker organizations to attract contracts and infrastructure investments. As noted in the case of the Kpone Landfill Waste Pickers Association (Ghana), waste picker organizations need sustainable financing and infrastructure to maximize and sustain their greenhouse gas mitigation.

More robust data are required for further understanding of the global impact of waste pickers on greenhouse gas emission mitigation. We therefore propose to strengthen statistics on the number of waste pickers worldwide and at regional levels and their impact. The calculation of avoided greenhouse gas by waste pickers should also be expanded with a range of different scenarios and locations. With improved data in hand, waste pickers will be able to advocate more effectively for access to climate finance.

Given the substantial impact waste pickers have on greenhouse gas emission mitigation, we propose that – through extended producer responsibility and other finance mechanisms – policymakers and local governments allocate funds to pay waste pickers to provide collection and recycling services in underserved communities, especially those that would otherwise burn waste.

Waste pickers support formal systems by reducing the burden on waste collection services, even in contexts where recycling and waste collection systems are well developed. By establishing recycling systems that allow waste pickers access to materials and markets, cities can reduce their greenhouse gas emissions.

## Lessons learned from using the Waste Picker Greenhouse Gas Calculator: Experiences of International Alliance of Waste Pickers (IAWP) affiliates

Waste picker groups who had used the Calculator were contacted to discuss its benefits and usability. Several groups, including Hasiru Dala (India) and Amelior (France) had published reports about their results, which they used for advocacy. Many, especially Bokk Diom (Dakar, Senegal), Kpone Landfill Waste Pickers Association (Accra, Ghana), and Ground Score Association (Portland, Oregon, USA), frequently use their results for advocacy, with Ground Score updating its results each year. In Belo Horizonte, Brazil, WIEGO and IAWP worked with waste picker cooperatives and government at municipal and ministerial levels to apply the methodology. The results then framed debates at the local multi-stakeholders forum (The Waste & Citizenship Forum) where cooperatives and the municipality negotiated the renewal of contracts for providing the service of collecting recyclables. A resource in Portuguese on this case can be found on WIEGO's website.

Waste picker groups reported using the calculator results for the following purposes:

- Initiating alliances with academic institutions to open new markets and develop alternative livelihoods.
- Publishing reports to highlight the impact of their work.
- Publishing results to improve their sustainability image and branding.
- Publishing results as part of funding proposals.
- Negotiating for new or better contracts.
- Strengthening experience in building their own data collection capacity.

While it cannot be said for certain that contracts or opportunities have been obtained as a result of use of the Waste Pickers Greenhouse Gas Calculator results, several organizations believe that their use of the results contributed to their securing of contracts and opportunities because the publication of results improved their professionalism and ability to demonstrate impact.

None of the waste picker groups featured in this study have accessed climate-change-specific financing as a result of using and publishing their results from the Calculator. Even when able to measure impact, grass-roots groups have historically struggled to access climate financing, especially carbon markets. Challenges include high costs of registering and verifying carbon offset projects, as well as the onerous challenge of demonstrating additionality (that the greenhouse gas emissions reductions would not have occurred without the project). Though new funding mechanisms are beginning to emerge (Gower and Tanner 2025), such opportunities are rarely linked to a group's ability to measure the quantity of greenhouse gas emissions mitigated.

Textiles are collected in several contexts worldwide, but evidence here and elsewhere suggests that they are not a major focus of collection activity for the informal waste sector. Given the large impact textile collection by waste pickers could have on climate change mitigation, we propose further research to identify current barriers as well as opportunities that could be pursued to improve market access and increase the rate of recovery.





## Development of the Waste Pickers Greenhouse Gas Calculator

The Waste Pickers Greenhouse Gas Calculator could increase its functionality and reporting capability with the following improvements:

- The contribution of each material to the greenhouse gas mitigation profile is not reported in detail by the Waste Pickers Greenhouse Gas Calculator. This functionality would be a useful addition because it would enable waste pickers to focus on specific material if they aspire to optimize their processes for climate change mitigation.
- While the Calculator provides robust estimates of the impact of recycling on climate change mitigation, it does not differentiate between reuse and recycling. This is important because waste pickers often recover and prepare glass bottles, textiles, electronics and other materials for reuse. In general, preparation for reuse is likely to have a much higher impact on climate change mitigation compared to recycling, because it does not require the resource-intensive reprocessing associated with the recycling of most engineered materials.
- To improve comparability between studies and enable the data to be used for generalization in modelling, we propose that several additional meta-data categories be collected:
  - The number of participants in activities should be expressed in "full-time- equivalent workers" – we suggest that the gathering of these data is enabled with a series of questions to ensure a harmonized approach. Ideally, these data should be recorded directly into the Calculator, alongside a feature to calculate the per capita emissions avoided.
  - The participants' activities to collect and recover waste should be quantified more accurately according to the amount of waste collected by each type of transport and sorted or otherwise processed. This would enable data to be compared between studies and produce a more accurate assessment of the types of operation that are most effective at increasing productivity and mitigating greenhouse gas emissions.
- Given the low mitigation potential revealed by the results from the sorting and transportation components of the Calculator, we recommend removing those sections to simplify the tool and make it more user-friendly for waste picker organizations.
- We believe that the Calculator has underestimated emissions from open burning in all contexts, but particularly in 15 contexts. To mitigate this, we propose adding a function in the tool to enable the use of proxies to estimate in countries where specific data on open burning activity are not available.

## References

Bogner, Jean, Riitta Pipatti, Seiji Hashimoto, Cristobal Diaz, Katarina Mareckova, Luis Diaz, Peter Kjeldsen, Suvi Monni, Andre Faaij, Qingxian Gao, Tianzhu Zhang, Mohammed Abdelrafie Ahmed, R T M Sutamihardja and Robert Gregory. 2008. Mitigation of global greenhouse gas emissions from waste: conclusions and strategies from the Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report. Working Group III (Mitigation). Waste Management and Research 26(1), 11-32.

Bouvier, Mathilde and Sonia Dias. 2021. Waste Pickers in Brazil: A Statistical Profile. WIEGO Statistical Brief No 29. WIEGO. https://www.wiego.org/research-library-publications/waste-pickers-brazil-statistical-profile/

Chen, Martha Alter. n.d. Waste Pickers Help Reduce Methane Emissions: The Case of Landfills in Delhi, India. 1800 Histories – Waste Pickers of India. https://histecon.fas.harvard.edu/1800_histories/sites/delhi.html

Chintan. 2009. Cooling Agents: An Examination of the Role of the Informal Recycling Sector in Mitigating Climate Change. New Delhi, India. https://www.archive.chintan-india.org/documents/research_and_reports/chintan_report_cooling_agents.pdf

Chintan. n.d. Chintan Fact Sheet: Who Recycles Your Waste? https://www.chintan-india.org/wp-content/uploads/2023/06/chintan_who_recycles_your_waste_fact_sheet-3.pdf

Chintan. 2024. *A Methodology to Assess the Living Income of Waste Pickers.* Chintan Environmental Research and Action Group. https://faircircularity.org/app/uploads/2025/07/New-Delhi-Download-PDF.pdf#:~:text=5,that%20their%20main%20source%20of

Cook, Ed., Nathalia Silva de Souza Lima Cano and Costas A. Velis. 2024a. Informal recycling sector contribution to plastic pollution mitigation: A systematic scoping review and quantitative analysis of prevalence and productivity. Resources, Conservation and Recycling, 206.

Cook, Ed., Costas Velis, Maria Tsakona and Ieva Ručevska. 2024b. Increasing the visibility of the informal waste sector as part of a pathway towards a Just Transition, GRID-Arendal, Norway. https://www.grida.no/publications/1760

Crippa, M., D. Guizzardi, F. Pagani, M. Banja, M. Muntean, E. Schaaf, W. Becker, F. Monforti-Ferrario, R. Quadrelli, A. Risquez Martin, P. Taghavi-Moharamli, J. Köykkä, G. Grassi, S. Rossi, J. Brandao De Melo, D. Oom, A. Branco, J. San-Miguel, and E. Vignati. 2023. GHG emissions of all world countries – 2023: Publications Office of the European Union. https://data.europa.eu/doi/10.2760/953322

Duan, Zhenhan, Peter Kjeldsen and Charlotte Scheutz. 2022. Efficiency of gas collection systems at Danish landfills and implications for regulations. Waste Management, 139, 269-278.

Fundación Avina. 2024. Huella de carbono de centros de reciclaje de la Ciudad Autónoma de Buenos Aires, Argentina. https://latitudr.org/wp-content/uploads/2024/08/Huella-de-Carbono-de-Centros-de-Reciclaje-de-la-Ciudad-Autonoma-de-Buenos-Aires-Argentina.pdf



WIEGO Technical Brief No 18

Gower, Richard and Lucy Tanner. 2025. The plastics treaty finance mechanism: Lessons from other Multilateral Environmental Agreements regarding Access for Waste Pickers and Other Grassroots Groups. Tearfund and IAWP. https://globalrec.org/wp-content/uploads/2025/06/2025-tearfund-the-plastics-treaty-finance-mechanism-en.pdf

Green Partners Ltd., 2019. Reducing Greenhouse Gas Emissions through Inclusive Recycling. WIEGO, Global Alliance of Waste Picklers, Resources Waste Advisory Group (RWA), Green Partners Environmental Consulting.

Ground Score Association. 2025. The People's Depot: 2025 Canner Survey Results, Ground Score Association, Portland, Oregon.

Gutberlet, Jutta. 2023. Global plastic pollution and informal waste pickers. Cambridge Prisms: Plastics 1, e9.

Hertwich, Edgar G. 2021. Increased carbon footprint of materials production driven by rise in investments. Nature Geoscience 14(3), 151-155.

ifeu. 2022. Manual: SWM-GHG Calculator (2023) – Life Cycle Assessment approach – Tool for Calculating Greenhouse Gases in Solid Waste Management, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), Eschborn, Germany. https://www.giz.de/de/downloads/giz2023-en-swm-ghg-calculator-manual.pdf

International Labour Office. 2013. Sustainable development, decent work and green jobs: Report V. International Labour Conference, 102nd Session, 2013. International Labour Office. https://www.ilo.org/resource/conference-paper/ilc/102/sustainable-development-decent-work-and-green-jobs-0

Instituto Atmos & Instituto Pragma. 2023. Anuário da Reciclagem 2023, Atmos, I., São Paulo, Brasil. https://institutoatmos.org/wp-content/uploads/2024/08/Anuario-da-Reciclagem-2023.pdf

IPCC. 2006. 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Volume 5: Waste, Intergovernmental Panel on Climate Change (IPCC) https://www.ipcc-nggip.iges.or.jp/public/2006gl/vol5.html

IPCC. 2018. Annex I: Glossary [Matthews, J.B.R. ]. In: Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor and T. Waterfield (eds.)], Press, C.U., New York, USA. https://doi.org/10.1017/9781009157940.008

IPCC. 2022. Climate Change 2022: Mitigation of Climate Change. Working Group III Contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Summary for Policymakers. https://www.ipcc.ch/report/ar6/wg3/downloads/report/IPCC_AR6_WGIII_SPM.pdf

International Alliance of Waste Pickers. 2023. IAWP's Vision for a Just Transition for Waste Pickers under the UN Plastics Treaty. https://globalrec.org/wp-content/uploads/2023/11/english_position-paper_IAWP-vision-just-transition_resolution150ppi.pdf

King, Megan F. and Jutta Gutberlet. 2013. Contribution of cooperative sector recycling to greenhouse gas emissions reduction: A case study of Ribeirão Pires, Brazil. Waste Management 33(12), 2771-2780. https://www.wiego.org/wp-content/uploads/2019/09/King-Gutberlet-2013.pdf

Lau, W.W.Y., Shiran, Y., Bailey, R.M., Cook, E., Stuchtey, M.R., Koskella, J., Velis, C.A., Godfrey, L., Boucher, J., Murphy, M.B., Thompson, R.C., Jankowska, E., Castillo, A.C., Pilditch, T.D., Dixon, B., Koerselman, L., Kosior, E., Favoino, E., Gutberlet, J., Baulch, S., Atreya, M.E., Fischer, D., He, K.K., Petit, M., Sumaila, U.R., Neil, E., Ochocki, M., Lawrence, K. and Palardy, J.E. 2020. Evaluating scenarios toward zero plastic pollution. Science 369 (6509): 1455–1461. https://doi.org/10.1126/science.aba9475

Mesquita, J.L., Gutberlet, J., de Araujo, K.P., Cruvinel, V.R. and Duarte, F.H. 2023. Greenhouse Gas Emission Reduction Based on Social Recycling: A Case Study with Waste Picker Cooperatives in Brasília, Brazil. Sustainability, 15(12), 9185. https://doi.org/10.3390/su15129185

Minx, Jan C., William F. Lamb, Robbie M. Andrew, Josep G. Canadell, Monica Crippa, Niklas Döbbeling, Piers M. Forster, Diego Guizzardi, Jos Olivier, Glen P. Peters, Julia Pongratz, Andy Reisinger, Matthew Rigby, Marielle Saunois, Steven J. Smith, Efisio Solazzo, and Hanqin Tian. 2021. A comprehensive and synthetic dataset for global, regional, and national greenhouse gas emissions by sector 1970–2018 with an extension to 2019. Earth System Science Data 13(11), 5213-5252.

Morais, Jandira, Glen Corder, Artem Golev, Lynda Lawson and Saleem Ali. 2022. Global review of human waste-picking and its contribution to poverty alleviation and a circular economy. Environmental Reseach Letters 17(6).

O'Hare, Patrick and Emmy Nøklebye. 2024. "The human face of the UN plastics treaty"? The role of waste pickers in intergovernmental negotiations to end plastic pollution and ensure a just transition. Cambridge Prisms: Plastics 2 (e12).

Oo, P.Z., Prapaspongsa, T., Strezov, V., Huda, N., Oshita, K., Takaoka, M., Ren, J., Halog, A. and Gheewala, S.H. 2024. The role of global waste management and circular economy towards carbon neutrality. Sustainable Production and Consumption 52, 498-510.

Reis-Filho, José, Jutta Gutberlet, and Tommaso Giarrizzo. 2025. Invisible Green Guardians: A long-term study on informal waste pickers' contributions to recycling and the mitigation of greenhouse gas emissions. Cleaner Waste Systems 10, 100217.

Swiss Contact. 2024. "Circular economy is fostering positive change for recycling organisations and their workers." https://www.swisscontact.org/en/news/circular-economy-is-fostering-positive-change-for-recycling-organisations-and-their-workers?

Turner, D.A., I.D. Williams and S. Kemp. 2015. Greenhouse gas emission factors for recycling of source-segregated waste materials. Resources, Conservation and Recycling 105: 186-197.

United Nations Environment Assembly of the United Nations Environment Programme. 2022. Resolution 5/14 - End plastic pollution: towards an international legally binding instrument, Nairobi.





Velis, Costas. 2022. Plastic pollution global treaty to cover waste pickers and open burning? Waste Management and Research 40(1), 1-2.

Velis, Costas, David C. Wilson, Ondina Rocca, Stephen R. Smith, Antonis Mavropoulos and C.R. Cheeseman. 2012. An analytical framework and tool ('InteRa') for integrating the informal recycling sector in waste and resource management systems in developing countries. Waste Management and Research 30(9 Suppl), 43-66.

Vergara, Sintana E., Anders Damgaard and Daniel Gomez. 2016. The Efficiency of Informality: Quantifying Greenhouse Gas Reductions from Informal Recycling in Bogotá, Colombia. Journal of Industrial Ecology 20(1), 107-119.

Wilson, David C., Costas Velis and C.R. Cheeseman. 2006. Role of Informal Sector Recycling in Waste Management in Developing Countries. Habitat International 30(4), 797-808.

Zero Waste Scotland. 2022. "Carbon Metric Factors 2011-2020." Stirling, Scotland. https://www.zerowastescotland.org.uk/our-work/carbon-metric-publications

WIEGO Technical Brief No 18

# Appendix A: Raw Data

**Table 3: Composition and quantity of materials collected by waste pickers in 20 cases worldwide**

| Study # | Year | Country | ISO3 | City | Organization | Organic | Wood | Paper & Card | Plastic | Glass | Metal | Rubber & leather | Textiles | Other | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GHGC-01 | 2021 | Argentina | ARG | Buenos Aires | Amanecer | 0.00 | 0.00 | 14.47 | 1.59 | 0.88 | 0.71 | 0.00 | 0.00 | 0.00 | 17.64 |
| GHGC-02 | 2024 | Brazil | BRA | Bello Horizonte | CCBH | 0.00 | 0.00 | 14.33 | 4.18 | 13.69 | 1.77 | 0.00 | 0.00 | 0.03 | 34.00 |
| GHGC-03 | 2022 | Chile | CHL | Maipú | Recicladores de Maipú | 0.00 | 15.55 | 4.15 | 1.04 | 0.00 | 23.32 | 0.00 | 5.18 | 2.59 | 51.83 |
| GHGC-04 | 2022 | Colombia | COL | Bogotá | ARB | 0.00 | 2.86 | 20.12 | 14.43 | 6.84 | 0.01 | 0.00 | 0.00 | 7.94 | 52.20 |
| GHGC-05 | 2022 | Colombia | COL | Popayán | Aremarpo | 0.00 | 0.00 | 14.63 | 3.33 | 4.12 | 2.63 | 0.00 | 0.00 | 0.05 | 24.76 |
| GHGC-06 | 2022 | Colombia | COL | Pasto | Coemprender | 0.00 | 0.00 | 20.53 | 4.22 | 2.42 | 0.08 | 0.00 | 0.00 | 0.00 | 27.25 |
| GHGC-07 | 2023 | Colombia | COL | La Ceja | Arofuturo | 0.00 | 0.00 | 12.50 | 4.11 | 2.92 | 4.50 | 0.00 | 0.00 | 0.15 | 24.17 |
| GHGC-08 | 2023 | Colombia | COL | Medellín | Barrio Colombia | 0.00 | 0.01 | 11.25 | 4.35 | 7.16 | 2.64 | 0.00 | 0.00 | 0.15 | 25.56 |
| GHGC-09 | 2023 | Colombia | COL | Bogotá | Puerta de Oro | 0.00 | 2.31 | 30.22 | 10.32 | 7.13 | 2.96 | 0.00 | 0.00 | 0.00 | 52.94 |
| GHGC-10 | 2022 | Colombia | COL | Rionegro | Planeta Verde | 0.00 | 0.00 | 16.54 | 4.84 | 2.20 | 2.23 | 0.00 | 0.00 | 0.19 | 26.00 |
| GHGC-11 | 2022 | Dominican Republic | DOM | Santo Domingo | MNR[a] | 0.00 | 0.00 | 0.13 | 5.33 | 0.33 | 0.46 | 0.13 | 0.13 | 0.00 | 6.50 |
| GHGC-12 | 2023 | France | FRA | Montreuil | Amelior | 0.00 | 0.21 | 1.96 | 0.84 | 0.31 | 0.99 | 0.00 | 13.91 | 1.07 | 19.28 |
| GHGC-13 | 2019 | Ghana | GHA | Accra | KLWPA | 0.00 | 0.00 | 0.00 | 0.38 | 0.00 | 1.92 | 0.00 | 0.05 | 0.00 | 2.36 |
| GHGC-14 | 2024 | Ghana | GHA | Accra | KLWPA | 9.14 | 0.02 | 0.10 | 0.27 | 0.02 | 0.06 | 0.00 | 0.12 | 0.00 | 9.72 |
| GHGC-15 | 2022 | India | IND | Bengaluru - Jayanagar | Hasiru Dala | 0.00 | 0.00 | 4.64 | 8.15 | 1.23 | 0.29 | 0.00 | 0.00 | 0.29 | 14.60 |
| GHGC-16 | 2022 | India | IND | Pune | SWaCH | 0.32 | 0.00 | 3.25 | 2.03 | 1.11 | 0.21 | 0.31 | 0.01 | 0.16 | 7.40 |
| GHGC-17 | 2022 | India | IND | Mumbai | SMS | 5.93 | 0.00 | 2.83 | 1.28 | 1.14 | 0.09 | 0.02 | 0.04 | 0.00 | 11.34 |
| GHGC-18 | 2021 | Senegal | SEN | Dakar | Bokk Diom | 0.79 | 0.17 | 0.10 | 5.53 | 4.74 | 9.67 | 13.23 | 0.24 | 0.07 | 34.55 |
| GHGC-19 | 2022 | USA | USA | Portland, Oregon | Ground Score | 0.00 | 0.00 | 0.00 | 0.20 | 0.05 | 0.42 | 0.00 | 0.00 | 0.00 | 0.67 |
| GHGC-20 | 2024 | USA | USA | Portland, Oregon | Ground Score | 0.00 | 0.00 | 0.00 | 0.72 | 0.20 | 1.96 | 0.00 | 0.00 | 0.00 | 2.88 |

[a] Data from: Rafey, Distrito Nacional and Duquesa. Abbreviations and initialisms: CCBH=Cooperativas dos Catadores de Belo Horizonte; MNR; Movimiento Nacional de los Recicladores de República Dominicana; KLWPA=Kpone Landfill Waste Pickers Association; SWaCH=Solid Waste Collection and Handling (cooperative - Pune City); and SMS Stree Mukti Sanghatana (Women's Liberation Organisation-SMS).

WIEGO Technical Brief No 18

**Table 4: Greenhouse gas emissions mitigated by waste picker activity in 20 locations worldwide (tonnes of $CO_2$eq emissions per waste picker per year)**

| Study # | Year | Country | ISO3 | City | Organization | Avoided anaerobic decomposition (in land disposal) | Avoided material production | Avoided open burning | Total avoided emissions | Total avoided emissions from anaerobic decomposition and material production |
|---|---|---|---|---|---|---|---|---|---|---|
| GHGC-03 | 2022 | Chile | CHL | Maipú | Recicladores de Maipú | 70.79 | 116.29 | 0.00 | 187.05 | 187.08 |
| GHGC-09 | 2023 | Colombia | COL | Bogotá | Puerta de Oro | 119.51 | 45.06 | 0.00 | 164.57 | 164.57 |
| GHGC-04 | 2022 | Colombia | COL | Bogotá | ARB | 82.90 | 28.04 | 0.00 | 110.85 | 110.94 |
| GHGC-06 | 2022 | Colombia | COL | Pasto | Coemprender | 76.56 | 18.84 | 0.00 | 95.65 | 95.41 |
| GHGC-10 | 2022 | Colombia | COL | Rionegro | Planeta Verde | 61.75 | 23.50 | 0.00 | 85.31 | 85.24 |
| GHGC-05 | 2022 | Colombia | COL | Popayán | Aremarpo | 54.67 | 24.33 | 0.00 | 79.00 | 79.00 |
| GHGC-07 | 2023 | Colombia | COL | La Ceja | Arofuturo | 46.67 | 30.03 | 0.00 | 76.83 | 76.70 |
| GHGC-12 | 2023 | France | FRA | Montreuil | Amelior | 11.35 | 52.49 | 0.00 | 63.85 | 63.84 |
| GHGC-16 | 2022 | India | IND | Pune | SWaCH | 5.06 | 6.06 | 47.71 | 59.30 | 11.11 |
| GHGC-18 | 2021 | Senegal | SEN | Dakar | Bokk Diom | 2.02 | 51.00 | 0.00 | 53.19 | 53.02 |
| GHGC-14 | 2024 | Ghana | GHA | Accra | KLWPA | 3.94 | 1.08 | 47.14 | 52.21 | 5.02 |
| GHGC-02 | 2024 | Brazil | BRA | Bello Horizonte | CCBH | 21.44 | 25.38 | 0.00 | 46.83 | 46.82 |
| GHGC-08 | 2023 | Colombia | COL | Medellín | Barrio Colombia | 16.86 | 25.29 | 0.00 | 42.28 | 42.14 |
| GHGC-01 | 2021 | Argentina | ARG | Buenos Aires | Amanecer | 15.74 | 12.34 | 13.46 | 41.54 | 28.08 |
| GHGC-17 | 2022 | India | IND | Mumbai | SMS | 15.15 | 4.03 | 13.22 | 32.45 | 19.18 |
| GHGC-15 | 2022 | India | IND | Bengaluru - Jayanagar | Hasiru Dala | 13.87 | 13.72 | 0.00 | 26.66 | 27.58 |
| GHGC-20 | 2024 | USA | USA | Portland, Oregon | Ground Score | 0.00 | 17.60 | 0.00 | 19.49 | 17.60 |
| GHGC-11 | 2022 | Dominican Republic | DOM | Santo Domingo | MNR | 0.31 | 12.43 | 0.00 | 12.83 | 12.74 |
| GHGC-13 | 2019 | Ghana | GHA | Accra | KLWPA | 0.02 | 7.46 | 0.00 | 7.49 | 7.48 |
| GHGC-19 | 2022 | USA | USA | Portland, Oregon | Ground Score | 0.00 | 3.86 | 0.00 | 4.21 | 3.86 |

Abbreviations and initialisms: CCBH=Cooperativas dos Catadores de Belo Horizonte; MNR; Movimiento Nacional de los Recicladores de República Dominicana; KLWPA=Kpone Landfill Waste Pickers Association; SWaCH=Solid Waste Collection and Handling (cooperative - Pune City); and SMS=Stree Mukti Sanghatana (Women's Liberation Organisation-SMS).

## Appendix B: Global Model

**Table 5: Assumptions and calculation steps for the prevalence-based model to assess emissions mitigated by the informal waste sector**

| | Number of waste pickers | | 85% low weight-based productivity waste pickers (tonnes $CO_2$eq per year) [c] | | 15% high weight-based productivity waste pickers (tonnes $CO_2$eq per year) [d] | | Total (tonnes $CO_2$eq per year) | |
|---|---|---|---|---|---|---|---|---|
| Income cat. | Low estimate [a] | High estimate [b] | Low estimate | High estimate | Low estimate | High estimate | Low estimate | High estimate |
| High-income countries | 183,688 | 359,797 | 2,342,022 | 4,587,412 | 1,212,341 | 2,374,661 | 3,554,363 | 6,962,073 |
| Upper middle-income countries | 4,223,183 | 8,272,118 | 53,845,583 | 105,469,504 | 27,873,008 | 54,595,979 | 81,718,591 | 160,065,483 |
| Lower middle-income countries | 4,990,491 | 9,775,075 | 63,628,760 | 124,632,205 | 32,937,241 | 64,515,495 | 96,566,001 | 189,147,700 |
| Low-income countries | 813,283 | 1,593,010 | 10,369,358 | 20,310,878 | 5,367,668 | 10,513,866 | 15,737,026 | 30,824,744 |
| **Total** | **10,210,645** | **20,000,000 [e]** | **130,185,724** | **255,000,000** | **67,390,257** | **132,000,000** | **197,575,981** | **387,000,000** |

a=Waste picker numbers (low estimate) based on the median proportion of population that is a waste picker in each income group as reported by Cook et al. (2024b). These are extrapolated by the populations in urban centres (excluding rural areas and smaller towns) - this assumes that few waste pickers operate in contexts where they lack access to markets.
b=waste picker numbers (high estimate), assumes 20 million waste pickers worldwide (ILO, 2013), distributed by the proportion in each income category from the low estimate;
c=Estimates for each income category assume 85% of waste pickers are lower weight-based waste pickers and use largely manual transport - low and high estimated number of waste pickers is multiplied by 15 tonnes CO2eq avoided per waste picker per year;
d=Estimates for each income category assume 15% of waste pickers are high weight-based productivity waste pickers and use mainly powered transport - low and high estimated number of waste pickers is multiplied by 45 tonnes CO2eq avoided per waste picker per year; and
e=estimated by ILO (2013). Numbers may not sum due to rounding.

**Table 6: Assumptions and calculation steps for the weight-based model to assess emissions mitigated by the informal waste sector**

| | | Greenhouse gases avoided (tonnes $CO_2$eq per year) | |
|---|---|---|---|
| Income cat. | Total recovered for recycling by informal sector (tonnes per year)[a] | Low estimate [b] | High estimate [c] |
| High-income countries | 7,599,808 | 12,159,693 | 25,079,366 |
| Upper middle-income countries | 42,090,245 | 67,344,392 | 138,897,809 |
| Lower middle-income countries | 49,774,454 | 79,639,126 | 164,255,698 |
| Low-income countries | 8,102,631 | 12,964,210 | 26,738,682 |
| **Total** | **107,567,138** | **172,107,421** | **354,971,555** |

a=quantity collected for recycling based on the median proportion of the population that is a waste picker in each income group and median productivity as reported by Cook et al. (2024b). These are extrapolated by the populations in urban centres (excluding rural areas and smaller towns) - this assumes that few waste pickers operate in contexts where they lack access to markets;
b=multiplied by the lower quartile of greenhouse gas emissions mitigated as reported in 20 studies that used the Waste Pickers Greenhouse Gas Calculator; (1.6 tonnes of $CO_2$eq per tonne waste recovered for recycling);
c=multiplied by the upper quartile of greenhouse gas emissions mitigated as reported in 20 studies that used the Waste Pickers Greenhouse Gas Calculator (3.3 tonnes of $CO_2$eq per tonne waste recovered for recycling).



WIEGO
Women in Informal Employment: Globalizing and Organizing

### About WIEGO

Women in Informal Employment: Globalizing and Organizing (WIEGO) is a global network focused on empowering the working poor, especially women, in the informal economy to secure their livelihoods. We believe all workers should have equal economic opportunities, rights, protection and voice. WIEGO promotes change by improving statistics and expanding knowledge on the informal economy, building networks and capacity among informal worker organizations and, jointly with the networks and organizations, influencing local, national and international policies. Visit www.wiego.org

INTERNATIONAL ALLIANCE OF WASTE PICKERS

### About IAWP

The International Alliance of Waste Pickers (IAWP) is a global union federation of waste pickers with 59 affiliates spread across 38 countries, reaching more than 500,000 waste pickers around the world. IAWP represents a diverse workforce of waste pickers who collect, sort, reuse, recycle, and sell discarded materials, often under precarious conditions. Waste pickers play a vital role in waste management, recovering a substantial portion of reusable and recyclable materials—usually exceeding that of formal systems—while contributing to environmental sustainability by mitigating plastic pollution and reducing carbon emissions. Despite their significant contributions, waste pickers frequently encounter marginalisation, stigma, and threats to their livelihoods, including the privatisation of waste systems and dumpsite closures. The Alliance strives to address these challenges by amplifying its voices on local and global platforms. Visit www.globalrec.org