Colombian Waste Sector Methane Analysis

CLEAN AIR TASK FORCE
WASTEMAP
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About

About Clean Air Task Force

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About the Waste Methane Assessment Platform

The Waste Methane Assessment Platform (WasteMAP), a joint initiative by RMI and CATF, is an open online platform that brings together waste methane emissions data with decision support tools for stakeholders in the waste sector. The platform is supported by country engagement that involves collaboration with national and subnational governments, waste management officials, and other key decision makers to provide capacity building and technical assistance—providing a pathway to reduce solid waste methane emissions.

Please visit our website https://wastemap.earth to learn more.

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Stock photos used throughout this report are not of Colombian waste sites

Acronyms

ARB	Association of Recyclers of Bogotá
BUR	Biennial Update Report
CATF	Clean Air Task Force
CO2e	carbon dioxide equivalent
CRA	Drinking Water and Basic Sanitation Regulatory Commission
DNP	National Planning Department
GCCS	gas collection and control systems
GHG	greenhouse gas
IDEAM	Institute of Hydrology, Meteorology and Environmental Studies
IPCC	Intergovernmental Panel on Climate Change
ISWM	Integrated Solid Waste Management
LAC	Latin America and the Caribbean
MinAmbiente	Ministry of Environment and Sustainable Development
MinEnergia	Ministry of Mines and Energy
MinVivienda	Ministry of Housing, City and Territory
MRV	Monitoring, Reporting, and Verification System
MSW	municipal solid waste
NAMA	Nationally Appropriate Mitigation Action
NDC	nationally determined contribution
PGIRS	Municipal Integral Solid Waste Management Plans
SDG	Sustainable Development Goals
SISCLIMA	National Climate Change System
SPA	Public Sanitation Service
SSPD	Superintendent of Residential Public Utilities
SUI	Unified Information System
UNFCCC	United Nations Framework Convention on Climate Change
WasteMAP	Waste Methane Assessment Platform

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SECTION 1

Introduction

According to the National Policy for the Integral Management of Solid Waste (CONPES 3874), Colombia is expected to generate more than 18 million metric tons of municipal solid waste (MSW) each year by 2030.[1] Methane from the solid waste sector—released when organic waste breaks down in landfills and dumpsites—currently accounts for more than 20% of the total methane emissions in the country, and as waste generation increases, so too will this potent greenhouse gas (GHG) unless changes are made to Colombia's waste management system.[2] Methane has a warming potential more than 80 times greater than carbon dioxide over a 20-year period. Significantly reducing methane pollution is one of the most important opportunities to slow the pace of global warming in the next two decades.[3,4] Historically, landfilling has been the cheapest option for final disposal of MSW and today, Colombia's waste management system still almost entirely relies on these facilities. With more than half of these landfills expected to reach their maximum capacity within the next ten years, an untapped potential exists to advance toward a circular economy by minimizing and diverting waste from these final disposal sites. This approach would not only reduce the total volume of waste sent to landfills, extending the lifetimes of existing sites, but will help Colombia cope with increasing emissions from its waste management sector.

Emissions from waste disposal (solid waste and wastewater) in the country have risen 213% in the last three decades—primarily driven by increases in emissions from solid waste disposal in landfills (Figure 1). Waste generation—one of the key factors for estimating waste emissions—is often tied to population growth and urbanization. However, in the same period Colombia's population grew 51%, suggesting other factors are at play.[5]

1 DNP. (2016). CONPES 3874. Dnp.gov.co. https://colaboracion.dnp.gov.co/CDT/Conpes/Econ

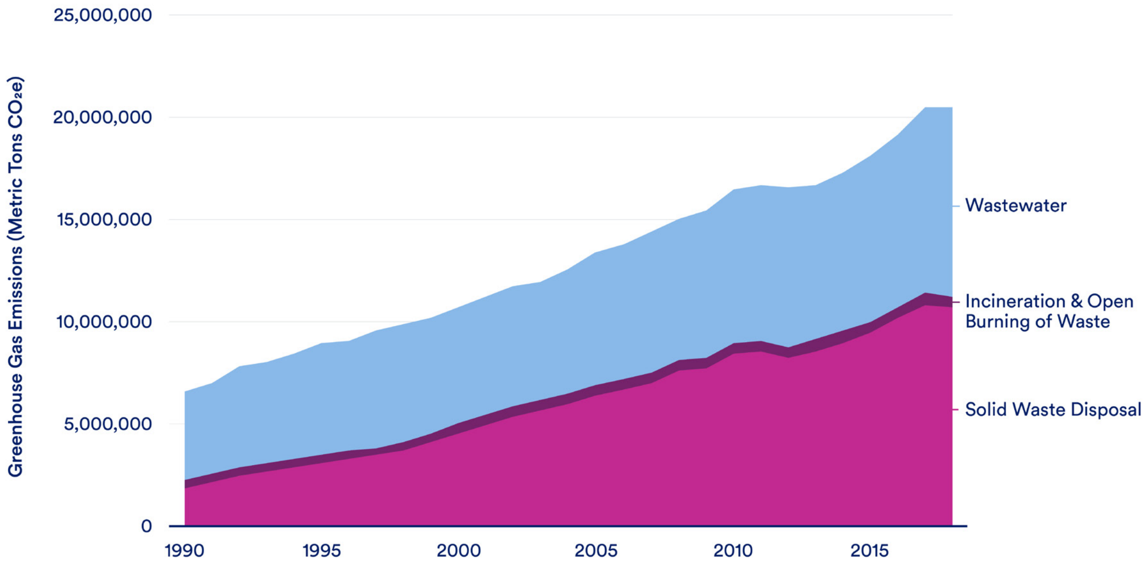
2 IDEAM et al. (2021). BUR 3 Tercer informe bienal de actualización de Colombia a la convención marco de las Naciones Unidas para el cambio climático (CMNUCC). https://unfccc.int/sites/default/files/resource/BUR3%20-%20COLOMBIA.pdf

3 IPCC, Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change: The Earth's energy budget, climate feedbacks, and climate sensitivity, Chapter 7, p. 7–125. https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_Chapter_07.pdf

4 Methane is also an important contributor to ground-level ozone formation, causing air quality degradation, respiratory diseases, and is responsible for one million premature deaths every year. Maley et al. (2017). Updated global estimates of respiratory mortality in adults ≥30 years of age attributable to long-term ozone exposure. Journal Environmental Health Perspectives, 125(8). https://doi.org/10.1289/EHP1390

5 CELADE—Population Division of CEPAL and United Nations, Department of Economic and Social Affairs, Population Division. (2022). World population prospects 2022. https://www.cepal.org/es/subtemas/proyecciones-demograficas/america-latina-caribe-estimaciones-proyecciones-poblacion/estimaciones-proyecciones-excel

Figure 1: Historic GHG Emissions from the Waste Sector in Colombia



Methane emissions are converted to metric tons carbon dioxide equivalent (CO_2e) using a 100-year global warming potential. Source: IDEAM et al. (2021). BUR 3 Tercer informe bienal de actualización de Colombia a la convención marco de las Naciones Unidas para el cambio climático.

Solutions must be implemented in this decade to mitigate waste methane and help Colombia achieve many of its climate and development goals, including:

a. Colombia's contribution as a signatory to the Paris Agreement to reduce economy-wide GHG emissions by as much as 51% by 2030 compared to a 2014 baseline scenario;[6]
b. The commitment to the Global Methane Pledge to collectively reduce methane emissions by 30% by 2030 with other signatories; and
c. Colombia's Sustainable Development Goals (SDG) Implementation Strategy, CONPES 3918, which set recycling and new use of solid waste targets of 10% by 2018 and 17.9% by 2030.[7]

This report assesses waste management in Colombia, with a focus on solutions that are known to improve waste management practices and abate methane from this critical sector. Section 2 overviews methane emissions from the Colombian Solid Waste Sector; Section 3 identifies key stakeholders involved in improving waste management and mitigating methane, and outlines their responsibilities; Section 4 presents the existing institutional framework for waste management and methane mitigation in the country; Section 5 discusses the current state of waste management through available data and trends on the sector; and Section 6 presents challenges and key opportunities to mitigate methane pollution from the waste sector in Colombia.

6 ClimateWatch. (2020). Summary of Updated First Nationally Determined Contribution (NDC).

7 DNP, et al. (2018). CONPES 3918: Estrategia para la implementación de los Objetivos de Desarrollo Sostenible en Colombia. https://www.minambiente.gov.co/wp-content/uploads/2021/08/conpes-3918-de-2018.pdf

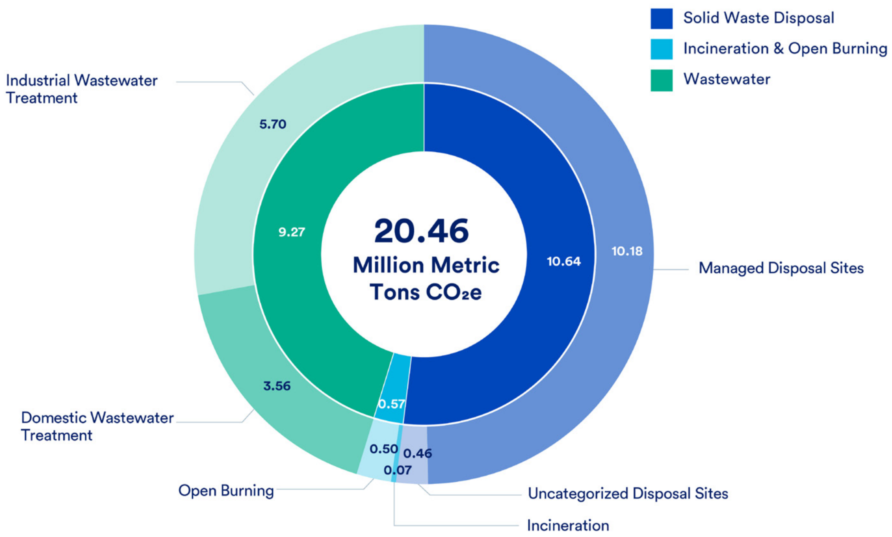
SECTION 2

Methane Emissions from the Colombian Solid Waste Sector

Colombia is the third largest emitter of waste methane in the Latin America and the Caribbean (LAC) region, following Brazil and Mexico.[8] Colombia's third Biennial Update Report (BUR3), submitted to the United Nations Framework Convention on Climate Change (UNFCCC) in 2021, reported total national GHG emissions of 303 million metric tons carbon dioxide equivalent in 2018.[9] The waste sector (solid waste and wastewater) represents 7% of this total; on average 93.4% of GHG emissions from waste in Colombia are methane pollution.

Of the approximately 20 million metric tons of carbon dioxide equivalent emitted by the waste sector, 52% stem from waste at disposal sites, 45% from wastewater, and 3% from incineration of waste (Figure 2); emissions from biological treatment are not considered in the national inventory. According to BUR3, the waste sector accounts for 22% of Colombia's annual methane emissions.[10]

Figure 2: Colombian Waste Sector GHG Emissions in 2018



Methane emissions are converted to metric tons carbon dioxide equivalent (CO_2e) using a 100-year global warming potential. Source: IDEAM et al. (2021). BUR 3 Tercer informe bienal de actualización de Colombia a la convención marco de las Naciones Unidas para el cambio climático.

8 Hub de Residuos Sólidos y Economía Circular. (2021). Estado de la gestión de flujo de materiales: residuos sólidos municipales para América Latina y el Caribe. https://hubresiduoscirculares.org/gestion-del-flujo-de-materiales/

9 IDEAM et al. (2021). BUR 3 Tercer informe bienal de actualización de Colombia a la convención marco de las Naciones Unidas para el cambio climático.

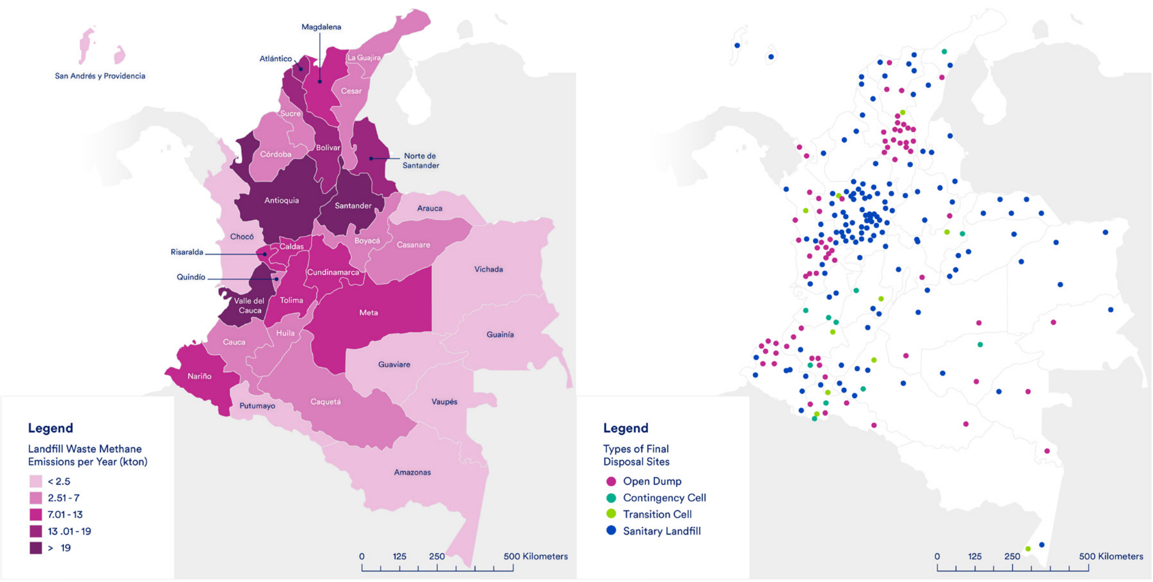
10 Ibid.

Colombia emits more than 692,000 metric tons of methane pollution from its waste sector. In its inventory, Colombia uses a 100-year global warming potential of 28 to calculate the carbon dioxide equivalence for methane. If a 20-year global warming potential is used for methane instead,[11] **waste sector emissions rise to 57 million metric tons carbon dioxide equivalent, an increase of more than 175%.**

At the department[12] level, GHG inventories developed by the Institute of Hydrology, Meteorology and Environmental Studies (IDEAM) reveal that more than 60% of methane emissions from solid waste disposal sites stem from six departments in the country.[13] These are also the six most populous areas of Colombia.

IDEAM data were prepared for 2018, based on the Intergovernmental Panel on Climate Change (IPCC) methodology for methane emissions from solid waste disposal in final disposal sites (Figure 3).

Figure 3: Departmental Waste Methane Emissions in ktons (2018) and Disposal Site Locations (2021)



Sources: IDEAM et al. (2018). Inventario departamental de gases de efecto invernadero y carbono negro – 2018. And DNP. (2021). Informe Nacional de Disposición Final de Residuos Sólidos 2021.

11 Using the AR-6 20-year non-fossil value for methane of 79.7.

12 Departments are decentralized territorial entities. Colombia has 32 departments with their respective capitals.

13 IDEAM et al. (2018). Inventario departamental de gases de efecto invernadero y carbono negro – 2018. https://www.cundinamarca.gov.co/wcm/connect/cbc99dae-c9c3-43cd-a7a5-13d4fb7e3c79/GOB_COL_InGEI+y+Carbono+Negro_2018_compressed.pdf?MOD=AJPERES&CONVERT_TO=url&CACHEID=ROOTWORKSPACE-cbc99dae-c9c3-43cd-a7a5-13d4fb7e3c79-oxTWjfz

SECTION 3

Stakeholders Involved in Waste Methane

Key stakeholders involved in improving waste management and mitigating waste methane emissions in Colombia include public institutions, private organizations, industries, local communities, waste workers, and other groups involved in the waste sector. Table 1 includes a list of relevant stakeholders and explains their role regarding Integrated Solid Waste Management (ISWM), climate change, and GHG mitigation.

Table 1. Key Solid Waste Stakeholders in Colombia

Stakeholder	Role
Ministry of Environment and Sustainable Development (MinAmbiente)	Leads policies, guidelines, and directives on environmental management issues, control of environmental impacts in infrastructure works, and particularly in the operation of waste disposal sites, as well as on climate change mitigation issues.
Ministry of Housing, City and Territory (MinVivienda)	National authority on technical issues related to MSW management and landfills. It also leads the National Policy for ISWM, together with MinAmbiente.
National Planning Department (DNP)	The technical entity in charge of directing and coordinating the country's strategic vision project in the social, economic, and environmental fields, by administrating public policies, public investments, and ISWM.
Superintendent of Residential Public Utilities (SSPD)	Responsible, at the national level, for inspecting, supervising, and controlling the entities and companies providing domiciliary public utilities of water, sewage, energy, gas, and sanitation.
Institute of Hydrology, Meteorology and Environmental Studies (IDEAM)	Responsible for official climate change information for Colombia, including the national GHG inventory.
Ministry of Mines and Energy (MinEnergia)	Establishes the parameters for the valorization of waste for energy.
Drinking Water and Basic Sanitation Regulatory Commission (CRA)	Special Autonomous Administrative Unit attached to MinVivienda, that establishes general policies for administering and controlling efficiency in providing household public utilities.
Mining and Energy Planning Unit	Supports studies and terms of reference for projects developed in the waste sector. It is an entity attached to MinEnergia.
National Environmental Licensing Agency	Entity responsible for ensuring that projects comply with environmental regulations during their implementation and development, granting licenses, permits, or environmental procedures.
Regional Autonomous Corporations	Environmental authorities at the municipal level, which are responsible for overseeing compliance with laws established at the ministerial level and for granting or denying environmental licenses.
Public Sanitation Service Companies	A group of companies responsible for providing public sanitation services according to national regulations, and complying with the environmental and sanitary parameters of the service. These companies have the responsibility for the collection, transportation, transfer, treatment, and final disposal of solid waste.
Informal Sector/Recyclers	Manage solid waste through collection, transportation, source selection, and commercialization, reducing the percentage of waste reaching final disposal. It is essential for them to participate in national waste management programs and policies.

Source: Anthesis Lavola. (2021). Estructuración y formulación de la NAMA de Residuos Sólidos Municipales.

SECTION 4

Institutional Framework for Waste Management and Methane Mitigation

National-Level Framework for Waste Management

Colombia has a robust regulatory framework for solid waste management. This section overviews significant policies, laws, resolutions, and decrees related to waste management, organic waste treatment, final disposal, and methane pollution. A more detailed list is included in Annex A.

National Policies on Waste Management

Colombia's National Environmental Policy (CONPES 2750), approved by the National Council of Economic and Social Policy (Consejo Nacional de Política Económica y Social, CONPES) in 1994, is the foundational policy for environmental programs in the country's National Development Plan, which includes solid waste management.[14]

CONPES 3874 of 2016, the National Policy for Integral Management of Solid Waste, complements CONPES 2750, and further identifies four strategic objectives for adequately managing waste:

1. Reduce the amount of waste generated at the source;
2. Minimize the amount of waste arriving at final disposal sites;
3. Promote reuse, recovery, recycling, and treatment of solid waste to further reduce landfilling rates; and,
4. Avoid the generation of GHGs.[15]

CONPES 3874 was developed to move toward a circular model for solid waste management and address targets in MinAmbiente's 1998 ISWM policy that were not met;[16,17] deadlines set by the 1998 policy were reached without showing any significant change either in minimizing waste, strengthening recycling chains, or modifying consumption patterns.[18]

CONPES 3530 of 2008 is another important waste management policy to highlight as it was created to encourage the regionalization of sanitary landfills to promote final disposal in authorized sites and improve solid waste management in urban and rural areas.[19] Regional landfills facilitate waste management in smaller municipalities that do not always have access to disposal facilities.

14 MinAmbiente. (1994). CONPES 2750: Política Nacional Ambiental Salto Social Hacia El Desarrollo Humano Sostenible. República De Colombia, Departamento Nacional de Planeación. https://colaboracion.dnp.gov.co/CDT/Conpes/Econ%C3%B3micos/2750.pdf

15 MinAmbiente. (2016). CONPES 3874: Política Nacional Para La Gestión Integral de Residuos Sólidos. República De Colombia, Departamento Nacional de Planeación. https://www.minambiente.gov.co/documento-normativa/conpes-3874-de-2016/

16 Ibid.

17 MinAmbiente. (1998). Política para la Gestión Integral de Residuos. República de Colombia, Ministerio del Medio Ambiente. https://archivo.minambiente.gov.co/images/AsuntosambientalesySectorialyUrbana/pdf/Polit%C3%ACcas_de_la_Direcci%C3%B3n/Pol%C3%ADtica_para_la_gesti%C3%B3n_integral_de__1.pdf

18 Cortés, C. M. (2018). *Estudio de los residuos sólidos en Colombia.*

19 DNP. (2008). CONPES 3530. Dnp.gov.co. https://colaboracion.dnp.gov.co/CDT/Conpes/Econ%C3%B3micos/3530.pdf

Other national-level policies that refer to waste management include:

- CONPES 3934 of 2018: Green Growth Policy. Ensures sustainable development by establishing a green growth model that safeguards natural capital and climate security.[20]
- CONPES 3918 of 2018: Strategy for the implementation of the Sustainable Development Goals (SDGs). Defines targets and indicators to ensure environmental conservation through a roadmap for implementing Agenda 2030 and the SDGs in Colombia. Regarding waste, the policy sets a national recycling target of 17.9% by 2030 in its SDG target 12 to increase recycling rates and reuse of solid waste.[21]

Note that Colombia does not currently have a national policy or strategy—or specific targets within the policies highlighted here—related to reducing and diverting organic waste from landfills and other final disposal sites to reduce methane pollution in the country.

Box 1: Colombia's Relevant Regulation Types

Per the General Archive of the Nation, a law, decree, and resolution are defined as follows:

Law. Following the constitution, a law is the legal norm with the highest rank. It is issued by the legislator and of permanent character. It establishes legal obligations and/or duties and grants rights.

Decree. An administrative act promulgated by the executive branch, which does not require to be submitted to the legislative body. Instances such as a Decree Law may be applied as a Law without requiring congress.

Resolution. A procedural act issued by a court, through which a dispute is resolved. A resolution may also authorize or order compliance with specific methods.

Source: Archivo General de La Nación Colombia. Normativa Que Regula La Entidad. normativa.archivogeneral.gov.co/inicio/definiciones/

National Regulatory Framework on Waste

Providing Public Services for MSW

Solid waste management functions through the Public Sanitation Service (SPA) were established by Law 142 of 1994.[22] This service is operated by the Public Service Companies, who are responsible for managing the country's domestic solid waste. This includes waste generated by the residential, commercial, institutional (military and educational institutions, among others), and non-hazardous industrial sectors. However, generators always have the option to manage their own waste by hiring a company of their choice for collection and disposal.[23]

Law 142 and the SPA have been modified numerous times throughout the past three decades. This includes charging the SSPD with supervising providers of public waste services, as well as administering the Unified Information System (SUI), a platform created through Law 689 of 2001, that collects and processes information reported by the public service companies.[24]

20 DNP. (2018). CONPES 3934. Dnp.gov.co. https://colaboracion.dnp.gov.co/cdt/conpes/econ%C3%B3micos/3934.pdf

21 DNP. (2018). CONPES 3918: Estrategia para la implementación de los Objetivos de Desarrollo Sostenible en Colombia. Dnp.gov.co.

22 Función Pública. (1994). Ley 142. www.funcionpublica.gov.co. https://www.funcionpublica.gov.co/eva/gestornormativo/norma.php?i=2752

23 MAG Consultoría S.A.S. (2021). Tratamiento de residuos sólidos en el marco del servicio público de aseo. https://www.minvivienda.gov.co/sites/default/files/documentos/20210806-entregable-1-v5-definitiva_0.pdf

24 Función Pública. (2001). Ley 689. www.funcionpublica.gov.co. https://www.funcionpublica.gov.co/eva/gestornormativo/norma.php?i=4633

Law 1450 of 2011 and Decree 596 of 2016 are also noteworthy, as they seek to recognize and formalize the role of the informal recycling sector in waste management activities in the country. Law 1450 charges the SSPD with their inclusion as business partners in waste management and Decree 596 incorporates their work into the SPA, thus granting them payment for services.[25,26] See Box 2 for more information on inclusive recycling and the role of the informal sector in Colombia.

Treatment and Final Disposal of Municipal Waste

In the past, Colombia has encouraged landfilling above other treatment and disposal alternatives to improve overall waste management in urban and rural areas and ensure service in municipalities of all sizes. Through Decree 838 of 2005 and Resolution 1890 of 2011, Colombia worked to ban illegal dumping and open burning of waste, and storage of waste in temporary cells by defining sanitary landfills (and interim steps to move toward sanitary landfills) as the preferred approach for municipalities.[27,28] Similarly, through CONPES 3530 of 2008, discussed above, Colombia encouraged regionalization of landfills to help smaller municipalities improve waste management.[29]

However, over the past decade, Colombia has sought to move toward a more circular waste management model where waste is reused, recycled, and treated to obtain resources, including compost and biogas. This has included developing quality standards for organic compost and soil amendments—Colombian Technical Standard 5167 of 2011—as well as standards for the production and sale of biogas and biomethane—Resolution 240 of 2016.[30,31] Colombia has also recently established a color code for source separation of MSW where organics, inorganic recyclables, and nonrecyclable waste are collected separately (Figure 4).[32]

Figure 4: Color Code for Source Separation of Municipal Waste

Source: Adapted from ecocleaner.com (2021)

25 Función Pública. (2011). Ley 1450. www.funcionpublica.gov.co. https://www.funcionpublica.gov.co/eva/gestornormativo/norma.php?i=43101

26 Función Pública. (2016). Decreto 596. www.funcionpublica.gov.co. https://www.funcionpublica.gov.co/eva/gestornormativo/norma.php?i=69038

27 Función Pública. (2005). Decreto 838. www.funcionpublica.gov.co. https://www.funcionpublica.gov.co/eva/gestornormativo/norma.php?i=16123

28 MinVivenda. (2011). Resolución 1890. Normas.cra.gov.co. https://normas.cra.gov.co/gestor/docs/resolucion_minambientevdt_1890_2011.htm

29 DNP. (2008). CONPES 3530. Dnp.gov.co. https://colaboracion.dnp.gov.co/CDT/Conpes/Econ

30 El Instituto Colombiano de Normas Técnicas y Certificación. (2011). Norma Técnica Colombiana 5167. https://www.cali.gov.co/dagma/loader.php?lServicio=Tools2&lTipo=descargas&lFuncion=descargar&idFile=31838

31 Comisión de Regulación de Energía y Gas. (2016). Resolución 240. Gestornormativo.creg.gov.co. https://gestornormativo.creg.gov.co/gestor/entorno/docs/resolucion_creg_0240_2016.htm

32 MinAmbiente. (2019). Resolución 2184. Ministerio de Ambiente Y Desarrollo Sostenible. https://www.minambiente.gov.co/documento-entidad/resolucion-2184-de-2019/

Financial Incentives for Waste Management

Much of the success of Colombia's waste management system can be attributed to the tariff the country has put in place to recover costs associated with providing improved waste management services and making funds available for infrastructure development.

Prior to 2015, the tariff primarily covered public sanitation services and final disposal of waste. SPA used two variables for tariff calculation:

1. Total fixed cost that charged each subscriber for administrative fees, street sweeping, and cleaning in public and urban areas; and,
2. Variable cost per ton of non-recoverable waste, which included costs for collection and transport, final disposal, and leachate treatment.

Decree 1077 of 2015 and Resolutions 720 of 2015 and 853 of 2018 issued by the CRA changed the tariff system to incentivize alternative waste management methods that divert MSW from landfills.[33,34,35] Through these resolutions, the tariff could include alternative treatment and recovery activities, either through avoided costs (i.e., the difference between the treatment cost and the final disposal cost, which includes leachate and disposal activities) or by a new cost addition to the tariff based on the technology used.

In order to provide equal services across all areas of the country, Colombia requires higher income neighborhoods to subsidize the tariff costs for lower income areas. The tariff is responsible for 85% of the waste sector's income in Colombia, with the remainder covered by national and municipal government funds.[36]

Additionally, through Decree 2412 of 2018, MinVivienda provided funds and incentives for pre-feasibility and feasibility studies to develop and expand solid waste treatment and recovery activities.[37] The funds available each year are based on the amount of waste generated, and in 2019, by taking advantage of this incentive, subnational governments could have accessed 74 billion Colombian pesos (approx. US$22 million) to conduct such feasibility studies.[38]

Municipal Solid Waste Management Planning

In Colombia, municipal governments are charged with implementing policies and laws set by MinVivienda and MinAmbiente regarding solid waste management. To do this, municipalities are tasked with developing ISWM plans (Planes de Gestión Integral de Residuos Sólidos—PGIRS in Spanish). Established through Resolution 1045 of 2003, PGIRS have a maximum planning horizon of 12 years and can be updated during the initial period of a new municipal mayor's term without creating a new plan.[39,40,41] This is designed to ensure some continuity in waste management services between municipal or regional government administrations.

PGIRS contain objectives, goals, programs, projects, activities, and resources defined by one or more territorial entity for managing solid waste, based on an initial diagnosis, its projection into the future, and a viable financial plan to ensure the continuous improvement of solid waste management and the provision of sanitation services.[42] Resolution 754 of 2014 defines the guidelines for development, implementation, evaluation, monitoring, control, and updating of PGIRS.[43]

33 MinVivienda. (2015). Decreto 1077. www.funcionpublica.gov.co. https://www.funcionpublica.gov.co/eva/gestornormativo/norma.php?i=77216

34 Comisión de Regulación de Energía y Gas. (2015). Resolución 720. Normas.cra.gov.co. https://normas.cra.gov.co/gestor/docs/resolucion_cra_0720_2015.htm

35 Comisión de Regulación de Energía y Gas. (2018). Resolución 853. Normas.cra.gov.co. https://normas.cra.gov.co/gestor/docs/resolucion_cra_0853_2018.htm

36 CCAP and ImplementaSur. (n.d.). Colombia waste tariff reform: A cost-recovery approach. https://www.recycleorganics.org/wp-content/uploads/2023/03/CASE_STUDIES_COLOMBIA_ESP.pdf

37 Función Pública. (2015). Decreto 2412. www.funcionpublica.gov.co. https://www.funcionpublica.gov.co/eva/gestornormativo/norma.php?i=76153

38 MAG Consultoría S.A.S. (2021). *Tratamiento de residuos sólidos en el marco del servicio público de aseo.*

39 MinVivienda. (2014). Resolución 754. https://www.minvivienda.gov.co/sites/default/files/2020-08/resolucion-754-de-2014.pdf

40 MinVivienda. (2015). Guía para la formulación, implementación, evaluación, (2015). Guía para la formulación, implementación, evaluación, seguimiento, control y actualización de los Planes de gestión integral de residuos sólidos (PGIRS). https://www.minvivienda.gov.co/sites/default/files/documentos/guia-pgirs.pdf

41 MinVivienda. (2015). Decreto 1077. www.funcionpublica.gov.co

42 MinVivienda. (2015). Guía para la formulación, implementación, evaluación, seguimiento, control y actualización de los Planes de gestión integral de residuos sólidos (PGIRS). https://www.minvivienda.gov.co/sites/default/files/documentos/guia-pgirs.pdf

43 MinVivienda. (2014). Resolución 754.

The steps for creating PGIRS in Colombia are as follows:

a. **Initial diagnosis:** Assessing waste characterization, existing management practices, available infrastructure, and needs for improvement in the jurisdiction.
b. **Formulation:** Developing PGIRS that include the strategies, objectives, goals, and actions to be followed to achieve ISWM.
c. **Citizen participation and consultation:** Involving the community in preparing the PGIRS. Using public consultations, workshops, and other participation mechanisms to gather opinions and suggestions.
d. **Approval:** Having the municipality or department approve the PGIRS through an administrative act. This may require validating environmental entities and other competent authorities.
e. **Implementation:** Executing actions established in the PGIRS, including awareness campaigns, recycling programs, and strengthening waste management infrastructure.
f. **Follow-up and evaluation:** Monitoring plan implementation and evaluation of results. If necessary, adjusting strategies to achieve the objectives set.

Box 2: Inclusive Recycling in Colombia

It's impossible to separate waste collection and disposal services from the work of the informal sector in many parts of the world. Colombia's informal sector is regarded as a world leader in working toward recognizing the work of, paying, and improving benefits and rights for informal workers. For more than 30 years, the Association of Recyclers of Bogota (Asociacion de Recicladores de Bogota, ARB), the National Association of Recyclers (Asociacion Nacional de Recicladores, ANR), and other local organizations have been championing the need to improve the conditions of recyclers, promote source separation of waste, selective collection, and recycling, and move toward a more sustainable waste management system.

Working through the legal system, ARB used the Constitutional Courts of Colombia to ensure recyclers' inclusion in waste recovery and payment for the services they provide. In 2013, two years after the Court's decision, Bogota launched a scheme to pay recyclers for their work, provided that recyclers register in the census of waste pickers, have an ID card, and a bank account. The money recyclers receive from the payment scheme is additional to what they receive from the sale of recyclables.

Decree 596, issued in 2016, went further by establishing an eight-year transition scheme for recycler cooperatives and organizations to become public sanitation service providers and, therefore, a formal part of waste management in Colombia.

By 2021, 55,579 recyclers were registered as part of this progressive process of formalization. Through these actions, Colombia recognizes the important contributions these workers make toward diverting waste from landfills, extending the lifetimes of sites, reducing ground and water pollution, and mitigating GHG emissions.

Sources: Olga Abizaid. (2015). ARB: fighting for an inclusive model for recycling in Bogota. And Neville and Cortes. (2023). Waste Pickers' Formalisation from Bogota to Cartagena de India: Dispossession and Socio-Economic Enclosures in Two Colombian Cities. And DNP. (2021). Informe Nacional de Disposición Final de Residuos Sólidos 2021.

National-Level Framework for Climate and Methane Mitigation from Waste

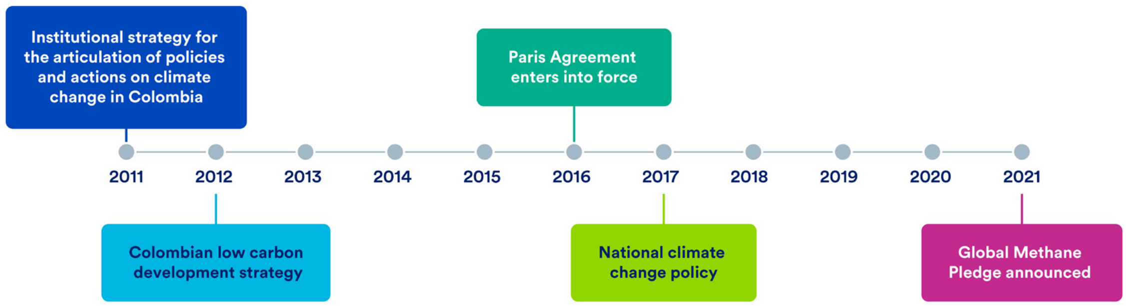
Although Colombia is a signatory of the Global Methane Pledge, the country currently lacks any national policies, regulations, or resolutions specifically targeting the reduction of methane emissions from the solid waste sector. Key Colombian strategies and policies aimed toward mitigating GHGs are listed in Figure 5.

In 2011, CONPES 3700 developed the institutional strategy for the articulation of policies and actions on climate change.[44] Its main objective is to coordinate and outline the policies and actions of different governmental and non-governmental entities in the fight against climate change. CONPES 3700 is also a fundamental tool for managing climate change activities in Colombia, as it establishes a reference framework for coordinating and articulating policies and actions at the national, regional, and local levels.[45]

In 2012, the Colombian Low Carbon Development Strategy was launched to promote a sustainable development model to reduce GHG emissions and promote adaptation to climate change across the economy.[46]

In 2017, the National Climate Change Policy was developed to reduce GHG emissions and serve as the foundation of the commitments included in Colombia's first nationally determined contribution (NDC) to the Paris Agreement.[47] As part of this policy, an action line was included that incentivizes the reduction, reuse, recycling, and utilization—including energy generation—of solid waste prior to its final disposition, as well as utilization of landfill gases. Solid waste mitigation actions included in the revised 2020 NDC are increased organics separation, collection and treatment via mechanical biological treatment systems, increased biogas collection from sanitary landfills, and increased landfill gas use to generate electricity, primarily in the Doña Juana landfill in Bogotá. These actions are estimated to lead to a 1.31 Mt carbon dioxide equivalent reduction, equivalent to 5% of total emissions from the waste sector.[48]

Figure 5: Timeline of Climate Change and Methane Policies



44 DNP. (2011). CONPES 3700. Dnp.gov.co. https://colaboracion.dnp.gov.co/cdt/conpes/econ%C3%B3micos/3700.pdf

45 Ibid.

46 MinAmbiente. (2012). Estrategia Colombiana de Desarrollo Bajo en Carbono. Ministerio de Ambiente Y Desarrollo Sostenible. https://www.minambiente.gov.co/cambio-climatico-y-gestion-del-riesgo/estrategia-colombiana-de-desarrollo-bajo-en-carbono-ecdbc/

47 MinAmbiente. (2017). Política Nacional de Cambio Climático. https://www.minambiente.gov.co/wp-content/uploads/2022/01/9.-Politica-Nacional-de-Cambio-Climatico.pdf

48 Gobierno de Colombia. (2020). Actualización de la Contribución Determinada a Nivel Nacional de Colombia. https://unfccc.int/sites/default/files/NDC/2022-06/NDC%20actualizada%20de%20Colombia.pdf

The following laws, decrees and resolutions regulate the GHG mitigation in Colombia:

- Law 164 of 1994 approves the UNFCCC signed in New York on October 9, 1992. The law establishes the framework for its implementation in Colombia.[49]

- Decree 298 of 2016 establishes the National Climate Change System (SISCLIMA) and regulates its operation. SISCLIMA develops, monitors, and evaluates the regulatory framework, projects, plans, actions, and measures for climate change mitigation and adaptation.[50]

- Law 1931 of 2018 establishes guidelines on management and adaptation to climate change for public and private entities to promote a sustainable and low-carbon transition and help to reduce the vulnerability to the impacts of climate change. It elevated the hierarchical rank of the SISCLIMA, making it an instrument at the ministerial, departmental, and municipal levels to facilitate the adoption and monitoring of climate change policies.[51]

- Resolution 1447 of 2018 regulates the Monitoring, Reporting, and Verification (MRV) system for GHG mitigation or GHG removal projects in the country. Actions can be registered either to obtain economic compensation such as carbon credits or to register the initiative to track progress toward national goals established within Colombia's NDC and other GHG commitments.[52] The administration of the MRV system falls under the authority of IDEAM.

- Resolution 431 of 2020 establishes the Integrated Sectoral Climate Change Management Plan, which applies to public sanitation service providers and other stakeholders who identify with the actions of this plan.[53] The plan aims to reduce the vulnerability of housing, drinking water, and basic sanitation sectors to the effects of climate change.

Box 3: Colombia's Solid Waste NAMA

Colombia's municipal solid waste Nationally Appropriate Mitigation Action (NAMA) is registered as part of the **National Registry for the Reduction of GHG Emissions within the MRV system**. The aim of the NAMA is to identify actions that reduce GHG emissions linked to the management of municipal solid waste during its treatment and final disposal in sanitary landfills. This NAMA comprises four objectives: (1) increasing the use and valorization of waste, (2) reincorporating waste into the economic cycle, (3) improving the health of the population, and (4) increasing the useful life sanitary landfils in the short- and medium-term. To meet these objectives, mitigation actions are designed based on the following technologies:

1. Landfill gas reduction,
2. Biological mechanical treatment, and
3. Waste-derived fuels and waste to energy.

The NAMA is developed by MinVivienda in partnership with MinAmbiente, Findeter, DNP, and the support of the Green Climate Fund.

Source: MinVivienda. (2021). https://minvivienda.gov.co/sala-de-prensa/minvivienda-lanza-nama-de-residuos-solidos-municipales-como-herramienta-de-lucha-contra-el-cambio-climatico-en-el-sector

49 MinAmbiente. (1994). Ley 164. https://www.minambiente.gov.co/documento-entidad/ley-164-de-1994/

50 Función Pública. (2016). Decreto 298. www.funcionpublica.gov.co. https://www.funcionpublica.gov.co/eva/gestornormativo/norma.php?i=68173

51 MinAmbiente. (2018). Ley 1931. https://www.minambiente.gov.co/wp-content/uploads/2021/06/ley-1931-2018.pdf

52 MinAmbiente. (2018). Resolución 1447. https://www.minambiente.gov.co/wp-content/uploads/2022/01/15.-Resolucion-1447-de-2018.pdf

53 MinVivienda. (2020). Resolución 431. www.alcaldiabogota.gov.co. https://www.alcaldiabogota.gov.co/sisjur/normas/Norma1.jsp?i=97065&dt=S

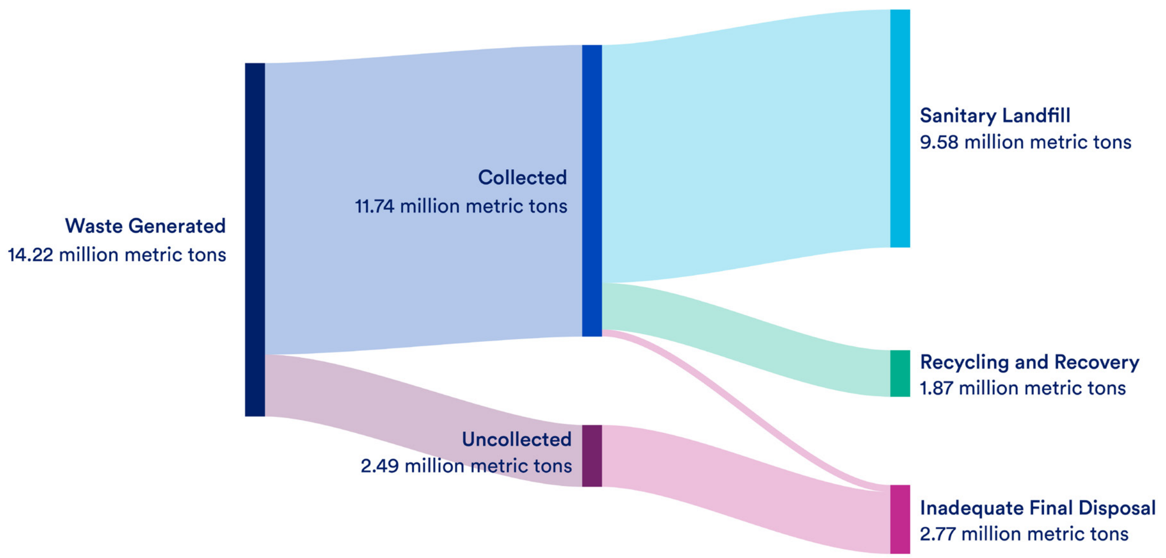
SECTION 5

Solid Waste Management in Colombia

In Colombia, the SPA covers the collection, transportation, transfer, treatment, and final disposal of solid waste. However, data are only reported on final disposal of solid waste going to sanitary landfills, emerging cells, and open dumps. This information is communicated by the suppliers of SPA at the municipal level to the SUI, which is the information collection system used by the companies that provide public sanitation services. In 2021, 87% of Colombian municipalities reported waste disposal data to the SUI platform.[54]

To craft an accurate picture of solid waste management in Colombia today from generation to final disposal, we have therefore identified additional information from sources including the InterAmerican Development Bank and private consulting firms. An overview of solid waste flows in 2021 is depicted in Figure 6.

Figure 6: Solid Waste Flows in Colombia



Source: Adapted from Hub de Residuos Sólidos y Economía Circular (2023).

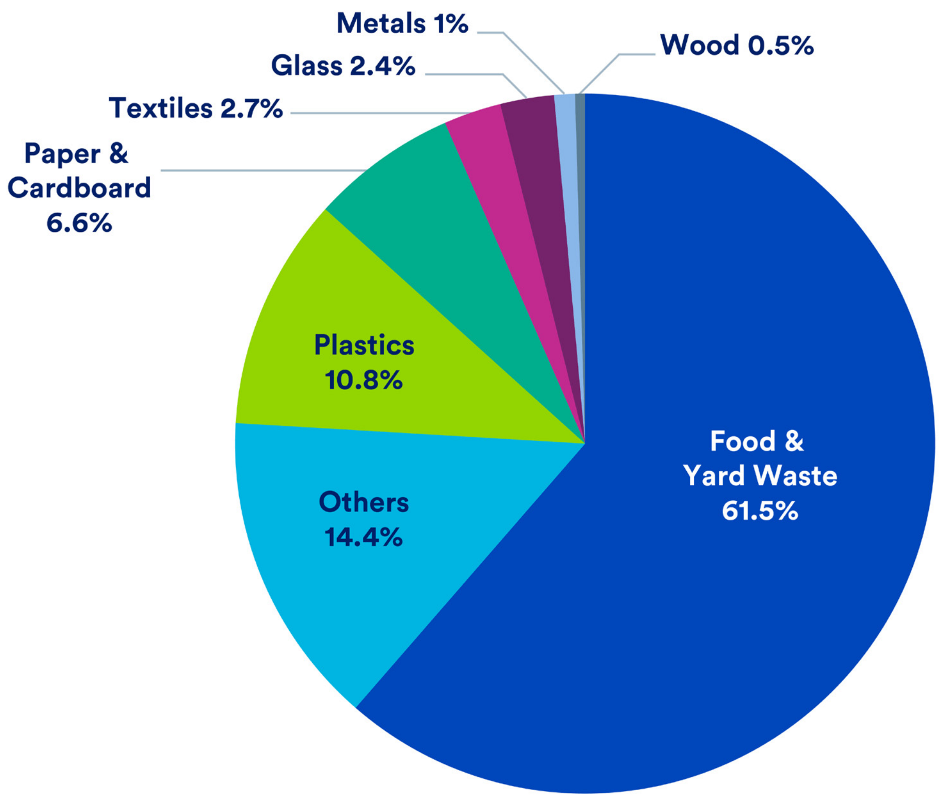
54 DNP. (2021). Informe Nacional de Disposición Final de Residuos Sólidos 2021. https://www.superservicios.gov.co/sites/default/files/inline-files/Informe-Nacional-de-Disposicion-Final-de-Residuos-Solidos.pdf.pdf

Generation, Collection, and Composition

More than 14 million metric tons of MSW was generated in Colombia in 2021.[55] Eighty two percent of that amount was collected for treatment and disposal, leaving just under 2.5 million metric tons of waste uncollected and eventually ending up in dumpsites, waterbodies, etc.[56] Although most collected waste ends up in engineered sanitary landfills or is recycled, 2% ends up in open dumpsites and other disposal sites with limited environmental controls (uncollected waste and waste that ends up in dumps and sites with little controls are grouped into inadequate final disposal in Figure 6).

Waste characterization information is not available at the national level. The composition of MSW in major Colombian cities, including Medellín, Cali, Barranquilla, and Bogotá, is detailed in Figure 7. Based on this analysis, organic waste is a significant component of solid waste produced throughout the country, accounting for approximately 70% of the waste stream. Plastic, metal, and glass waste, on the other hand, collectively account for 14% of solid waste.

Figure 7: Composition of Waste from Landfills of Major Cities in Colombia in 2015 (% of wet mass)



Source: Adapted from Caicedo-Concha, D. M., Sandoval-Cobo, J. J., Stringfellow, A., & Colmenares-Quintero, R. F. (2021). An evaluation of final disposal alternatives for municipal solid waste through life cycle assessment: A case of study in Colombia. In S. K. Shukla (Ed.), Cogent Engineering 8(1).

55 Hub de Residuos Sólidos y Economía Circular. (2023). “Base Datos Regional 150523 Descargar.” https://hubresiduoscirculares.org/gestion-del-flujo-de-materiales/

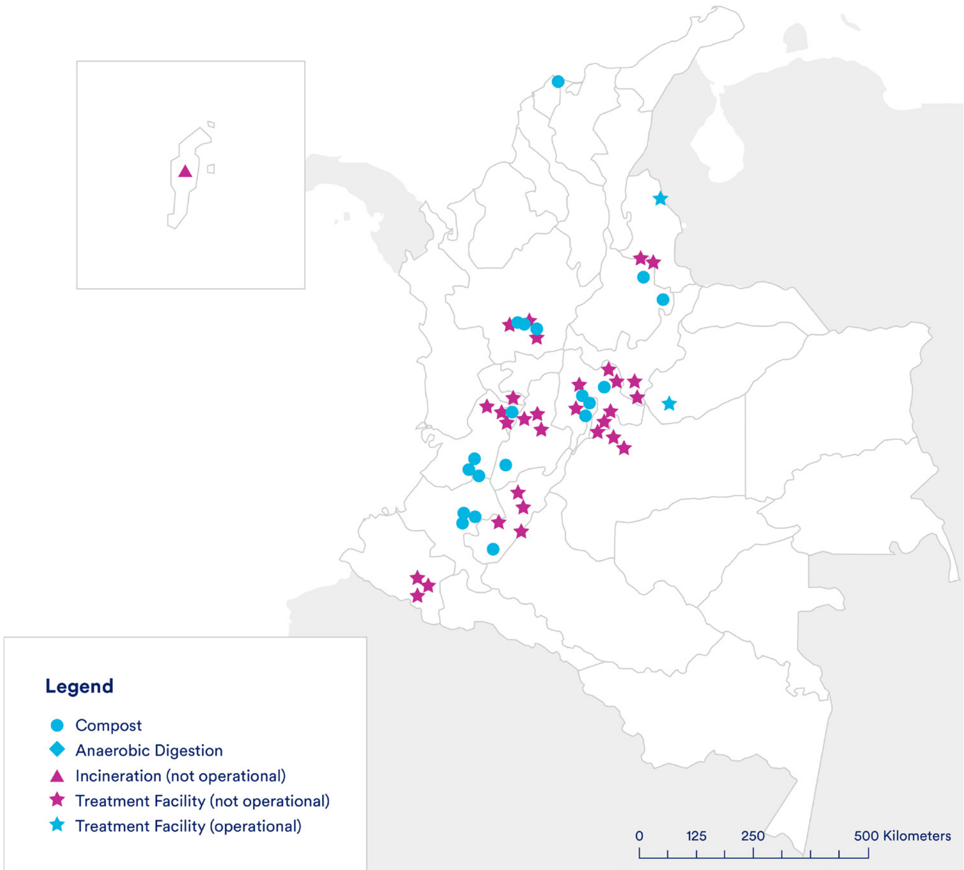
56 Departamento Administrativo Nacional de Estadística. (2021). “Anexos-ECV-2021.” https://www.dane.gov.co/index.php/estadisticas-por-tema/salud/calidad-de-vida-ecv

Recycling and Treatment

In 2020, the recycling and reuse rate in Colombia was just under 15% of the total solid waste generated.[57] Approximately 55% of municipal recycling in Colombia is performed by informal recyclers, and the government estimates there are at least 60,000 informal waste workers in the country.[58]

Colombia does not have a national organic waste management strategy or targets regarding recycling and treatment of organic waste. However, due to low tipping fees, composting is the most common treatment option for organic waste treatment in Colombia with a few anaerobic digestion systems in use. As of 2021, the country had 59 organic waste treatment facilities (25 composting, 33 treatment plants,[59] 1 anaerobic digester) and 1 incineration facility;[60] however, only 28 of these were operational.[61] Figure 8 identifies the locations and types of facilities. Additional information on operational organic waste treatment facilities can found in Annex B.

Figure 8: Organic Waste Treatment Facilities in Colombia



Source: MAG Consultoria S.A.S. (2021). Tratamiento de residuos solidos en el marco del servicio publico de aseo.

57 Departamento Administrativo Nacional de Estadística. (2022). *Cuenta ambiental y económica de flujos de materiales—residuos sólidos.*

58 MinVivienda. (2016). Queremos que a las organizaciones de recicladores se les pague formalmente un porcentaje de las tarifas de aseo MinVivienda. https://minvivienda.gov.co/sala-de-prensa/queremos-que-las-organizaciones-de-recicladores-se-les-pague-formalmente-un-porcentaje-de-las-tarifas-de-aseo-minvivienda

59 Treatment plants, as defined by the source, are facilities that both separate materials for recycling and recovery and compost.

60 The San Andres incineration facility is currently non-operational. As per the monthly report of Interaseo, the private company contracted for sanitation in this municipality, waste is being sent to the Magic Garden landfill.

61 MAG Consultoría S.A.S. (2021). *Tratamiento de residuos sólidos en el marco del servicio público de aseo.*

Final Disposal of MSW

In the past, MSW in Colombia was primarily buried, incinerated, and disposed in water bodies or open dumps.[62] As recently as 2021, 90 municipalities were still practicing open dumping of municipal waste.[63] Apart from illegal dumping, landfilling is the cheapest option for final disposal of MSW and in 2021 nearly 70% of total waste generated in Colombia was landfilled.[64] According to the latest report on national solid waste disposal, the country currently has 266 final disposal sites: 165 landfills, 77 open dumps, 12 contingency cells, and 12 transitory cells.[65]

Table 2. Regional Disposal Sites in 2021

Landfill	Department	Location	Metric Tons/ Day	Municipalities served	%
Doña Juana landfill	Bogotá, D.C.	Bogotá, D.C.	6,238	8	19.7
La Pradera landfill	Antioquia	Don Matías	3,360	49	10.6
Regional landfill Colomba-el Guabal	Valle del Cauca	Yotoco	2,344	25	7.4
Nuevo Mondoñedo landfill	Cundinamarca	Bojacá	1,719	79	5.4
Landfill Environmental park los Pocitos	Atlántico	Galapa	1,662	6	5.3
Loma de los cocos Environmental park	Bolívar	Turbaná	1,321	12	4.2
El Carrasco sanitary landfill	Santander	Bucaramanga	1,030	16	3.3
El Clavo landfill	Atlántico	Palmar de Varela	1,001	20	3.2
Guayabal landfill	Norte de Santander	San José de Cúcuta	923	20	2.9
Total of the above municipalities			**19,599**	**235**	**62%**
National total			**31,587**	**1028**	**100%**

62 Cortés, C. M. (2018). *Estudio de los residuos sólidos en Colombia.*

63 DNP. (2021). *Informe Nacional de Disposición Final de Residuos Sólidos 2021.*

64 Hub de Residuos Sólidos y Economía Circular. (2023). "Base Datos Regional 150523 Descargar."

65 Sanitary landfills and contingency cells are considered authorized final disposal sites in Colombia, whereas open dumps and transitory cells are unauthorized.

Of the 165 landfills, 72 are larger regional disposal sites, one of which has already reached the end of its useful life, and as of 2021, 10 sites have less than three years of useful life.[66] According to other sources, more than 50% of landfills in Colombia are estimated to reach capacity within the next ten years.[67] Concerns also exist regarding the environmental compliance of many of these sites.[68]

As detailed in Table 2, nine regional landfills collect 62% of solid waste disposed daily in the country; all the landfills listed here have landfill gas capture systems in place.[69] The Doña Juana landfill, which serves the Bogotá capital district, is the largest final disposal site in the country with more than 6,000 metric tons of solid waste disposed daily.

Colombia's Solid Waste NAMA (see Box 3) covers 21 of the largest landfills in the country. Of these, 18 landfills have gas collection and control systems (GCCS) but only flare the gas onsite.[70] Only the Doña Juana landfill, located in the city of Bogotá, has an activate landfill gas utilization system that converts gas to electricity; the current installed capacity is 1.7 MW, but a more optimized system could reach an installed capacity of 19.88 MW.[71] Detailed information on landfills with gas capture and utilization are shown in Annex B.

SECTION 6

Challenges and Opportunities to Mitigate Waste Methane

Colombia is a leader in Latin America in improving environmental and human health by closing dumpsites, providing waste collection and sanitation services for most of the population, and recognizing the work of the informal sector. The country has a robust regulatory framework for waste management, and at the national and subnational levels there is political will to continue to engage and improve waste methane mitigation solutions. However, challenges, outlined in Figure 9, exist that will bar Colombia from continued rapid progress and hinder meeting mitigation and development targets set by the country.

This section highlights key challenges and opportunities to improve waste management and mitigate methane emissions within the Colombian waste management system.

Figure 9: Challenges to Methane Mitigation from Waste Management Processes

66 DNP. (2021). *Informe Nacional de Disposición Final de Residuos Sólidos 2021.*

67 OECD. (2022), Enabling conditions for bioenergy finance and investment in Colombia, Green Finance and Investment, OECD Publishing, Paris. https://doi.org/10.1787/20f760d6-en

68 MAG Consultoría S.A.S. (2021). *Tratamiento de residuos sólidos en el marco del servicio público de aseo.*

69 Superintendencia Servicios Públicos Domiciliarios (SSPD). (2021). Sistema único de información de SSPD. Superservicios.gov.co. https://sui.superservicios.gov.co

70 Anthesis Lavola. (2021). Estructuración y formulación de la NAMA de Residuos Sólidos Municipales. https://www.minvivienda.gov.co/sites/default/files/documentos/resumen-ejecutivo-nama-rsm-colombia_final.pdf

71 Ibid.

The information presented here is based on a review of public and academic literature, meetings with different national entities, and a waste clinic hosted in Bogotá in August 2023 with representatives of 18 municipalities, national government, and other stakeholders. For more information on the waste clinic and the challenges identified by the participants, please see Box 4.

Box 4: Identifying Challenges in Colombia's Waste Management Sector with Municipal Stakeholders

What is a waste clinic?

A waste clinic is an expert and peer assit group session that:

1. Focuses on the specific challenges faced by **local governments (the patients)** in managing their municipal solid waste,
2. Draws on the perspectives and knowledge of each other,
3. Is facilitated by **experts (the doctors)** who help diagnose problems and identify remedies, and
4. Results in a draft workplan that helps local governments identify specific activities to address their challenges and areas of technical assistance needed.

On August 22-23, 2023, CATF convened 18 municipalities and national government representatives in Bogota to discuss waste management and methane mitigation. As part of the waste clinic conducted during these two days, participants discussed challenges and solutions focused on four topics: (1) waste sector data, (2) source separation, collection, and organics treatment, (3) final waste disposal, and (4) financing for waste management. Challenges identified by the municipalities include:

Waste Sector Data

Process/Reporting

1. Difficulties collecting and uploading information due to staff turnover (contractors) and lack of training
2. Information is not uploaded to the platform in the stipulated time
3. No standardized methodology for data reporting
4. No clear requirements for when certain data needed to be updated (i.e., waste characterizations)

Data and Quality

1. Small municipalities do not have high quality data
2. Lack of reliability of available data; differences in data between municipalities and SSPD
3. Landfill data is not linked to emissions in SUI
4. The information available is not disaggregated to be able to carry out future projects
5. Data on the use of organics is not collected because it is not part of the sanitation service
6. No or little information is available on informal recycling

Source Separation, Collection, and Organic Treatment

Source Separation and Collection

1. Source separation is not implemented and no economic incentives exist to do so
2. There are no routes for differential collection
3. Inefficient collection coverage in rural areas
4. Privatization of collection activities
5. No full participation of recyclers in the waste collection process

Organic Waste Treatment

1. Operators are too focused on landfilling
2. Limited number of pilot projects for treatment and use of organic waste
3. Lack of permits for the commercialization of compost (quality standard are too high)
4. Community resistance to organic waste treatment projects

Other

1. Lack of incentives for professional recyclers
2. Companies do not have financing for treatment actvities

Final Disposal

1. Closure of landfills immanent with limited area available for new sites
2. Poor road conditions at final disposal sites
3. Encroachment of land adjacent to sanitary landfills
4. Underestimated projections of waste sent to landfill
5. Municipal planning departments do not prioritize the problem of solid waste
6. Inefficient legal guidelines for sanitary landfills
7. Lack of investment in staff operational and maintenance training
8. Citizen culture promotes disposal of materials, not reduction and reuse
9. All cities do not promote circular economy objectives, creating tensions at regional landfills

Financing for Waste Management

1. Lack of knowledge of the responsibilities of subnational governments for PGIRS
2. Lack of education in solid waste management
3. No prioritization by municipal planning departments
4. No continuity of staff due to changes in administration of mayors, governors, etc.
5. Lack of funding and lack of knowledge of the entities for proposals to access funding
6. High interest rates
7. Low stringency of PGIRS, particularly, an absence of a section dedicated to organic waste

Waste Treatment Systems and Infrastructure

A lack of adequate infrastructure for improved solid waste management makes it difficult to implement both upstream and downstream waste methane mitigation solutions in Colombia. From poor implementation of existing systems, the lack of utilization of collected landfill gas, and the end of life of existing landfills, infrastructure and systems barriers are present at every stage of waste management.

For example, despite having a framework for source separation of waste, which was established through Resolution 2184 of 2019, implementation of separated collection is poor due to several factors:

a. a lack of public education related to waste management and outreach to stakeholders,
b. insufficient collection infrastructure for the different waste streams, and
c. inadequate treatment facilities.[72]

Furthermore, some citizens get discouraged from separating their waste if they witness it being co-mingled in collection vehicles and sent to landfill.

Sanitary landfills serve as the predominant mode for disposing waste; nevertheless, the effectiveness of this approach in limiting the environmental and climate impacts of waste disposal is significantly constrained by the availability and quality of these landfills. A substantial number of these landfill sites lack gas collection and utilization systems. This deficiency can be attributed to two factors: a lack of access to infrastructure investments and deficient requisite technical expertise for the successful implementation of these technologies.

72 MinAmbiente. (2019). Resolución 2184. Ministerio de Ambiente Y Desarrollo Sostenible. https://www.minambiente.gov.co/documento-entidad/resolucion-2184-de-2019/

Emissions Visibility—Detection, Quantification, and Repair

Activity data collected by the SUI is tied to the tariff framework, and as a result, waste data are, for the most part, aggregated and focused on the amount of waste sent to landfill. Little additional, disaggregated information on waste flows (i.e., composition of waste, organic waste amounts sent to treatment facilities, etc.) is routinely collected, verified, and published by SSPD. This limits visibility into the sector as a whole, the ability to accurately estimate and quantify emissions and mitigation, and has negative effects on scoping and financing waste treatment projects. Currently, Bogotá is the only municipality that has daily updated information on the amount of organic waste used in processes such as composting.[73]

A clear example of the lack of disaggregated information on waste is that Colombia's NDC only includes landfill gas capture projects—amounting to a small 5% emission reduction—and omits other organic waste treatment activities occurring in the country. From other sources, we know that there are at least 29 operational organic treatment facilities in the country mitigating emissions, which could contribute to Colombia's targets for methane and climate mitigation.

In recent years, remote sensing observations of methane from a mix of satellite-, airborne, and ground-based instrumentation have helped estimate methane emissions and detect and repair leaks from waste emission sources. However, in Colombia, as with many countries, such measurements of methane emissions are sparce and have generally been project dependent. Challenges to methane emission detection are often financial, as current technologies can be expensive, and measurement efforts also require human resource availability, technical expertise, and partnerships with research institutions. Some guidance for governments exists in using these measurements for official reporting—the IPCC includes guidance on using atmospheric inversion results in inventory validation in the *2019 Refinement to the 2006 IPCC Guideline for National GHG Inventories.* However, as these technologies and data sources continue to evolve, governments require additional support on how they can be used to further inform inventories, policy, and decision making on mitigation actions.

Priority recommendations that the Government of Colombia can take to improve emissions visibility include:

- SSPD, in cooperation with MinVivienda, should expand SUI data coverage to include the location and type of non-landfill waste treatment facilities, the amounts of waste processed at these sites, average municipal waste composition, informal sector recycling, and other data points needed to estimate waste methane emissions and track mitigation.
- SSPD should provide guidance and training to service providers on how, and how often, to properly collect and report this information in the system.
- IDEAM, in partnership with the government entities that assist with the national inventory,[74] academia, and civil society, should identify opportunities to incorporate remote sensing measurements of waste methane into tracking of emissions and mitigation.

Finance

Capital and operational expenses for waste management and infrastructure are financed through Colombia's tariff system. Although updates have been made to this system over time to provide funding for activities that mitigate methane, the tariff system is still a barrier to adequate organics treatment because a conflict of interests arises wherein landfill operators are remunerated based on the quantity of waste they dispose and lose revenue as the organic fraction is diverted from these sites.[75] Further, the low tariffs for organic waste treatment make the projects economically unfeasible in Colombia under existing conditions. In addition, the tariff framework disproportionately benefits public sanitation service companies by granting them access to utilization and treatment incentives.[76] As recipients

73 UAESP. (2023). Observatorio de residuos. https://www.uaesp.gov.co/content/observatorio-residuos

74 These entities include: MinAmbiente, Foreign Affairs, DNP, Ministry of Agriculture and Rural Development, Ministry of Mines and Energy, Ministry of Transportation, Ministry of Commerce, Industry, and Tourism, Mining and Energy Planning Unit, Rural Agricultural Planning Unit, National Business Association of Colombia, SSPD, Colombian Livestock Federation, National Rice Federation, Colombian Association of Electric Energy Generators.

75 MAG Consultoría S.A.S. (2021). *Tratamiento de residuos sólidos en el marco del servicio público de aseo.*

76 Ibid.

of these funds are limited, so are the number of projects that have the resources to develop pre-feasibility and feasibility studies for organic waste treatment.

Financing landfill gas capture and utilization systems is also a challenge in Colombia. CONPES 3874 of 2016 indicates that CRA is responsible for incorporating a tariff aspect reflecting the requirement that landfills be equipped with GCCS.[77] However, through Concept 3561 of 2019, CRA explicitly indicates that constraints exist that hinder including these remunerations within the existing framework.[78]

Finally, the economic incentives provided by the government are primarily tailored toward attracting capital investment rather than facilitating operational costs of waste management initiatives. Such a focus on investment may hinder the long-term growth and stability of these projects unless they adhere to principles of financial sustainability (i.e., ensuring that project revenues cover operational and maintenance expenses).

Priority recommendations that the Government of Colombia can take to improve access to funds to develop and scale waste methane mitigation solutions include:

- CRA and the Energy and Gas Regulatory Commissions should revise the tariff for treatment activities to accurately represent real capital expenses incurred by organics diversion, treatment, and gas capture, rather than being based on a comparison with final disposal and leachate treatment costs.
- CRA and SSPD can investigate the impacts associated with including the environmental costs of methane emissions from landfills and other final disposal sites in Colombia's waste tariff.

Enabling Policy and Regulatory Framework

The regulatory framework in Colombia is not sufficiently robust with respect to waste methane mitigation. Although Colombia has committed to waste emissions reductions through its NDC and NAMA, these commitments are limited, and no national waste methane target or roadmap exists. Further, the current framework exacerbates methane pollution from the sector by continuing to incentivize the disposal of all waste in final disposal sites with no strict standards on landfill gas capture.

Little coordination exists between the different national and subnational entities, which is heightened by the differing municipal conditions that may not be considered at the national level. Little continuity happens in implementing programs planned by previous administrations at the municipal level. These challenges lead to municipal plans that are not aligned with national objectives, delays, and the potential for new administrations to abandon nascent projects or programs. PGIRS, which were envisioned to solve these problems by creating a planning instrument to (1) help municipalities align waste management planning with national objectives and (2) facilitate the continuity waste management planning over multiple administrations, are not effective because the documents are too general and don't provide a well-developed plan for subsequent administrations to follow. A coordinated approach among all stakeholders engaged in ISWM is required to establish a comprehensive national-level strategy that can be implemented at a local level.

Priority recommendations that the Government of Colombia can take to improve enabling environments to foster waste methane mitigation include:

- Develop a national waste methane mitigation, organic waste management strategy, or zero waste target to identify a target for methane mitigation from solid waste disposal and plot Colombia's path toward achieving it. DNP and MinAmbiente should develop this strategy through a collaborative process with all necessary stakeholders, including the informal sector. Further, this strategy should be aligned with the 2050 Strategy process that is being led by MinAmbiente to guide national, sectoral, and territorial actions to achieve the objectives of the Paris Agreement.
- MinVivienda and MinAmbiente can create regional solid waste management working groups with experts from municipalities, including the informal sector; facilitate communication between these groups and other national experts within MinAmbiente, MinVivienda, DNP, and SSPD.

77 DNP. (2016). *CONPES 3874*. Dnp.gov.co.

78 CRA. (2019). *CONCEPTO 3561 DE 2019*. https://normas.cra.gov.co/gestor/docs/concepto_cra_0003561_2019.htm

- MinVivienda and MinAmbiente, through modification of Resolution 754 of 2015, should publish structured guidelines on the content of PGIRS for local governments to reference and follow. These guidelines should require municipalities to estimate methane emissions at the local level and planned efforts to mitigate these emissions in the waste sector; this information could then be incorporated into the national GHG inventory process.
- DNP and the General Participation System—which is responsible for delivering subsidies and contributions to the providers of public sanitation services—should provide additional funding for developing PGIRS, which will lay the groundwork for improved long-term planning.

Stakeholder Awareness and Capacity Strengthening

Lack of awareness of regulations and programs by stakeholders hinders the implementation of actions across the waste management chain. This includes a lack of technical expertise and training within municipalities and waste management staff, as well as a lack of public awareness and education.

Government representatives do not have sufficient capacity and expertise to develop policies, evaluate ISWM projects, access incentives, and verify compliance. For example, lack of awareness of financial incentives derived from Resolution 720 of 2015, Resolution 853 of 2018, and Law 2099 of 2021 has continued to result in a lack of development of non-landfill waste treatment facilities. This is exacerbated by a lack of continuity in government staff due political changes.

In addition, lack of public awareness and education of the environmental and climate impacts associated with waste management limit support to implement priority solutions.

Furthermore, this lack of general public awareness hinders the implementation of best practices as they relate to organic waste prevention and waste separation, which are the initial steps toward emission mitigation in the sector.

Priority recommendations that the Government of Colombia can take to improve capacity and understanding to develop and implement methane solutions include:

- DNP, with support from key stakeholders, should improve coordination and information sharing between national, departmental, and municipal government staff to increase awareness of programs and incentives. Provide trainings for municipal staff and the informal sector to strengthen their capacity to develop, implement, and oversee waste methane mitigation activities.
- MinVivienda, municipalities, and/or operators, with support from stakeholders, can develop public education campaigns on actions to reduce waste methane including campaigns on waste reduction and source separation at the national and municipal levels.
- The Ministry of Education, in coordination with Colombia's education secretariats, can incorporate waste management and methane mitigation information into school curriculums, so students are taught the importance of waste management and its links to climate change.

SECTION 7

Conclusions

Colombia has seen significant progress in upgrading its waste management system in recent decades. The country has high collection rates, sends most waste to engineered disposal sites, and has developed a sustainable funding mechanism through its waste tariff.

Now, Colombia has the opportunity to build on these successes by reducing the climate impacts of its waste management system. With a municipal waste generation of more than 14 million metric tons in 2021[79] and solid waste disposal emissions of more than 380,000 metric tons of methane, there is significant mitigation potential in this sector.

ISWM and waste methane mitigation require a systems solution in which not only subnational and national agencies are aligned, but industry, informal sector, and civil society, alongside other key stakeholders, are integrated. Although the challenges mentioned above, among others, may slow this transition, by implementing the recommendations included here and developing a path toward improving the capture and use of landfill gas while stopping practices that send organic waste to final disposal sites, Colombia can move from being the third largest emitter of waste methane in Latin America to a leader in the region.

79 Hub de Residuos Sólidos y Economía Circular. (2023). "Base Datos Regional 150523 Descargar."

Annex A. Detailed Information on Colombia's Waste Management Regulatory Framework

Table A-1. Expanded Legal and Regulatory Framework for Waste Management

Sources: Anthesis Lavola. (2021). Estructuración y formulación de la NAMA de Residuos Sólidos Municipales. And INERCO. (2018). Valorización energética de residuos: Proyecto WTE Colombia. And MAG Consultoría S.A.S. (2021). Tratamiento de residuos sólidos en el marco del servicio público de aseo.

Regulatory Framework	Description
National Policies on Waste Management	
CONPES 2750 of 1994	CONPES 2750 was the foundational policy for environmental programs in the country's National Development Plan, which includes solid waste management. Its objective was to gradually advance toward sustainable human development and thus incorporate environmental considerations in policies for urban development, industrial, agricultural, and others. As part of its programs and actions for environmental improvement and, specifically, for Better Cities and Populations line of action, CONPES 2750 establishes, among others, the following: ■ Establish, control, and monitor minimum quality standards for solid waste management and atmospheric emissions; and ■ Promote a national program for solid waste management and recycling, which involves municipalities, private sector, and civil society and covers the waste value chains for production, distribution, and final disposal.
Policy for Integrated Solid Waste Management of 1998	To manage waste in a way that it compatible with the environment and public health, it establishes objectives, goals, strategies, and action plans. Objectives and goals include: ■ Implement waste minimization programs; ■ Divert 30% of waste from final disposition sites and favor use and treatment; and ■ At least 50% of municipalities should have adequate waste disposal systems. Through this policy Municipalities and cities are responsible for, among others: ■ Elaborating and implementing an ISWM plan; and ■ Promote projects and programs for waste minimization, separation, and use.
CONPES 3530 of 2008	Created to encourage the regionalization of sanitary landfills to promote final disposal in authorized sites and improve solid waste management in urban and rural areas. CONPES 3530 also establishes a goal to create organized systems for use and recycling of waste.
CONPES 3819 of 2014	Establishes the National Policy for Consolidating the City System in Colombia, as part of its action plan the Solid Waste Plan for the City System must be aligned with the PGIRS and include actions on use, treatment, and valorization of waste.

Regulatory Framework	Description
National Policies on Waste Management	
CONPES 3874 of 2016: National Policy for Integrated Solid Waste Management	Formulated as a fundamental directive, the aim is to enact a comprehensive strategy for ISWM at the national level, thereby advancing principles of a circular economy, sustainable development, and measures to address climate change through adaptation and mitigation. Outlined below are the precise focal points of this endeavor: ■ Propel the adoption of circular economy practices; ■ Foster a culture of active citizen participation; ■ Facilitate seamless coordination among diverse institutions and stakeholders to bolster the advancement of ISWM initiatives; ■ Enhance the MRV framework to bolster the efficacy of ISWM oversight.
CONPES 3934 of 2018: Green Growth Policy	Ensures sustainable development by establishing a green growth model that safeguards natural capital and climate security.
CONPES 3918 of 2018: Strategy for the implementation of the SDGs	Defines targets and indicators to ensure environmental conservation through a roadmap for the implementation of Agenda 2030 and the SDGs in Colombia. The country has set national targets of 10% by 2018 and 17.9% by 2030 in its SDG target 12 to increase recycling rates and reuse of solid waste.
Provision of Public Services for MSW	
Law 142 of 1994	Establishes Colombia's framework for domiciliary public services, focusing on public sanitation services. The scope of this law encompasses municipal waste collection, with a primary emphasis on solid waste. Additionally, the law extends its applicability to ancillary activities involving the transportation, treatment, use, and final disposal of these wastes.
Law 689 of 2001	Modifies Article 14 of Law 142 of 1994 by including grass cutting, pruning of trees located in public areas, treatment, and recovery in the Public Sanitation Service. SSPD acquired the functions of administrator of the Unified Information System (SUI), a platform created through this law, that collects and processes information reported by the public services sector.
Law 1450 of 2011	Establishment of the National Development Plan 2010–2014. Aims to include recyclers' organizations giving them a strategic role in waste management. SSPD must oversee the inclusion of recyclers in solid waste collection and disposal activities.
Decree 2981 of 2013	Regulates the provision of SPA under Law 142 of 1994. Also outlines storage, waste collection and transport, sweeping and cleaning of public areas, ISWM, user service and commercial management of the public sanitation service, and obligations of the service providers.
Decree 596 of 2016	Modifies and incorporates the activity of waste recovery in the SPA. Seeks the formalization of waste recyclers through a transitional regime.
Decree 1345 of 2021	Modifies Decree 596 of 2016, mainly with the objective of extending from five to eight years the period of progressivity for the formalization of professional recycling organizations.

Regulatory Framework	Description
Landfill and Final Disposal	
Resolution 1390 of 2005	Defines guidelines for closing inadequate final disposal sites of waste that do not comply with environmental standards.
Decree 838 of 2005	Works to prohibit uncontrolled dumping and burning of waste by allowing landfills as a final disposal alternative.
Resolution 1529 of 2010	Establishes a maximum period of 12 months for the transition period and/or closure of unsuitable disposal sites.
Resolution 1890 of 2011	Prohibits uncontrolled dumping, burning, and storage of waste in temporary cells by stating final disposal alternatives for MSW, approved by the environmental authorities. The alternatives that could be applied by the different municipalities are as follows: ■ Disposal cells in the closing and decommissioning stage that have not completed these activities. ■ Transformation of sites that would have functioned as transitory disposal cells into sanitary landfills. ■ Transformation of sites that would have functioned as contingency cells into sanitary landfills. ■ Sanitary landfills in contiguous areas where closed cells were operating.
Decree 2041 of 2014	Establishes guidelines for environmental authorities to grant or deny environmental licenses for the construction and operation of facilities for the storage, treatment, use, recovery and/or final disposal of waste.
Resolution 330 of 2017	Guidance on design aspects, and technical regulations for collection, transport, and disposal activities.

Resolution 938 of 2019	Defines SPA guidelines for complementary activities of treatment and final disposal:
	■ Defines available areas for landfill expansion and new construction, and new waste treatment projects.
	■ Establishes minimum guidelines for the design and operation of disposal sites, as well as guidelines for closure, decommissioning and post-closure. In terms of operation, the following minimum standards are defined for all disposal sites:
	  ■ Technician gas capture and flaring.
	  ■ Measurement of gases such as methane and hydrogen sulfide, and flammability limits using sensor equipment.

Organic Treatment of Waste	
Colombian Technical Standard 5167 of 2011	Establishes guidelines and tests that organic products must meet to be used as soil conditioners or soil improvers.
Decree 1077 of 2015	Outlines factors for municipalities to evaluate in their waste recovery feasibility projects.

Regulatory Framework	Description
Law 1753 of 2015	Establishes an incentive for territorial entities to make use of solid waste based on the projects set out in PGIRS.
Decree 1784 of 2017	Establishes guidelines for complementary treatment activities and empowers operators and providers of public sanitation services to charge fees for these activities. Provides a tariff for the public sanitation service for both technologies that support the extraction and capture of gases in landfills.
Resolution 240 of 2016	Establishes the standards for domestic public gas utilities concerning biogas and biomethane.
Law 2099 of 2021	Defines biomass within the Colombian energy matrix as a non-conventional source of renewable energy, allowing such projects to obtain tax benefits. This law makes amendments and supplements the Law 1715 of 2014.
Resolution 2184 of 2019	Establishes a color code for the separation of solid waste at source at the national level: green for recoverable organic waste; white for recyclable inorganic waste such as plastic, glass, metals, multilayer, paper, and cardboard; black for non-recoverable waste.
Financial Incentives for Waste Management	
Law 1176 of 2007	Establishes that solid waste projects involving treatment, recovery, and final disposal activities, will receive funds from the drinking water and basic sanitation sector.
Resolution 720 of 2015	Establishes the tariff regulation regime for landfill operators with monthly final disposal of more than 300 tons of waste, and public waste service providers in municipalities with more than 5,000 subscribers in urban areas. Also establishes alternatives to landfilling that can be charged under the tariff regime if they do not exceed the Cost of Final Disposal plus the Cost of Leachate Treatment.
Resolution 853 of 2018	Establishes the tariff regulation regime for landfill operators with monthly final disposal of less than 300 tons of waste, and public sanitation service providers serving municipalities with less than 5,000 subscribers in urban areas.
Resolution 431 of 2020	Establishes the possibility, through territorial measures, to reduce the impacts of climate change on housing and basic sanitation sectors.
Decree 2412 of 2018	Defines, by Law 1753 of 2015, incentives for solid waste treatment and recovery activities, establishing mechanisms for invoicing, collection, and investment of resources at the national level. Defines projects complementary to the recovery and treatment of solid waste that must be evaluated within the framework of the SPA for allocation of incentives.
Resolution 176 of 2020	Defines the evaluation criteria for waste treatment activities and establishes the criteria for accessing incentives for solid waste recovery and treatment activities.
Decree 802 of 2022	Modifies Decree 1077 of 2015 regulating the incentive for the recovery and treatment of solid waste, defining the way in which funds are calculated, invoiced, collected, allocated, and used.
Municipal Solid Waste Management Planning	
Resolution 1045 of 2003	Establishes guidelines for municipalities to develop PGIRS, an instrument for planning and improving processes related to the generation, collection, disposal, and recovery of solid waste in each territorial entity.
Resolution 754 of 2014	Defines the guidelines for PGIRS formulation, implementation, evaluation, monitoring, control, and updating.

Annex B. Waste Disposal and Treatment Sites

Table A-2. Operational Organic Waste Treatment Facilities

Source: MAG Consultoría S.A.S. (2021). Tratamiento de residuos sólidos en el marco del servicio público de aseo.

Location		Company	Facility Type	SPA Facility
Dept.	Municipality			
Antioquia	Medellín	Gestión y Desarrollo Ambiental	Compost	No
Antioquia	Medellín	Funglus	Compost	No
Antioquia	Heliconia	Evas – Enviambientales S.A. E.S.P.	Treatment plant[80]	Yes
	Guarne	S.I.	Treatment plant	Yes
Atlántico	Barranquilla	Ecopars S.A.S. TRIPLE A DE BARRANQUILLA S.A. E.S.P	Anaerobic digestion	Yes
Boyacá	Garagoa	Empresas Públicas de Garagoa—EPGA S.A. E.S.P.	Treatment plant	Yes
	Santa María	Oficina de Servicios Públicos de Santa María	Treatment plant	Yes
Casanare	Tauramena	S.I.	Treatment plant	Yes
Cauca	Popayán	Universidad del Cauca	Compost	No
	Puerto Tejada	SOLTAC	Compost	No
	Timbío	Alcaldía municipal – Asociación de Recicladores de Oficio Goleros (AROG)	Compost	Yes

80 Treatment plants, as defined by the source, are facilities that both separate materials for recycling and recovery and compost.

Location		Company	Facility Type	SPA Facility
Dept.	Municipality			
Cundinamarca	Bojacá	Biocarbono S.A.S.	Compost	No
	Madrid	BIOCARBONO S.A.S E.S.P.	Compost	Yes
	Nocaima	Unidad Administradora de Servicios Públicos de Nocaima	Treatment plant	Yes
	Tocancipá	Ibicol S.A.S.	Compost	Yes
	Madrid	SAID S.A.S.	Compost	No
	Mosquera	COMPOSTAGRO WILLYS S.A.S.	Compost	No
	Mosquera	CREAR VIDA S.A.S.	Compost	No
Huila	Santa María	Unidad de Servicios Públicos de Santa María	Treatment plant	Yes
Meta	Acacías	Empresa de Servicios Públicos de Acacías -ESPA E.S.P.	Treatment plant	Yes
Nariño	Pupiales	Emserp E.S.P.	Treatment plant	Yes
Santander	Suratá	Unidad de Servicios Públicos de Suratá	Treatment plant	Yes
	Bucaramanga	Distriabonos del Oriente S.A.S.	Compost	No
Tolima	Cajamarca	Agua Viva E.S.P.	Treatment plant	Yes
Valle Del Cauca	Cali	Distriabonos	Compost	No
	Caicedonia	Empresas Públicas de Caicedonia E.P.C. E.S.P.	Treatment plant	Yes
	Versalles	Cooperativa de Servicios Públicos de Versalles	Treatment plant	Yes
	La Victoria	Secretaría de Planeación de La Victoria	Treatment plant	Yes

Table A-3. Sanitary Landfills Included in Colombia's Solid Waste NAMA

Source: Anthesis Lavola. (2021). Estructuración y formulación de la NAMA de Residuos Sólidos Municipales.

Landfill	Location		GCCS	Gas Use
	Dept.	Municipality		
Doña Juana	Bogotá, D.C.	Bogotá, D.C.	X	X
Los Pocitos	Atlántico	Galapa	X	
Los Cocos Environmental Park	Bolívar	Turbaná	X	
Pradera	Antioquia	Don Matias	X	
Colomba-el Guabal de Yotoco	Valle del Cauca	Yotoco	X	
Nuevo Mondoñedo	Cundinamarca	Bojacá	X	
El Carrasco	Santander	Bucaramanga	X	
Guayabal Environmental Technology Park	Norte de Santander	San Jose de Cúcuta	X	
Regional Presidente	Valle del Cauca	San Pedro	X	
Loma Grande	Córdoba	Monteria	X	
Parque Ecológico Reciclante	Meta	Villavicencio	X	
Palangana Environmental Park	Magdalena	Santa Marta	X	
Los Corazones	Cesar	Valledupar	X	
Solid Waste Industrial Park La Miel	Tolima	Ibagué	X	
El Oasis	Sucre	Sincelejo	X	
Antanas Environmental Technology Park	Nariño	Pasto	X	
Pirgua Environmental Park	Boyacá	Tunja	X	
La Esmeralda	Caldas	Manizales	X	
Andalucía Environmental Park	Quindío	Montenegro	X	
Los Picachos	Cauca	Popayán		
El Clavo	Atlántico	Palmar de Varela		