OTCA
Organización del Tratado de Cooperación Amazónica

BANCO DE DESARROLLO DE AMÉRICA LATINA Y EL CARIBE

Baseline, Benchmarking, Amazon Climate Database and Systematization of Monitoring, Reporting and Verification Systems

AMAZON BASELINE ON CLIMATE CHANGE

Strengthening and expansion of the Amazon Regional Observatory (ORA) in the areas of climate change, forests and biodiversity and climate change

Prepared by:

.

libélula

I. Presentation

In terms of mitigation, historical information is presented over the years, explaining the behavior of greenhouse gas (GHG) emissions generated in the Amazon region of each ACTO member country, which are Bolivia, Brazil, Colombia, Ecuador, Guyana, Peru, Suriname and Venezuela. This activity was developed with the objective of having a comparative analysis of how these emissions will evolve towards 2030 considering the base scenario in which no mitigation measures are applied. This information was obtained by searching for official and updated data from each member country, such as GHG Inventory Reports, Biennial Reports, Communications, BUR, among others. However, there were some challenges in obtaining data from some countries such as Guyana, Suriname and Venezuela, because their available information was not solid enough for the basis of this work, so we proceeded to request data by means of "notes verbales" to each of the countries mentioned. However, only Bolivia responded by means of document **EB.BR.Cs. 91/2024 / Roadmap 19906.23** (see here)**.** Therefore, for the other countries, information from reference sources obtained from the Climate Watch platform (www.climatewatchdata.org) was used.

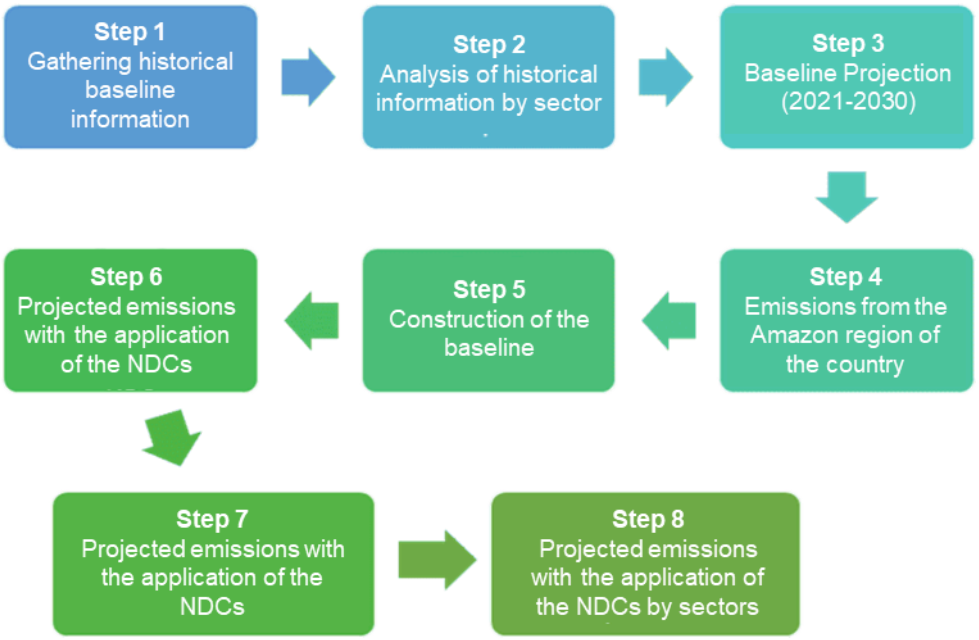
The compilation of historical information on GHG emissions for each country was evaluated considering only the Amazonian territory of each country, which was differentiated considering the political-administrative division. Likewise, the construction of the historical base was developed in different years and goes from 1990 to 2015, 2018 or 2020 depending on the availability of information for each country. These, in turn, are divided into five (5) evaluation sectors: Energy, Industrial Processes and Product Use (IPPU), Agriculture, Forestry and Other Land Use, Land Use Change, and Waste; which were determined according to the criteria established by the 2006 IPCC Guidelines[1] for National Greenhouse Gas Inventories (2006 Guidelines).

1 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Available at https://www.ipcc-nggip.iges.or.jp/public/2006gl/spanish/pdf/1_Volume1/V1_1_Ch1_Introduction.pdf

II. Methodology used

Mitigation

The methodology applied to obtain the data and the projection of GHG emissions for each of the ACTO Member Countries has been developed in eight (8) steps, which in turn contain sub-steps and some specificities, especially in the case of the land use change sector.



The following activities were systematically carried out for the construction of the baseline for the Amazon region:

Initially, a search was carried out for official information on greenhouse gas inventories of ACTO member countries, contrasted with information from the official platform for biennial reports of non-Annex 1 countries (https://unfccc.int/BURs) of the United Nations Framework Convention on Climate Change (UNFCCC).

Although not all ACTO member countries have published their GHG inventories, efforts were made to systematize the official information available. The countries for which it was possible to obtain historical information were: Brazil, Colombia, Ecuador and Peru; in the rest of the cases the information is very scarce or other sources of reference information had to be used.

Based on official data from ACTO member countries and benchmark data from some countries, a historical series of data was constructed from 1990 to 2015, 2018 or 2020 depending on the availability of information for the five (5) sectors: Energy, Industrial Processes, Agriculture, Land Use Change and Waste.

Steps for data projection

To project the data up to the year 2030, linear equations were used to represent the trend in greenhouse gas emissions in each of the member countries. These equations and operational procedures were developed according to the types of data obtained and sectors evaluated. The data are presented below:

Step 1: Starting data (Baseline) total country:

Historical baseline information corresponds to: GHG emissions inventory published by the PM or referential sources.

Step 2: Analysis of historical information by sector

The historical data were analyzed to determine whether their growth responded to a linear trend.

For the sectors: Energy, Industrial Processes, Agriculture and Waste the trend line shows that the data series can be described with a linear equation.

Table 1. Linear equation of the evaluated sectors

	Energy	Industrial Processes	Agriculture	Waste
a =	-17,972,307	-3,036,002	-12,491,117	-2,795,866
b =	9,124	1,554	6,417	1,418
r2 =	0.95	0.97	0.98	1.00

The equation is:

$$Y = a + b * X$$

Where:

Y = Gg CO_2/year $_i$
a = Ordinate to origin
b = Slope
X = year $_i$

Step 2.1 Land Use Change

GHG emissions from land use change in general do not respond to a linear trend, but rather to regulatory decisions of the MPs to create or eliminate protected areas or authorizations for the total or partial removal of vegetation from forest land and/or forests to be used for non-forest activities.

The impact of emissions data series (land use change) on PM emissions data and especially from Amazonia is relevant, as it can be in the range of 20 to 65% of the total.

In order to improve the analysis, we analyzed the official information available for each of the MPs on changes in land use. In order to better understand the analysis, the case of Brazil is used as an example:

The Brazilian Institute of Geography and Statistics (IBGE), shows biannual information on land use change and it is evident that from 2010 to 2020 it has doubled, i.e. its rate is over 10% per year.

Table 3. Land use change 2010 and 2020

Data in km²	2010		2020		Growth 2010-2020	
	Agricultural area	Grazing area	Agricultural area	Grazing area	Agricultural area	Grazing area
Amazonas	180	2,598	608	8,413		
Roraima	324	574	698	1,455		
Amapa	5	166	191	144		
Para	1,086	74,111	9,158	157,510		
Acre	44	7,378	21	12,795		
Rondonia	1,337	37,714	3,740	70,973		
Matto Grosso	68,582	144,103	119,198	189,553		
Tocantins	2,966	40,842	13,911	58,811		
Maranhao	4,468	36,673	12,767	63,159		
Total Amazon	**78,992**	**344,159**	**160,292**	**562,813**	**103%**	**64%**

Source: IBGE

Since it is not possible to use the 1990-2020 historical series, given that it responds to policy and/or regulatory changes and not to a trend, we looked for options to construct it:

Option 1: Use Emissions Inventory for the last four (4) years

Reduction of the period for construction to the last four years (2017-2020), and the linear equation would be:

Table 4. Linear equation for land use change

	Land use change
a =	-244,607,586
b =	121,410
r2 =	0.96

Option 2: We use the annual cumulative growth rate of land cover and land use change in Brazil, reported by IBGE.

With the historical series 2010-2020, the annual cumulative rate is calculated, which indicates the trend of land cover and land use change (growth rate).

From these two options, the one that best fits the historical series of emissions from land use change should be selected.

To complement the analysis, a frequency distribution for the period 1990-2020 should be elaborated, which indicates that 52% of the emissions data is above 761,147 Gg CO_2/year, so there is a 52% probability that the trend of emissions will be upward with a very strong increasing trend.

Based on this analysis, **option 1** was used to project emissions data for the land-use change sector. This result was also developed for all the countries evaluated.

Table 5. Cumulative annual rate of land use and land cover change trend

Surface	km 2	Brazil Total 8,510,418	Cumulative annual growth rate
Tabela 7319 - Estoque, por classes de cobertura e uso da terra e evolução do estoque			**2.86%**
2010	km 2	1,382,408	
2011	km 2	1,538,792	
2012	km 2	1,695,175	
2013	km 2	1,722,738	
2014	km 2	1,750,300	
2015	km 2	1,769,958	
2016	km 2	1,789,616	
2017	km 2	1,796,898	
2018	km 2	1,804,179	
2019	km 2	1,818,100	
2020	km 2	1,832,021	

Source: IBGE

Step 3: Baseline Projection to 2030

With linear equations of the type Y = a + b*X, the baseline projection is made and the corresponding graphs are constructed.

Step 4: Emissions from the Amazon region of the country.

The methodology is selected to determine the percentage of GHG emissions emitted by the Amazon region of each country by sector (energy, industrial processes, agriculture, land use change and waste) in its internal political-administrative division: state; department or province, as appropriate.

Table 6. Percentage of political-administrative criterion

Emissions sector	Criterion
Energy	% of GDP represented by the Amazon of the PM
Industrial Processes	
Agriculture	Area used for agriculture
Land use change	Surface area that changes in land cover
Waste	% of GDP represented by the Amazon region of the MP

Step 4.1: Internal political-administrative division of the Amazon in the MP.

The official information of the states/departments/provinces that are part of the Amazon is obtained with the latest available information on surface area, Gross Domestic Product (GDP) and population. With this information, the contribution to the country's GDP is calculated for each of the states/departments/provinces that are part of the Amazon for its application in the energy, industrial processes and waste

sectors.

Step 4.2: Agriculture and land use change sectors.

For the agriculture and land use change sectors, official information on the evolution of land cover and land use is considered, which makes it possible to determine the amount of area applied to agriculture and the amount of land use change. With this information, the percentages to be applied to agriculture and land use change are determined. This means determining the percentage of emissions that correspond to each state/department/province due to land use change and agriculture. On this basis, the following criteria are applied for the missing periods:

- The period (years) over which the value (%) of a year is to be kept constant is determined.
- Projection period: The annual growth of the period determined previously with the following equation is considered:

$$\%\ year_{n} = \%\ year_{(n-1)} * \left(\frac{\%\ 2020}{\%\ 2019}\right)$$

Step 5: Construction of the baseline

With the inventory data (historical data) and the projection equations, baselines are prepared by country, sector, state/department/province/region with historical and projected data.

Once the baselines have been projected to the year 2030, the cause-effect variables between emissions and human activity are identified for each of the sectors, as follows:

- For energy, industrial processes and waste, the GDP of each country is used, relating it to its Amazonian territories.
- For land use change and agriculture, the area used is the area used for agriculture and/or the area of forest that changed its cover, i.e. the land use change applied to it.

With this information for each of the countries and their Amazonian territory according to political-administrative division, greenhouse gas (GHG) emissions by sector are estimated for the year 2030.

In the absence of information from some MPs, such as Venezuela, Guyana and partially Suriname, the only available information on emissions inventories can be found on the platform of the organization "Climate Watch" (www.climatewatchdata.org), used as a baseline.

III. Criteria for the collection of GHG inventory data

GHG inventory data from member countries were obtained using the criteria established by the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (2006 Guidelines) for National Greenhouse Gas Inventories (2006 Guidelines). This was done through the invitation to update the 1996 Guidelines and associated good practice guidance from the

United Nations Framework Convention on Climate Change (UNFCCC). In the meantime, the update integrates internationally agreed methodologies to be used by countries to estimate greenhouse gas inventories and report them to the UNFCCC (IPCC, 2006).

The 2006 IPCC Guidelines contain 5 volumes, one for each sector (Volumes 2 to 5) and one for general guidance applicable to all sectors (Volume 1).

Volume 1: General orientation and reporting Volume 2: Energy
Volume 3: Industrial Processes and Product Use (IPPU) Volume 4:
Agriculture, Forestry and Other Land Use (AFOLU) Volume 5: Waste

However, for the purposes of this paper, the following will be considered: Volumes 2, 3, 4 and 5 of the 2006 IPCC Guidelines.

IV. GHG emissions sectors

Energy

Globally, for the vast majority of countries' economies, energy systems are developed based on the combustion of fossil fuels. That combustion process releases gases that are converted into carbon dioxide (CO_2) and water (H_2O), the former qualified as part of the GHGs that cause Global Warming of the Earth. This sector tends to be one of the main sources assessed within GHG emissions inventories, given that it usually contributes about 95% of CO_2 emissions and the remaining 5% is methane and nitrous oxide (IPCC, 2019).

As described by the IPCC 2006, the energy sector comprises the following sources:

- Exploration and exploitation of primary energy sources.
- The conversion of primary energy sources into more usable forms in refineries and power plants.
- Transmission and distribution of fuels.
- The use of fuels in stationary and mobile applications.
- Emissions arise from these activities by combustion and as fugitive emissions, or by exhaust without combustion.

Industrial Processes and Product Use (IPPU)

The IPPU sector includes GHG emissions generated by a wide variety of activities within industrial processes, such as the use of furnaces in the iron and steel industry, ammonia and other chemical products made from fossil fuels used as chemical intermediates, and the cement industry; these processes transform materials by chemical or physical means. The main emissions associated with this sector are: carbon dioxide (CO_2), methane (CH4), nitrous oxide (N2O), hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs) (IPCC, 2016b).

As described by the IPCC 2006, the IPPU sector comprises the following categories:

- Minerals industry.
- Chemical industry.
- Metals industry.
- Use of non-energy products, fuels and solvents.

- Electronics industry.
- Use of substitute products for ozone-depleting substances.
- Manufacture and use of other products.
- DH others.

Agriculture, forestry and other land use (AFOLU)

The assessment in the AFOLU sector recognizes that GHG emissions and removals, different forms of carbon stocks and land use changes can occur on different types of land (IPCC, 2019c). Therefore, according to the IPCC 2006, the following should be taken into account for the estimation of GHG emissions and removals:

- CO_2 emissions and removals resulting from changes in carbon stocks in biomass, dead organic matter and mineral soils, for all managed lands.
- CO_2 and non-CO_2 emissions produced by fires on all managed lands.
- N2O emissions from all managed lands.
- CO_2 emissions related to the application of lime and urea on managed land.
- CH4 emissions from rice cultivation.
- CO2 and N2O emissions from organic cropland.
- CO2 and N2O emissions from managed wetlands (with a basis for methodological development for CH4 emissions from flooded lands presented in Appendix 3).
- The emission of CH4 produced by livestock (enteric fermentation).
- CH4 and N2O emissions from manure management systems.
- The change in carbon stocks is related to harvested wood products.

It should be noted that, for the purposes of this paper, this sector will be divided into two topics: Agriculture and Land Use Change.

Waste

For this sector, the Waste volume is evaluated which provides methodical data to estimate the emissions of the main GHGs which are CO2, CH4, N2O coming from four assessment categories, within which the largest source of CH4 emission of the total GHG emissions in the present sector, is given by the SWDS category followed by CH4 emissions from wastewater treatment and disposal (IPCC, 2019d).

As described by the IPCC 2006, the Waste sector comprises the following categories:

- Solid waste disposal (SEDS).
- Biological treatment of solid waste.
- Incineration and open waste incineration.
- Wastewater treatment and disposal.

Understanding the criteria established by the 2006 IPCC Guidelines, the present report develops the initial criteria as shown in Table 7, the compilation of the database is generated to analyze them.

Criteria for segmenting GHG inventory data.

Emissions sector		Initial Criteria
1) Energy		% of GDP represented by the Amazon region of the MP
2) Industrial Processes and Product Use (IPPU)		
3) Agriculture, forestry and other land use	3.1) Agriculture	Area under Agriculture (km2)
	3.2) Land Use Change	Surface area changing its coverage (km2)
4) Waste		% of GDP represented by the Amazon region of the MP

Source: Own elaboration

V. Official GHG inventories of the member countries of the Amazon region and their prioritized emission sectors

GHG inventory information was obtained from the official sources of each of the member countries, which were taken in accordance with the criteria established by the *2006 IPCC Guidelines* and explained in previous paragraphs. This section includes the analysis of the data obtained from the different sectors evaluated in each country, where the following scenarios are considered:

- Historical GHG emissions data - Sector vs. Amazon for each country: Shows the BAU scenario for the prioritized emission sectors within the Amazon for each country.
- Projection to 2030 of GHG emissions - Sector vs. Amazon for each country: Shows the projections of the emissions of the prioritized sector if no mitigation scenario is applied or if the NDC targets of each country are met.

5.1. Analysis of the Business As Usual (BAU) scenario of GHG emissions by Amazonian territory for each country and its projection to 2030.

The following section shows the BAU scenario that represents the baseline of the historical behavior of GHG emissions ($GgCO_2$/year) generated by the activities carried out in the Energy, Industrial Processes, Land Use Change, Agriculture and Waste sectors over the years by the states/regions/provinces that make up the Amazon region of each country.

Similarly, the projection of the amount of GHG emissions that would be generated by 2030 if mitigation measures were not applied as proposed in the NDCs of each country is shown, the data for which are highlighted in light blue.

To obtain these results, we proceeded to review different sources that contain the official inventories of the countries, but especially of the departments/states/provinces that make up the Amazon region.

Bolivia

The Bolivian Amazon is made up of 5 departments: Beni, Pando, Santa Cruz, La Paz and Cochabamba, which together form about 502,882 km^2. The country, like the different member countries of the Amazon region, presents environmental challenges focused on the different sectors evaluated, one of which is the increase in GHG emissions.

According to the information obtained, the historical data base of GHG emissions in Bolivia is from 1990 to 2020 for all the sectors evaluated. Meanwhile, if we visualize the results of the departments of the Bolivian Amazon with the highest GHG emissions in the energy sector through these years are Beni, La Paz and Santa Cruz tending 182, 167 and 161 $GgCO_2$/year in 1990 and 393, 362 and 349 $GgCO_2$/year in 2020, respectively.

It also shows how GHG emissions in the energy sector would evolve if mitigation measures were not incorporated to counteract the increase in these emissions. In 2030, the three departments with the highest GHG index would be Beni, La Paz and Santa Cruz, which could emit around 454, 418 and 403 $GgCO_2$/year, respectively.

Bolivia - GHG Inventories Gg CO_2/year of the Energy Sector (1990-2020) + Projection to 2030

Country	Area	Department	Sector	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Bolivia	Amazon	Pando	Energy	44	48	54	60	66	67	69	70	71	67	62	58	57	58	61	64	66	69	72	76
Bolivia	Amazon	Beni	Energy	182	202	224	248	275	281	286	291	297	277	257	241	236	243	253	265	276	289	302	315
Bolivia	Amazon	Santa Cruz	Energy	161	179	199	220	245	249	254	259	263	246	228	214	209	216	225	235	246	257	268	280
Bolivia	Amazon	La Paz	Energy	167	186	206	228	253	258	263	268	273	255	237	222	217	223	233	244	254	266	278	290
Bolivia	Amazon	Cochabamba	Energy	110	122	135	150	166	169	172	176	179	167	155	146	142	146	153	160	167	174	182	190

Country	Area	Department	Sector	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Bolivia	Amazon	Pando	Energy	79	83	86	90	94	98	89	90	91	93	94	96	97	99	100	102	103	105	106	108	109
Bolivia	Amazon	Beni	Energy	329	344	360	376	392	410	369	375	381	387	393	399	405	411	417	423	430	436	442	448	454
Bolivia	Amazon	Santa Cruz	Energy	293	306	319	334	348	364	327	333	338	344	349	354	360	365	371	376	381	387	392	398	403
Bolivia	Amazon	La Paz	Energy	303	317	331	346	361	377	339	345	351	356	362	367	373	379	384	390	395	401	407	412	418
Bolivia	Amazon	Cochabamba	Energy	199	208	217	226	237	247	222	226	230	233	237	241	244	248	252	255	259	263	266	270	274

Within all the sectors evaluated, it is observed that the IPPU sector is the one with the lowest amount of emissions generation, since the values obtained tend to be lower than the rest. However, it can be seen that the departments with the highest GHG emissions are also Beni, La Paz and Santa Cruz, which increase from 11, 10 and 10 Gg CO_2/year in 1990 to 46, 42 and 41 Gg CO_2/year in 2020, respectively.

The departments with the lowest GHG emissions are Cochabamba and Pando with 7 and 3 Gg CO_2/year in 1990 and by 2020 they increased by 28 and 11 Gg CO_2/year, respectively. Comparing the results of these two departments, it can be seen that there was a significant increase in GHG emissions in the department of Pando. On the other hand, in 10 years after the last official information, emissions for each department will increase significantly, due to the fact that a scenario of no mitigation measures is considered. By 2030, Beni will generate emissions of up to 57 Gg CO_2/year, La Paz up to 52 Gg CO_2/year, Santa Cruz 50 Gg CO_2/year, Cochabamba 34 Gg CO_2/year and Pando 14 Gg CO_2/year.

Table 9. Bolivia Database - GHG Inventories Gg CO_2/year of the Industrial Processes and Product Use Sector (1990-2020) + Projection to 2030

Country	Area	Department	Sector	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Bolivia	Amazon	Pando	Industrial Processes	3	3	3	4	4	4	5	5	6	5	5	6	6	6	7	7	7	7	8	8
Bolivia	Amazon	Beni	Industrial Processes	11	12	14	15	17	18	20	22	23	23	22	25	26	27	28	29	30	30	32	32
Bolivia	Amazon	Santa Cruz	Industrial Processes	10	11	12	13	15	16	18	19	21	20	19	22	23	24	25	26	27	27	28	29
Bolivia	Amazon	La Paz	Industrial Processes	10	11	13	14	15	17	18	20	22	21	20	23	24	24	26	27	28	28	29	30
Bolivia	Amazon	Cochabamba	Industrial Processes	7	7	8	9	10	11	12	13	14	14	13	15	16	16	17	17	18	18	19	20

Country	Area	Department	Sector	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Bolivia	Amazon	Pando	Industrial Processes	8	8	9	9	9	9	10	10	10	11	11	11	11	12	12	12	13	13	13	13	14
Bolivia	Amazon	Beni	Industrial Processes	33	35	36	36	38	39	41	42	43	45	46	47	48	49	50	51	52	53	55	56	57
Bolivia	Amazon	Santa Cruz	Industrial Processes	30	31	32	32	33	34	37	38	39	40	41	42	42	43	44	45	46	47	48	49	50
Bolivia	Amazon	La Paz	Industrial Processes	31	32	33	34	35	35	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
Bolivia	Amazon	Cochabamba	Industrial Processes	20	21	22	22	23	23	25	25	26	27	28	28	29	30	30	31	32	32	33	34	34

Regarding the activity of the agriculture sector in the departments of the Bolivian Amazon, Santa Cruz is the department with the highest GHG emissions, emitting 6,587.00 Gg CO_2/year in 1999 and increasing to more than double with 14,200.00 Gg CO_2/year in 2020. Likewise, the departments that also increased their emissions over 30 years are Pando and La Paz, which in 2020 generated emissions of 661 and 183 Gg CO_2/year.

However, Cochabamba is the department that has had significant decreases in GHG emissions, since in 1990 it generated around 380 Gg CO_2/year and in 2020 these emissions will be reduced to 32 Gg CO_2/year.

In addition, Table 10 shows the projected GHG emissions of these departments without mitigation measures. Santa Cruz alone will emit around 15,534.00 Gg CO_2/year. Cochabamba, for example, would increase its emissions with respect to 2020, but it is still the one that would generate the least emissions with 77 Gg CO_2/year.

Bolivia - GHG Inventories Gg CO_2/year of the AFOLU / Agriculture sector (1990-2020) + Projection to 2030.

Country	Area	Department	Sector	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Bolivia	Amazon	Pando	Agriculture	42	43	45	46	47	48	49	51	52	53	55	55	12	11	173	140	39	0	19	46
Bolivia	Amazon	Beni	Agriculture	275	282	290	298	306	313	321	329	337	347	357	354	212	195	354	286	102	183	333	304
Bolivia	Amazon	Santa Cruz	Agriculture	6.587	6.765	6.947	7.135	7.327	7.507	7.691	7.880	8.073	8.320	8.567	8.484	9.705	9.839	10.107	9.549	11.196	10.017	10.707	11.042
Bolivia	Amazon	La Paz	Agriculture	114	117	120	123	127	130	133	136	140	144	148	147	223	358	246	400	152	405	708	693
Bolivia	Amazon	Cochabamba	Agriculture	380	390	401	412	423	433	444	454	466	480	494	489	228	315	255	420	306	335	440	503

Country	Area	Department	Sector	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Bolivia	Amazon	Pando	Agriculture	162	645	571	414	312	236	265	188	159	252	661	300	461	468	476	483	491	498	506	513	521
Bolivia	Amazon	Beni	Agriculture	843	1.016	992	690	261	90	225	425	735	709	505	1.157	1.562	1.588	1.613	1.638	1.664	1.689	1.714	1.740	1.765
Bolivia	Amazon	Santa Cruz	Agriculture	10.616	10.184	8.971	10.437	13.531	14.655	14.206	14.076	13.826	13.885	14.200	13.926	13.750	13.973	14.196	14.419	14.642	14.865	15.088	15.311	15.534
Bolivia	Amazon	La Paz	Agriculture	595	1.314	1.687	609	368	305	113	233	160	318	183	141	163	166	168	171	173	176	179	181	184
Bolivia	Amazon	Cochabamba	Agriculture	384	269	504	1.641	112	52	68	78	87	170	32	50	68	69	70	71	72	73	74	75	77

Regarding the land use change sector, Santa Cruz is the department with the highest GHG emissions, increasing from 17,456.00 Gg CO_2/year in 1990 to 30,483.00 Gg CO_2/year in 2020. However, it is important to note that the rest of the departments have decreased their emissions from this activity, the most notable case being Cochabamba, which went from having 1,007 Gg CO_2/year in 1990 to 70 Gg CO_2/year in 2020.

On the other hand, in terms of projected emissions to 2030, Santa Cruz continues to be the department with the highest GHG emissions due to land use change, while Cochabamba will increase its emissions, but it continues to be the department with the lowest emissions, with 158 Gg CO_2/year to 2030.

Bolivia Database - GHG Inventories Gg CO_2/year of the AFOLU sector / Land Use Change (1990-2020) + Projection to 2030.

Country	Area	Department	Sector	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Bolivia	Amazon	Pando	Change Use of Soils	112	116	119	123	127	128	129	129	130	132	133	137	29	28	423	338	93	0	45	106
Bolivia	Amazon	Beni	Change Use of Soils	728	751	775	799	824	829	835	840	846	855	864	886	526	478	863	691	244	434	781	705
Bolivia	Amazon	Santa Cruz	Change Use of Soils	17.456	18.003	18.567	19.148	19.748	19.878	20.010	20.142	20.275	20.490	20.705	21.246	24.075	24.148	24.678	23.056	26.788	23.741	25.083	25.587
Bolivia	Amazon	La Paz	Change Use of Soils	302	311	321	331	342	344	346	348	351	354	358	368	554	879	602	966	365	959	1.659	1.606
Bolivia	Amazon	Cochabamba	Change Use of Soils	1.007	1.038	1.071	1.104	1.139	1.147	1.154	1.162	1.169	1.182	1.194	1.225	565	773	622	1.014	732	794	1.030	1.166

Country	Area	Department	Sector	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Bolivia	Amazon	Pando	Change Use of Soils	371	1.458	1.273	911	677	503	581	410	344	543	1.419	641	979	991	1.002	1.013	1.024	1.035	1.047	1.058	1.069
Bolivia	Amazon	Beni	Change Use of Soils	1.929	2.297	2.212	1.518	565	192	493	927	1.593	1.530	1.084	2.471	3.321	3.359	3.397	3.435	3.473	3.511	3.549	3.587	3.625
Bolivia	Amazon	Santa Cruz	Change Use of Soils	24.303	23.017	20.011	22.952	29.319	31.271	31.155	30.698	29.989	29.958	30.483	29.746	29.227	29.562	29.896	30.231	30.565	30.900	31.234	31.569	31.903
Bolivia	Amazon	La Paz	Change Use of Soils	1.363	2.971	3.763	1.338	798	651	247	508	346	687	394	302	346	350	354	358	362	366	370	374	378
Bolivia	Amazon	Cochabamba	Change Use of Soils	880	608	1.125	3.609	242	112	148	170	189	367	70	106	144	146	147	149	151	152	154	155	157

Of the emissions generated by the waste sector in the departments that make up the Bolivian Amazon from 1990 to 2020, Beni, La Paz and Santa Cruz are the departments with the highest emissions in 2020, with 115, 106 and 102 Gg CO_2/year, respectively. The opposite case is shown with Cochabamba and Pando whose emissions in 2020 were 69 and 28 Gg CO_2/year. Although it can be seen that all departments have increased their emissions within the 30 years evaluated, it can also be seen that these emissions are not as high as in the sectors previously analyzed. Similarly, projections to 2030 show that the department with the highest GHG emissions continues to be Beni with 153 Gg CO_2/year, followed by La Paz, Santa Cruz, Cochabamba and Pando with 141, 136, 92 and 37 Gg CO_2/year, respectively.

Bolivia database - GHG inventories Gg CO_2/year of the Waste sector (1990-2020) + Projection to 2030.

Country	Area	Department	Sector	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Bolivia	Amazon	Pando	Waste	1	1	2	2	4	4	5	7	8	9	10	11	11	12	13	14	15	16	17	18
Bolivia	Amazon	Beni	Waste	3	5	7	10	15	18	22	27	33	36	40	44	48	52	55	59	62	66	70	73
Bolivia	Amazon	Santa Cruz	Waste	3	4	6	9	14	16	20	24	29	32	35	39	42	46	49	52	55	59	62	65
Bolivia	Amazon	La Paz	Waste	3	4	6	10	14	17	21	25	30	33	37	41	44	47	51	54	57	61	64	67
Bolivia	Amazon	Cochabamba	Waste	2	3	4	6	9	11	14	16	20	22	24	27	29	31	33	35	38	40	42	44

Country	Area	Department	Sector	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Bolivia	Amazon	Pando	Waste	19	19	20	21	22	23	24	25	26	27	28	29	30	30	31	32	33	34	35	36	37
Bolivia	Amazon	Beni	Waste	77	81	84	88	92	95	100	104	108	111	115	119	123	127	130	134	138	142	146	149	153
Bolivia	Amazon	Santa Cruz	Waste	68	72	75	78	81	85	89	92	96	99	102	106	109	112	116	119	123	126	129	133	136
Bolivia	Amazon	La Paz	Waste	71	74	78	81	84	88	92	96	99	103	106	110	113	117	120	124	127	131	134	138	141
Bolivia	Amazon	Cochabamba	Waste	46	49	51	53	55	57	60	63	65	67	69	72	74	76	79	81	83	86	88	90	92

Table 12 shows that from 1990 to 2020, the sector with the greatest increase in GHG emissions was Land Use Change, from 22,097.00 Gg CO_2/year to 34,834.00 Gg CO_2/year. If we look at the projection to 2030, we can see that emissions from land use change would increase to 38,914.00 Gg CO_2/year if no mitigation measures were applied.

Table 12. Comparison of the Bolivia Database - GHG Inventories Gg CO_2/year of the prioritized sectors (1990-2015) + Projection to 2030.

Country	Area	Sector	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Bolivia	Total Country	Energy	5.072	5.627	6.242	6.925	7.683	7.827	7.974	8.124	8.277	7.726	7.175	6.736	6.579	6.774	7.064	7.381	7.713	8.059	8.421	8.798
Bolivia	Total Country	Industrial Processes	314	346	381	420	464	505	551	600	654	631	608	691	724	741	777	804	834	847	880	903
Bolivia	Total Country	Agriculture	8.338	8.563	8.794	9.031	9.275	9.502	9.735	9.974	10.219	10.531	10.844	10.740	10.999	11.266	11.544	11.831	12.128	12.437	12.759	13.096
Bolivia	Total Country	Change Land Use	22.097	22.789	23.502	24.238	24.997	25.162	25.329	25.496	25.665	25.937	26.209	26.893	27.284	27.650	28.188	28.566	29.018	29.475	29.891	30.346
Bolivia	Total Country	Waste	90	132	195	288	425	516	625	757	918	1.014	1.111	1.241	1.335	1.437	1.540	1.642	1.740	1.842	1.943	2.044

Country	Area	Sector	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Bolivia	Total Country	Energy	9.192	9.603	10.032	10.479	10.946	11.433	10.287	10.457	10.626	10.796	10.966	11.136	11.305	11.475	11.645	11.815	11.985	12.154	12.324	12.494	12.664
Bolivia	Total Country	Industrial Processes	931	974	998	1.017	1.047	1.075	1.148	1.180	1.211	1.242	1.273	1.304	1.335	1.366	1.397	1.429	1.460	1.491	1.522	1.553	1.584
Bolivia	Total Country	Agriculture	13.447	13.813	14.195	14.596	15.017	15.456	15.139	15.411	15.683	15.955	16.227	16.499	16.771	17.043	17.315	17.587	17.859	18.132	18.404	18.676	18.948
Bolivia	Total Country	Land Use Change	30.783	31.218	31.664	32.099	32.540	32.981	33.202	33.610	34.018	34.426	34.834	35.242	35.650	36.058	36.466	36.874	37.282	37.690	38.098	38.506	38.914
Bolivia	Total Country	Waste	2.150	2.253	2.351	2.453	2.555	2.657	2.790	2.896	3.002	3.108	3.214	3.321	3.427	3.533	3.639	3.745	3.852	3.958	4.064	4.170	4.276

Brazil

Brazil is a country rich in diversity of flora and fauna due to its large extension of the Amazon, the same fact that also led it to carry out different types of economic activities that generate GHG emissions. Being a member country of the Amazon region, it was necessary to develop the calculations of the emissions generated by the prioritized sectors.

Data obtained from official sources show that they exist from 1990 to 2020 for all the sectors evaluated:

The results obtained regarding the emissions generated by the energy sector in Brazil show that Pará is the state that generates the highest emissions with 5,274.00 $GgCO_2$/year in 1990 and 11,052.00 $GgCO_2$/year in 2020, followed by Mato Grosso with 4,363.00 $GgCO_2$/year in 1990 and 9,144.00 $GgCO_2$/year in 2020.

Similarly, the state that generates the lowest emissions during the 30 years evaluated is Roraima, with 391 $GgCO_2$/year in 1990 and 820 $GgCO_2$/year in 2020, although the comparison in these years shows that there has been an increase in emissions, Table 13 shows that over the years the value of emissions fluctuates. However, projections to 2030, without mitigation actions, reflect a gradual increase in GHG emissions.

Table 13. Brazil Database - GHG Inventories Gg CO_2/year Energy Sector (1990-2020) + Projection to 2030

Country	Area	No.	State	Sector	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Brazil	Amazon	1	Amazon	Energy	2.834	2.920	2.972	3.046	3.180	3.405	3.646	3.876	4.028	4.211	4.319	4.473	4.449	4.367	4.609	4.766	4.836	5.043	5.340	5.167
Brazil	Amazon	2	Roraima	Energy	391	403	410	421	439	470	504	535	556	582	597	618	614	603	637	658	668	697	738	714
Brazil	Amazon	3	Amapá	Energy	451	465	473	485	506	542	580	617	641	670	688	712	708	695	734	759	770	803	850	823
Brazil	Amazon	4	Para	Energy	5.274	5.435	5.531	5.669	5.918	6.338	6.786	7.214	7.498	7.837	8.038	8.326	8.281	8.127	8.579	8.871	9.001	9.386	9.939	9.618
Brazil	Amazon	5	Acre	Energy	402	415	422	433	452	484	518	550	572	598	613	635	632	620	655	677	687	716	758	734
Brazil	Amazon	6	Rondônia	Energy	1.260	1.299	1.322	1.355	1.414	1.515	1.621	1.724	1.792	1.873	1.921	1.990	1.979	1.942	2.050	2.120	2.151	2.243	2.375	2.298
Brazil	Amazon	7	Mato Grosso	Energy	4.363	4.497	4.576	4.690	4.896	5.244	5.614	5.968	6.203	6.484	6.650	6.888	6.851	6.724	7.098	7.339	7.447	7.766	8.223	7.957
Brazil	Amazon	8	Tocantins	Energy	1.066	1.099	1.118	1.146	1.196	1.281	1.372	1.458	1.516	1.584	1.625	1.683	1.674	1.643	1.734	1.793	1.820	1.897	2.009	1.944
Brazil	Amazon	9	Maranhão	Energy	2.611	2.691	2.738	2.807	2.930	3.138	3.360	3.572	3.712	3.880	3.980	4.122	4.100	4.024	4.248	4.392	4.457	4.647	4.921	4.762

.

Country	Area	No.	State	Sector	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Brazil	Amazon	1	Amazon	Energy	5.656	5.864	6.380	6.897	7.290	6.923	6.442	6.548	6.202	6.226	5.938	7.124	7.263	7.402	7.542	7.681	7.820	7.959	8.098	8.237	8.376
Brazil	Amazon	2	Roraima	Energy	781	810	881	953	1.007	956	890	904	857	860	820	984	1.003	1.022	1.042	1.061	1.080	1.099	1.118	1.138	1.157
Brazil	Amazon	3	Amapá	Energy	900	933	1.016	1.098	1.161	1.102	1.025	1.042	987	991	945	1.134	1.156	1.178	1.201	1.223	1.245	1.267	1.289	1.311	1.333
Brazil	Amazon	4	Para	Energy	10.527	10.913	11.874	12.837	13.569	12.885	11.989	12.188	11.543	11.587	11.052	13.260	13.519	13.778	14.036	14.295	14.554	14.813	15.072	15.331	15.590
Brazil	Amazon	5	Acre	Energy	803	833	906	979	1.035	983	915	930	881	884	843	1.012	1.031	1.051	1.071	1.091	1.111	1.130	1.150	1.170	1.190
Brazil	Amazon	6	Rondônia	Energy	2.516	2.608	2.837	3.067	3.242	3.079	2.865	2.912	2.758	2.769	2.641	3.168	3.230	3.292	3.354	3.416	3.478	3.540	3.602	3.663	3.725
Brazil	Amazon	7	Mato Grosso	Energy	8.710	9.029	9.824	10.620	11.226	10.660	9.919	10.083	9.550	9.587	9.144	10.970	11.184	11.399	11.613	11.827	12.041	12.255	12.470	12.684	12.898
Brazil	Amazon	8	Tocantins	Energy	2.128	2.206	2.400	2.595	2.743	2.605	2.424	2.464	2.333	2.342	2.234	2.680	2.733	2.785	2.837	2.890	2.942	2.994	3.047	3.099	3.151
Brazil	Amazon	9	Maranhaõ	Energy	5.212	5.404	5.879	6.356	6.718	6.380	5.936	6.035	5.716	5.737	5.472	6.56	6.693	6.822	6.950	7.078	7.206	7.334	7.463	7.591	7.719

Regarding the IPPU sector, the state that generates the most GHG emissions is also Pará with 1,477.00 Gg CO_2/year in 1990 and 2,893.00 Gg CO_2/year in 2020, respectively. This is followed by the state of Mato Grosso with 1,222.00 Gg CO_2/year in 1990 and 2,393.00 Gg CO_2/year in 2020, respectively. On the other hand, the states with the lowest GHG emissions are Roraima and Acre with 110 and 113 Gg CO_2/year in 1990 and by 2020 increased by 215 and 221 Gg CO_2/year, respectively.

On the other hand, 10 years after the last official information obtained, emissions for each state will increase significantly, due to the fact that a scenario of no mitigation measures is considered. By 2030, Pará will generate emissions of up to 3,35400 Gg CO_2/year, Mato Grosso up to 2,775.00 Gg CO_2/year, Amazonas with 1,802.00 Gg CO_2/year, Maranhão with 1,661.00 Gg CO_2/year and Rondônia with 801 Gg CO_2/year.

Table 14. Brazil Database - GHG Inventories Gg CO_2/year of the Industrial Processes sector (1990-2020) + Projection to 2030.

Country	Area	No.	State	Sector	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Brazil	Amazon	1	Amazon	Industrial Processes	794	895	873	940	949	996	1.017	1.042	1.082	1.078	1.127	1.071	1.136	1.146	1.225	1.193	1.213	1.211	1.253	1.108
Brazil	Amazon	2	Roraima	Industrial Processes	110	124	121	130	131	138	140	144	149	149	156	148	157	158	169	165	167	167	173	153
Brazil	Amazon	3	Amapá	Industrial Processes	126	143	139	150	151	159	162	166	172	172	179	171	181	182	195	190	193	193	199	176
Brazil	Amazon	4	Para	Industrial Processes	1.477	1.667	1.625	1.749	1.766	1.855	1.893	1.940	2.014	2.006	2.097	1.994	2.114	2.132	2.280	2.220	2.257	2.254	2.331	2.063
Brazil	Amazon	5	Acre	Industrial Processes	113	127	124	133	135	142	144	148	154	153	160	152	161	163	174	169	172	172	178	157
Brazil	Amazon	6	Rondônia	Industrial Processes	353	398	388	418	422	443	452	463	481	479	501	476	505	509	545	531	539	539	557	493
Brazil	Amazon	7	Mato Grosso	Industrial Processes	1.222	1.379	1.345	1.447	1.461	1.534	1.566	1.605	1.666	1.660	1.735	1.650	1.749	1.764	1.886	1.837	1.867	1.865	1.929	1.707
Brazil	Amazon	8	Tocantins	Industrial Processes	299	337	329	354	357	375	383	392	407	406	424	403	427	431	461	449	456	456	471	417
Brazil	Amazon	9	Maranhão	Industrial Processes	731	825	805	866	874	918	937	960	997	993	1.038	987	1.047	1.056	1.129	1.099	1.117	1.116	1.154	1.021

Country	Area	No.	State	Sector	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Brazil	Amazon	1	Amazon	Industrial Processes	1.371	1.446	1.463	1.475	1.484	1.466	1.374	1.497	1.472	1.547	1.554	1.589	1.612	1.636	1.660	1.683	1.707	1.731	1.755	1.778	1.802
Brazil	Amazon	2	Roraima	Industrial Processes	189	200	202	204	205	203	190	207	203	214	215	219	223	226	229	233	236	239	242	246	249
Brazil	Amazon	3	Amapá	Industrial Processes	218	230	233	235	236	233	219	238	234	246	247	253	257	260	264	268	272	276	279	283	287
Brazil	Amazon	4	Para	Industrial Processes	2.552	2.692	2.722	2.746	2.762	2.729	2.557	2.785	2.740	2.879	2.893	2.957	3.001	3.045	3.089	3.133	3.177	3.221	3.265	3.310	3.354
Brazil	Amazon	5	Acre	Industrial Processes	195	205	208	210	211	208	195	213	209	220	221	226	229	232	236	239	242	246	249	253	256
Brazil	Amazon	6	Rondonia	Industrial Processes	610	643	650	656	660	652	611	666	655	688	691	707	717	728	738	749	759	770	780	791	801
Brazil	Amazon	7	Mato Grosso	Industrial Processes	2.112	2.227	2.252	2.272	2.285	2.258	2.115	2.305	2.267	2.382	2.393	2.446	2.483	2.519	2.556	2.592	2.629	2.665	2.702	2.738	2.775
Brazil	Amazon	8	Tocantins	Industrial Processes	516	544	550	555	558	552	517	563	554	582	585	598	607	616	624	633	642	651	660	669	678
Brazil	Amazon	9	Maranhão	Industrial Processes	1.264	1.333	1.348	1.360	1.367	1.351	1.266	1.379	1.357	1.426	1.432	1.464	1.486	1.508	1.530	1.551	1.573	1.595	1.617	1.639	1.661

Table 15 shows the results of GHG emissions from the AFOLU - Agriculture sector in Brazil from 1990 to 2020. The state with the greatest increase in GHG emissions was Mato Grosso, from 42,904.00 Gg CO_2/year to 85,648.00 Gg CO_2/year, which indicates that it is the sector that represents the greatest agricultural activity in the Brazilian Amazon. If we look at its projection to 2030, we can see that the sector's emissions will increase to 103,799.00 Gg CO_2/year if no mitigation measures are applied.

The state with the lowest emissions in the last 30 years is Acre, which in 1990 emitted approximately 28 Gg CO_2/year and in 2020 emitted 15 Gg CO_2/year of GHG, suggesting a significant reduction in its emissions. Its projection to 2030 shows that the state will generate 586 Gg CO_2/year of GHG, which implies an exponential increase. Likewise, it is shown that the state of Amapá had average GHG emissions of 4 Gg CO_2/year of GHG during the years 1990 to 2024, after that year the GHG values increase exponentially and by 2030 the emissions will be up to 374 Gg CO_2/year.

Brazil - GHG inventories Gg CO_2/year of the AFOLU / Agriculture sector (1990-2020) + Projection to 2030.

Country	Area	No.	State	Sector	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Brazil	Amazon	1	Amazon	Agriculture	113	116	118	119	122	124	119	121	123	125	129	133	138	146	152	154	154	151	153	155
Brazil	Amazon	2	Roraima	Agriculture	203	209	213	215	220	224	214	219	222	224	232	240	249	263	274	277	277	271	275	280
Brazil	Amazon	3	Amapá	Agriculture	3	3	3	3	3	3	3	3	3	3	4	4	4	4	4	4	4	4	4	4
Brazil	Amazon	4	Para	Agriculture	679	700	714	719	736	750	718	733	742	752	777	804	833	882	918	929	928	908	923	937
Brazil	Amazon	5	Acre	Agriculture	28	28	29	29	30	30	29	30	30	30	31	33	34	36	37	38	38	37	37	38
Brazil	Amazon	6	Rondônia	Agriculture	836	861	879	885	907	923	884	902	914	925	957	989	1.026	1.086	1.130	1.143	1.143	1.118	1.136	1.154
Brazil	Amazon	7	Mato Grosso	Agriculture	42.904	44.180	45.107	45.404	46.505	47.355	45.345	46.289	46.887	47.466	49.066	50.745	52.604	55.711	57.959	58.648	58.633	57.369	58.270	59.200
Brazil	Amazon	8	Tocantins	Agriculture	1.856	1.911	1.951	1.964	2.011	2.048	1.961	2.002	2.028	2.053	2.122	2.195	2.275	2.409	2.507	2.536	2.536	2.481	2.520	2.560
Brazil	Amazon	9	Maranhão	Agriculture	2.795	2.878	2.939	2.958	3.030	3.085	2.954	3.016	3.055	3.092	3.197	3.306	3.427	3.630	3.776	3.821	3.820	3.737	3.796	3.857

Country	Area	No.	State	Sector	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Brazil	Amazon	1	Amazon	Agriculture	160	117	77	77	77	62	49	50	49	54	60	65	71	78	85	93	102	112	123	134	147
Brazil	Amazon	2	Roraima	Agriculture	287	303	307	305	303	321	344	372	379	438	502	563	641	729	829	942	1.071	1.217	1.383	1.572	1.786
Brazil	Amazon	3	Amapá	Agriculture	4	5	5	4	3	50	96	106	110	123	137	150	166	184	204	226	250	276	306	338	374
Brazil	Amazon	4	Para	Agriculture	963	1.615	2.109	2.195	2.272	3.143	4.027	4.749	5.221	5.870	6.580	7.235	8.060	8.977	9.997	11.131	12.392	13.793	15.351	17.081	19.004
Brazil	Amazon	5	Acre	Agriculture	39	21	4	5	6	6	6	6	6	10	15	22	31	45	65	94	135	195	281	406	586
Brazil	Amazon	6	Rondônia	Agriculture	1.186	1.312	1.373	1.420	1.463	1.500	1.556	2.042	2.426	2.543	2.687	2.785	2.925	3.072	3.225	3.385	3.552	3.728	3.911	4.103	4.303
Brazil	Amazon	7	Mato Grosso	Agriculture	60.826	66.060	68.217	69.170	69.917	72.654	76.313	81.350	81.916	83.329	85.648	86.338	88.181	90.048	91.939	93.854	95.794	97.757	99.746	101.760	103.799
Brazil	Amazon	8	Tocantins	Agriculture	2.631	4.018	5.049	5.216	5.365	6.477	7.640	8.444	8.792	9.344	9.996	10.487	11.148	11.848	12.591	13.377	14.210	15.093	16.029	17.019	18.068
Brazil	Amazon	9	Maranhão	Agriculture	3.963	5.150	5.975	6.166	6.336	6.712	7.168	7.847	8.099	8.590	9.174	9.608	10.196	10.817	11.475	12.170	12.906	13.684	14.507	15.376	16.296

Table 16 shows that of the AFOLU Sector - Land Use Change, Mato Grosso is the state that generates the highest GHG emissions despite its emissions reduction from 1990 to 2020, going from 122,852.00 Gg CO_2/year to 107,853.00 Gg CO_2/year. Its projection to 2030 indicates that the sector will increase to 326,796.00 Gg CO_2/year if no mitigation measures are applied.

On the other hand, the state with the lowest emissions in the last 30 years is Acre, which in 1990 emitted approximately 4,319.00 Gg CO_2/year and in 2020 emitted 4,512.00 Gg CO_2/year of GHG, suggesting that its emissions levels have not varied significantly over time. As for its projection to 2030, it shows that the state will increase 13,716.00 Gg CO_2/year of GHG.

Table 16. Database Brazil - GHG Inventories Gg CO_2/year of the AFOLU sector / Land Use Change (1990-2020) + Projection to 2030.

Country	Area	No.	State	Sector	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Brazil	Amazon	1	Amazon	Land Use Change	1.908	1.580	1.923	2.071	2.071	4.447	2.832	2.104	2.720	2.701	2.848	2.838	3.359	5.552	6.026	3.656	2.670	1.967	2.216	762
Brazil	Amazon	2	Roraima	Land Use Change	602	498	606	653	653	1.403	893	664	858	852	898	895	1.059	1.751	1.900	1.153	842	620	699	240
Brazil	Amazon	3	Amapá	Land Use Change	195	162	197	212	212	455	290	215	279	277	292	291	344	569	617	374	273	201	227	78
Brazil	Amazon	4	Para	Land Use Change	44.075	36.508	44.423	47.840	47.841	102.753	65.437	48.612	62.841	62.400	65.809	65.569	77.616	128.282	139.215	84.471	61.683	45.442	51.208	17.610
Brazil	Amazon	5	Acre	Land Use Change	4.319	3.578	4.353	4.688	4.688	10.070	6.413	4.764	6.158	6.115	6.449	6.426	7.606	12.571	13.643	8.278	6.045	4.453	5.018	1.726
Brazil	Amazon	6	Rondônia	Land Use Change	22.697	18.800	22.876	24.636	24.637	52.914	33.698	25.034	32.361	32.134	33.889	33.766	39.969	66.061	71.691	43.500	31.765	23.401	26.370	9.069
Brazil	Amazon	7	Mato Grosso	Land Use Change	122.852	101.759	123.821	133.345	133.350	286.407	182.394	135.499	175.159	173.929	183.431	182.761	216.340	357.566	388.040	235.449	171.931	126.661	142.733	49.085
Brazil	Amazon	8	Tocantins	Land Use Change	25.391	21.031	25.591	27.560	27.561	59.194	37.697	28.005	36.202	35.947	37.911	37.773	44.713	73.901	80.200	48.662	35.535	26.178	29.500	10.145
Brazil	Amazon	9	Maranhão	Land Use Change	24.922	20.643	25.118	27.050	27.051	58.100	37.000	27.487	35.532	35.283	37.210	37.075	43.886	72.535	78.717	47.763	34.878	25.694	28.955	9.957

Country	Area	No.	State	Sector	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Brazil	Amazon	1	Amazon	Land Use Change	675	654	257	1.079	531	1.050	1.324	1.421	1.579	2.698	3.166	3.885	4.619	5.388	6.193	7.036	7.918	8.840	9.805	10.813	11.866
Brazil	Amazon	2	Roraima	Land Use Change	213	166	58	236	113	236	313	342	387	675	808	1.011	1.226	1.458	1.710	1.981	2.274	2.589	2.929	3.294	3.687
Brazil	Amazon	3	Amapá	Land Use Change	69	49	16	63	30	59	76	81	89	153	180	222	265	310	358	408	461	516	574	636	700
Brazil	Amazon	4	Para	Land Use Change	15.596	14.320	5.486	22.359	10.716	21.043	26.383	27.743	30.227	50.830	58.732	70.973	83.098	95.456	108.053	120.890	133.973	147.305	160.888	174.727	188.826
Brazil	Amazon	5	Acre	Land Use Change	1.528	1.214	428	1.710	805	1.588	2.000	2.130	2.349	3.927	4.512	5.422	6.312	7.211	8.117	9.030	9.952	10.881	11.818	12.763	13.716
Brazil	Amazon	6	Rondônia	Land Use Change	8.031	6.598	2.376	9.604	4.567	9.088	11.539	12.287	13.553	22.725	26.183	31.550	36.834	42.192	47.623	53.129	58.711	64.370	70.105	75.919	81.811
Brazil	Amazon	7	Mato Grosso	Land Use Change	43.471	31.340	10.326	41.808	19.911	39.057	48.919	51.503	56.179	93.897	107.853	129.563	150.799	172.202	193.774	215.515	237.427	259.510	281.765	304.193	326.796
Brazil	Amazon	8	Tocantins	Land Use Change	8.985	6.753	2.294	9.236	4.376	8.746	11.152	11.809	12.956	21.918	25.471	30.957	36.453	42.116	47.948	53.953	60.136	66.500	73.050	79.790	86.725
Brazil	Amazon	9	Maranhão	Land Use Change	8.818	6.851	2.380	9.975	4.906	9.687	12.209	12.923	14.171	23.726	27.298	32.849	38.298	43.808	49.380	55.013	60.709	66.468	72.291	78.178	84.129

Table 17 shows that, in the Waste Sector, Pará is the state that generates the highest GHG emissions from 1990 to 2020, going from 783 Gg CO_2/year to 1,976.00 Gg CO_2/year. Its projection to 2030 indicates that the sector will increase to 2,348.00 Gg CO_2/year if no mitigation measures are applied.

On the other hand, the state with the lowest emissions despite a slight increase in the last 30 years is Roraima, which in 1990 emitted approximately 48 Gg CO_2/year and in 2020 emitted 147 Gg CO_2/year of GHG. As for its projection to 2030, it shows that the state will have a slight increase in its emissions to 174 Gg CO_2/year of GHG.

Table 17. Database Brazil - GHG Inventories Gg CO_2/year of the Waste sector (1990-2020) + Projection to 2030.

Country	Area	No.	State	Sector	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Brazil	Amazon	1	Amazon	Waste	421	437	454	470	486	505	524	544	562	585	604	622	650	677	691	714	735	754	766	774
Brazil	Amazon	2	Roraima	Waste	58	60	63	65	67	70	72	75	78	81	83	86	90	93	95	99	102	104	106	107
Brazil	Amazon	3	Amapá	Waste	67	70	72	75	77	80	83	87	90	93	96	99	103	108	110	114	117	120	122	123
Brazil	Amazon	4	Para	Waste	783	813	846	874	905	940	976	1.013	1.047	1.090	1.125	1.158	1.209	1.260	1.286	1.328	1.369	1.404	1.425	1.441
Brazil	Amazon	5	Acre	Waste	60	62	65	67	69	72	74	77	80	83	86	88	92	96	98	101	104	107	109	110
Brazil	Amazon	6	Rondônia	Waste	187	194	202	209	216	225	233	242	250	260	269	277	289	301	307	317	327	336	341	344
Brazil	Amazon	7	Mato Grosso	Waste	648	673	700	723	749	778	807	838	866	901	930	958	1.000	1.042	1.064	1.099	1.132	1.162	1.179	1.192
Brazil	Amazon	8	Tocantins	Waste	158	164	171	177	183	190	197	205	212	220	227	234	244	255	260	269	277	284	288	291
Brazil	Amazon	9	Maranhão	Waste	388	403	419	433	448	466	483	501	518	539	557	573	599	624	637	658	678	695	706	713

Country	Area	No.	State	Sector	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Brazil	Amazon	1	Amazon	Waste	809	848	863	928	941	944	959	982	1.016	1.029	1.062	1.067	1.089	1.110	1.132	1.154	1.175	1.197	1.218	1.240	1.262
Brazil	Amazon	2	Roraima	Waste	112	117	119	128	130	130	132	136	140	142	147	147	150	153	156	159	162	165	168	171	174
Brazil	Amazon	3	Amapá	Waste	129	135	137	148	150	150	153	156	162	164	169	170	173	177	180	184	187	191	194	197	201
Brazil	Amazon	4	Para	Waste	1.505	1.578	1.605	1.727	1.751	1.758	1.784	1.828	1.892	1.914	1.976	1.986	2.026	2.067	2.107	2.147	2.187	2.228	2.268	2.308	2.348
Brazil	Amazon	5	Acre	Waste	115	120	122	132	134	134	136	139	144	146	151	152	155	158	161	164	167	170	173	176	179
Brazil	Amazon	6	Rondônia	Waste	360	377	384	413	418	420	426	437	452	457	472	475	484	494	503	513	523	532	542	552	561
Brazil	Amazon	7	Mato Grosso	Waste	1.246	1.305	1.328	1.429	1.449	1.454	1.476	1.512	1.565	1.584	1.635	1.643	1.676	1.710	1.743	1.776	1.810	1.843	1.876	1.909	1.943
Brazil	Amazon	8	Tocantins	Waste	304	319	325	349	354	355	361	370	382	387	399	401	410	418	426	434	442	450	458	467	475
Brazil	Amazon	9	Maranhão	Waste	745	781	795	855	867	870	884	905	937	948	978	983	1.003	1.023	1.043	1.063	1.083	1.103	1.123	1.143	1.163

Regarding the comparison between all the sectors evaluated in Brazil, Table 18 shows that from 1990 to 2020 the sector with the greatest increase in GHG emissions was Agriculture, going from 287,132.00 Gg CO_2/year to 477,671.00 Gg CO_2/year. If we look at the projection to 2030, we can see that emissions from the Agriculture sector would increase to 535,535.00 Gg CO_2/year if no mitigation measures were applied.

The opposite is true for emissions generated in the Land Use Change sector, which, according to historical data, reduce their emissions in the following sectors: land-use change, land-use change, land-use change, land-use change, land-use change and land-use change.

GHG emissions from 794,330.00 Gg CO_2/year to 637,039.00 Gg CO_2/year in 1999 and 2020, respectively. However, it is shown that by 2030 their emissions will increase to 1,854,917 Gg CO_2/year.

Table 18. Comparison of the Brazil Database - GHG Inventories Gg CO_2/year of the prioritized sectors (1990-2020) + Projection to 2030.

Country	Area	Sector	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2
Brazil	Total Country	Energy	185.854	191.548	194.900	199.787	208.546	223.359	239.130	254.210	264.225	276.175	283.268	293.405	291.813	286.411	302.320	312.623	317.201	3
Brazil	Total Country	Industrial Processes	52.060	58.733	57.273	61.650	62.233	65.358	66.718	68.349	70.978	70.697	73.897	70.270	74.503	75.137	80.351	78.249	79.534	7
Brazil	Total Country	Agriculture	287.132	295.671	301.875	303.862	311.227	316.917	303.467	309.782	313.783	317.660	328.367	339.602	352.045	372.841	387.881	392.492	392.392	3
Brazil	Total Country	Change of Use	794.330	657.946	800.596	862.171	862.204	1.851.837	1.179.314	876.099	1.132.530	1.124.578	1.186.019	1.181.688	1.398.801	2.311.928	2.508.963	1.522.354	1.111.662	8
Brazil	Total Country	Waste	27.596	28.650	29.800	30.800	31.900	33.136	34.394	35.689	36.886	38.396	39.631	40.807	42.602	44.397	45.335	46.813	48.228	4

Country	Area	Sector	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	
Brazil	Total Country	Energy	370.983	384.587	418.455	452.368	478.165	454.056	422.498	429.503	406.793	408.343	389.484	467.273	476.397	485.521	494.645	503.769	512.893	522.017	531.141	5
Brazil	Total Country	Industrial Processes	89.946	94.866	95.929	96.776	97.327	96.172	90.107	98.161	96.575	101.463	101.936	104.200	105.754	107.307	108.861	110.415	111.969	113.523	115.076	1
Brazil	Total Country	Agriculture	407.072	419.107	414.987	420.969	425.702	429.510	439.213	464.502	464.178	468.371	477.671	477.782	484.199	490.616	497.033	503.450	509.867	516.284	522.701	5
Brazil	Total Country	Land Use Change	281.073	194.442	62.021	250.821	119.325	233.134	290.867	306.444	334.502	556.818	637.039	762.226	883.636	1.005.046	1.126.456	1.247.866	1.369.277	1.490.687	1.612.097	1.7
Brazil	Total Country	Waste	53.054	55.603	56.574	60.873	61.703	61.939	62.884	64.425	66.661	67.467	69.630	69.990	71.408	72.826	74.244	75.663	77.081	78.499	79.917	8

Colombia

As shown in the first chapters of this document, the Colombian Amazon is made up of 6 departments: Amazonas, Caquetá, Guainía, Guaviare, Putumayo, Vaupés, where together they form about 403,348 km². These departments are developed through different economic activities, which as expressed in previous paragraphs, generate GHG emissions causing various socio-environmental impacts in the country.

Regarding the data obtained from official sources, it is shown that they exist from 1990 to 2018 for all the sectors evaluated:

When visualizing the results obtained (see Table 19) regarding the emissions generated by the energy sector in Colombia, Putumayo is the department that generated the highest emissions with 195 $GgCO_2$/year in 1990 and 360 $GgCO_2$/year in 2018, followed by Caquetá with 188 $GgCO_2$/year in 1990 and 347 $GgCO_2$/year in 2018.

Similarly, the state that generates the lowest GHG emissions is Vaupés with 13 $GgCO_2$/year in 1990 and 24 $GgCO_2$/year in 2018. However, projections to 2030, without mitigation actions, reflect a gradual increase in GHG emissions,

Table 19. Colombia database - GHG inventories Gg CO_2/year of the Energy sector (1990-2018) + Projection to 2030.

Country	Area	Departments	Sector	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Colombia	Amazon	Putumayo	Energy	195	202	217	183	221	231	233	251	252	232	239	230	226	233	237	249	262	261	270	289
Colombia	Amazon	Amazon	Energy	37	38	41	34	42	43	44	47	47	44	45	43	43	44	45	47	49	49	51	54
Colombia	Amazon	Caquetá	Energy	188	195	209	176	213	222	224	242	242	223	231	222	218	224	228	239	252	252	260	278
Colombia	Amazon	Vaupés	Energy	13	14	15	12	15	16	16	17	17	16	16	16	15	16	16	17	18	18	18	20
Colombia	Amazon	Guaviare	Energy	39	40	43	36	44	46	46	50	50	46	47	46	45	46	47	49	52	52	53	57
Colombia	Amazon	Guainía	Energy	17	18	19	16	19	20	20	22	22	20	21	20	20	20	21	22	23	23	24	25

Country	Area	Departments	Sector	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Colombia	Amazon	Putumayo	Energy	315	309	324	342	352	362	371	344	360	360	366	373	379	385	391	397	403	409	415	421	428
Colombia	Amazon	Amazon	Energy	59	58	61	65	66	68	70	65	68	68	69	70	71	73	74	75	76	77	78	79	81
Colombia	Amazon	Caquetá	Energy	303	298	313	330	339	349	357	331	347	347	353	359	365	371	377	382	388	394	400	406	412
Colombia	Amazon	Vaupés	Energy	21	21	22	23	24	24	25	23	24	24	25	25	26	26	26	27	27	28	28	28	29
Colombia	Amazon	Guaviare	Energy	62	61	64	68	70	72	73	68	71	71	73	74	75	76	77	79	80	81	82	84	85
Colombia	Amazon	Guainía	Energy	28	27	29	30	31	32	33	30	32	32	32	33	33	34	34	35	35	36	36	37	38

Table 20 shows that the IPPU sector, compared to the other sectors evaluated, has low levels of GHG generated. However, the department that reports the highest GHG emissions is Putumayo with 17 Gg CO_2/year in 1990 and 41 Gg CO_2/year in 2018. This is followed by the department of Caquetá with 16 Gg CO_2/year in 1990 and 39 Gg CO_2/year in 2018. On the other hand, the departments with the lowest GHG emissions are Vaupés and Guainía with 1 Gg CO_2/year in 1990 and for 2018 increased by 3 and 4 Gg CO_2/year respectively.

On the other hand, 12 years after the last official information obtained, emissions in most of the departments will have a slight increase, due to the fact that a scenario of no mitigation measures is considered. By 2030 Putumayo will generate emissions of up to 49 Gg CO_2/year, Caquetá up to 47 Gg CO_2/year, Guaviare with 10 Gg CO_2/year, Amazonas with 9 Gg CO_2/year, Guainía with 4 Gg CO_2/year and Vaupés with 3 Gg CO_2/year of GHG.

Colombia - GHG Inventories Gg CO_2/year of the Industrial Processes sector (1990-2018) + Projection to 2030.

Country	Area	Department s	Sector	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Colombia	Amazon	Putumayo	Industrial Processes	17	17	18	19	22	23	22	23	22	18	20	20	22	24	24	29	30	32	31	28
Colombia	Amazon	Amazon	Industrial Processes	3	3	3	4	4	4	4	4	4	3	4	4	4	4	5	5	6	6	6	5
Colombia	Amazon	Caquetá	Industrial Processes	16	17	18	19	21	22	21	23	21	18	19	19	21	23	23	28	29	31	29	27
Colombia	Amazon	Vaupés	Industrial Processes	1	1	1	1	1	2	1	2	1	1	1	1	1	2	2	2	2	2	2	2
Colombia	Amazon	Guaviare	Industrial Processes	3	3	4	4	4	5	4	5	4	4	4	4	4	5	5	6	6	6	6	6

Colombia	Amazon	Guainía	Industrial Processes	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3

Country	Area	Departments	Sector	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Colombia	Amazon	Putumayo	Industrial Processes	29	32	35	36	37	37	39	39	41	40	40	41	42	43	44	45	45	46	47	48	49
Colombia	Amazon	Amazon	Industrial Processes	6	6	7	7	7	7	7	7	8	7	8	8	8	8	8	8	9	9	9	9	9
Colombia	Amazon	Caquetá	Industrial Processes	28	30	34	34	36	36	38	38	39	38	39	40	41	41	42	43	44	45	45	46	47
Colombia	Amazon	Vaupés	Industrial Processes	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Colombia	Amazon	Guaviare	Industrial Processes	6	6	7	7	7	7	8	8	8	8	8	8	8	9	9	9	9	9	9	10	10
Colombia	Amazon	Guainía	Industrial Processes	3	3	3	3	3	3	3	3	4	3	4	4	4	4	4	4	4	4	4	4	4

Table 21 shows that the AFOLU - Agriculture sector, where the department reporting the highest GHG emissions is Amazonas with 6,639.00 Gg CO_2/year in 1990 and 9,269.00 Gg CO_2/year in 2018. This is followed by the department of Guainía with 4,373.00 Gg CO_2/year in 1990 and 6,106.00 Gg CO_2/year in 2018. On the other hand, the department that presents minimum GHG emissions is Putumayo with 1,507.00 Gg CO_2/year in 1990 and for 2018 increased by 2,103.00 Gg CO_2/year respectively.

On the other hand, 12 years after the last official information obtained, all departments will not have a significant increase in GHG emissions. However, in 2030 Amazonas will continue to be the department with the highest GHG emissions generation with 9,408.00 Gg CO_2/year.

Table 21. Colombia database - GHG inventories Gg CO_2/year of the AFOLU/ Agriculture sector (1990-2018) + Projection to 2030.

Country	**Area**	**Department s**	**Sector**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
Colombia	Amazon	Putumayo	Agriculture	1.507	1.514	1.524	1.538	1.554	1.526	1.576	1.586	1.582	1.601	1.594	1.634	1.650	1.725	1.763	1.758	1.765	1.807	1.763	1.793
Colombia	Amazon	Amazon	Agriculture	6.639	6.670	6.718	6.778	6.848	6.726	6.944	6.990	6.970	7.056	7.024	7.202	7.270	7.604	7.771	7.749	7.778	7.964	7.769	7.901
Colombia	Amazon	Caquetá	Agriculture	5.386	5.411	5.450	5.499	5.555	5.456	5.633	5.670	5.654	5.724	5.698	5.842	5.898	6.168	6.304	6.286	6.310	6.461	6.303	6.410
Colombia	Amazon	Vaupés	Agriculture	3.277	3.293	3.316	3.346	3.381	3.320	3.428	3.450	3.440	3.483	3.467	3.555	3.589	3.753	3.836	3.825	3.840	3.932	3.835	3.900

Colombia	Amazon	Guaviare	Agriculture	3.236	3.252	3.275	3.304	3.338	3.279	3.385	3.407	3.398	3.440	3.424	3.511	3.544	3.707	3.788	3.777	3.792	3.883	3.787	3.852
Colombia	Amazon	Guainía	Agriculture	4.373	4.394	4.425	4.465	4.511	4.430	4.574	4.604	4.591	4.648	4.627	4.744	4.789	5.009	5.119	5.104	5.124	5.246	5.118	5.205

Country	Area	Departments	Sector	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Colombia	Amazon	Putumayo	Agriculture	1.841	1.833	1.794	1.796	1.783	1.844	1.877	1.912	2.103	1.954	1.971	1.987	2.004	2.020	2.036	2.053	2.069	2.086	2.102	2.119	2.135
Colombia	Amazon	Amazon	Agriculture	8.112	8.077	7.906	7.914	7.859	8.128	8.270	8.427	9.269	8.613	8.685	8.758	8.830	8.902	8.975	9.047	9.119	9.191	9.264	9.336	9.408
Colombia	Amazon	Caquetá	Agriculture	6.581	6.553	6.414	6.420	6.375	6.593	6.709	6.836	7.519	6.987	7.046	7.105	7.163	7.222	7.281	7.339	7.398	7.456	7.515	7.574	7.632
Colombia	Amazon	Vaupés	Agriculture	4.004	3.987	3.903	3.907	3.879	4.012	4.083	4.160	4.576	4.252	4.287	4.323	4.359	4.395	4.430	4.466	4.502	4.537	4.573	4.609	4.644
Colombia	Amazon	Guaviare	Agriculture	3.955	3.938	3.854	3.858	3.831	3.962	4.032	4.108	4.518	4.199	4.234	4.269	4.304	4.340	4.375	4.410	4.445	4.481	4.516	4.551	4.586
Colombia	Amazon	Guainía	Agriculture	5.344	5.321	5.208	5.213	5.177	5.354	5.448	5.551	6.106	5.674	5.721	5.769	5.816	5.864	5.912	5.959	6.007	6.055	6.102	6.150	6.197

Table 22 shows that GHG emissions generated from 1990 to 2018 for the AFOLU - Land Use Change sector do not vary significantly. However, to this it is seen that as of 2018 the department that has generated the highest GHG emissions was Amazonas with 21,604.00 Gg CO_2/year, followed by Caquetá with 1,526.00 Gg CO_2/year, Guainía with 14,231.00 Gg CO_2/year, Vaupés with 10,665.00 Gg CO_2/year, Guaviare with 10,532.00 Gg CO_2/year and Putumayo with 4,902.00 Gg CO_2/year.

On the other hand, looking at the projection to 2030, most of the departments will increase their emissions significantly. By 2030, Amazonas will generate 53,012.00 Gg CO_2/year, followed by Caquetá with 43,006.00 Gg CO_2/year, Guainía with 34,920.00 Gg CO_2/year, Vaupés with 26,169.00 Gg CO_2/year, Guaviare with 25,843.00 Gg CO_2/year and Putumayo with 12,029.00 Gg CO_2/year.

Table 22. Colombia database - GHG inventories Gg CO_2/year of the AFOLU/ Land Use Change sector (1990-2018) + Projection to 2030.

Country	Area	Department s	Sector	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Colombia	Amazon	Putumayo	Land Use Change	4.934	4.982	5.000	5.025	5.065	5.073	5.102	5.171	5.153	5.169	4.439	3.708	3.715	4.310	4.343	3.875	3.870	3.982	3.853	
Colombia	Amazon	Amazon	Land Use Change	21.742	21.956	22.037	22.146	22.321	22.355	22.484	22.787	22.708	22.781	19.561	16.340	16.372	18.996	19.140	17.075	17.053	17.546	16.981	16.121
Colombia	Amazon	Caquetá	Land Use Change	17.638	17.812	17.877	17.966	18.108	18.136	18.240	18.485	18.422	18.481	15.869	13.256	13.282	15.410	15.527	13.852	13.834	14.234	13.776	13.078

Colombia	Amazon	Vaupés	Land Use Change	10.733	10.838	10.878	10.932	11.019	11.035	11.099	11.248	11.210	11.246	9.656	8.066	8.082	9.377	9.448	8.429	8.418	8.662	8.383	7.958
Colombia	Amazon	Guaviare	Land Use Change	10.599	10.703	10.742	10.796	10.881	10.898	10.961	11.108	11.070	11.105	9.536	7.965	7.981	9.260	9.331	8.324	8.313	8.554	8.278	7.859
Colombia	Amazon	Guainía	Land Use Change	14.322	14.463	14.516	14.588	14.703	14.726	14.811	15.010	14.958	15.006	12.885	10.763	10.785	12.513	12.608	11.248	11.233	11.558	11.186	10.619

Country	Area	Departments	Sector	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Colombia	Amazon	Putumayo	Land Use Change	3.699	4.089	4.059	3.520	3.705	3.383	4.104	5.200	4.902	5.811	6.376	6.941	7.507	8.072	8.637	9.203	9.768	10.333	10.899	11.464	12.029
Colombia	Amazon	Amazon	Land Use Change	16.303	18.019	17.886	15.510	16.325	14.909	18.088	22.916	21.604	25.607	28.099	30.590	33.081	35.573	38.064	40.555	43.047	45.538	48.029	50.521	53.012
Colombia	Amazon	Caquetá	Land Use Change	13.225	14.618	14.510	12.583	13.244	12.095	14.673	18.590	17.526	20.774	22.795	24.816	26.837	28.858	30.879	32.900	34.921	36.942	38.964	40.985	43.006
Colombia	Amazon	Vaupés	Land Use Change	8.048	8.895	8.829	7.657	8.059	7.360	8.929	11.312	10.665	12.641	13.871	15.101	16.330	17.560	18.790	20.020	21.250	22.479	23.709	24.939	26.169
Colombia	Amazon	Guaviare	Land Use Change	7.947	8.784	8.719	7.561	7.958	7.268	8.817	11.171	10.532	12.483	13.698	14.912	16.127	17.341	18.556	19.770	20.985	22.199	23.414	24.628	25.843
Colombia	Amazon	Guainía	Land Use Change	10.739	11.870	11.782	10.217	10.754	9.821	11.915	15.095	14.231	16.868	18.509	20.150	21.791	23.432	25.073	26.714	28.356	29.997	31.638	33.279	34.920

Table 23 shows that the GHG emissions generated from 1990 to 2018 for the Waste or Residues sector show a gradual increase in emissions, although the values obtained are low compared to the other sectors evaluated.

However, as of 2018, the department that generated the highest GHG emissions was Putumayo with 79 Gg CO_2/year, followed by Caquetá with 76 Gg CO_2/year, Guaviare with 16 Gg CO_2/year, Amazonas with 15 Gg CO_2/year, Guainía with 7 Gg CO_2/year and Vaupés with 5 Gg CO_2/year.

On the other hand, looking at the projection to 2030, all departments will increase their emissions. Putumayo will have 99 Gg CO_2/year by 2030, followed by Caquetá with 96 Gg CO_2/year, Guaviare with 20 Gg CO_2/year, Amazonas with 19 Gg CO_2/year, Guainía with 9 Gg CO_2/year and Vaupés with 7 Gg CO_2/year.

Table 23. Colombia database - GHG inventories Gg CO_2/year of the Waste sector (1990-2018) + Projection to 2030.

Country	Area	Department s	Sector	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Colombia	Amazon	Putumayo	Waste	25	27	30	31	32	35	35	37	38	39	41	43	45	46	48	52	54	56	58	60
Colombia	Amazon	Amazon	Waste	5	5	6	6	6	7	7	7	7	7	8	8	9	9	9	10	10	11	11	11
Colombia	Amazon	Caquetá	Waste	24	26	29	30	31	33	34	36	37	38	40	42	44	45	47	50	52	54	56	58
Colombia	Amazon	Vaupés	Waste	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	4	4	4	4	4
Colombia	Amazon	Guaviare	Waste	5	5	6	6	6	7	7	7	8	8	8	9	9	9	10	10	11	11	12	12
Colombia	Amazon	Guainía	Waste	2	2	3	3	3	3	3	3	3	3	4	4	4	4	4	5	5	5	5	5

Country	Area	Departments	Sector	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Colombia	Amazon	Putumayo	Waste	64	65	64	64	67	70	74	79	79	79	81	82	84	86	88	90	92	94	96	97	99
Colombia	Amazon	Amazon	Waste	12	12	12	12	13	13	14	15	15	15	15	16	16	16	17	17	17	18	18	18	19
Colombia	Amazon	Caquetá	Waste	62	62	62	62	64	67	72	77	76	76	78	79	81	83	85	87	88	90	92	94	96
Colombia	Amazon	Vaupés	Waste	4	4	4	4	5	5	5	5	5	5	5	6	6	6	6	6	6	6	6	7	7
Colombia	Amazon	Guaviare	Waste	13	13	13	13	13	14	15	16	16	16	16	16	17	17	17	18	18	19	19	19	20
Colombia	Amazon	Guainía	Waste	6	6	6	6	6	6	7	7	7	7	7	7	7	8	8	8	8	8	8	9	9

Table 24 shows that from 1990 to 2018 the sector with the greatest increase in GHG emissions was Energy, going from 50,306.00 Gg CO_2/year to 92,940.00 Gg CO_2/year. If we look at its projection to 2030, we can see that emissions from the Energy sector would have an increase of 110.30.00 Gg CO_2/year by not applying any mitigation measures.

The sector with the lowest increase in emissions in the last 19 years is Agriculture, which in 1990 emitted approximately 40,697.00 Gg CO_2/year and in 2018 emitted 56,819.00 Gg CO_2/year of GHG. Its projection to 2030 shows that the sector will have a slight increase in emissions with 57,673.00 Gg CO_2/year of GHG. Likewise, it is visualized that the Industrial Processes sector had a gradual growth regarding its generated emissions having values such as 6,545.00 Gg CO_2/year in 1990 to 10,495.00 Gg CO_2/year in 2018, however, it is also observed that by 2030 these emissions will have an increase of up to 12,584.00 Gg CO_2/year.

Table 24. Comparison of Colombia Database - GHG Inventories Gg CO_2/year of prioritized sectors (1990-2018) + Projection to 2030.

Country	Area	Sector	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Colombia	Total Country	Energy	50.306	52.109	55.911	47.168	57.004	59.468	60.095	64.702	64.909	59.744	61.749	59.431	58.357	60.025	61.154	64.136	67.511	67.449	69.568	74.469
Colombia	Total Country	Industrial Processes	4.376	4.483	4.701	4.997	5.711	5.953	5.564	6.037	5.700	4.729	5.184	5.201	5.578	6.074	6.264	7.454	7.728	8.364	7.883	7.343
Colombia	Total Country	Agriculture	40.697	40.890	41.179	41.551	41.979	41.229	42.567	42.848	42.724	43.254	43.058	44.147	44.568	46.610	47.635	47.501	47.680	48.822	47.624	48.436
Colombia	Total Country	Land Use Change	123.028	124.238	124.693	125.315	126.304	126.497	127.225	128.937	128.493	128.905	110.685	92.458	92.642	107.487	108.305	96.620	96.492	99.286	96.088	91.221
Colombia	Total Country	Waste	6.545	6.999	7.779	7.947	8.351	8.951	8.996	9.582	9.796	10.152	10.653	11.204	11.729	11.957	12.499	13.379	13.813	14.403	15.048	15.426

Country	Area	Sector	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Colombia	Total Country	Energy	81.270	79.752	83.710	88.318	90.828	93.466	95.654	88.715	92.940	92.958	94.534	96.111	97.688	99.264	100.841	102.418	103.994	105.571	107.148	108.724	110.301
Colombia	Total Country	Industrial Processes	7.585	8.146	9.032	9.206	9.565	9.563	10.115	10.171	10.495	10.225	10.439	10.654	10.868	11.083	11.297	11.512	11.726	11.941	12.155	12.370	12.584
Colombia	Total Country	Agriculture	49.727	49.514	48.465	48.512	48.175	49.822	50.698	51.656	56.819	52.798	53.241	53.685	54.128	54.571	55.014	55.457	55.900	56.343	56.786	57.230	57.673
Colombia	Total Country	Change of Usage of Soils	92.248	101.961	101.210	87.765	92.376	84.363	102.348	129.667	122.247	144.899	158.996	173.093	187.190	201.287	215.385	229.482	243.579	257.676	271.773	285.870	299.967
Colombia	Total Country	Waste	16.479	16.687	16.519	16.620	17.271	18.058	19.162	20.493	20.474	20.282	20.767	21.253	21.739	22.224	22.710	23.195	23.681	24.166	24.652	25.137	25.623

Ecuador

The Ecuadorian Amazon is made up of 6 provinces: Sucumbíos, Orellana, Napo, Pastaza, Morona Santiago and Zamora Chinchipe, which together make up about 116,604 km² and have a diversity of biodiversity and natural resources. As in the other countries evaluated, the economic activities carried out in this territory emit greenhouse gases. For this reason, the evaluation of the amount of GHG emissions in the evaluated sectors is also considered.

Regarding the data obtained from official sources, it is shown that they exist from 1990 to 2018 for all the sectors evaluated:

When visualizing the results obtained (see Table 39) regarding the emissions generated by the energy sector in Ecuador, Orellana is the province that generated the highest emissions with 1,456.00 $GgCO_2$/year in 1990 and 2,962.00 $GgCO_2$/year in 2018, followed by Sucumbíos with 894 $GgCO_2$/year in 1990 and 1,819.00 $GgCO_2$/year in 2018.

Similarly, the provinces that generate the lowest GHG emissions are Morona Santiago and Zamora Chichinpe with 202 $GgCO_2$/year in 1990 and 411 $GgCO_2$/year in 2018. However, the projection to 2030, without mitigation actions, reflects a gradual increase in GHG emissions,

Ecuador database - GHG inventories Gg CO_2/year of the Energy sector (1990-2018) + Projection to 2030.

Country	Area	Province	Sector	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Ecuador	Amazon	Sucumbíos	Energy	894	858	823	790	758	792	827	864	903	943	985	1.040	1.099	1.160	1.225	1.294	1.366	1.419	1.475	1.533
Ecuador	Amazon	Orellana	Energy	1.456	1.397	1.340	1.286	1.234	1.289	1.347	1.407	1.470	1.535	1.604	1.694	1.788	1.889	1.994	2.106	2.224	2.311	2.401	2.495
Ecuador	Amazon	Napo	Energy	239	229	220	211	202	211	221	231	241	252	263	278	293	310	327	345	365	379	394	409
Ecuador	Amazon	Pastaza	Energy	276	265	254	244	234	244	255	267	279	291	304	321	339	358	378	399	422	438	455	473
Ecuador	Amazon	Morona Santiago	Energy	202	194	186	179	171	179	187	195	204	213	223	235	248	262	277	292	309	321	333	346
Ecuador	Amazon	Zamora Chinchipe	Energy	202	194	186	179	171	179	187	195	204	213	223	235	248	262	277	292	309	321	333	346

Country	Area	Province	Sector	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Ecuador	Amazon	Sucumbíos	Energy	1.593	1.635	1.678	1.782	1.886	1.841	1.796	1.808	1.819	1.950	1.995	2.040	2.086	2.131	2.176	2.221	2.266	2.312	2.357	2.402	2.447
Ecuador	Amazon	Orellana	Energy	2.593	2.662	2.732	2.901	3.070	2.997	2.923	2.942	2.962	3.174	3.248	3.322	3.395	3.469	3.542	3.616	3.689	3.763	3.837	3.910	3.984
Ecuador	Amazon	Napo	Energy	425	437	448	476	504	492	480	483	486	521	533	545	557	569	581	593	605	617	629	641	654
Ecuador	Amazon	Pastaza	Energy	491	505	518	550	582	568	554	558	561	602	616	630	644	658	671	685	699	713	727	741	755
Ecuador	Amazon	Morona Santiago	Energy	360	370	379	403	426	416	406	409	411	441	451	461	471	482	492	502	512	522	533	543	553
Ecuador	Amazon	Zamora Chinchipe	Energy	360	370	379	403	426	416	406	408	411	441	451	461	471	482	492	502	512	522	533	543	553

Table 26 shows that the IPPU sector compared to the other sectors evaluated, has relatively low levels of GHGs. However, the province reporting the highest GHG emissions is Orellana with 89 Gg CO_2/year in 1990 and 185 Gg CO_2/year in 2018. This is followed by the province of Sucumbíos with 54 Gg CO_2/year in 1990 and 114 Gg CO_2/year in 2018. On the other hand, the departments with the lowest GHG emissions are Morona Santiago and Zamora Chinchipe with 12 Gg CO_2/year in 1990 and increased by 26 Gg CO_2/year in 2018.

On the other hand, 12 years after the last official information obtained, emissions in most of the provinces will have a slight increase, due to the fact that a scenario of no mitigation measures is considered. By 2030, Orellana will generate emissions of up to 246 Gg CO_2/year and Sucumbíos up to 151 Gg CO_2/year.

Table 26. Ecuador database - GHG inventories Gg CO_2/year of the Industrial Processes sector (1990-2018) + Projection to 2030.

Country	Area	Province	Sector	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Ecuador	Amazon	Sucumbíos	Industrial Processes	54	56	57	59	60	60	60	60	59	59	59	63	68	74	79	86	92	95	98	101
Ecuador	Amazon	Orellana	Industrial Processes	89	91	93	96	98	98	97	97	97	96	96	103	111	120	129	139	150	155	160	165
Ecuador	Amazon	Napo	Industrial Processes	15	15	15	16	16	16	16	16	16	16	16	17	18	20	21	23	25	25	26	27
Ecuador	Amazon	Pastaza	Industrial Processes	17	17	18	18	19	19	18	18	18	18	18	20	21	23	24	26	28	29	30	31
Ecuador	Amazon	Morona Santiago	Industrial Processes	12	13	13	13	14	14	14	13	13	13	13	14	15	17	18	19	21	21	22	23
Ecuador	Amazon	Zamora Chinchipe	Industrial Processes	12	13	13	13	14	14	14	13	13	13	13	14	15	17	18	19	21	21	22	23

Country	Area	Province	Sector	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Ecuador	Amazon	Sucumbíos	Industrial Processes	104	109	114	114	114	111	109	111	114	122	125	128	130	133	135	138	141	143	146	149	151
Ecuador	Amazon	Orellana	Industrial Processes	170	178	186	186	185	181	177	181	185	199	203	208	212	216	220	225	229	233	238	242	246
Ecuador	Amazon	Napo	Industrial Processes	28	29	30	30	30	30	29	30	30	33	33	34	35	35	36	37	38	38	39	40	40
Ecuador	Amazon	Pastaza	Industrial Processes	32	34	35	35	35	34	34	34	35	38	39	39	40	41	42	43	43	44	45	46	47
Ecuador	Amazon	Morona Santiago	Industrial Processes	24	25	26	26	26	25	25	25	26	28	28	29	29	30	31	31	32	32	33	34	34
Ecuador	Amazon	Zamora Chinchipe	Industrial Processes	24	25	26	26	26	25	25	25	26	28	28	29	29	30	31	31	32	32	33	34	34

Table 27 shows the AFOLU - Agriculture sector where the province reporting the highest GHG emissions is Pastaza with 242 Gg CO_2/year in 1990 and 453 Gg CO_2/year in 2018. This is followed by the province of Morona Santiago with 196 Gg CO_2/year in 1990 and 368 Gg CO_2/year in 2018. On the other hand, the departments with the lowest GHG emissions are Napo with 102 Gg CO_2/year in 1990 and increased by 192 Gg CO_2/year in 2018 and Zamora Chinchipe with 86 Gg CO_2/year in 1990 and increased by 162 Gg CO_2/year in 2018.

On the other hand, 12 years after the last official information obtained, all provinces will have an increase, due to the fact that a scenario of no mitigation measures is considered. By 2030, Pastaza will generate emissions of up to 559 Gg CO_2/year and Morona Santiago up to 453 Gg CO_2/year.

Table 27. Ecuador database - GHG inventories Gg CO_2/year of the AFOLU/ Agriculture sector (1990-2018) + Projection to 2030.

Country	Area	Province	Sector	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Ecuador	Amazon	Sucumbíos	Agriculture	147	171	200	232	270	269	268	267	266	265	263	265	268	270	272	274	276	279	282	286
Ecuador	Amazon	Orellana	Agriculture	177	206	239	279	324	323	321	320	319	317	316	318	321	323	326	328	331	335	339	343
Ecuador	Amazon	Napo	Agriculture	102	119	138	161	187	187	186	185	184	183	183	184	186	187	188	190	191	194	196	198
Ecuador	Amazon	Pastaza	Agriculture	242	281	327	381	443	441	439	437	435	434	432	435	439	442	445	449	452	458	463	468
Ecuador	Amazon	Morona Santiago	Agriculture	196	228	265	309	359	358	356	355	353	352	350	353	356	359	362	364	367	371	376	380
Ecuador	Amazon	Zamora Chinchipe	Agriculture	86	100	117	136	158	157	157	156	155	155	154	155	157	158	159	160	162	163	165	167

Country	Area	Province	Sector	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Ecuador	Amazon	Sucumbíos	Agriculture	289	290	290	291	293	288	282	279	277	309	311	314	317	320	323	326	329	332	335	338	341
Ecuador	Amazon	Orellana	Agriculture	347	347	348	350	351	345	339	335	332	370	374	377	381	384	388	391	395	398	402	405	409
Ecuador	Amazon	Napo	Agriculture	200	201	201	202	203	200	196	194	192	214	216	218	220	222	224	226	228	230	232	234	236
Ecuador	Amazon	Pastaza	Agriculture	474	475	475	478	480	471	463	458	453	506	510	515	520	525	530	535	539	544	549	554	559
Ecuador	Amazon	Morona Santiago	Agriculture	385	385	386	388	390	383	376	372	368	410	414	418	422	426	430	434	438	442	446	450	453
Ecuador	Amazon	Zamora Chinchipe	Agriculture	169	169	170	171	171	168	165	164	162	181	182	184	186	187	189	191	193	194	196	198	199

Table 28 shows the AFOLU - Land Use Change sector, where it is observed that all provinces recorded a decrease in their GHG emissions over the years. For example: Pastaza went from 4,556.00 Gg CO_2/year in 1990 to 1,629.00 Gg CO_2/year in 2018. This is followed by the province of Morona Santiago with 3,698.00 Gg CO_2/year in 1990 and 1,322.00 Gg CO_2/year in 2018.

On the other hand, 12 years after the last official information obtained, all provinces will continue to reduce the amount of their GHG emissions despite the fact that these data were calculated under a scenario without mitigation measures.

Table 28. Ecuador database - GHG inventories Gg CO_2/year of the AFOLU sector/ Land Use Change (1990-2018) + Projection to 2030.

Country	Area	Province	Sector	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Ecuador	Amazon	Sucumbíos	Land Use Change	2.779	3.011	3.261	3.533	3.827	3.628	3.439	3.260	3.090	2.929	2.777	2.713	2.651	2.590	2.531	2.473	2.416	2.185	1.976	1.787
Ecuador	Amazon	Orellana	Land Use Change	3.334	3.611	3.912	4.238	4.590	4.351	4.125	3.910	3.707	3.514	3.331	3.255	3.180	3.107	3.036	2.966	2.898	2.621	2.370	2.143
Ecuador	Amazon	Napo	Land Use Change	1.928	2.088	2.262	2.450	2.654	2.516	2.385	2.261	2.143	2.032	1.926	1.882	1.839	1.797	1.755	1.715	1.676	1.516	1.370	1.239
Ecuador	Amazon	Pastaza	Land Use Change	4.556	4.935	5.346	5.790	6.272	5.946	5.637	5.343	5.065	4.801	4.551	4.447	4.345	4.246	4.149	4.054	3.961	3.582	3.239	2.929
Ecuador	Amazon	Morona Santiago	Land Use Change	3.698	4.005	4.339	4.700	5.091	4.826	4.575	4.337	4.111	3.897	3.694	3.610	3.527	3.446	3.367	3.290	3.215	2.907	2.629	2.377
Ecuador	Amazon	Zamora Chinchipe	Land Use Change	1.627	1.762	1.909	2.068	2.240	2.123	2.013	1.908	1.809	1.714	1.625	1.588	1.552	1.516	1.481	1.447	1.414	1.279	1.157	1.046

Country	Area	Province	Sector	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Ecuador	Amazon	Sucumbíos	Land Use Change	1.616	1.548	1.481	1.359	1.238	1.402	1.567	1.280	994	1.131	1.080	1.028	977	926	875	823	772	721	669	618	567
Ecuador	Amazon	Orellana	Land Use Change	1.938	1.857	1.776	1.631	1.485	1.682	1.880	1.536	1.192	1.357	1.295	1.234	1.172	1.110	1.049	987	926	864	803	741	680
Ecuador	Amazon	Napo	Land Use Change	1.121	1.074	1.027	943	858	973	1.087	888	689	784	749	713	678	642	607	571	535	500	464	429	393
Ecuador	Amazon	Pastaza	Land Use Change	2.649	2.538	2.427	2.228	2.029	2.299	2.569	2.099	1.629	1.854	1.770	1.686	1.601	1.517	1.433	1.349	1.265	1.181	1.097	1.013	929
Ecuador	Amazon	Morona Santiago	Land Use Change	2.150	2.060	1.970	1.808	1.647	1.866	2.085	1.703	1.322	1.505	1.436	1.368	1.300	1.232	1.163	1.095	1.027	959	891	822	754
Ecuador	Amazon	Zamora Chinchipe	Land Use Change	946	906	867	796	724	821	917	749	582	662	632	602	572	542	512	482	452	422	392	362	332

Table 29 shows that the Waste sector has relatively low levels of GHG emissions compared to the other sectors evaluated. However, the province that reports the highest GHG emissions is Orellana, which according to the results shows constant periods in its emissions, this is observed until 2010, when its GHG emissions begin to increase year after year, with emissions of 196 Gg CO_2/year in 2018. This is followed by the province of Sucumbíos with 40 Gg CO_2/year in 1990 and 120 Gg CO_2/year in 2018. On the other hand, the departments with the lowest GHG emissions are Morona Santiago and Zamora Chinchipe with 9 Gg CO_2/year in 1990 and increased by 27 Gg CO_2/year in 2018.

On the other hand, 12 years after the last official information obtained, emissions in most of the provinces will have a slight increase, due to the fact that a scenario of no mitigation measures is considered. By 2030, Orellana will generate emissions of up to 244 Gg CO_2/year and Sucumbíos up to 150 Gg CO_2/year.

Table 29. Ecuador database - GHG inventories Gg CO_2/year of the Waste sector (1990-2018) + Projection to 2030.

Country	Area	Province	Sector	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Ecuador	Amazon	Sucumbíos	Waste	40	40	40	40	26	26	26	26	26	26	49	49	49	49	49	49	65	65	65	65
Ecuador	Amazon	Orellana	Waste	65	65	65	65	42	42	42	42	42	42	80	80	80	80	80	80	107	107	107	107
Ecuador	Amazon	Napo	Waste	11	11	11	11	7	7	7	7	7	7	13	13	13	13	13	13	17	17	17	17
Ecuador	Amazon	Pastaza	Waste	12	12	12	12	8	8	8	8	8	8	15	15	15	15	15	15	20	20	20	20
Ecuador	Amazon	Morona Santiago	Waste	9	9	9	9	6	6	6	6	6	6	11	11	11	11	11	11	15	15	15	15
Ecuador	Amazon	Zamora Chinchipe	Waste	9	9	9	9	6	6	6	6	6	6	11	11	11	11	11	11	15	15	15	15

Country	Area	Province	Sector	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Ecuador	Amazon	Sucumbíos	Waste	67	79	92	100	108	113	118	119	120	113	116	119	123	126	130	133	136	140	143	147	150
Ecuador	Amazon	Orellana	Waste	109	129	150	163	176	184	192	194	196	183	189	194	200	205	211	216	222	227	233	239	244
Ecuador	Amazon	Napo	Waste	18	21	25	27	29	30	32	32	32	30	31	32	33	34	35	36	36	37	38	39	40
Ecuador	Amazon	Pastaza	Waste	21	24	28	31	33	35	36	37	37	35	36	37	38	39	40	41	42	43	44	45	46
Ecuador	Amazon	Morona Santiago	Waste	15	18	21	23	24	26	27	27	27	25	26	27	28	29	29	30	31	32	32	33	34
Ecuador	Amazon	Zamora Chinchipe	Waste	15	18	21	23	24	26	27	27	27	25	26	27	28	29	29	30	31	32	32	33	34

Table 30 shows that from 1990 to 2018, the sector with the greatest increase in GHG emissions was Energy, going from 18,878.00 Gg CO_2/year to 38,400.00 Gg CO_2/year. According to the projection made to 2030, it can be seen that the emissions of the Energy sector would have an increase of 51,655.00 Gg CO_2/year if no mitigation measures are applied.

The opposite case is presented in the emissions generated in the Land Use Change sector, which according to historical data reduces its GHG emissions from 45,543.00 Gg CO_2/year to 16,283.00 Gg CO_2/year in the years 1999 and 2018.

Table 30. Comparison of the Ecuador Database - GHG Inventories Gg CO_2/year of the prioritized sectors (1990-2018) + Projection to 2030.

Country	Area	Sector	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Ecuador	Total Country	Energy	18.878	18.113	17.380	16.676	16.001	16.716	17.462	18.242	19.057	19.908	20.797	21.961	23.190	24.487	25.857	27.304	28.832	29.960	31.132	32.350
Ecuador	Total Country	Industrial Processes	1.150	1.180	1.210	1.241	1.273	1.268	1.263	1.258	1.253	1.248	1.243	1.339	1.443	1.555	1.675	1.805	1.945	2.007	2.071	2.137
Ecuador	Total Country	Agriculture	8.365	9.734	11.327	13.181	15.338	15.273	15.209	15.145	15.081	15.017	14.954	15.070	15.188	15.306	15.425	15.545	15.666	15.848	16.033	16.219
Ecuador	Total Country	Land Use Change	45.543	49.334	53.441	57.889	62.708	59.444	56.350	53.417	50.636	48.001	45.502	44.460	43.441	42.446	41.474	40.524	39.596	35.806	32.379	29.280
Ecuador	Total Country	Waste	838	838	838	838	547	547	547	547	547	547	1.043	1.043	1.043	1.043	1.043	1.043	1.382	1.382	1.382	1.382

Country	Area	Sector	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Ecuador	Total Country	Energy	33.616	34.521	35.425	37.614	39.802	38.854	37.906	38.153	38.400	41.160	42.114	43.068	44.022	44.976	45.930	46.884	47.838	48.793	49.747	50.701	51.655
Ecuador	Total Country	Industrial Processes	2.205	2.307	2.409	2.406	2.403	2.349	2.294	2.349	2.404	2.581	2.636	2.692	2.747	2.803	2.859	2.914	2.970	3.025	3.081	3.136	3.192
Ecuador	Total Country	Agriculture	16.408	16.435	16.462	16.546	16.629	16.329	16.029	15.864	15.699	17.514	17.680	17.847	18.014	18.181	18.348	18.515	18.681	18.848	19.015	19.182	19.349
Ecuador	Total Country	Land Use Change	26.478	25.373	24.267	22.275	20.282	22.981	25.680	20.982	16.283	18.532	17.691	16.851	16.011	15.170	14.330	13.490	12.649	11.809	10.968	10.128	9.288
Ecuador	Total Country	Waste	1.407	1.674	1.940	2.111	2.281	2.387	2.492	2.517	2.541	2.376	2.448	2.520	2.591	2.663	2.735	2.806	2.878	2.949	3.021	3.093	3.164

Guyana

Guyana is a country whose Amazon represents one hundred percent of the entire country, which is why the results obtained are based on a general comparison of the sectors evaluated over the years. Therefore, we have the following:

Table 31 shows that from 1990 to 2020, the sector with the greatest increase in GHG emissions was Land Use Change, from 5,480.00 Gg CO_2/year to 12,880.00 Gg CO_2/year. If we look at its projection to 2030, we can see that the sector's emissions would increase to 17,690.00 Gg CO_2/year if no mitigation measures were applied.

The sector with the lowest increase in emissions over the last 30 years is the waste sector, which in 1990 emitted approximately 130 Gg CO_2/year and in 2020 emitted 160 Gg CO_2/year of GHG. The projection for 2030 shows that the sector will generate 180 Gg CO_2/year of GHG. Likewise, it can be seen that the Industrial Processes sector had an exponential growth with respect to its generated emissions, having minimum emission values of 10 Gg CO_2/year in 1996 to 260 Gg CO_2/year in 2020; however, it can also be seen that by 2030 these emissions will have a minimum reduction of up to 330 Gg CO_2/year.

Table 31. Comparison of the Guyana Database - GHG Inventories Gg CO_2/year of the prioritized sectors (1990-2020) + Projection to 2030.

Country	Area	Sector	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Guyana	Total Country	Energy	1,280	1,200	1,130	1,140	1,470	1,590	1,640	1,790	1,810	1,800	1,730	1,710	1,690	1,680	1,740	1,540	1,390	1,660	1,660	1,690
Guyana	Total Country	Industrial Processes	0	0	0	0	0	0	10	10	10	10	10	20	20	20	20	20	20	20	30	30
Guyana	Total Country	Agriculture	880	1,140	1,190	1,340	1,320	1,560	1,550	1,610	1,510	1,630	1,360	1,420	1,330	1,550	1,490	1,330	1,290	1,330	1,480	1,480
Guyana	Total Country	Land Use Change	5,480	5,480	5,480	6,120	6,110	6,450	6,670	6,740	6,960	6,840	6,840	7,550	7,550	7,630	7,910	7,910	7,890	7,890	7,880	7,890
Guyana	Total Country	Waste	130	130	130	130	130	130	130	130	130	130	140	140	150	150	150	150	150	150	150	160

Country	Area	Sector	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Guyana	Total Country	Energy	1,820	1,890	2,060	2,040	2,130	2,110	2,380	2,380	2,490	2,700	2,860	2,841	2,938	3,035	3,132	3,229	3,326	3,423	3,520	3,617	3,714
Guyana	Total Country	Industrial Processes	30	40	50	50	60	100	230	240	250	250	260	267	274	281	288	295	302	309	316	323	330
Guyana	Total Country	Agriculture	1,570	1,580	1,660	1,840	1,960	2,070	1,700	1,840	1,870	1,960	2,000	2,090	2,162	2,234	2,306	2,378	2,450	2,522	2,594	2,666	2,738
Guyana	Total Country	Land Use Change	7,930	15,540	15,530	15,530	15,530	15,550	12,930	12,880	12,890	12,900	12,880	14,682	15,016	15,350	15,685	16,019	16,353	16,687	17,022	17,356	17,690
Guyana	Total Country	Waste	160	160	160	160	160	160	160	160	160	160	160	168	170	171	172	174	175	176	178	179	180

Peru

The Peruvian Amazon is made up of 5 departments: Amazonas, Loreto, San Martin, Madre de Dios and Ucayali (Figure 6), where together they make up about 610,800 km². It includes a variety of natural resources and is home to a large number of animal and plant species. However, it also represents a challenge in environmental terms, since the different economic activities in the territory also generate GHGs, which are shown below:

Table 32 shows the emissions of the Energy sector in Peru, where the region reporting the highest GHG emissions is Loreto 357 Gg CO_2/year in 1994 and 583 Gg CO_2/year 2018, followed by San Martin with 252 Gg CO_2/year in 1994 and 411 Gg CO_2/year 2018, Ucayali with 184 Gg CO_2/year in 1994 and 299 Gg CO_2/year 2018 and, Huánuco with 180 Gg CO_2/year in 1994 and 293 Gg CO_2/year 2018. On the other hand, the region with the lowest GHG emissions is Madre de Dios with 70 Gg CO_2/year in 1994 and by 2018 increased by 1152 Gg CO_2/year.

On the other hand, after the last official information obtained, all regions will have an increase, due to the fact that a scenario of no mitigation measures is considered. By 2030, Loreto will generate emissions of up to 954 Gg CO_2/year and San Martin up to 673 Gg CO_2/year.

Zero emissions are also observed from 1990 to 1993, due to the fact that the country did not report emissions for those years.

Table 32. Peru database - GHG inventories Gg CO_2/year of the Energy sector (1990-2018) + Projection to 2030.

Country	Area	Region	Sector	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Peru	Amazon	Loreto	Energy	0	0	0	0	357	362	366	370	374	378	382	394	406	418	430	443	468	494	522	551
Peru	Amazon	Amazon	Energy	0	0	0	0	125	127	128	130	131	133	134	138	142	147	151	156	164	173	183	193
Peru	Amazon	San Martín	Energy	0	0	0	0	252	255	258	261	264	267	270	278	287	295	304	313	331	349	368	389
Peru	Amazon	Ucayali	Energy	0	0	0	0	184	186	188	190	192	194	196	202	208	215	221	228	241	254	268	283
Peru	Amazon	Madre de Dios	Energy	0	0	0	0	70	71	72	73	74	75	75	78	80	82	85	87	92	97	103	109
Peru	Amazon	Huánuco	Energy	0	0	0	0	180	182	184	186	188	190	192	198	204	210	216	223	235	248	262	277

Country	Area	Region	Sector	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Peru	Amazon	Loreto	Energy	581	580	578	606	634	631	629	606	583	606	748	768	789	810	830	851	871	892	912	933	954
Peru	Amazon	Amazon	Energy	204	203	203	213	222	222	221	213	204	213	263	270	277	284	291	299	306	313	320	327	335
Peru	Amazon	San Martín	Energy	411	409	408	428	447	446	444	428	411	428	528	543	557	572	586	601	615	630	644	659	673
Peru	Amazon	Ucayali	Energy	299	298	297	311	326	324	323	311	299	312	384	395	405	416	426	437	448	458	469	479	490
Peru	Amazon	Madre de Dios	Energy	115	114	114	119	125	124	124	119	115	120	147	152	156	160	164	168	172	176	180	184	188
Peru	Amazon	Huánuco	Energy	292	291	291	304	318	317	316	304	293	305	376	386	396	407	417	428	438	448	459	469	479

Table 33 shows the emissions of the IPPU sector where all regions decrease their GHG emissions over the years as Loreto generated 160 Gg CO_2/year in 1994 and 121 Gg CO_2/year 2018, followed by San Martin with 113 Gg CO_2/year in 1994 and 85 Gg CO_2/year 2018, Ucayali with 82 Gg CO_2/year in 1994 and 62 Gg CO_2/year 2018 and, Huánuco with 80 Gg CO_2/year in 1994 and 61 Gg CO_2/year 2018, Amazonas with 56 Gg CO_2/year in 1994 and 42 Gg CO_2/year 2018 and Madre de Dios with 31 Gg CO_2/year in 1994 and 24 Gg CO_2/year 2018,

On the other hand, after the last official information obtained, all regions will have an increase under a scenario of no mitigation measures.

Table 33. Peru database - GHG inventories Gg CO_2/year of the Industrial Processes sector (1990-2018) + Projection to 2030.

Country	Area	Region	Sector	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Peru	Amazon	Loreto	Industrial Processes	0	0	0	0	160	129	105	85	69	56	45	48	50	53	55	58	61	64	67	70
Peru	Amazon	Amazon	Industrial Processes	0	0	0	0	56	45	37	30	24	20	16	17	18	18	19	21	21	22	23	24
Peru	Amazon	San Martín	Industrial Processes	0	0	0	0	113	91	74	60	49	39	32	34	35	37	39	41	43	45	47	49
Peru	Amazon	Ucayali	Industrial Processes	0	0	0	0	82	66	54	44	35	29	23	24	26	27	29	30	31	33	34	36
Peru	Amazon	Madre de Dios	Industrial Processes	0	0	0	0	31	26	21	17	14	11	9	9	10	10	11	12	12	13	13	14
Peru	Amazon	Huánuco	Industrial Processes	0	0	0	0	80	65	53	43	35	28	23	24	25	26	28	29	31	32	33	35

Country	Area	Region	Sector	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Peru	Amazon	Loreto	Industrial Processes	73	78	83	92	101	103	106	113	121	121	107	110	112	114	117	119	121	123	126	128	130
Peru	Amazon	Amazon	Industrial Processes	26	27	29	32	35	36	37	40	42	42	38	38	39	40	41	42	43	43	44	45	46
Peru	Amazon	San Martín	Industrial Processes	51	55	59	65	71	73	75	80	85	85	76	77	79	81	82	84	86	87	89	90	92
Peru	Amazon	Ucayali	Industrial Processes	37	40	43	47	52	53	54	58	62	62	55	56	58	59	60	61	62	63	65	66	67
Peru	Amazon	Madre de Dios	Industrial Processes	14	15	16	18	20	20	21	22	24	24	21	22	22	23	23	23	24	24	25	25	26
Peru	Amazon	Huánuco	Industrial Processes	37	39	42	46	51	52	53	57	61	61	54	55	56	57	59	60	61	62	63	64	66

Table 34 shows the emissions of the AFOLU-Agriculture sector in Peru, where the region reporting the highest GHG emissions is San Martin with 1,524.00 Gg CO_2/year in 1994 and 1,923.00 Gg CO_2/year 2018, followed by Loreto with 1,050.00 Gg CO_2/year in 1994 and 1,324.00 Gg CO_2/year 2018, Huánuco with 1,032.00 Gg CO_2/year in 1994 and 1,301.00 Gg CO_2/year 2018, Amazonas with 886 Gg CO_2/year in 1994 and 1,117.003 Gg CO_2/year 2018. On the other hand, the region with the lowest GHG emissions is Madre de Dios with 479 Gg CO_2/year in 1994 and by 2018 increased by 604 Gg CO_2/year.

On the other hand, after the last official information obtained, all regions will have an increase, due to the fact that a scenario of no mitigation measures is considered. In 2030, San Martin will generate emissions of up to 2,989.00 Gg CO_2/year and Amazonas 2,081 Gg CO_2/year.

Table 34. Peru database - GHG inventories Gg CO_2/year of the AFOLU/Agriculture sector (1990-2018) + Projection to 2030.

Country	Area	Region	Sector	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Peru	Amazon	Loreto	Agriculture	0	0	0	0	1.050	1.071	1.093	1.116	1.139	1.162	1.186	1.198	1.211	1.223	1.236	1.249	1.264	1.279	1.294	1.309
Peru	Amazon	Amazon	Agriculture	0	0	0	0	886	904	922	941	961	980	1.001	1.011	1.021	1.032	1.043	1.053	1.066	1.079	1.091	1.104
Peru	Amazon	San Martín	Agriculture	0	0	0	0	1.524	1.556	1.588	1.620	1.654	1.688	1.722	1.740	1.758	1.776	1.795	1.813	1.835	1.857	1.879	1.901
Peru	Amazon	Ucayali	Agriculture	0	0	0	0	876	894	913	931	951	970	990	1.000	1.011	1.021	1.032	1.042	1.055	1.067	1.080	1.093
Peru	Amazon	Madre de Dios	Agriculture	0	0	0	0	479	489	499	509	519	530	541	547	552	558	564	570	576	583	590	597
Peru	Amazon	Huánuco	Agriculture	0	0	0	0	1.032	1.053	1.075	1.097	1.119	1.142	1.166	1.178	1.190	1.202	1.215	1.227	1.242	1.257	1.272	1.287

Country	Area	Region	Sector	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Peru	Amazon	Loreto	Agriculture	1.325	1.332	1.339	1.333	1.327	1.327	1.328	1.326	1.324	1.355	1.682	1.360	1.390	1.420	1.450	1.481	1.511	1.541	1.571	1.601	1.632
Peru	Amazon	Amazon	Agriculture	1.117	1.124	1.130	1.125	1.119	1.120	1.120	1.118	1.117	1.143	1.419	1.734	1.773	1.811	1.850	1.888	1.927	1.965	2.004	2.042	2.081
Peru	Amazon	San Martín	Agriculture	1.923	1.934	1.945	1.936	1.927	1.928	1.928	1.925	1.923	1.968	2.442	2.491	2.546	2.601	2.657	2.712	2.767	2.823	2.878	2.933	2.989
Peru	Amazon	Ucayali	Agriculture	1.106	1.112	1.118	1.113	1.108	1.108	1.108	1.107	1.105	1.131	1.404	945	966	987	1.008	1.028	1.049	1.070	1.091	1.112	1.133

Peru	Amazon	Madre de Dios	Agriculture	604	607	611	608	605	605	606	605	604	618	767	1.098	1.123	1.147	1.172	1.196	1.220	1.245	1.269	1.294	1.318
Peru	Amazon	Huánuco	Agriculture	1.302	1.309	1.316	1.310	1.304	1.305	1.305	1.303	1.301	1.332	1.653	1.951	1.995	2.038	2.081	2.125	2.168	2.211	2.255	2.298	2.341

Table 35, shows the emissions of the AFOLU-Land Use Change sector, where the region that reports a significant increase in its GHG emissions is Loreto with 6,552.00 Gg CO_2/year in 1994 and 12,746.00 Gg CO_2/year 2018, followed by Ucayali with 3,834.00 Gg CO_2/year in 1994 and 12,643.00 Gg CO_2/year 2018, Madre de Dios with 1,326.00 Gg CO_2/year in 1994 and 11,427.00 Gg CO_2/year 2018, San Martin with 7,483.00 Gg CO_2/year in 1994 and 10,398.00 Gg CO_2/year 2018. On the other hand, the region with the lowest GHG emissions is Amazonas with 4,786.00 Gg CO_2/year in 1994 and by 2018 it decreased by 3,625.00 Gg CO_2/year.

On the other hand, after the last official information obtained and its projection to 2030, all regions will have an increase, due to the fact that a scenario of no mitigation measures is considered. However, it is observed that Ucayali will have an exponential growth of up to 34,413.00 Gg CO_2/year.

Table 35. Peru database - GHG inventories Gg CO_2/year of the AFOLU sector/Land Use Change (1990-2018) + Projection to 2030.

Country	Area	Region	Sector	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Peru	Amazon	Loreto	Land Use Change	0	0	0	0	6.552	6.912	7.292	7.693	8.116	8.563	9.033	10.938	13.295	9.966	16.186	12.937	15.187	18.241	25.148	18.245
Peru	Amazon	Amazonas	Land Use Change	0	0	0	0	4.786	5.049	5.327	5.620	5.929	6.255	6.599	2.214	3.250	3.807	2.936	2.036	4.634	5.077	3.004	2.938
Peru	Amazon	San Martín	Land Use Change	0	0	0	0	7.483	7.895	8.329	8.787	9.270	9.780	10.317	12.647	17.868	15.030	19.935	19.258	18.235	33.760	17.516	25.395
Peru	Amazon	Ucayali	Land Use Change	0	0	0	0	3.834	4.044	4.267	4.501	4.749	5.010	5.286	8.457	8.760	11.685	9.575	12.523	14.800	9.302	16.787	16.600
Peru	Amazon	Madre de Dios	Land Use Change	0	0	0	0	1.326	1.399	1.476	1.558	1.643	1.734	1.829	4.089	4.326	5.507	6.415	4.660	6.918	6.674	10.351	3.679
Peru	Amazon	Huánuco	Land Use Change	0	0	0	0	3.482	3.673	3.875	4.088	4.313	4.550	4.800	7.936	8.521	13.829	7.526	14.846	10.455	10.616	16.881	16.156

Country	Area	Region	Sector	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Peru	Amazon	Loreto	Land Use Change	17.103	16.182	21.057	21.489	18.777	16.335	22.639	9.326	12.746	15.714	18.479	15.850	16.177	16.504	16.832	17.159	17.486	17.814	18.141	18.468	18.796
Peru	Amazon	Amazon	Land Use Change	2.440	2.418	3.023	4.982	2.599	3.575	4.256	4.132	3.625	3.942	6.132	3.460	3.532	3.603	3.675	3.746	3.818	3.889	3.961	4.032	4.104
Peru	Amazon	San Martín	Land Use Change	23.676	19.041	18.546	16.789	13.196	11.400	12.546	6.110	10.398	7.493	10.706	10.455	10.671	10.887	11.103	11.319	11.535	11.751	11.966	12.182	12.398
Peru	Amazon	Ucayali	Land Use Change	12.167	18.184	15.770	27.433	16.314	15.328	18.045	14.615	12.643	26.061	25.115	29.019	29.619	30.218	30.817	31.417	32.016	32.615	33.214	33.814	34.413
Peru	Amazon	Madre de Dios	Land Use Change	9.697	8.946	7.454	9.246	7.881	9.183	10.393	11.567	11.427	14.517	12.243	18.498	18.880	19.262	19.644	20.026	20.408	20.790	21.172	21.554	21.936
Peru	Amazon	Huánuco	Land Use Change	12.153	14.576	14.814	15.505	13.794	11.819	11.090	9.401	8.055	10.157	9.517	12.006	12.254	12.502	12.750	12.998	13.246	13.494	13.742	13.990	14.238

Table 36 shows the emissions of the Waste or Residues sector, where the region that reports a significant increase in its GHG emissions is Loreto with 104 Gg CO_2/year in 1994 and 167 Gg CO_2/year 2018, followed by San Martin with 74 Gg CO_2/year in 1994 and 118 Gg CO_2/year 2018, Ucayali with 54 Gg CO_2/year in 1994 and 86 Gg CO_2/year 2018, Huánuco with 53 Gg CO_2/year in 1994 and 84 Gg CO_2/year 2018. On the other hand, the region with the lowest GHG emissions is Madre de Dios with 21 Gg CO_2/year in 1994 and for 2018 with 33 Gg CO_2/year.

On the other hand, after the last official information obtained and its projection to 2030, all regions will have an increase, due to the fact that a scenario of no mitigation measures is considered. For example, Loreto will emit up to 34,413.00 Gg CO_2/year of GHG and San Martin up to 166 Gg CO_2/year.

Table 36. Peru database - GHG inventories Gg CO_2/year of the Waste sector (1990-2018) + Projection to 2030.

Country	Area	Region	Sector	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Peru	Amazon	Loreto	Waste	0	0	0	0	104	106	108	111	112	115	117	119	121	123	125	127	130	131	131	132
Peru	Amazon	Amazon	Waste	0	0	0	0	37	37	38	39	39	40	41	42	43	43	44	45	46	46	46	46
Peru	Amazon	San Martín	Waste	0	0	0	0	74	75	77	78	79	81	83	84	86	87	89	90	92	92	92	93

Country	Area	Region	Sector	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Peru	Amazon	Ucayali	Waste	0	0	0	0	54	55	56	57	58	59	60	61	62	63	64	65	67	67	67	68
Peru	Amazon	Madre de Dios	Waste	0	0	0	0	21	21	21	22	22	23	23	24	24	24	25	25	26	26	26	26
Peru	Amazon	Huánuco	Waste	0	0	0	0	53	54	54	56	57	58	59	60	61	62	63	64	65	66	66	67

Country	Area	Region	Sector	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Peru	Amazon	Loreto	Waste	134	137	140	145	151	154	157	162	167	168	188	193	198	202	207	212	216	221	226	231	235
Peru	Amazon	Amazonas	Waste	47	48	49	51	53	54	55	57	59	59	66	68	69	71	73	74	76	78	79	81	83
Peru	Amazon	San Martín	Waste	95	97	99	102	106	109	111	114	118	119	133	136	140	143	146	150	153	156	160	163	166
Peru	Amazon	Ucayali	Waste	69	70	72	75	77	79	80	83	86	86	97	99	102	104	106	109	111	114	116	119	121
Peru	Amazon	Madre de Dios	Waste	26	27	28	29	30	30	31	32	33	33	37	38	39	40	41	42	43	44	45	45	46
Peru	Amazon	Huánuco	Waste	67	69	70	73	76	78	79	81	84	84	95	97	99	102	104	106	109	111	114	116	118

Table 37 shows that from 1994 to 2018 the sector with the greatest increase in GHG emissions was Land Use Change, going from 41,218.00 Gg CO_2/year to 75,28.00 Gg CO_2/year. According to the projection made for 2030, the sector's emissions would increase by up to 130,784.00 Gg CO_2/year if no mitigation measures were applied. The opposite case is presented in the emissions generated in the Industrial Processes sector, which according to historical data reduces its GHG emissions from 9,899.00 Gg CO_2/year to 7,47.00 Gg CO_2/year in the years 1994 and 2018.

Although it Table 37 shows that the GHG emissions generated from 1990 to 1993 are equal to zero, this does not mean that there were zero emissions, but rather that there are no sources to support the emissions during that period of time.

Table 37. Comparison of the Peru Database - GHG Inventories Gg CO_2/year of the prioritized sectors (1990-2018) + Projection to 2030.

Country	Area	Sector	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Peru	Total Country	Energy	0	0	0	0	22.154	22.404	22.658	22.914	23.173	23.435	23.699	24.412	25.145	25.901	26.680	27.482	29.011	30.625	32.329	34.128
Peru	Total Country	Industrial Processes	0	0	0	0	9.899	8.019	6.496	5.263	4.263	3.454	2.798	2.946	3.102	3.266	3.439	3.621	3.783	3.951	4.128	4.312
Peru	Total Country	Agriculture	0	0	0	0	22.059	22.513	22.976	23.449	23.931	24.423	24.926	25.184	25.445	25.708	25.974	26.243	26.554	26.868	27.186	27.508
Peru	Total Country	Land Use Change	0	0	0	0	41.218	43.484	45.875	48.397	51.058	53.865	56.827	61.300	66.124	71.329	76.943	82.999	89.532	96.578	104.180	98.365
Peru	Total Country	Waste	0	0	0	0	6.476	6.598	6.721	6.856	6.969	7.108	7.266	7.389	7.512	7.639	7.768	7.896	8.051	8.093	8.109	8.203

Country	Area	Sector	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Peru	Total Country	Energy	36.026	35.926	35.825	37.546	39.267	39.115	38.964	37.533	36.103	37.584	46.345	47.620	48.895	50.170	51.445	52.720	53.995	55.270	56.545	57
Peru	Total Country	Industrial Processes	4.505	4.834	5.163	5.706	6.249	6.406	6.564	7.005	7.475	7.475	6.651	6.794	6.936	7.079	7.222	7.365	7.507	7.650	7.793	7
Peru	Total Country	Agriculture	27.833	27.988	28.143	28.016	27.888	27.894	27.901	27.861	27.821	28.478	35.340	36.143	36.945	37.748	38.551	39.354	40.157	40.960	41.763	42
Peru	Total Country	Land Use Change	92.448	93.929	95.217	112.049	88.757	80.708	100.343	76.199	75.282	100.794	108.007	110.285	112.563	114.840	117.118	119.395	121.673	123.951	126.228	128
Peru	Total Country	Waste	8.322	8.489	8.691	8.988	9.343	9.570	9.701	10.017	10.359	10.419	11.658	11.951	12.244	12.537	12.830	13.123	13.416	13.709	14.002	14

Suriname

Similar to Guyana, the Suriname Amazon represents the total percentage of the entire country, which is why the results obtained are made in a general comparison of the sectors evaluated over the years. The results are as follows:

Table 38 shows that from 2000 to 2020, the sector with the greatest increase in GHG emissions was Land Use Change, increasing from 3,300.00 Gg CO_2/year to 9,230.00 Gg CO_2/year. If we look at the projection to 2030, we can see that emissions from the Land Use Change sector would increase to 13,589.00 Gg CO_2/year if no mitigation measures were applied.

The emissions with the smallest increase in emissions over the last 20 years are:

The agriculture sector, which in 2000 emitted approximately 600 Gg CO_2/year and by 2020 emitted 650 Gg CO_2/year of GHG. Its projection to 2030 shows that the sector will generate 730 Gg CO_2/year of GHG.

The waste sector emitted approximately 80 Gg CO_2/year in 2000 and 100 Gg CO_2/year of GHG in 2020. Its projection to 2030 shows that the sector will generate 112 Gg CO_2/year of GHG.

Although Table 38 shows that GHG emissions generated from 1990 to 1999 are equal to zero, this does not mean that there were zero emissions, but rather that there are no sources to support the emissions during that period of time.

Table 38. Comparison of the Suriname Database - GHG Inventories Gg CO_2/year of the prioritized sectors (1990-2020) + Projection to 2030.

Country	Area	Sector	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Suriname	Total Country	Energy	0	0	0	0	0	0	0	0	0	0	1,940	1,980	1,570	1,690	1,850	2,150	2,040	1,980	2,080	2,140
Suriname	Total Country	Industrial Processes	0	0	0	0	0	0	0	0	0	0	50	50	50	50	50	50	60	60	60	60
Suriname	Total Country	Agriculture	0	0	0	0	0	0	0	0	0	0	600	630	480	560	580	500	530	500	570	640
Suriname	Total Country	Change Land Use	0	0	0	0	0	0	0	0	0	0	3,330	3,650	3,660	3,680	3,830	3,820	3,820	3,820	3,820	3,820
Suriname	Total Country	Waste	0	0	0	0	0	0	0	0	0	0	80	80	80	80	80	80	80	90	90	90

Country	Area	Sector	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030

Surinam	Total Country	Energy	2,500	2,700	3,190	3,040	3,400	3,520	3,780	3,260	2,970	3,480	3,430	3,430	3,430	3,430	4,066	4,171	4,275	4,380	4,484	4,589	4,693
Surinam	Total Country	Industrial Processes	60	80	100	100	100	100	90	100	110	130	140	126	130	135	139	143	148	152	156	160	165
Surinam	Total Country	Agriculture	640	660	620	630	680	640	680	670	600	650	650	674	680	687	693	699	705	712	718	724	730
Surinam	Total Country	Land Use Change	3,820	8,100	8,110	8,100	8,110	8,110	9,220	9,220	9,220	9,220	9,230	10,211	10,586	10,961	11,337	11,712	12,087	12,463	12,838	13,214	13,589
Surinam	Total Country	Waste	90	90	90	90	90	90	100	100	100	100	100	102	103	104	105	106	108	109	110	111	112

Venezuela

The Venezuelan Amazon is made up of 3 states: Amazonas, Delta Amacuro and Bolivar, which together form about 458,345 km². These states face various challenges in environmental terms, due to the different economic activities that also generate GHGs, as shown below:

Table 39 shows the emissions of Venezuela's energy sector, where it can be seen that the emissions of the provinces from 1990 to 2020 decreased. Therefore, Bolivar generated 7,773.00 Gg CO_2/year in 1990 and 4,198.00 Gg CO_2/year 2020, followed by Amazonas with 753 Gg CO_2/year in 1990 and 407 Gg CO_2/year 2020 and Delta Amacuro with 718 Gg CO_2/year in 1990 and 388 Gg CO_2/year 2020.

As for its projection to 2030, it can be seen that unlike the historical record, all regions will have an increase. For example, Bolivar will emit up to 8,408.00 Gg CO_2/year of GHG, Amazonas up to 815 Gg CO_2/year and Delta Curo up to 77 Gg CO_2/year.

Table 39. Database Venezuela - GHG Inventories Gg CO_2/year of the Energy sector (1990-2020) + Projection to 2030.

Country	Area	Province	Sector	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Venezuela	Amazon	Bolivar	Energy	7,773	8,227	8,295	8,555	8,683	9,509	10,412	11,010	10,973	10,298	10,769	10,935	10,417	9,834	10,642	11,221	11,077	10,907	11,368	10,982
Venezuela	Amazon	Amazon	Energy	753	797	804	829	841	921	1,009	1,067	1,063	998	1,043	1,059	1,009	953	1,031	1,087	1,073	1,057	1,101	1,064
Venezuela	Amazon	Delta Amacuro	Energy	718	760	766	790	802	879	962	1,017	1,014	952	995	1,010	963	909	983	1,037	1,024	1,008	1,050	1,015

Country	Area	Province	Sector	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Venezuela	Amazon	Bolivar	Energy	11,236	11,145	12,084	12,134	11,983	11,235	10,386	9,251	7,969	6,300	4,198	6,257	7,765	7,842	7,921	8,000	8,080	8,161	8,243	8,325	8,408
Venezuela	Amazon	Amazonas	Energy	1,089	1,080	1,171	1,176	1,161	1,088	1,006	896	772	610	407	606	752	760	767	775	783	791	799	807	815
Venezuela	Amazon	Delta Amacuro	Energy	1,038	1,030	1,117	1,121	1,107	1,038	960	855	736	582	388	578	717	725	732	739	747	754	762	769	777

Table 40 shows the IPPU sector's emissions, which have increased over the years. Bolivar generated 293 Gg CO_2/year in 1990 and 377 Gg CO_2/year in 2020, followed by Amazonas with 28 Gg CO_2/year in 1990 and 36 Gg CO_2/year in 2020, and Delta Amacuro with 27 Gg CO_2/year in 1990 and 35 Gg CO_2/year in 2020.

In terms of projections to 2030, all regions will have a slight increase in GHG emissions. For example, Bolivar will emit up to 428 Gg CO_2/year of GHG, Amazonas up to 41 Gg CO_2/year and Delta Curo up to 40 Gg CO_2/year.

Table 40. Venezuela Database - GHG Inventories Gg CO_2/year of the Industrial Process sector (1990-2020) + Projection to 2030.

Country	Area	Province	Sector	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Venezuela	Amazon	Bolivar	Processes Industrials	293	297	289	281	270	270	259	258	250	249	242	245	223	234	199	212	304	284	305	324
Venezuela	Amazon	Amazon	Processes Industrials	28	29	28	27	26	26	25	25	24	24	23	24	22	23	19	21	29	28	30	31
Venezuela	Amazon	Delta Amacuro	Processes Industrials	27	27	27	26	25	25	24	24	23	23	22	23	21	22	18	20	28	26	28	30

Country	Area	Province	Sector	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Venezuela	Amazon	Bolivar	Processes Industrials	337	348	359	368	361	368	356	370	346	354	377	384	389	393	398	403	408	413	418	423	428
Venezuela	Amazon	Amazon	Processes Industrials	33	34	35	36	35	36	35	36	34	34	36	37	38	38	39	39	40	40	40	41	41
Venezuela	Amazon	Delta Amacuro	Processes Industrials	31	32	33	34	33	34	33	34	32	33	35	35	36	36	37	37	38	38	39	39	40

Table 41 shows the emissions of the AFOLU-Agriculture sector, where an increase in emissions over the years can be observed: Bolivar generated 8,237.00 Gg CO_2/year in 1990 and 10,233.00 Gg CO_2/year 2020, followed by Amazonas with 6,082.00 Gg CO_2/year in 1990 and 7,557.00 Gg CO_2/year 2020 and Delta Amacuro with 1,377.00 Gg CO_2/year in 1990 and 1,710.00 Gg CO_2/year 2020.

In terms of projections to 2030, all regions will have a slight increase in GHG emissions. For example, Bolivar will emit up to 11,379.00 Gg CO_2/year of GHG, Amazonas up to 8,403.00 Gg CO_2/year and Delta Curo up to 1,902.00 Gg CO_2/year.

Table 41. Venezuela database - GHG inventories Gg CO_2/year of the AFOLU/Agriculture sector (1990-2020) + Projection to 2030.

Country	Area	Province	Sector	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Venezuela	Amazon	Bolivar	Agriculture	8,237	8,478	8,494	8,326	8,580	8,664	8,517	8,612	8,769	8,782	9,108	9,457	9,485	9,840	9,944	10,299	10,220	10,461	10,708	10,674
Venezuela	Amazon	Amazon	Agriculture	6,082	6,261	6,272	6,148	6,336	6,398	6,290	6,359	6,476	6,485	6,726	6,983	7,004	7,266	7,343	7,605	7,547	7,725	7,907	7,882
Venezuela	Amazon	Delta Amacuro	Agriculture	1,377	1,417	1,420	1,392	1,434	1,448	1,424	1,439	1,466	1,468	1,522	1,580	1,585	1,645	1,662	1,721	1,708	1,748	1,790	1,784

Country	Area	Province	Sector	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Venezuela	Amazon	Bolivar	Agriculture	9,189	9,121	10,485	10,590	10,577	10,396	10,173	9,944	9,834	9,955	10,233	10,722	10,795	10,868	10,941	11,014	11,087	11,160	11,233	11,306	11,379
Venezuela	Amazon	Amazon	Agriculture	6,786	6,735	7,742	7,820	7,810	7,677	7,512	7,343	7,262	7,351	7,557	7,918	7,972	8,026	8,079	8,133	8,187	8,241	8,295	8,349	8,403
Venezuela	Amazon	Delta Amacuro	Agriculture	1,536	1,524	1,752	1,770	1,768	1,737	1,700	1,662	1,644	1,664	1,710	1,792	1,804	1,816	1,829	1,841	1,853	1,865	1,877	1,890	1,902

Table 42 shows the emissions of the AFOLU-Land Use Change sector, which shows a significant decrease in emissions over the years, where: Bolivar generated 38,052.00 Gg CO_2/year in 1990 and 11,377.00 Gg CO_2/year 2020, followed by Amazonas with 28,099.00 Gg CO_2/year in 1990 and 8,401.00 Gg CO_2/year 2020, and Delta Amacuro with 6,360.00 Gg CO_2/year in 1990 and 1,901.00 Gg CO_2/year 2020.

In terms of projections to 2030, all regions will have a reduction of almost double their GHG emissions. For example, Bolivar will emit up to 4,970.00 Gg CO_2/year of GHG, Amazonas up to 3,670.00 Gg CO_2/year and Delta Curo up to 831 Gg CO_2/year.

Table 42. Venezuela database - GHG Inventories Gg CO_2/year of the AFOLU sector/ Land Use Change (1990-2020) + Projection to 2030.

Country	Area	Province	Sector	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Venezuela	Amazon	Bolivar	Land Use Change	38,052	38,052	38,052	38,052	38,052	38,049	38,104	38,173	38,671	38,209	38,348	22,845	22,719	23,115	22,735	22,777	22,746	22,824	22,738	22,719
Venezuela	Amazon	Amazon	Land Use Change	28,099	28,099	28,099	28,099	28,099	28,097	28,138	28,188	28,556	28,215	28,318	16,870	16,777	17,070	16,789	16,820	16,796	16,855	16,791	16,777
Venezuela	Amazon	Delta Amacuro	Land Use Change	6,360	6,360	6,360	6,360	6,360	6,359	6,368	6,380	6,463	6,386	6,409	3,818	3,797	3,863	3,800	3,807	3,802	3,815	3,800	3,797

Country	Area	Province	Sector	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Venezuela	Amazon	Bolivar	Land Use Change	22,984	28,270	28,267	28,346	28,370	28,388	11,272	11,125	11,188	11,348	11,377	13,005	12,112	11,220	10,327	9,434	8,541	7,648	6,756	5,863	4,970
Venezuela	Amazon	Amazonas	Land Use Change	16,973	20,876	20,874	20,932	20,949	20,963	8,324	8,215	8,262	8,380	8,401	9,604	8,944	8,285	7,626	6,967	6,307	5,648	4,989	4,329	3,670
Venezuela	Amazon	Delta Amacuro	Land Use Change	3,841	4,725	4,724	4,738	4,741	4,745	1,884	1,859	1,870	1,897	1,901	2,174	2,024	1,875	1,726	1,577	1,428	1,278	1,129	980	831

Table 43 shows the emissions of the waste sector, with an increase in emissions over the years: Bolivar generated 192 Gg CO_2/year in 1990 and 354 Gg CO_2/year in 2020, followed by Amazonas with 19 Gg CO_2/year in 1990 and 34 Gg CO_2/year in 2020, and Delta Amacuro with 18 Gg CO_2/year in 1990 and 33 Gg CO_2/year in 2020.

In terms of projections to 2030, all regions will have a slight increase in GHG emissions. For example, Bolivar will emit up to 417 Gg CO_2/year of GHG, Amazonas up to 40 Gg CO_2/year and Delta Curo up to 39 Gg CO_2/year.

Table 43. Venezuela database - GHG inventories Gg CO_2/year of the Waste sector (1990-2020) + Projection to 2030.

Country	Area	Province	Sector	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Venezuela	Amazon	Bolivar	Waste	192	198	204	209	214	220	225	230	236	241	247	251	256	260	264	269	276	284	291	299
Venezuela	Amazon	Amazon	Waste	19	19	20	20	21	21	22	22	23	23	24	24	25	25	26	26	27	27	28	29
Venezuela	Amazon	Delta Amacuro	Waste	18	18	19	19	20	20	21	21	22	22	23	23	24	24	24	25	26	26	27	28

Country	Area	Province	Sector	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Venezuela	Amazon	Bolivar	Waste	307	313	319	326	332	338	342	345	348	351	354	366	372	378	383	389	395	400	406	412	417
Venezuela	Amazon	Amazonas	Waste	30	30	31	32	32	33	33	33	34	34	34	35	36	37	37	38	38	39	39	40	40
Venezuela	Amazon	Delta Amacuro	Waste	28	29	30	30	31	31	32	32	32	32	33	34	34	35	35	36	36	37	38	38	39

Regarding the comparison between all the sectors evaluated in Venezuela, Table 44 shows that from 1990 to 2020 the sector with the greatest increase in GHG emissions was Agriculture, going from 31,400.00 Gg CO_2/year to 39,010.00 Gg CO_2/year. If we look at the projection to 2030, we can see that emissions from the Agriculture sector would increase to 43,380.00 Gg CO_2/year if no mitigation measures were applied.

The opposite case is presented in the emissions generated in the Energy sector, which according to historical data reduce their GHG emissions from 244,840.00 Gg CO_2/year to 132,240.00 Gg CO_2/year in the years 1999 and 2020 respectively. However, it is shown that by 2030 they will increase their emissions to 264,838.00 Gg CO_2/year.

Table 44. Comparison of the Venezuela Database - GHG Inventories Gg CO_2/year of the prioritized sectors (1990-2020) + Projection to 2030.

Country	Area	Province	Sector	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Venezuela	Total Country	Total Country	Energy	244,840	259,120	261,270	269,450	273,480	299,500	327,960	346,800	345,610	324,360	339,210	344,420	328,110	309,740	335,210	353,430	348,910	343,530	358,070	345,920
Venezuela	Total Country	Total Country	Industrial Processes	9,220	9,350	9,100	8,850	8,520	8,490	8,150	8,140	7,880	7,850	7,610	7,710	7,010	7,370	6,270	6,670	9,570	8,960	9,610	10,220
Venezuela	Total Country	Total Country	Agriculture	31,400	32,320	32,380	31,740	32,710	33,030	32,470	32,830	33,430	33,480	34,720	36,050	36,160	37,510	37,910	39,260	38,960	39,880	40,820	40,690
Venezuela	Total Country	Total Country	Land Use Change	145,060	145,060	145,060	145,060	145,060	145,050	145,260	145,520	147,420	145,660	146,190	87,090	86,610	88,120	86,670	86,830	86,710	87,010	86,680	86,610
Venezuela	Total Country	Total Country	Waste	6,060	6,230	6,410	6,580	6,750	6,920	7,090	7,260	7,430	7,600	7,770	7,910	8,050	8,180	8,320	8,460	8,700	8,940	9,180	9,420

Country	Area	Province	Sector	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Venezuela	Total Country	Total Country	Energy	353,910	351,040	380,630	382,200	377,420	353,880	327,130	291,370	250,990	198,430	132,240	197,085	244,573	247,019	249,489	251,984	254,504	257,049	259,619	262,215	264,838
Venezuela	Total Country	Total Country	Industrial Processes	10,610	10,950	11,310	11,590	11,370	11,590	11,220	11,660	10,900	11,150	11,860	12,084	12,238	12,392	12,546	12,700	12,854	13,008	13,162	13,316	13,470
Venezuela	Total Country	Total Country	Agriculture	35,030	34,770	39,970	40,370	40,320	39,630	38,780	37,910	37,490	37,950	39,010	40,874	41,153	41,431	41,709	41,988	42,266	42,545	42,823	43,102	43,380
Venezuela	Total Country	Total Country	Land Use Change	87,620	107,770	107,760	108,060	108,150	108,220	42,970	42,410	42,650	43,260	43,370	49,577	46,174	42,771	39,367	35,964	32,561	29,157	25,754	22,351	18,947
Venezuela	Total Country	Total Country	Waste	9,660	9,860	10,060	10,260	10,460	10,660	10,760	10,860	10,960	11,050	11,150	11,535	11,714	11,892	12,071	12,249	12,428	12,607	12,785	12,964	13,142

VI. Bibliography

- Government of Ecuador, 2022. Fourth National Communication and Second Biennial Update of Ecuador. Retrieved February 16, 2024, from https://unfccc.int/sites/default/files/resource/ECUADOR_%20CN4_%20BUR2.pdf
- Bouroncle, C., Rodríguez, C., & Florián, M. (2016, June). *Sistema Nacional de Indicadores*
- *de Adaptación al Cambio Climático (SIACC): - definición del conjunto de indicadores* Climate Technology Centre and Network (CTCN). Retrieved February 9, 2024, from https://www.ctc-n.org/system/files/dossier/3b/siacc_v2.pdf
- *Brazil. Biennial update report (BUR). BUR4.* (2020, December 31). UNFCCC. Retrieved February 16, 2024, from https://unfccc.int/documents/267661
- CIPCA (n.d.). *Fortaleciendo procesos de resiliencia de sistemas productivos en territorios*
  campesinos e indígenas de Bolivia. Retrieved February 14, 2024, from https://cipca.org.bo/docs/publications/es/291_fortaleciendo-procesos-de-resiliencia-de- sistemas-productivos-en-territorios-campesinos-e-indigenas-de-bolivia.pdf
- CIPCA (2020). *Acciones de mitigación y adaptación para una producción sostenible y*
- *resiliente ante el cambio climático en Bolivia*. Retrieved February 14, 2024, from https://cipca.org.bo/docs/publications/es/244_244acciones-de-mitigacion-propuesta-politica-publica-3.pdf
- Climate Watch Data (n.d.). *Greenhouse Gas (GHG) Emissions.* Climate Watch. Retrieved February 16, 2024, from https://www.climatewatchdata.org/ghg-emissions
- National Planning Department (DNP), Ministry of Environment and Sustainable Development, IDEAM, Republic of Colombia, National Disaster Risk Management System, & NGRD. (2012). *ABC: ADAPTACIóN BASES CONCEPTUALES - MARCO*
- *CONCEPTUAL Y LINEAMIENTOS.* UNFCCC. Retrieved February 9, 2024, from https://www.minambiente.gov.co/wp-content/uploads/2022/01/01/1._Plan_Nacional_de_Adaptacion_al_Cambio_Climatico.pdf
- Plurinational State of Bolivia (n.d.). *NATIONALLY DETERMINED CONTRIBUTION (NDC) OF THE PLURINATIONAL STATE OF BOLIVIA.* UNFCCC. Retrieved February 14, 2024, from

https://unfccc.int/sites/default/files/NDC/2022-06/NDC_Bolivia-2021-2030_UNFCCC_en.pdf

- Federative Republic of Brazil (2022, March 21). *NDC revisada inglês FINAL - PDF*. UNFCCC. Retrieved February 12, 2024, from https://unfccc.int/sites/default/files/NDC/2022-06/Updated%20-%20First%20NDC%20-%20%20FINAL%20-%20PDF.pdf
- Fernandes, V. (2023, November 22). *Cambio climático en Brasil: Impactos y el camino por recorrer.* PADF. Retrieved February 9, 2024, from https://www.padf.org/cambio-climatico- en-brasil-impacts-and-the-path-to-be-traveled/
- Government of Colombia (2020). *Actualización de la Contribución Determinada a Nivel Nacional de Colombia (NDC).* UNFCCC. Retrieved February 12, 2024, from https://www.minambiente.gov.co/wp-content/uploads/2021/10/informe-actualizacion-contribucion-determinada-Colombia-ndc-2020.pdf
- Government of Colombia (2021, July 13). *Financiado por.* UNFCCC. Retrieved February 14, 2024, from https://unfccc.int/sites/default/files/resource/BUR3%20-%20COLOMBIA.pdf
- Government of Peru (2020, December 16). *CONTRIBUCIONES DETERMINADAS A NIVEL*
- *NACIONAL DEL PERÚ.* UNFCCC. Retrieved February 13, 2024, from https://unfccc.int/sites/default/files/NDC/2022-06/Reporte%20de%20Actualizacio%CC%81n%20de%20las%20NDC%20del%20Peru%20 CC%81.pdf
- Guyana Government (2017, November 9). YouTube: Home. Retrieved February 12, 2024, from. https://unfccc.int/sites/default/files/NDC/2022-06/Guyana%27s%20revised%20NDC%20-%20Final.pdf.
- *IBGE*. (n.d.). IBGE | Portal do IBGE | IBGE. Retrieved February 16, 2024, from http://www.ibge.gov.br
- *INEI*. (n.d.). *Medio Ambiente- Condiciones y Calidad Ambiental.* Retrieved February 16, 2024, from https://www.inei.gob.pe/estadisticas/indice-tematico/medio-ambiente/
- *Inventario Nacional de Gases Efecto Invernadero – INGEI.* (n.d.). National Greenhouse Gas Inventory System - SINGEI. Retrieved February 16, 2024, from https://singei.ambiente.gob.ec/singei/?page_id=1565
- IPCC (2006). *IPCC-TFI*. Publications - IPCC-TFI. Retrieved February 14, 2024, from https://www.ipcc-nggip.iges.or.jp/public/2006gl/spanish/index.html
- IPCC (2021). *Cambio climático 2021*. IPCC. Retrieved February 14, 2024, from https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WG1_SPM_Spanish.pdf
- J-CCCP. (n.d.). *National Adaptation Plan Guyana Inception Report*. UNDP | Procurement Notices. Retrieved February 14, 2024, from https://procurement-notices.undp.org/view_file.cfm?doc_id=131467
- LEDsLAC, Dragonfly, UNDP, IDB, European Union, Euroclimate, ECLAC, & GIZ. (2023, April 13). *LEDSenLAC 2022*. Retrieved February 16, 2024, from https://www.ledslac.org/wp-content/uploads/2023/04/Reporte-anual-LEDSenLAC-2022_c-3.pdf.
- Ministry of Rural Development and Lands. (n.d.). (675$7(*,$ 1$&,21$/. Retrieved February 14, 2024, from https://faolex.fao.org/docs/pdf/bol197414.pdf

- Ministry of Environment (n.d.). *INVENTARIO NACIONAL DE GASES DE EFECTO INVERNADERO 2019.* Infocarbono. Retrieved February 16, 2024, from https://infocarbono.minam.gob.pe/annios-inventarios-nacionales-gei/ingei-2019/
- Ministry of Environment (2012). *Untitled*. Ministry of Environment, Water and Ecological Transition. Retrieved February 15, 2024, from https://www.ambiente.gob.ec/wp-content/uploads/downloads/2017/10/ESTRATEGIA-NACIONAL-DE-CAMBIO-CLIMATICO-DEL-ECUADOR.pdf
- Ministry of the Environment (2021). Retrieved February13 , 2024, from https://cdn.www.gob.pe/uploads/document/file/1936379/RM.%20096-2021-MINAM%20con%20anexo%20Plan%20Nacional%20de%20Adaptaci%C3%B3n%20al%20Cambio%20Clim%C3%A1tico%20del%20Per%C3%BA.pdf.pdf?v=1623245610
- Ministry of Environment (2023, July 1). *3BUR - Peru*. UNFCCC. Retrieved February 16, 2024, from https://unfccc.int/sites/default/files/resource/Tercer%20BUR_Per%C3%BA_Jun2023.pdf
- Ministry of Environment, Water and Ecological Transition (n.d.). *Untitled*. Ministry of Environment, Water and Ecological Transition . Retrieved February12 , 2024, from https://www.ambiente.gob.ec/wp-content/uploads/downloads/2023/02/PNA_Plan-Nacional-de-Adaptacion_2023_2027.pdf
- Ministry of the Presidency (2015, November). *DRAFT FOR CONSULTATION*. Office of ClimateChange-Guyana. RetrievedFebruary12 , 2024, from https://www.greenpolicyplatform.org/sites/default/files/downloads/policy-database//GUYANA%29%20%20Climate%20Resilience%20Strategy%20and%20Actin%20Pl an%20for%20Guyana.pdf.
- Ministry of Environment and Water. (2023). *NATIONALLY DETERMINED CONTRIBUTION (NDC) OF THE PLURINATIONAL STATE OF BOLIVIA.* UNFCCC. Retrieved February 14, 2024, from https://unfccc.int/sites/default/files/NDC/2022-06/NDC_Bolivia-2021-2030_UNFCCC_en.pdf
- Ministry of Environment and Climate Change (2021, December 23). *Plano Nacional de Adaptação - Ministério do Meio Ambiente e Mudança do Clima*. Portal Gov.br. Retrieved February 12, 2024, from https://www.gov.br/mma/pt-br/assuntos/climaozoniodesertificacao/plano-nacional-de-adaptacao
- *Primer Informe Bienal Actualización de Reporte (BUR1)* (2022, November). UNFCCC. Retrieved February 16,2024, from https://unfccc.int/sites/default/files/resource/Suriname%20BUR1%20Final%20.pdf
- Bolivarian Republic of Venezuela (2021). *Actualización de la Contribución Nacionalmente Determinada de la República Bolivariana de Venezuela para la lucha contra el Cambio Climático y sus efectos.* UNFCCC. Retrieved February 13, 2024, from https://unfccc.int/sites/default/files/NDC/2022-06/Actualizacion%20NDC%20Venezuela.pdf
- Republic of Ecuador (2019, March). *REPÚBLICA DEL ECUADOR PRIMERA CONTRIBUCIÓN DETERMINADA A NIVEL NACIONAL PARA EL ACUERDO DE PARÍS BAJO LA CONVENCIÓN MARCO DE.* UNFCCC. Retrieved February 12, 2024, from https://unfccc.int/sites/default/files/NDC/2022-06/Primera%20NDC%20Ecuador.pdf

- Republic of Suriname (2019). *The Republic of Suriname Nationally Determined Contribution 2020.* UNFCCC. Retrieved February 13, 2024, from https://unfccc.int/sites/default/files/NDC/2022-06/Suriname%20Second%20NDC.pdf
- Republiek Suriname, Japan Caribbean, & From the people of Japan. (2019). *Suriname National Adaptation Plan (NAP).* UNFCCC. Retrieved February 13, 2024, from https://www4.unfccc.int/sites/NAPC/Documents/Parties/Suriname%20Final%20NAP_apr%202020.pdf
- Subchefia para Assuntos Jurídicos, 2010. (2010, December 9). *Decree N° 7390.* Planalto. Retrieved February 9, 2024, from https://www.planalto.gov.br/ccivil_03/_Ato2007-2010/2010/Decreto/D7390.htm.
- Transforma y WWF. (2019, December). *LA CONTRIBUCIÓN NACIONALMENTE DETERMINADA (NDC) COLOMBIANA:.* Panda.org. Retrieved February 9, 2024, from https://wwflac.awsassets.panda.org/downloads/cop_espana_resumen_b6_c4_web.pdf
- UNFCCC (2021, July 13). Colombia's Third Biennial Climate Change Update Report. Retrieved February 16, 2024, from https://unfccc.int/sites/default/files/resource/BUR3%20-%20COLOMBIA.pdf
- The World Bank, Washington DC, IDEAM, Conservación Internacional Colombia, Invemar, GEF, & Corporación para el Desarrollo Sostenible del Archipielago de San Andrés, Providencia y Santa Catalina (2011). *RESULTADOS DEL PROYECTO INAP*. Ministry of Environment and Sustainable Development. Retrieved February 12, 2024, from https://www.minambiente.gov.co/wp-content/uploads/2022/01/Proyecto_nacional_de_adaptacion_al_cambio_climatico_INAP.pdf

www.libelula.com.pe

Join the community:

Facebook: /LibelulaCommunity X: /LibelulaPeru
LinkedIn: /libelula
Instagram: /libelulacomunidad
Newsletter: Subscribe.

Learn about our services: