9. Recalculations and Improvements

Each year, many emission and sink estimates in the *Inventory of U.S. Greenhouse Gas Emissions and Sinks* are recalculated and revised, as efforts are made to improve the estimates through the use of better methods and/or data with the goal of improving inventory quality, including the transparency, completeness, consistency and overall usefulness of the report. In this effort, the United States follows the *2006 IPCC Guidelines* (IPCC 2006), which states, "Both methodological changes and refinements over time are an essential part of improving inventory quality. It is *good practice* to change or refine methods when available data have changed; the previously used method is not consistent with the IPCC guidelines for that category; a category has become key; the previously used method is insufficient to reflect mitigation activities in a transparent manner; the capacity for inventory preparation has increased; improved inventory methods become available; and/or for correction of errors."

In general, when methodological changes have been implemented, the previous Inventory's time series (i.e., 1990 to 2017) will be recalculated to reflect the change, per guidance in IPCC (2006). Changes in historical data are generally the result of changes in statistical data supplied by other agencies, and do not necessarily impact the entire time series.

The results of all methodological changes and historical data updates made in the current Inventory are presented in Table 9-1 and Table 9-2. Table 9-1 summarizes the quantitative effect of all changes on U.S. greenhouse gas emissions in the Energy, Industrial Processes and Product Use (IPPU), Agriculture, and Waste sectors, while Table 9-2 summarizes the quantitative effect of changes on annual net fluxes from Land Use, Land-Use Change, and Forestry (LULUCF). Both tables present results relative to the previously published Inventory (i.e., the 1990 to 2017 report) in units of million metric tons of carbon dioxide equivalent (MMT CO_2 Eq.). To understand the details of any specific recalculation or methodological improvement, see the *Recalculations* within each source/sink categories' section found in Chapters 3 through 7 of this report. A discussion of Inventory improvements in response to review processes is described in Annex 8.

The following source and sink categories underwent the most significant methodological and historical data changes. A brief summary of the recalculations and/or improvements undertaken are provided for these categories.

- *Agricultural Soil Management (N_2O).* Several major improvements have been implemented in this Inventory leading to the need for recalculations, including additional information from the United States Department of Agriculture-Natural Resource Conservation Service's Conservation Effects Assessment Project (USDA-NRCS CEAP) survey, United States Department of Agriculture- Economic Research Service's Agricultural Resource Management Survey (USDA-ERS ARMS) data, Conservation Technology Information Center (CTIC) data and USDA Census of Agriculture data, Natural Resource Inventory (NRI) survey, (National Land Cover Database) NLCD data, modeling soil organic carbon stock changes to 30 cm with the Tier 3 approach (previously modeled to 20 cm depth), modeling the N cycle with freeze-thaw effects on soil N_2O emission, and addressing the effect of cover crops on greenhouse gas emissions and removals. Other improvements include better resolving the timing of tillage, planting, fertilization and harvesting based on the USDA-NRCS CEAP survey and state-level information on planting and harvest dates; improving the timing of irrigation; and crop senescence using growing degree relationships. The surrogate

data method was also applied to re-estimate N_2O emissions from 2016 to 2017. These changes resulted in an average increase in emissions of 57.3 MMT CO_2 Eq. (22 percent) from 1990 to 2017 relative to the previous Inventory.

- *Forest Land Remaining Forest Land: Changes in Forest Carbon Stocks (CO_2).* New national forest inventory (NFI) data contributed to increases in forest land area and stock changes, particularly in the Intermountain West region. Soil carbon stocks decreased in the latest Inventory relative to the previous Inventory and this change can be attributed to refinements in the Digital General Soil Map of the United States (STATSGO2) dataset where soil orders may have changed in the updated data product. This resulted in a structural change in the soil organic carbon estimates for mineral and organic soils across the entire time series. Updated harvested wood products (HWPs) data from 2003 through 2017 led to changes in Products in Use and Solid Waste Disposal Sites (SWDS) between the previous Inventory and the current Inventory. The recalculations resulted in an average annual increase in C stock change losses of 46.4 MMT CO_2 Eq. (7 percent), across the 1990 through 2017 time series, relative to the previous Inventory.
- *Land Converted to Grassland: Changes in all Ecosystem Carbon Stocks (CO_2).* Differences in biomass, dead wood and litter C stock changes in *Forest Land Converted to Grassland* can be attributed to incorporation of the latest Forest Inventory and Analysis National Program (FIA) data. Recalculations for the soil C stock changes are associated with several improvements to both the Tier 2 and 3 approaches that are discussed in the *Cropland Remaining Cropland* section. As a result of these improvements to the Inventory, *Land Converted to Grassland* has a larger reported gain in C compared to the previous Inventory, estimated at an average of 35.2 MMT CO_2 Eq. over the time series. This represents greater than 610 percent increase of C for *Land Converted to Grassland* compared to the previous Inventory and is largely driven by the methodological changes for estimating the soil C stock changes.
- *Natural Gas Systems (CH_4).* EPA thoroughly evaluated relevant information available and made several updates to the Inventory, including: using EPA's Greenhouse Gas Reporting Program (GHGRP), Bureau of Ocean Energy Management (BOEM), and other data to calculate emissions from offshore production; and using GHGRP and Zimmerle et al. study data to calculate gathering and boosting station emissions. In addition, certain sources did not undergo methodological updates, but CH_4 and/or CO_2 emissions changed by greater than 0.05 MMT CO_2 Eq., comparing the previous estimate for 2017 to the current (recalculated) estimate for 2017 (the emissions changes were mostly due to GHGRP data submission revisions). These sources include: hydraulically fractured (HF) gas well completions; production segment pneumatic controllers; liquids unloading; production segment storage tanks; HF and non-HF gas well workovers; and acid gas removal (AGR) vents, flares, reciprocating compressors, and blowdowns at gas processing plants. The recalculations resulted in an average decrease in CH_4 emission estimates across the 1990 through 2017 time series, compared to the previous Inventory, of 14.2 MMT CO_2 Eq., or 8 percent.
- *Grassland Remaining Grassland: Changes in Mineral and Organic Carbon Stocks (CO_2).* The current Inventory is the first reporting of biomass, dead wood and litter C stock changes for woodlands. Recalculations for the soil C stock changes are associated with several improvements to both the Tier 2 and 3 approaches that are discussed in the *Cropland Remaining Cropland* section. As a result of these improvements to the Inventory, C stocks decline on average across the time series for *Grassland Remaining Grassland*, compared to an average increase in C stocks in the previous Inventory. The average reduction in C stock change is 14.0 MMT CO_2 Eq. over the time series, which is a 738 percent decrease in C stock changes compared to the previous Inventory. This is largely driven by the methodological changes associated with estimating soil C stock changes and to a lesser extent by the inclusion of biomass, dead wood and litter C stock changes for woodlands.
- *Land Converted to Cropland: Changes in all Ecosystem Carbon Stocks (CO_2).* Differences in biomass, dead wood and litter C stock changes in *Forest Land Converted to Cropland* can be attributed to incorporation of the latest FIA data. Recalculations for the soil C stock changes are associated with several improvements to both the Tier 2 and 3 approaches that are discussed in the Recalculations section of *Cropland Remaining Cropland*. As a result of these improvements to the Inventory, *Land Converted to Cropland* has a smaller reported loss of C compared to the previous Inventory, estimated at an average of

13.4 MMT CO_2 Eq. over the time series. This represents a 19 percent decline in losses of C for *Land Converted to Cropland* compared to the previous Inventory and is largely driven by the methodological changes for estimating the soil C stock changes.

- *Settlements Remaining Settlements: Changes in Organic Soil Carbon Stocks (CO_2).* The entire time series was recalculated based on updates to the land representation data with the release of the 2018 NRI (USDA-NRCS 2018) and additional information from the National Land Cover Database (Yang et al. 2018; Fry et al. 2011; Homer et al. 2007, 2015). In addition, the data splicing method has been used to re-estimate CO_2 emissions for 2016 to 2017 in the previous Inventory. However, the major change was the correction of a quality control problem that led to an under-estimation of drained organic soils in settlements. The recalculations led to an increase in emissions of 12.0 MMT CO_2 Eq., or more than 6,500 percent, on average across the entire time series.
- *Land Converted to Forest Land: Changes in Carbon Stocks (CO_2).* The *Land Converted to Forest Land* estimates in this Inventory are based on the land use change information in the annual NFI. This is the second year that remeasurement data from the annual NFI were available throughout the CONUS (with the exception of Wyoming and western Oklahoma) to estimate land use conversion. The availability of remeasurement data from the annual NFI allowed for consistent plot-level estimation of C stocks and stock changes for *Forest Land Remaining Forest Land* and the *Land Converted to Forest Land* categories. Estimates in the previous Inventory were based on state-level carbon density estimates and a combination of NRI data and NFI data in the eastern United States. The refined analysis in this Inventory resulted in changes in the Land Converted to Forest Land categories. Overall, the *Land Converted to Forest Land* C stock changes decreased by 8 percent in 2018 between the previous Inventory and the current Inventory. This decrease is directly attributed to the incorporation of annual NFI data into the compilation system and new data and methods used to compile estimates of C in mineral soils. In the previous Inventory, *Grasslands Converted to Forest Land* represented the largest transfer and uptake of C across the land use conversion categories. In this Inventory*, Cropland Converted to Forest Land* represented the largest transfer and uptake of C across the land use change categories followed by *Settlements Converted to Forest Land*. These changes resulted in an average annual increase in C stock of 9.8 MMT CO_2 Eq. (8 percent) relative to the previous Inventory.
- *Fossil Fuel Combustion (CO_2)*. The Energy Information Administration (EIA 2019) updated energy consumption statistics across the time series relative to the previous Inventory. As a result of updated liquid petroleum gas (LPG) heat contents, EIA updated LPG consumption in the residential, commercial, industrial, and transportation sectors across the time series. EIA also revised sector allocations for propane and total hydrocarbon gas liquids for 2010 through 2017, and for distillate fuel oil in 2017, which impacted petroleum consumption by sector for those years. EIA also revised 2017 natural gas consumption in all sectors. EIA revised assumptions for the percentage of fossil fuels consumed for non-combustion use which impacted non-energy use sequestration statistics, particularly for petroleum coke and residual fuel across the time series relative to the previous Inventory. These changes resulted in an average annual decrease of 6.6 MMT CO_2 Eq. (0.1 percent) in CO_2 emissions from fossil fuel combustion for the period 1990 through 2017, relative to the previous Inventory.
- *Substitution of Ozone Depleting Substances (HFCs).* For the current Inventory, updates to the Vintaging Model included renaming the non-metered dose inhaler (non-MDI) aerosol end-use to consumer aerosol and updating stock and emission estimates to align with a recent national market characterization. In addition, a technical aerosol end-use was added to the aerosols sector, in order to capture a portion of the market that was not adequately encompassed by the former non-MDI aerosol end-use (EPA 2019b). Within the Fire Protection sector, a correction was made to the lifetime for streaming agents, which was changed from 18 years to 24 years. The polyurethane rigid spray foam end-use was divided into two end-uses representing high pressure and low pressure two-component spray foam. Market size,and foam blowing agent transition assumptions were adjusted to align with stakeholder input and market research. Together, these updates increased greenhouse gas emissions an average of 3.3 percent across the timeseries, relative to the previous Inventory.

Finally, in addition to the more significant methodological updates noted above, the Inventory includes new categories not included in the previous Inventory that improve completeness of the national estimates. Specifically, the current report includes fluorinated greenhouse gas emissions (HFCs, PFCs, SF_6, and NF_3) from the Electronics Industry from manufacturing micro-electronic mechanical systems (MEMS) and photovoltaics (PV).[401]

Table 9-1: Revisions to U.S. Greenhouse Gas Emissions (MMT CO_2 Eq.)

Gas/Source	1990	2005	2014	2015	2016	2017	Average Annual Change
CO_2	**7.1**	**1.3**	**(10.4)**	**(10.5)**	**(14.4)**	**(17.1)**	**(1.2)**
Fossil Fuel Combustion	1.2	(4.1)	(14.6)	(15.3)	(19.5)	(19.7)	(6.6)
Electric Power Sector	NC	NC	NC	NC	NC	+	+
Transportation	+	(0.9)	(7.9)	(8.7)	(13.7)	(13.3)	(2.5)
Industrial	(0.5)	(3.4)	(6.7)	(6.6)	(6.2)	(5.6)	(4.3)
Residential	+	+	+	+	0.3	(0.6)	+
Commercial	1.7	0.1	+	+	0.2	(0.1)	0.2
U.S. Territories	NC	+	NC	NC	NC	+	+
Non-Energy Use of Fuels	+	0.1	0.1	0.1	(0.1)	(0.1)	+
Natural Gas Systems	2.1	2.7	4.1	4.3	4.4	4.0	2.9
Cement Production	NC	NC	NC	NC	NC	NC	NC
Lime Production	NC	NC	NC	NC	(0.3)	(0.3)	+
Other Process Uses of Carbonates	NC	NC	NC	NC	(0.5)	(0.2)	+
Glass Production	NC	NC	NC	NC	+	+	+
Soda Ash Production	NC	NC	NC	NC	NC	NC	NC
Carbon Dioxide Consumption	NC	NC	NC	NC	NC	NC	NC
Incineration of Waste	+	+	+	+	0.2	0.3	+
Titanium Dioxide Production	NC	NC	NC	NC	NC	NC	NC
Aluminum Production	NC	NC	NC	NC	+	NC	+
Iron and Steel Production & Metallurgical Coke Production	3.1	1.9	(0.2)	0.1	1.3	(1.2)	1.8
Ferroalloy Production	NC	NC	NC	NC	NC	NC	NC
Ammonia Production	NC	NC	NC	NC	NC	NC	NC
Urea Consumption for Non-Agricultural Purposes	NC	NC	NC	NC	NC	(1.2)	+
Phosphoric Acid Production	NC	NC	+	NC	NC	+	+
Petrochemical Production	0.4	0.6	(0.2)	NC	0.2	0.7	0.4
Carbide Production and Consumption	NC	NC	NC	NC	NC	NC	NC
Lead Production	NC	NC	NC	NC	+	0.1	+
Zinc Production	NC	NC	NC	NC	NC	NC	NC
Petroleum Systems	0.7	0.6	0.9	1.0	0.8	1.1	0.8
Abandoned Oil and Gas Wells	+	+	+	+	+	+	+
Magnesium Production and Processing	NC	NC	NC	NC	NC	NC	NC
Liming	NC	NC	NC	NC	(0.1)	(0.1)	+
Urea Fertilization	(0.4)	(0.4)	(0.6)	(0.6)	(0.8)	(0.5)	(0.5)
International Bunker Fuels[b]	NC	NC	NC	NC	NC	NC	NC
Wood Biomass, Ethanol, and Biodiesel Consumption[a]	NC	NC	NC	NC	+	+	+
CH_4[c]	**(5.4)**	**(11.9)**	**(23.0)**	**(22.9)**	**(30.6)**	**(26.0)**	**(10.9)**
Stationary Combustion	+	+	+	+	+	+	+
Mobile Combustion	+	+	0.1	0.1	0.1	0.1	+

[401] This completeness improvement was phased so while these emissions are currently reported as an "Unspecified Mix of HFCs, NF_3, PFCs, and SF_6," EPA anticipates being able to report the specific gases in future submissions.

Coal Mining	NC	NC	NC	NC	NC	(0.9)	+
Abandoned Underground Coal Mines	NC	NC	NC	NC	NC	NC	NC
Natural Gas Systems	(9.8)	(13.3)	(24.0)	(25.3)	(29.9)	(26.3)	(14.2)
Petroleum Systems	4.0	2.1	1.4	1.1	0.8	1.0	3.5
Abandoned Oil and Gas Wells	+	+	+	+	+	0.1	+
Petrochemical Production	NC	NC	NC	NC	NC	NC	NC
Carbide Production and Consumption	NC	NC	NC	NC	NC	NC	NC
Iron and Steel Production & Metallurgical Coke Production	NC	NC	NC	NC	NC	NC	NC
Ferroalloy Production	NC	NC	NC	NC	NC	NC	NC
Enteric Fermentation	NC	NC	+	+	+	+	+
Manure Management	+	(2.2)	(3.5)	(3.0)	(1.9)	(1.8)	(1.7)
Rice Cultivation	+	1.3	2.7	3.9	(0.2)	1.4	1.2
Field Burning of Agricultural Residues	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Landfills	NC	(0.1)	+	0.1	0.1	+	+
Wastewater Treatment	0.1	+	+	0.1	0.2	(0.1)	+
Composting	NC	NC	NC	NC	0.1	0.3	+
Incineration of Waste	NC	NC	NC	NC	NC	NC	NC
International Bunker Fuels[b]	NC	NC	+	+	+	+	+
N_2O[c]	**64.3**	**56.9**	**86.5**	**69.7**	**61.6**	**60.7**	**57.1**
Stationary Combustion	+	+	+	+	+	+	+
Mobile Combustion	+	(1.7)	(0.5)	(0.5)	(0.5)	(0.6)	(0.3)
Adipic Acid Production	NC	NC	NC	NC	NC	NC	NC
Nitric Acid Production	NC	NC	NC	NC	NC	NC	NC
Manure Management	NC	(0.1)	(0.1)	(0.1)	(0.1)	+	(0.1)
Agricultural Soil Management	64.2	58.5	86.9	70.3	62.2	61.0	57.3
Field Burning of Agricultural Residues	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Wastewater Treatment	+	+	+	+	+	+	+
N_2O from Product Uses	NC	NC	NC	NC	NC	NC	NC
Caprolactam, Glyoxal, and Glyoxylic Acid Production	NC	NC	NC	(0.2)	(0.3)	0.1	+
Incineration of Waste	NC	NC	NC	NC	NC	NC	NC
Composting	NC	NC	NC	NC	0.1	0.3	+
Electronics Industry	NC	NC	+	+	+	+	+
Natural Gas Systems	+	+	+	+	+	+	+
Petroleum Systems	+	+	+	+	+	+	+
International Bunker Fuels[b]	NC	NC	+	+	+	+	+
HFCs, PFCs, SF_6 and NF_3	**+**	**6.4**	**15.9**	**16.3**	**15.3**	**13.9**	**6.6**
HFCs	**(0.1)**	**6.3**	**15.7**	**16.6**	**15.6**	**14.2**	**6.3**
Substitution of Ozone Depleting Substances[d]	(0.1)	6.3	15.7	16.6	15.6	14.2	6.3
HCFC-22 Production	NC	NC	+	NC	NC	+	+
Electronics Industry	NC	+	+	+	+	+	+
Magnesium Production and Processing	NC	NC	NC	NC	NC	NC	NC
PFCs	**NC**	**+**	**+**	**+**	**+**	**(0.1)**	**+**
Aluminum Production	NC	NC	NC	NC	+	(0.1)	+
Electronics Industry	NC	+	+	+	+	(0.1)	+
Substitution of Ozone Depleting Substances[d]	NC	NC	+	+	+	+	+
SF_6	**0.1**	**+**	**0.2**	**(0.3)**	**(0.3)**	**(0.2)**	**+**
Electrical Transmission and Distribution	0.1	+	0.2	(0.3)	(0.3)	(0.2)	+
Electronics Industry	NC	+	+	+	+	+	+
Magnesium Production and Processing	NC	NC	NC	NC	+	+	+
NF_3	**NC**	**+**	**+**	**+**	**+**	**+**	**+**
Electronics Industry	NC	+	+	+	+	+	+
Unspecified Mix of HFCs, NF_3, PFCs and SF_6	**NC***	**NC***	**NC***	**NC***	**NC***	**NC***	**NC***
Electronics Industry	NC*	NC*	NC*	NC*	NC*	NC*	NC*

Net Emissions (Sources and Sinks)	**19.6**	**(21.9)**	**16.0**	**(11.9)**	**(34.5)**	**(18.3)**	**(8.7)**
Percentage change	**0.4%**	**-0.3%**	**0.3%**	**-0.2%**	**-0.6%**	**-0.3%**	**-0.1%**

Notes: Net change in total emissions presented without LULUCF. Totals may not sum due to independent rounding
NC (No Change)

+ Absolute value does not exceed 0.05 MMT CO_2 Eq. or 0.05 percent.

* Indicates a new source for the current Inventory year. Emissions from new sources are captured in net emissions and percent change totals.

[a] Emissions from Wood Biomass, Ethanol, and Biodiesel Consumption are not included specifically in summing Energy sector totals. Net carbon fluxes from changes in biogenic carbon reservoirs are accounted for in the estimates for Land Use, Land-Use Change, and Forestry.

[b] Emissions from International Bunker Fuels are not included in totals.

[c] LULUCF emissions of CH_4 and N_2O are reported separately from gross emissions totals. LULUCF emissions include the CH_4, and N_2O emissions from *Peatlands Remaining Peatlands*; CH_4 and N_2O emissions reported for Non-CO_2 Emissions from Forest Fires, Non-CO_2 Emissions from Grassland Fires, and *Coastal Wetlands Remaining Coastal Wetlands*; CH_4 emissions from Land Converted to Coastal Wetlands; and N_2O emissions from Forest Soils and Settlement Soils.

[d] Small amounts of PFC emissions also result from this source.

[e] LULUCF Carbon Stock Change is the net C stock change from the following categories: *Forest Land Remaining Forest Land*, *Land Converted to Forest Land*, *Cropland Remaining Cropland*, *Land Converted to Cropland*, *Grassland Remaining Grassland*, *Land Converted to Grassland*, *Wetlands Remaining Wetlands*, *Land Converted to Wetlands*, *Settlements Remaining Settlements*, and *Land Converted to Settlements*.

[f] The LULUCF Sector Net Total is the net sum of all CH_4 and N_2O emissions to the atmosphere plus net carbon stock changes.

Table 9-2: Revisions to U.S. Greenhouse Gas Emissions and Removals (Net Flux) from Land Use, Land-Use Change, and Forestry (MMT CO_2 Eq.)

Land-Use Category	1990	2005	2014	2015	2016	2017	Average Annual Change
Forest Land Remaining Forest Land	**(63.3)**	**(39.6)**	**(50.9)**	**(31.5)**	**(31.4)**	**(15.9)**	**(48.2)**
Changes in Forest Carbon Stocks[a]	(62.3)	(39.2)	(50.0)	(30.9)	(29.0)	(26.7)	(46.4)
Non-CO_2 Emissions from Forest Fires[b]	(1.0)	(0.4)	(0.8)	(0.6)	(2.4)	10.7	(1.8)
N_2O Emissions from Forest Soils[c]	NC	NC	NC	NC	NC	NC	NC
Non-CO_2 Emissions from Drained Organic Soils[d]	+	+	+	+	+	+	+
Land Converted to Forest Land	**9.6**	**9.7**	**10.0**	**10.0**	**10.1**	**10.0**	**9.8**
Changes in Forest Carbon Stocks[e]	9.6	9.7	10.0	10.0	10.1	10.0	9.8
Cropland Remaining Cropland	**17.8**	**(2.5)**	**(0.2)**	**(6.5)**	**(12.8)**	**(12.0)**	**2.5**
Changes in Mineral and Organic Soil Carbon Stocks	17.8	(2.5)	(0.2)	(6.5)	(12.8)	(12.0)	2.5
Land Converted to Cropland	**(21.5)**	**(12.8)**	**(10.1)**	**(9.5)**	**(11.9)**	**(11.2)**	**(13.4)**
Changes in all Ecosystem Carbon Stocks[f]	(21.5)	(12.8)	(10.1)	(9.5)	(11.9)	(11.2)	(13.4)
Grassland Remaining Grassland	**13.3**	**5.2**	**27.3**	**4.0**	**11.2**	**11.0**	**14.0**
Changes in Mineral and Organic Soil Carbon Stocks	13.3	5.2	27.3	4.0	11.2	11.0	14.0
Non-CO_2 Emissions from Grassland Fires[g]	NC	NC	NC	NC	NC	NC	NC
Land Converted to Grassland	**(15.4)**	**(45.4)**	**(32.8)**	**(32.9)**	**(33.3)**	**(33.3)**	**(35.2)**
Changes in all Ecosystem Carbon Stocks[f]	(15.4)	(45.4)	(32.8)	(32.9)	(33.3)	(33.3)	(35.2)
Wetlands Remaining Wetlands	**+**	**+**	**+**	**+**	**+**	**+**	**+**
Changes in Organic Soil Carbon Stocks in Peatlands	NC	NC	NC	NC	NC	NC	NC
Changes in Aboveground and Soil Carbon Stocks in Coastal Wetlands	+	+	+	+	+	+	+
CH_4 Emissions from Coastal Wetlands Remaining Coastal Wetlands	NC	NC	NC	NC	NC	NC	NC
N_2O Emissions from Coastal Wetlands Remaining Coastal Wetlands	NC	NC	NC	NC	+	+	+
Non-CO_2 Emissions from Peatlands	NC	NC	NC	NC	NC	NC	NC

Remaining Peatlands							
Land Converted to Wetlands	**+**	**+**	**+**	**+**	**+**	**+**	**+**
Changes in Aboveground and Soil Carbon Stocks	+	+	+	+	+	+	+
CH_4 Emissions from Land Converted to Coastal Wetlands	NC	NC	NC	NC	NC	NC	NC
Settlements Remaining Settlements	**13.1**	**11.7**	**8.9**	**8.3**	**8.7**	**8.5**	**11.6**
Changes in Organic Soil Carbon Stocks	11.2	11.7	13.8	14.4	14.7	14.7	12.0
Changes in Settlement Tree Carbon Stocks	(0.1)	(0.6)	(4.4)	(6.0)	(5.9)	(5.9)	(1.2)
Changes in Yard Trimming and Food Scrap Carbon Stocks in Landfills	1.5	+	(0.2)	0.2	0.2	(0.2)	0.5
N_2O Emissions from Settlement Soils[h]	0.6	0.6	(0.4)	(0.4)	(0.2)	(0.1)	0.2
Land Converted to Settlements	**(0.1)**	**(1.0)**	**(5.2)**	**(6.3)**	**(7.0)**	**(6.9)**	**(1.8)**
Changes in all Ecosystem Carbon Stocks[f]	(0.1)	(1.0)	(5.2)	(6.3)	(7.0)	(6.9)	(1.8)
LULUCF Emissions[i]	**(0.4)**	**0.2**	**(1.2)**	**(0.9)**	**(2.7)**	**10.6**	**(1.6)**
LULUCF Total Net Flux[j]	**(46.0)**	**(74.9)**	**(51.8)**	**(63.6)**	**(63.7)**	**(60.5)**	**(59.1)**
LULUCF Sector Total[k]	**(46.4)**	**(74.6)**	**(53.0)**	**(64.5)**	**(66.3)**	**(49.8)**	**(60.7)**
Percent Change	**-5.7%**	**-10.1%**	**-7.9%**	**-9.1%**	**-9.2%**	**-7.0%**	**-8.4%**

Note: Totals may not sum due to independent rounding

NC (No Change)

+ Absolute value does not exceed 0.05 MMT CO_2 Eq. or 0.05 percent.

[a] Includes the net changes to carbon stocks stored in all forest ecosystem pools and harvested wood products.

[b] Estimates include emissions from fires on both *Forest Land Remaining Forest Land* and *Land Converted to Forest Land.*

[c] Estimates include emissions from N fertilizer additions on both *Forest Land Remaining Forest Land* and *Land Converted to Forest Land*.

[d] Estimates include emissions from drained organic soils on both *Forest Land Remaining Forest Land* and *Land Converted to Forest Land.*

[e] Includes the net changes to carbon stocks stored in all forest ecosystem pools.

[f] Includes changes in mineral and organic soil carbon stocks for all land use conversions to cropland, grassland, and settlements, respectively. Also includes aboveground/belowground biomass, dead wood, and litter carbon stock changes for conversion of forest land to cropland, grassland, and settlements, respectively.

[g] Estimates include emissions from fires on both *Grassland Remaining Grassland* and *Land Converted to Grassland.*

[h] Estimates include emissions from N fertilizer additions on both *Settlements Remaining Settlements* and *Land Converted to Settlements* because it is not possible to separate the activity data at this time.

[i] LULUCF emissions include the CH_4 and N_2O emissions reported for Peatlands Remaining Peatlands, Forest Fires, Drained Organic Soils, Grassland Fires, and Coastal Wetlands Remaining Coastal Wetlands; CH_4 emissions from Land Converted to Coastal Wetlands; and N_2O emissions from Forest Soils and Settlement Soils.

[j] LULUCF Carbon Stock Change includes any C stock gains and losses from all land use and land use conversion categories.

[k] The LULUCF Sector Net Total is the net sum of all CH_4 and N_2O emissions to the atmosphere plus net carbon stock changes.