9. Recalculations and Improvements

Each year, many of 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."

The results of all methodological changes and historical data updates made in the current Inventory report are presented in Table 9-1 and Table 9-2. To understand the details of any specific recalculation see the *Recalculations Discussion* within each source/sink categories' section found in Chapters 3 through 7 of this report. Table 9-1 summarizes the quantitative effect of all changes on U.S. greenhouse gas emissions in the Energy, IPPU, Agriculture, and Waste chapters, while Table 9-2 summarizes the quantitative effect of changes on annual net fluxes from LULUCF. Both tables present results relative to the previously published U.S. Inventory (i.e., the 1990 to 2014 report) in units of million metric tons of carbon dioxide equivalent (MMT CO_2 Eq.).

In general, when methodological changes have been implemented, the previous inventory's time series (i.e., 1990 to 2014) 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 following source and sink categories underwent the most significant methodological and historical data changes. A brief summary of the recalculations and/or improvements undertaken is provided for each of the following categories.

- *Land Converted to Forest Land - Changes in Forest Carbon Stocks (CO_2 sink).* This is the first U.S. Inventory report to include the biomass, dead wood, litter and mineral soil C pools for *Land Converted to Forest Land.* In the 1990 to 2014 report, only mineral soil C stock changes were reported in this category. The changes made this year to include the biomass, dead wood, and litter pools resulted in an average annual increase in sequestration of 89.9 MMT CO_2 Eq. relative to the previous Inventory.
- *Agricultural Soil Management (N_2O).* Methodological recalculations in the current Inventory are associated with the following improvements: (1) driving the DAYCENT simulations with updated land management input data through 2012 from the National Resources Inventory (NRI) (previous report used NRI data through 2010), the data from 2012 was utilized for 2013 to 2015; (2) modifying the number of experimental study sites used to quantify model uncertainty for direct N_2O emissions; (3) DAYCENT model development to improve the simulation of soil temperature; (4) improvements in the cropping and land use histories that are simulated in DAYCENT between 1950 and 1979 that generate initial values for the model state variables, such as initial soil organic C stock values; and (5) implementing a more robust set of model output variables that enabled a more accurate and detailed accounting of N from synthetic fertilizers, managed manure, and pasture, range, and paddock (PRP) manure applied to grasslands. These changes resulted in a decrease in emissions of approximately 14.4 percent on average relative to the previous Inventory and an increase in the upper bound of the 95 percent confidence interval for direct N_2O emissions from 24 to 31 percent. The differences in emissions

and uncertainty are mainly due to modifying the number of study sites used to quantify model uncertainty. These changes resulted in an average annual decrease in emissions of 44.5 MMT CO_2 Eq. relative to the previous Inventory.

- *Forest Land Remaining Forest Land - Changes in Forest Carbon Stocks (CO_2 sink).* Forest ecosystem stock and stock-change estimates differ from previous Inventory reports in two primary ways. First, a different estimation system was used in the current Inventory and the previous (e.g., 1990 to 2014) Inventory (Woodall et al. 2015a). The major differences between the estimation system used in the last two Inventory reports and prior estimation approaches is the sole use of annual FIA data and the back-casting of forest C stocks across the 1990s based on forest C stock density and land use change information obtained from the nationally consistent annual forest inventory, coupled with in situ observations of non-tree C pools such as soils, dead wood, and litter in the current and previous Inventory. The use of this estimation framework has enabled the creation of the two land use sections for forest C stocks: *Forest Land Remaining Forest Land* and *Land Converted to Forest Land*. In previous Inventory reports (e.g., the 1990 to 2013 Inventory), the C stock changes from *Land Converted to Forest Land* were a part of the *Forest Land Remaining Forest Land* section and it was not possible to disaggregate the estimates with the methodology applied at that time. A second major change in the previous (1990 to 2014) Inventory was the adoption of a new approach to estimate forest soil C, the largest C stock in the United States. However, there was a unit error identified in the litter and soil C stock and stock change estimates reported in the 1990 to 2014 Inventory. The new estimates now reflect the correct units. In addition to these major changes, the refined land representation analysis described in Section 6.1 Representation of the U.S. Land Base re-classified some of the forest land in south central and southeastern coastal Alaska as unmanaged; this is in contrast to past assumptions where forest lands included in the FIA database were always considered part of the "managed" land base. Therefore, the C stock and flux estimates for southeast and south central coastal Alaska, as included here, reflect that adjustment, which effectively reduces the managed forest area in southeast and south central coastal Alaska by approximately 5 percent.

  In addition, emissions from drained organic soil within the *Forest Land Remaining Forest Land* and *Land Converted to Forest Land* source categories are reported for the first time in the current Inventory. These estimates of drained organic soils on forest land are identified separately from other forest soils largely because mineralization of the exposed or partially dried organic material results in continuous CO_2 emissions (IPCC 2006). This distinction merits the separate estimates provided here according to IPCC (2006) and primarily the *2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands* (IPCC 2013). All these changes resulted in an average annual decrease in sequestration of 40.7 MMT CO_2 Eq. relative to the previous Inventory.

- *Land Converted to Grassland – Changes in all Ecosystem Carbon Stocks (CO_2).* Methodological recalculations are applied to the entire time series to ensure time-series consistency from 1990 through 2015. Differences in biomass, dead wood and litter C stock changes in *Forest Land Converted to Grassland* since previous Inventory can be attributed to four factors. First, the land area conversion in this Inventory is compiled based on the latest FIA and NRI data that led to differences in the areas of *Forest Land Converted to Grassland* compared to the previous Inventory. Second, the C densities on forest land prior to conversion are compiled using additional data from the FIA program in this inventory and covers all C pools, while the previous Inventory only included aboveground live biomass (trees and saplings). Third, the IPCC default values (IPCC 2006) for annual biomass crop growth following conversion are included in this Inventory, whereas the new growth was not addressed in the previous Inventory. Finally, to account for this transfer of C in woody biomass to woodlands in the Western United States and Great Plains Regions, state-specific C densities for woody biomass have been developed under the assumption that only 50 percent of tree biomass is lost for *Forest Land Converted to Grassland* in these regions.

  Recalculations for the soil C stock methods had a smaller impact than the biomass, dead wood and litter C stocks, and included: (1) driving the DAYCENT simulations with updated input data for land use and management from the National Resources Inventory that extended the time series through 2012; (2) modifying the number of experimental study sites used to quantify model uncertainty for the soil C stock changes; (3) DAYCENT model development to improve the simulation of soil temperature; and (4) improvements in the cropping and land use histories that are simulated in DAYCENT between 1950 and 1979.

  As a result of the improvements to the Inventory, the loss of C for *Land Converted to Grassland*, relative to the previous report, decreased by an average of 19.7 MMT CO_2 Eq. annually over the time series. This represents a

49 percent decline in the losses of carbon from *Land Converted to Grassland* compared to the previous Inventory. This change is primarily due to lower amounts of aboveground biomass C that are lost from *Forest Land Converted to Grassland*.

- *Natural Gas Systems (CH_4).* EPA received information and data related to the emission estimates through GHGRP reporting, the annual Inventory formal public notice periods, stakeholder feedback on updates under consideration, and new studies. EPA thoroughly evaluated relevant information available, and made several updates in the Inventory, including revisions to production segment activity and emissions data, gathering and boosting facility emissions, and processing segment activity and emissions data. The impact of all revisions to natural gas systems CH_4 estimates is a decrease of 13.6 MMT CO_2 Eq., or 8 percent, comparing the 2014 value from the previous Inventory to the 2014 value in this Inventory. Over the time series, the average change is a decrease of 17 MMT CO_2 Eq., or 9 percent.

- *Land Converted to Cropland – Changes in All Ecosystem Carbon Stocks (CO_2).* Methodological recalculations are applied to the entire time series to ensure time-series consistency from 1990 through 2015. Differences in biomass, dead wood and litter C stock changes in *Forest Land Converted to Cropland* since previous Inventory can be attributed to three factors. First, the land area conversion in this Inventory is compiled based on the latest FIA and NRI data that led to differences in the areas of *Forest Land Converted to Cropland* compared to the previous Inventory. Second, the C densities on forest land prior to conversion are compiled using additional data from the FIA program in this inventory and covers all C pools, while the previous Inventory only included aboveground live biomass (trees and saplings). Third, the IPCC default values (IPCC 2006) for annual biomass crop growth following conversion is included in this Inventory, but the new growth was not addressed in the previous Inventory.

  Recalculations for the soil C stock methods had a smaller impact than the biomass, dead wood and litter C stocks, and included: (1) driving the DAYCENT simulations with updated input data for land use and management from the National Resources Inventory that extended the time series through 2012 (previous report used NRI data through 2010), the data from 2012 was utilized for 2013 to 2015; (2) modifying the number of experimental study sites used to quantify model uncertainty for the soil C stock changes; (3) DAYCENT model development to improve the simulation of soil temperature; and (4) improvements in the cropping and land use histories that are simulated in DAYCENT between 1950 and 1979.

  As a result of these improvements to the Inventory, C loss from *Land Converted to Cropland* decreased compared to the previous *Inventory*, estimated at annual average decline of 10.7 MMT CO_2 Eq. over the time series. This represents a 21 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 biomass C stock changes associated with *Forest Land Converted to Cropland*.

- *Landfills (CH_4).* Four major methodological recalculations were performed for the current Inventory. First, net CH_4 emissions as directly reported to subpart HH of EPA's GHGRP were used for 2010 to 2015. Second, a 12.5 percent scale-up factor was applied to the subpart HH data to account for emissions from MSW landfills that are not required to report under subpart HH. Third, the net CH_4 emissions from 2010 to 2015 from subpart HH were used to estimate, or back-cast, net CH_4 emissions for 2005 to 2009. Fourth, the previously used method, which relies on the first order decay model, was applied with revised MSW generation data for years 1990 to 2004. The overall impact to the Inventory from these changes resulted in an average decrease of nearly 7 percent across the time series. These changes resulted in an average annual decrease in emissions of 10.2 MMT CO_2 Eq. relative to the previous Inventory.

- *Cropland Remaining Cropland - Changes in Mineral and Organic Carbon Stocks (CO_2 sink).* Methodological recalculations in the current Inventory are associated with the following improvements: (1) driving the DAYCENT simulations with updated input data for land management from the National Resources Inventory from 1979 through 2012 (previous report used NRI data through 2010), the data from 2012 was utilized for 2013 to 2015; (2) increasing the number of experimental study sites used to quantify model uncertainty; (3) DAYCENT model development to improve the simulation of soil temperature; and (4) improvements in the cropping and land use histories that are simulated in DAYCENT between 1950 and 1979. The fourth improvement reduced the amount of grassland converted into cropland when the NRI histories begin in 1979 (Note the histories generate initial values for the model state variables, including the initial soil organic C stock values; more detail is provided in Annex 3.12). These changes in soil organic carbon (SOC) stocks resulted in

an average annual increase in sequestration of 7.8 MMT CO_2 Eq. relative to the previous Inventory. The changes resulted in an average increase in sequestration of 70 percent across the time series. The largest driver of this change is associated with corrective actions taken to more accurately represent the land use histories prior to 1979.

- *Rice Cultivation (CH_4).* Methodological recalculations in the current Inventory are associated with the following improvements: (1) DAYCENT model development to improve the simulation of soil temperature; (2) improvements in the cropping and land use histories that are simulated in DAYCENT between 1950 and 1979, which generate initial values for the state variables in the model and (3) driving the DAYCENT simulations with updated input data for land use and management from the National Resources Inventory, which revised the time series from 1990 through 2012. These changes resulted in an increase in emissions of approximately 25 percent on average relative to the previous Inventory and an increase in uncertainty from a confidence interval with a lower bound and upper bound of 17 percent to a confidence interval with an upper and lower bound of 28 percent. These changes resulted in an average annual increase in emissions of 2.9 MMT CO_2 Eq. relative to the previous Inventory.
- *Electrical Transmission and Distribution (SF_6).* The historical emissions estimated for this source category have undergone several revisions. SF_6 emission estimates for the period 1990 through 2014 were updated relative to the previous Inventory based on revisions to interpolated and extrapolated non-reported Partner data. For the current Inventory, historical estimates for the period 2011 through 2014 were also updated relative to the previous Inventory based on revisions to reported historical data in EPA's GHGRP. The regression coefficients to estimate emissions from non-reporting utilities was adjusted between the years 1999 and 2014 due to methodology updates, and as a result, there were changes to the emissions from non-reporting utilities. Emissions estimates for original equipment manufacturers (OEMs) were updated to incorporate Subpart SS reported emissions and assumptions on the percent share of emissions from EPA's GHGRP reporters. As a result of the recalculations, SF_6 emissions from electrical transmission and distribution decreased by 14 percent for 2014 relative to the previous report. On average, the SF_6 emission estimates for the entire time series decreased by approximately 14 percent per year, or 1.7 MMT CO_2 Eq.
- *Petroleum Systems (CH_4).* The EPA received information and data related to the emission estimates through GHGRP reporting, the annual Inventory formal public notice periods, stakeholder feedback on updates under consideration, and new studies. The EPA thoroughly evaluated relevant information available, and made updates to the production segment methodology for the Inventory including revised well count, equipment count, and pneumatic controller activity data, and revised activity and emissions data for tanks and associated gas venting and flaring. In addition, as the updates to emission factors resulted in calculation of net emissions (already taking into account any reduced emissions) for sources in petroleum production, EPA removed Gas STAR reductions from the calculations. The combined impact of revisions to 2014 petroleum production segment CH_4 emissions, compared to the previous Inventory, is a decrease from 68 to 43 MMT CO_2 Eq. (25 MMT CO_2 Eq., or 37 percent). The recalculations resulted in an average increase in emission estimates across the 1990 through 2014 time series, compared to the previous Inventory, of 1 MMT CO_2 Eq., or 6 percent.

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

Gas/Source	1990	2005	2011	2012	2013	2014	Average Annual Change
CO_2	**7.9**	**9.1**	**10.0**	**12.9**	**11.5**	**9.5**	**9.2**
Fossil Fuel Combustion	(0.3)	(0.2)	(0.6)	+	(1.1)	(5.9)	(0.4)
Electricity Generation	*NC*	*NC*	*NC*	*NC*	*NC*	*(1.3)*	*(0.1)*
Transportation	*NC*	*NC*	+	*NC*	+	*5.2*	*0.2*
Industrial	*NC*	*NC*	*1.6*	*NC*	+	*(7.2)*	*(0.2)*
Residential	*NC*	*NC*	*(1.3)*	*NC*	*NC*	*0.3*	+
Commercial	*NC*	*NC*	*(0.4)*	*NC*	*NC*	*(3.3)*	*(0.1)*
U.S. Territories	*(0.3)*	*(0.2)*	*(0.6)*	+	*(1.1)*	*0.4*	*(0.1)*
Non-Energy Use of Fuels	(0.5)	+	1.2	1.1	2.0	4.7	0.4
Natural Gas Systems	NC	NC	NC	NC	NC	NC	NC
Cement Production	0.2	0.3	0.2	0.2	0.2	0.7	0.2
Lime Production	+	+	+	0.1	+	0.1	+
Other Process Uses of Carbonates	NC	NC	NC	NC	NC	(0.3)	+

Glass Production	NC	NC	NC	NC	NC	+	+
Soda Ash Production and Consumption	NC	NC	NC	NC	NC	NC	NC
Carbon Dioxide Consumption	NC	NC	NC	NC	NC	NC	NC
Incineration of Waste	+	+	+	+	1.0	1.2	0.1
Titanium Dioxide Production	NC	NC	NC	NC	NC	(0.1)	+
Aluminum Production	NC	NC	NC	NC	NC	NC	NC
Iron and Steel Production & Metallurgical Coke Production	1.8	1.5	1.2	1.2	1.1	3.3	1.6
Ferroalloy Production	NC	NC	NC	NC	NC	NC	NC
Ammonia Production	NC	NC	NC	NC	NC	0.2	+
Urea Consumption for Non-Agricultural Purposes	NC	NC	+	+	(0.2)	(2.6)	(0.1)
Phosphoric Acid Production	NC	NC	+	+	+	(0.1)	+
Petrochemical Production	(0.3)	(0.4)	+	+	+	+	(0.3)
Silicon Carbide Production and Consumption	NC	NC	NC	NC	NC	+	+
Lead Production	NC	NC	NC	NC	NC	(0.1)	+
Zinc Production	NC	NC	NC	NC	NC	+	+
Petroleum Systems	NC	NC	NC	NC	NC	NC	NC
Magnesium Production and Processing	NC	NC	NC	NC	NC	+	+
Liming	NC	NC	NC	NC	+	(0.5)	+
Urea Fertilization	NC	NC	+	+	0.2	0.3	+
Biomass – Wood[a]	*(215.2)*	*(206.0)*	*(186.8)*	*(186.4)*	*(198.1)*	*(204.3)*	*(206.9)*
International Bunker Fuels[a]	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*
Biofuels-Ethanol[a]	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*
Biomass-Biodiesel[a]	*NC**	*NC**	*NC**	*NC**	*NC**	*NC**	*NC**
CH_4	**6.9**	**(36.4)**	**(45.3)**	**(48.3)**	**(62.7)**	**(71.7)**	**(22.9)**
Stationary Combustion	+	+	+	+	+	+	+
Mobile Combustion	+	0.1	+	+	+	+	+
Coal Mining	NC	NC	NC	NC	NC	(2.7)	(0.1)
Abandoned Underground Coal Mines	NC	NC	NC	NC	NC	NC	NC
Natural Gas Systems	(12.7)	(17.7)	(15.6)	(16.5)	(16.4)	(13.6)	(17.0)
Petroleum Systems	16.7	(2.8)	(8.2)	(11.9)	(20.2)	(25.1)	1.0
Petrochemical Production	NC	NC	NC	NC	NC	NC	NC
Silicon 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	+	NC	+	(0.1)	+
Manure Management	NC	NC	1.5	1.9	1.9	1.7	0.4
Rice Cultivation	2.9	3.7	2.3	(0.6)	(0.6)	(0.5)	2.9
Field Burning of Agricultural Residues	+	+	+	+	+	+	+
Landfills	NC	(19.7)	(25.3)	(21.4)	(27.6)	(31.4)	(10.2)
Wastewater Treatment	+	0.1	0.1	0.1	0.1	0.1	0.1
Composting	NC	NC	NC	NC	NC	+	+
Incineration of Waste	NC	NC	NC	NC	NC	NC	NC
International Bunker Fuels[a]	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*
N_2O	**(46.7)**	**(35.9)**	**(52.5)**	**(68.6)**	**(67.8)**	**(68.0)**	**(43.9)**
Stationary Combustion	+	+	+	+	+	+	+
Mobile Combustion	+	1.4	0.4	0.3	0.3	0.3	0.5
Adipic Acid Production	NC	NC	+	+	+	NC	+
Nitric Acid Production	+	+	+	+	+	+	+
Manure Management	NC	NC	+	+	+	+	+
Agricultural Soil Management	(46.7)	(37.3)	(53.0)	(69.0)	(68.1)	(68.4)	(44.5)
Field Burning of Agricultural Residues	+	+	+	+	+	+	+
Wastewater Treatment	+	+	0.1	0.1	0.1	0.1	+
N_2O from Product Uses	NC	NC	NC	NC	NC	NC	NC
Incineration of Waste	NC	NC	NC	NC	NC	NC	NC
Composting	NC	NC	NC	NC	NC	+	+
Semiconductor Manufacture	NC	NC	+	+	+	+	+
International Bunker Fuels[a]	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*	*NC*
HFCs	**+**	**0.1**	**0.1**	**0.1**	**0.1**	**+**	**+**
Substitution of Ozone Depleting Substances	+	0.1	0.1	0.1	0.1	0.1	+
HCFC-22 Production	NC	NC	NC	NC	NC	NC	NC

Semiconductor Manufacture	NC	+	+	+	+	+	+
Magnesium Production and Processing	NC	NC	NC	NC	NC	(0.1)	+
PFCs	**NC**	**+**	**(0.1)**	**+**	**(0.1)**	**0.2**	**+**
Aluminum Production	NC	NC	NC	NC	NC	NC	NC
Semiconductor Manufacture	NC	+	(0.1)	+	(0.1)	0.2	+
Substitution of Ozone Depleting Substances	NC*	NC*	NC*	NC*	NC*	NC*	NC*
SF_6	**(2.3)**	**(2.3)**	**(0.8)**	**(0.8)**	**(0.8)**	**(0.8)**	**(1.7)**
Electrical Transmission and Distribution	(2.3)	(2.3)	(0.8)	(0.8)	(0.8)	(0.8)	(1.7)
Semiconductor Manufacture	NC	+	+	+	+	+	+
Magnesium Production and Processing	NC	NC	NC	NC	NC	+	+
NF_3	**NC**	**+**	**+**	**+**	**+**	**+**	**+**
Semiconductor Manufacture	NC	+	+	+	+	+	+
Net Change in Total Emissions	**(34.1)**	**(65.5)**	**(88.7)**	**(104.7)**	**(119.9)**	**(130.8)**	
Percent Change	**-0.5%**	**-0.9%**	**-1.3%**	**-1.6%**	**-1.8%**	**-1.9%**	

Note: Net change in total emissions presented without LULUCF.
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.
[a] Not included in emissions total.
Notes: Totals may not sum due to independent rounding. Parentheses indicate negative values.

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	2011	2012	2013	2014	Average Annual Change
Forest Land Remaining Forest Land	**25.7**	**26.5**	**67.2**	**68.6**	**68.1**	**73.1**	**40.5**
Changes in Forest Carbon Stocks[a]	25.8	27.3	66.7	68.9	68.3	73.1	40.7
Non-CO_2 Emissions from Forest Fires	(0.2)	(0.9)	0.3	(0.4)	(0.2)	(0.1)	(0.3)
N_2O Emissions from Forest Soils[b]	NC	NC	NC	NC	NC	NC	NC
Non-CO_2 Emissions from Drained Organic Soils	NC*	NC*	NC*	NC*	NC*	NC*	NC*
Land Converted to Forest Land	**(91.3)**	**(80.6)**	**(75.4)**	**(74.8)**	**(74.9)**	**(74.9)**	**(89.9)**
Changes in Forest Carbon Stocks[c]	(91.3)	(80.6)	(75.4)	(74.8)	(74.9)	(74.9)	(89.9)
Cropland Remaining Cropland	**(13.7)**	**(20.3)**	**(14.6)**	**(20.4)**	**(18.6)**	**(19.0)**	**(15.6)**
Changes in Mineral and Organic Soil Carbon Stocks	(6.6)	(12.4)	(6.7)	(10.2)	(10.3)	(10.3)	(7.8)
Land Converted to Cropland	**(22.4)**	**(6.3)**	**1.6**	**0.7**	**0.6**	**0.6**	**(10.7)**
Changes in all Ecosystem Carbon Stocks[d]	(22.4)	(6.3)	1.6	0.7	0.6	0.6	(10.7)
Grassland Remaining Grassland	**8.8**	**9.4**	**(14.0)**	**(23.2)**	**(23.8)**	**(23.3)**	**(0.9)**
Changes in Mineral and Organic Soil Carbon Stocks	8.7	8.7	(15.6)	(24.4)	(24.2)	(24.1)	(1.5)
Non-CO_2 Emissions from Grassland Fires	NC*	NC*	NC*	NC*	NC*	NC*	NC*
Land Converted to Grassland	**(21.2)**	**(23.9)**	**(19.1)**	**(19.9)**	**(19.9)**	**(19.9)**	**(19.7)**
Changes in all Ecosystem Carbon Stocks[e]	(21.2)	(23.9)	(19.1)	(19.9)	(19.9)	(19.9)	(19.7)
Wetlands Remaining Wetlands	**(5.0)**	**(6.4)**	**(4.9)**	**(4.9)**	**(4.9)**	**(4.9)**	**(5.0)**
Changes in Mineral and Organic Soil Carbon Stocks	NC*	NC*	NC*	NC*	NC*	NC*	NC*
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*	NC*	NC*	NC*
Non-CO_2 Emissions from Peatlands Remaining Peatlands	NC	NC	NC	NC	NC	NC	NC
Land Converted to Wetlands	**NC***	**NC***	**NC***	**NC***	**NC***	**NC***	**NC***
Changes in Mineral and Organic Soil Carbon Stocks[f]	NC*	NC*	NC*	NC*	NC*	NC*	NC*
CH_4 Emissions from Land Converted to Coastal Wetlands	NC*	NC*	NC*	NC*	NC*	NC*	NC*
Settlements Remaining Settlements	**0.2**	**0.6**	**1.4**	**1.6**	**1.6**	**1.1**	**0.6**
Changes in Organic Soil Carbon Stocks	NC*	NC*	NC*	NC*	NC*	NC*	NC*

Changes in Urban Tree Carbon Stocks	NC	NC	NC	NC	NC	NC	NC
N_2O Emissions from Settlement Soils[g]	0.1	0.1	0.1	0.2	0.2	0.1	0.1
Changes in Yard Trimming and Food Scrap Carbon Stocks in Landfills	NC	+	+	+	0.1	(0.4)	+
Land Converted to Settlements	**NC***	**NC***	**NC***	**NC***	**NC***	**NC***	**NC***
Changes in all Ecosystem Carbon Stocks[h]	NC*	NC*	NC*	NC*	NC*	NC*	NC*
LULUCF Emissions[i]	**(4.4)**	**(5.2)**	**(3.0)**	**(6.3)**	**(4.9)**	**(4.9)**	
LULUCF Carbon Stock Change[j]	**(77.2)**	**(27.3)**	**15.8**	**2.2**	**1.5**	**6.0**	
LULUCF Sector Net Total[k]	**(81.6)**	**(32.5)**	**12.8**	**(4.1)**	**(3.4)**	**1.1**	
Percent Change	**-11.1%**	**-4.7%**	**1.7%**	**-0.5%**	**-0.4%**	**0.1%**	

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.

+ Absolute value does not exceed 0.05 MMT CO_2 Eq.

[a] Includes the net changes to carbon stocks stored in all forest ecosystem pools (including drained and undrained organic soils) and harvested wood products.

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

[c] Includes the net changes to carbon stocks stored in all forest ecosystem pools (excludes organic soils)

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

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

[f] Includes carbon stock changes for land converted to vegetated coastal wetlands

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

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

[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 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.*

[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.

Notes: Totals may not sum due to independent rounding. Parentheses indicate net sequestration.