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Emissions due to agriculture

Global, regional and country trends 2000–2018

HIGHLIGHTS

- **In 2018, global emissions due to agriculture (within the farm gate and including related land use/land use change) were 9.3 billion tonnes of CO₂ equivalent (CO₂eq).**
- **Methane and nitrous oxide emissions from crop and livestock activities contributed 5.3 billion tonnes CO₂eq in 2018, a 14 percent growth since 2000.**
- **Livestock production processes such as enteric fermentation and manure deposition on pastures dominated farm-gate emissions, together generating 3 billion tonnes CO₂eq in 2018.**
- **Land use and land use change emissions were 4 billion tonnes CO₂eq in 2018, caused mainly by deforestation (2.9 billion tonnes CO₂eq) and drainage and burning of organic soils (1 billion tonnes CO₂eq). They decreased globally by 20 percent since 2000.**
- **While emissions from deforestation decreased, those from drainage and fires of organic soils increased by nearly 35 percent since 2000.**
- **In Africa, both farm-gate and land use-related emissions increased over the entire 2000–2018 period, by 38 and 20 percent respectively.**

FAOSTAT EMISSIONS

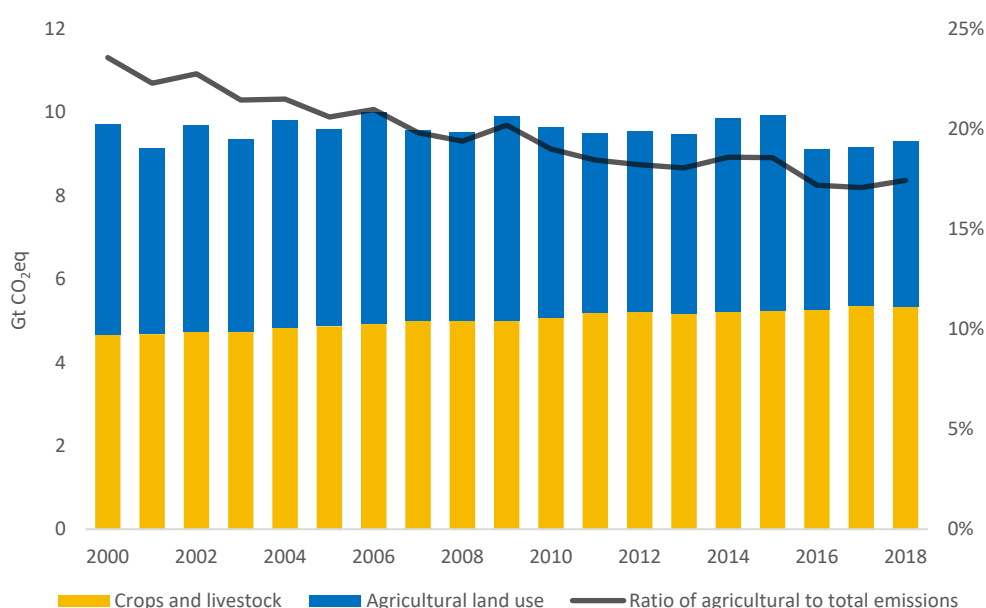
Agriculture as a sector is responsible for non-CO₂ emissions generated within the farm gate by crops and livestock activities, as well as for CO₂ emissions caused by the conversion of natural ecosystems, mostly forest land and natural peatlands, to agricultural land use.

The FAOSTAT Emissions database provides a comprehensive picture of methane (CH₄), nitrous oxide (N₂O) and carbon dioxide (CO₂) emissions and removals from [agriculture](#) production and associated [land use](#) activities at the country, regional and global levels. It helps document the main trends and impacts of food and agriculture on atmospheric greenhouse gas (GHG) concentrations over the period 1961–2018. The data use as input crop and livestock production reported by countries to FAO, using the guidelines for national GHG inventories of the International Panel on Climate Change (IPCC, 2006) to estimate emissions. This analytical brief focuses on overall trends over the period 2000–2018. Emissions from forest biomass fires and burning of organic soils in the humid tropics are included in these estimates. More in-depth analysis on the emissions and removals of GHG for [livestock](#), [forests](#), and the degradation of [organic soils](#) are discussed in other briefs and peer-reviewed publications.

GLOBAL

In 2018, world total agriculture and related land use emissions reached 9.3 billion tonnes of carbon dioxide equivalent (Gt CO₂eq). Crop and livestock activities within the farm gate generated more than half of this total (5.3 Gt CO₂eq), with land use and land use change activities responsible for nearly 4 Gt CO₂eq. These components were respectively 4.6 and 5.0 Gt CO₂eq in the year 2000. During the 2000s, emissions from within the farm gate and those from land use both increased, and then trends in these two components began diverging. Emissions from crops and livestock activities kept growing over the entire 2000–2018 period and were 14 percent larger in 2018 than in 2000. Conversely, emissions from land use and land use change decreased over the study period, consistently with observed decreases in [deforestation](#). As a result, the combined farm gate and land emissions due to agriculture were about 4 percent lower in 2018 than in 2000. In 2018, agriculture and related land use emissions accounted for 17 percent of global GHG emissions from all sectors, down from 24 percent in the 2000s. In addition to the noted slight decrease in absolute emissions, this reduction in 2018 was also the result of emissions from other economic sectors growing at relatively faster rates during 2000–2018 (Figure 1).

Figure 1. Yearly emissions from crops and livestock and related land use, and share of agriculture in global GHG emissions from all sectors, 2000–2018

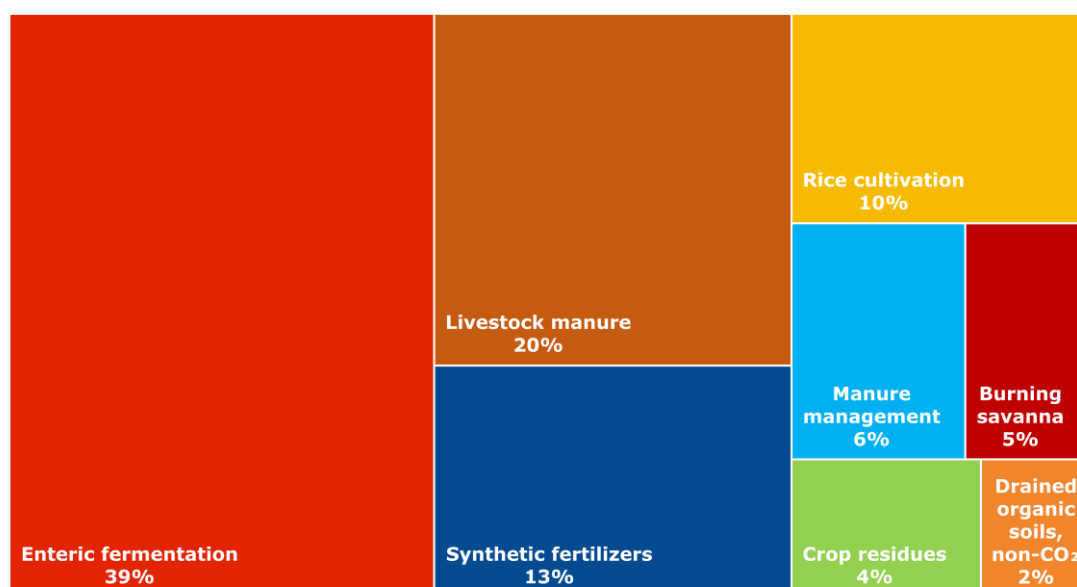


Source: FAOSTAT 2020.

Crops and livestock, non-CO₂ emissions

Agricultural activities from crops and livestock production release significant amounts of non-CO₂ emissions such as methane and nitrous oxide, both powerful greenhouse gases, totaling 5.3 Gt CO₂eq in 2018, with livestock production contributing two-thirds of this total (Figure 2). In particular, in 2018 CH₄ emissions from enteric fermentation in digestive systems of ruminant livestock continued to be the single largest component of farm-gate emissions (2.1 Gt CO₂eq).

Figure 2. Contribution of crops and livestock activities to total non-CO₂ emissions from agriculture in 2018 (5.3 Gt CO₂eq)



Source: FAOSTAT 2020.

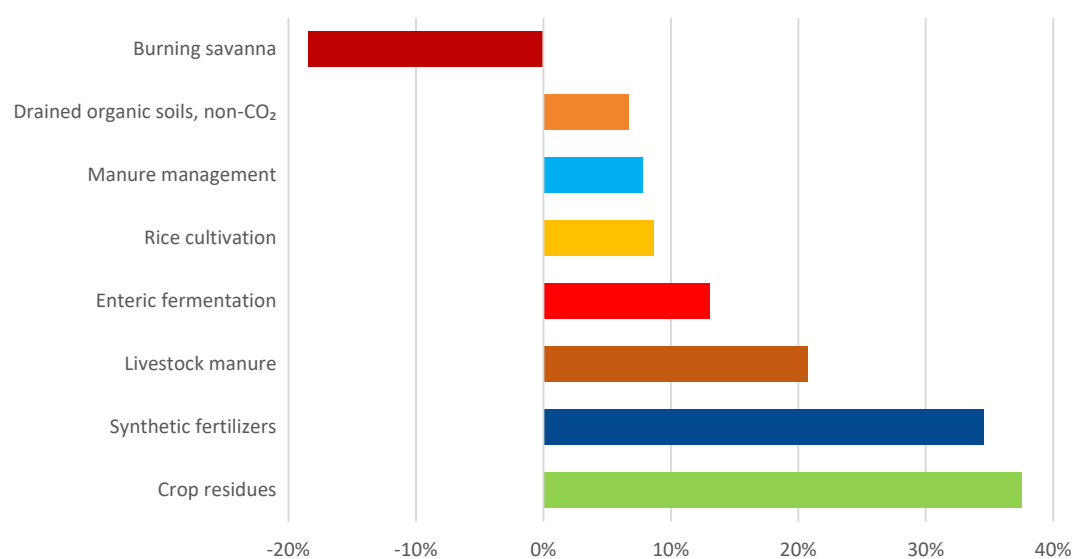
N₂O emissions from livestock manure left on pastures by grazing animals and applications of manure to cropland contributed an additional 1 Gt CO₂eq in 2018. Furthermore, N₂O emissions from synthetic fertilizers contributed 13 percent to the total (0.7 Gt CO₂eq) and CH₄ emissions from rice cultivation another 10 percent (0.5 Gt CO₂eq).

The relative contribution of each process in crop and livestock production did not vary significantly during the past two decades. N₂O emissions from synthetic fertilizers and crop residues incorporation had the largest relative growth over the study period, being more than 35 percent higher in 2018. This is consistent with the growing intensification of crop production globally and the related increase in chemical fertilizers inputs worldwide.

The growth in livestock numbers drove the increase in the emissions from manure and from enteric fermentation (i.e. 20 and 13 percent in 2018 compared to 2000, respectively). Finally, emissions from rice cultivation, manure management systems and drained organic soils increased by about 7 percent over the period 2000–2018.

The data showed a decline in emissions from prescribed fires on grasslands and savannahs, in line with previous findings in recent literature of an overall decline of fire rates in Africa between 2001 and 2016 (e.g. Wei *et al.*, 2020). These studies attributed these trends to cropland expansion in northern sub-Saharan Africa at the cost of traditional, fire-managed rangelands.

Figure 3. Changes in non-CO₂ emissions from crops and livestock activities, 2000–2018

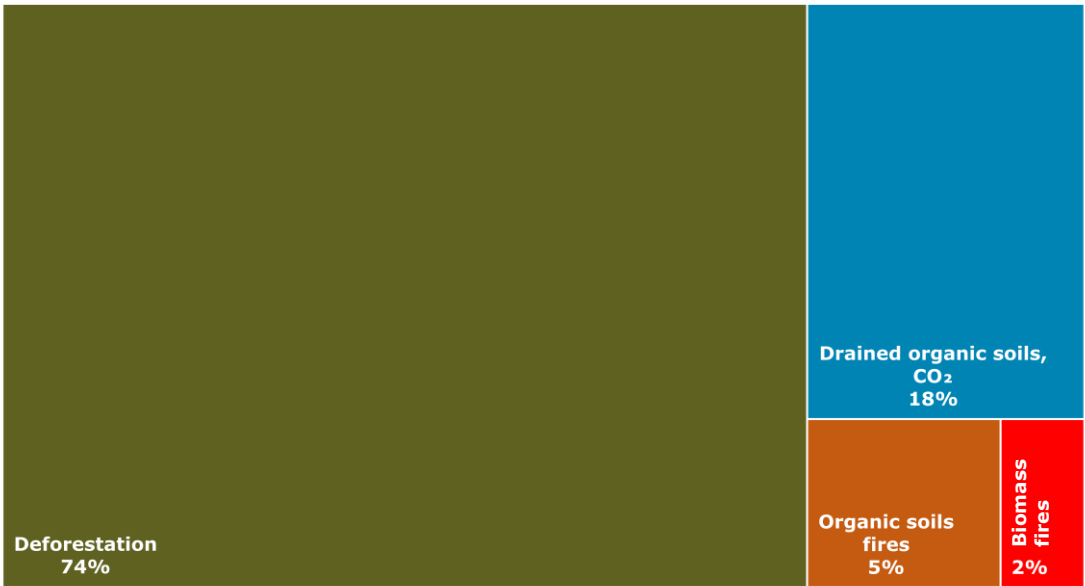


Source: FAOSTAT 2020.

Agricultural land use and land use change, CO₂ emissions

In 2018, global land use and land use change emissions related to agriculture were nearly 4 Gt CO₂ eq. Deforestation, assumed herein as fully driven by agriculture, represented nearly three-fourths of these global emissions. Drainage and burning of organic soils were responsible for the remaining quarter (Figure 4). While agriculture is the largest driver of deforestation globally, important non-agricultural drivers may exist at the regional and local levels, so that the overall global total is likely an overestimate.

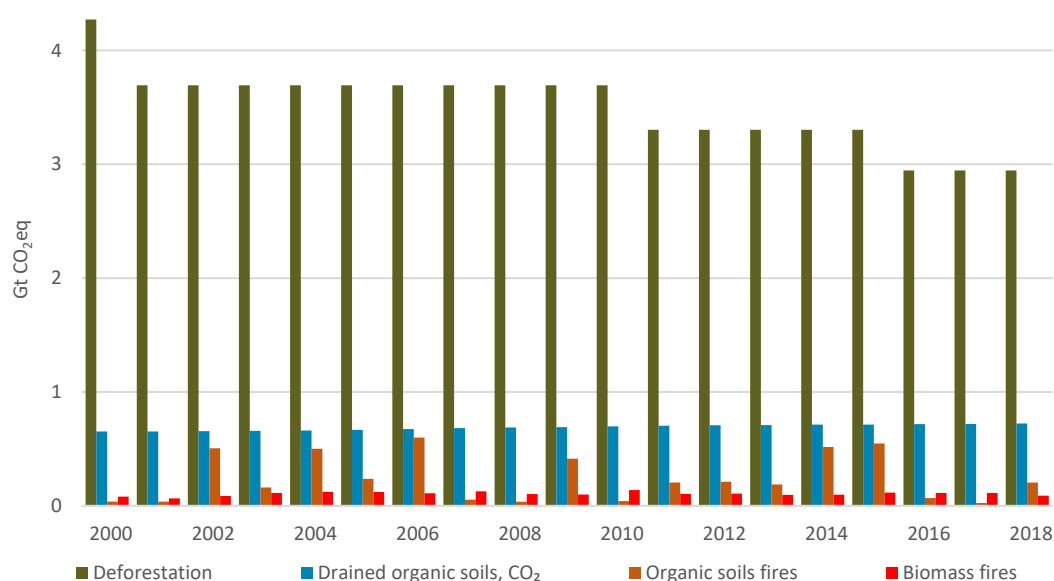
Figure 4. Contribution of activities to total agricultural land use and land use change emissions in 2018 (3.9 Gt CO₂eq)



Source: FAOSTAT 2020.

In 2018, global emissions from agricultural land use and land use change were about 3.9 Gt CO₂eq, or 21 percent less than in 2000 (5 Gt CO₂eq). This decline was primarily due to significant declines in deforestation emissions, especially since 2010 (Figure 5). In 2018, global emissions from deforestation were 2.9 Gt CO₂eq, down from 4.3 Gt CO₂eq in 2000. Conversely, emissions from drainage and burning of peatlands were about 1 Gt CO₂eq in 2018, nearly 35 percent higher than in 2000. Finally, emissions from fires in humid tropical forests, though small in absolute terms, kept growing during the twenty-year period of this analysis. They reached 0.2 Gt CO₂eq in 2018, or 10 percent higher than in 2000.

Figure 5. Emissions from the components of agricultural land use, 2000–2018



Source: FAOSTAT 2020.

REGIONAL

Regional trends in emissions due to agriculture were significantly different from global trends discussed above (Figure 6).

In **Africa**, emissions due to agriculture exhibited an upward trend during the 2000–2018 period. They reached 2.2 Gt CO₂eq in 2018, or 24 percent of world total agricultural emissions, up from 18 percent in 2000.

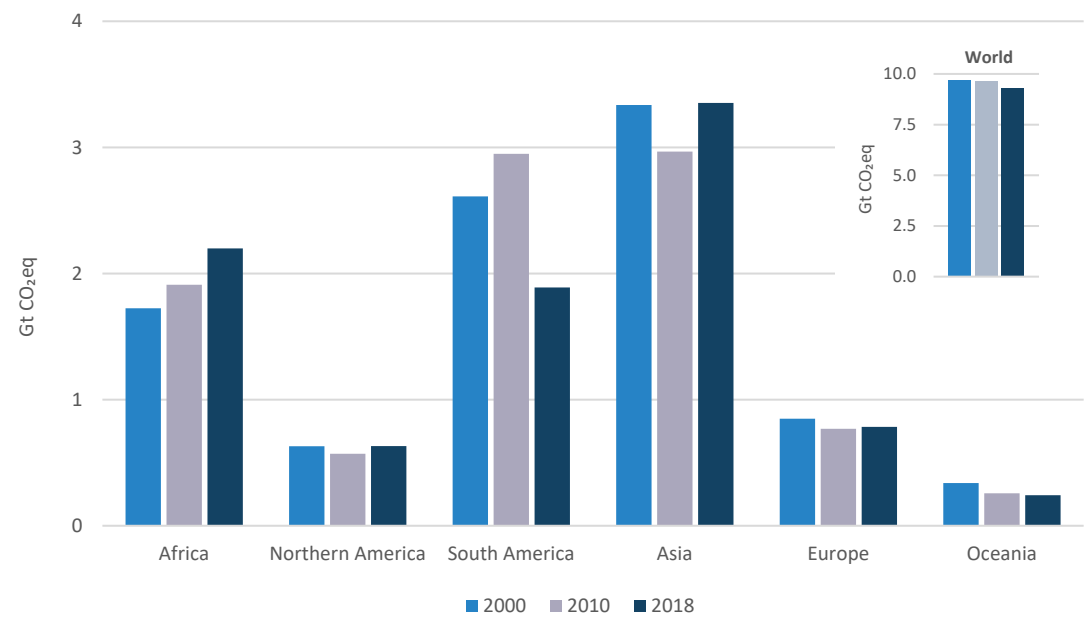
North America, which contributed on average 6 percent to the world total agriculture emissions, showed a decline in emissions in the 2000s, followed by a similar increase since 2010. Agriculture emissions decreased in **South America** by 10 percent over the 2000–2010 period, and by an additional 36 percent up to 2018, to reach 1.9 Gt CO₂eq in 2018. Sharp decreases in emissions from deforestation were the main driver of these trends.

In **Asia**, similarly to North America, the 2000s showed a decrease in emissions followed by an increase since 2010. In 2018, emissions due to agriculture were 3.3 Gt CO₂eq, substantially unchanged from their levels in 2000.

Europe (including the Russian Federation) accounted for approximately one-tenth of global emissions due to agriculture. Emissions declined during 2000–2010 and increased in the following decade, though this increase was less pronounced than in other regions. In 2018, total agricultural emissions were 0.8 CO₂eq, 8 percent less than in 2000.

Finally, agriculture and related land use emissions decreased steadily in **Oceania** during the two decades of this analysis, exhibiting the largest proportional reduction. In 2018, total agricultural emissions were 0.2 Gt CO₂eq, roughly 30 percent less than in 2000.

Figure 6. Trends in regional and global emissions due to agriculture



Source: FAOSTAT 2020.

Farm gate production and land use contributed differently to the emissions due to agriculture in the regions analysed (Figure 7). In 2018, crops and livestock production contributed two-thirds or more in **North America** (66 percent), **Asia** (69 percent), **Europe** (73 percent) and **Oceania** (80 percent). Conversely, land use and land use change processes contributed nearly 60 percent of the total in **Africa** and **South America**.

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