Project note - Food Loss and Waste country profile for Colombia

Estimates of Food Loss and Waste, associated GHG emissions and nutritional losses

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Urgency and call for action on FLW reduction

Theoretically, the world produces enough food to nourish the growing world population. Although precise data remains scarce, according to most recent studies, globally each year possibly as much as 40 per cent of the food produced is being lost or wasted somewhere between farm and fork. This not only represents a threat to food security but also severely and negatively impacts our food systems and natural resources. Food Loss and Waste (FLW) accounts for around 8 to 10 percent of our global Greenhouse Gas Emissions (GHGEs). Approximately a quarter of all freshwater used by agriculture is associated to the lost and wasted food. 4.4 million km² of land is used to grow food which is lost or wasted - farmland area larger than the Indian subcontinent - and FLW contributes to the degradation of natural ecosystems (FAO, 2019; WWF, 2021; Guo et al., 2020). The Sustainable Development Goal (SDG) Target 12.3 calls to 'halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses' (Lipinski, B. 2022). With only 8 years to go, the world is far from being on track to achieve this target. In 2011, the global amount of FLW was estimated at 1.3 billion tons (Guo et al., 2020), whereas the latest update on 2019 data estimates a total amount of FLW sitting at 2.5 billion tons - almost doubling the estimate from 2011 (FAO, 2021).

Way forward reducing FLW without baseline data

The UN and the Champions 12.3 Coalition launched the 'Target-Measure-Act approach' calling on all governments and companies to set FLW reduction targets, measure FLW, identify hotspots, and to take action to reduce FLW accordingly (Lipinski, 2020). However, with respect to primary data on FLW, much remains to be done. Just a handful of mainly western countries have taken action to systematically measure and reduce FLW. Lack of data make it particularly difficult for lower-and-middle-income countries (LMIC), including Colombia, to specify the hotspot food products and chain stages, to define smart targets and to identity adequate interventions.
In order to contribute to this essential information we developed and used a mass flow model based on secondary data (see next section for details). This approach allows to present an indicative country profile showing per food product category and chain stage not only the amount of FLW but also the GHGEs related to producing the FLW and induced nutrient losses. The sum differs per product and chain stage. Focusing on food products and chain stages which largely contribute to FLW, FLW-induced GHGEs and nutrient loss can substantially lead to resource use efficiency and at the same time to climate mitigation action and nutrition security. This integrated approach towards FLW reduction can support policy makers and other food system actors taking informed decisions contributing to several sustainability objectives in parallel.

Food Loss and Waste (FLW) definition

FLW refers to all food intended for human consumption that is finally not consumed by humans. **Food Loss** is the decrease in the quantity or quality of food resulting from decisions and actions by food suppliers from the production stage in the chain, excluding retail, food service providers and consumers. **Food Waste** is the decrease in the quantity or quality of food resulting from decisions and actions by retailers, food services and consumers (FAO, 2019). Under this definition, FLW does not include food that is consumed in excess of nutritional requirements nor food that incurs a decrease of market value due to over-supply or other market forces, and not due to reduced quality.

Modelling country data on FLW and impact of FLW on GHGEs and nutrition

FLW data was generated through a bottom-up, mass-flow model (Guo et al., 2020) that combines data on production and outputs as well as imports and exports at the country level. Estimates of losses per chain stage are derived from Porter et al. (2016) to calculate the FLW in the value chain according to the country's production and trade.
Furthermore, a Protein and Nutrition Database developed by WUR (built on nutritional compositions derived from databases from FAO, USDA, Denmark and Japan) was used to calculate the nutritional value of the total consumed food in each country. The nutrient intakes are compared with estimated nutrition requirements per country (which is based on the composition of the population and per capita nutrient demand, according to WHO dietary recommendations).

FLW, GHGEs and nutrition country profile Colombia

Based on the country data modelling, estimates on FLW-associated GHGEs were retrieved for Colombia and plotted with the FLW total tonnage and the associated protein loss (note: in a different unit) to visualize the three components in a comparative way (Figure 1).
Food categories were ranked according to the production of GHGEs. The five food products with the highest sum on FLW, FLW-associated GHGEs and nutrient losses (weighted as represented in **Error! Reference source not found.**), the four hotspot products, for Colombia are: bovine meat, milk, rice, and poultry.
From the bovine meat chains, 0.13 million tons of FLW represents 4.7 million tons CO_2-eq. of GHGEs. For rice 0.77 million FLW tons are generated, inducing 2 million tons CO_2-eq. GHGEs.
From another perspective, taking the percentages of FLW in relation to production percentages, vegetables and fruits are identified as the main hotspots showing average FLW 55% along the chains, while for rice FLW is estimated around 31% (Figure 2).

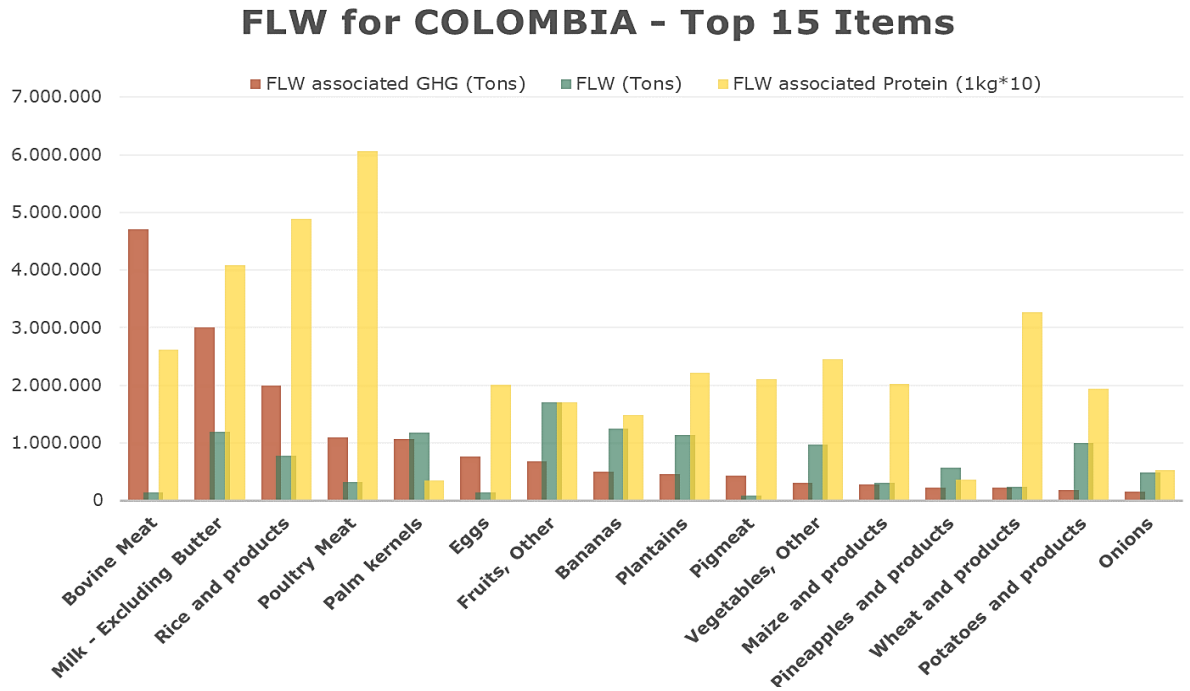

Figure 1. Top 15 Hotspot categories of food loss and waste in terms of volumes, loss of proteins and ranked on FLW-associated GHG emissions (in CO2-eq.).
Remark: Protein losses are depicted by 100kg to make the values visible and comparable. Other FLW total values are in tons

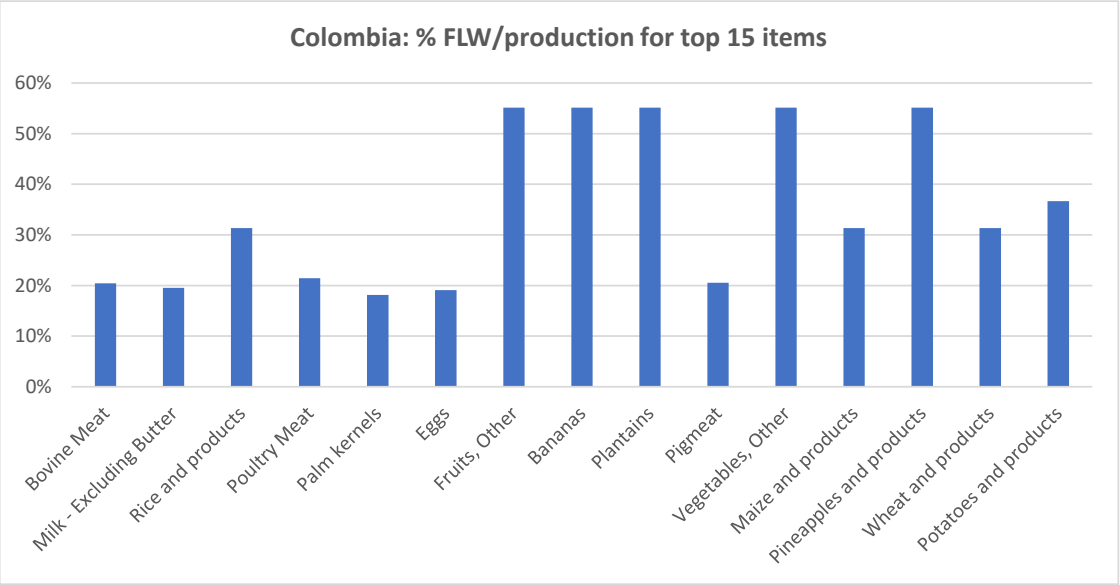

Figure 2. Percentages of FLW per product category

Further insights in hotspots is developed from estimated distribution of the FLW along supply chains for the 5 hotspots in the region (Figure 3). These data suggest that the retail stage of bovine meat, milk and rice retail phase embodies bottlenecks. For milk and rice products 'processing' and for rice the 'postharvest handling and storage' stage are also hotspots. These could be points for further data gathering and analysis of causes to make potential interventions.

Smart interventions in such 'hotspots' in food supply chains can substantially contribute to GHG emission mitigation of food systems. Analysis of specificities of such chains (e.g. comparing informal and formal supply chains, and urban and rural settings) including comparison with supply chains for similar product categories may reveal promising interventions. Interventions may combine hardware (packaging, cooling, etc.), orgware (e.g. arrangements in chains) and software (knowledge, information) elements.

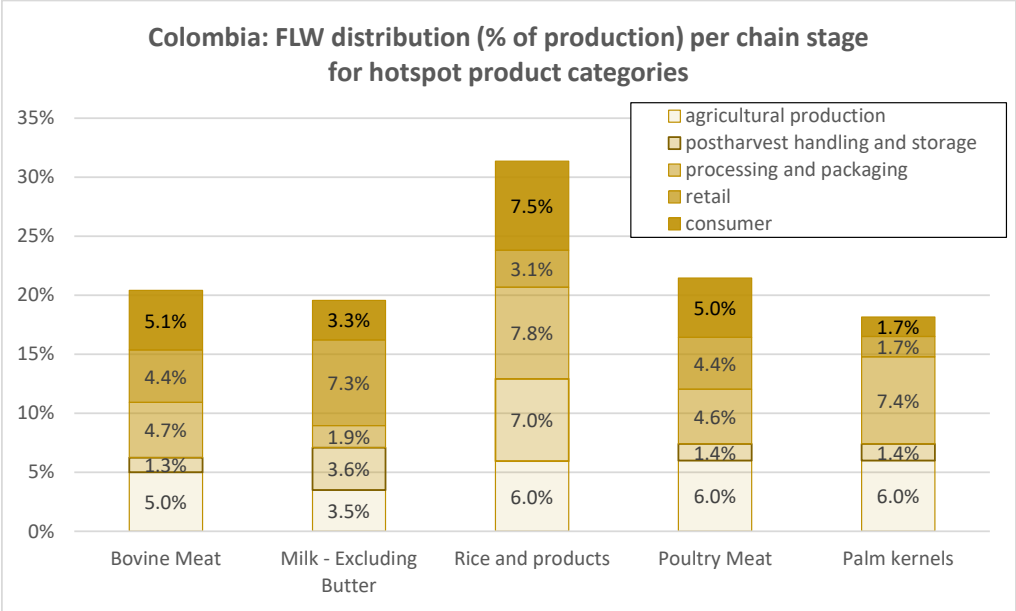

Figure 3. Percentages of FLW per stage in the supply chain for top 5 hotspots.
Remark: Agricultural production does not include any potential yield gaps and focuses on actual production and harvest losses.

Finally, the food supply and FLW data were used to assess nutrient supply per capita in the Colombian population in relation to recommended nutrient intake (Figure 4). The results imply that there are populations that suffer insufficiencies of calcium, folate, iron, vitamin A, and zinc.

From nutrition security perspective, efforts for mitigating FLW in milk/dairy and fresh vegetables chains would contribute the most to population nutrient gains (**Error! Reference source not found.**).

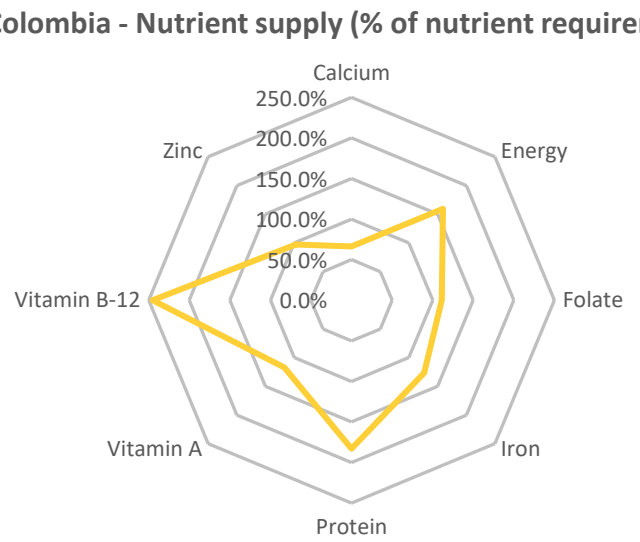

Figure 3. Average provision of nutrients per capita relative to WHO dietary recommendations
Remark: because of uneven distribution of food over the population, parts of the population will suffer more insufficiencies than this diagram implies.

Table 1. Food product categories for which the FLW have highest share for the most critical nutrients.

Critical nutrients	FLW categories with highest loss of the nutrient (highest first)
Calcium	milk, vegetables, fruits, plantains, soybeans, rice, potato, onions, eggs, wheat
Folate	vegetables, fruits, rice, bananas
Iron	rice, vegetables, potato, fruits, wheat
Vitamin A	vegetables, poultry meat, plantains, fruits, milk, eggs,
Zinc	rice, wheat, bovine meat, poultry meat, vegetables, milk

Value loss

In Dep. Nac. Plan. (2016) the value loss for food waste (90 kton) in retail was identified at 204 billion pesos (64 million USD). The total value loss for Colombia was estimated at 5.4 billion USD[1].

Validation

The data used in Porter are not sufficiently granular to apply separate country commodity-stage-loss factors. Hence, the mass flow model described here might show data that don't match reality for the specific country at hand: Colombia. In that context a literature review was carried out to check whether the derived data are more or less in line with research related to Colombia itself. From the UN Food System Summit in 2021 it is known that national FLW data are scarce and difficult to obtain. Countries have been invited by the UN to take action on national level and develop policies laid down in a 'national pathway' document.

One article was found on FLW in Colombia as a whole. In a document from Dep. Nac. Plan. (2016) the FLW weight was identified for various categories, and can be compared to the data shown earlier, although the years they relate to are different

Table 2: FLW weight (MTons) validation

Food category	FLW (here)	FLW (2016)
Fruits and vegetables	6.1	7.4
Roots and tubers	1	2.4
Cereals	1.3	0.77
Meat	0.55	0.27
Dairy	1.34	0.029

The table shows that cereals and dairy are overestimated, whereas for fruit and vegetables and roots and tubers the opposite holds. In general the top 3 FLW food categories are the same and more or less in line (although a factor 2 might be considered significant), and will lead to the correct food groups for FLW interventions.
According to Dep. Nac. Plan. (2016) 9.8 million tons (or 34%) of food destined for human consumption is lost and/or wasted. This is lower than the 13.5 million tons estimated from the mass-flow model that is used here.

1 https://www.foodandlandusecoalition.org/country/colombia/#:~:text=Approximately%20one%2Dthird%20of%20all,a%20healthy%20and%20active%20life.

Overall conclusions and suggestions for the next steps

This analysis indicates that overall hotspots of products with high FLW-GHGEs mitigation potential for Colombia are bovine meat, milk, rice, and poultry. Of these, especially milk and rice are also essential for improving nutritional status; also vegetables and wheat are of high importance for nutrition.

The collection of primary data is advised for chain-specific interventions. The focus of the data collection should particularly be on the hotspot chain stages of the priority products.

Then, our suggestion for an immediate next step forward to developing FLW reduction actions, with synergy on GHGE mitigation and nutrition, is to implement monitoring and gather primary data for hotspot supply chains of the country. This should particularly pay attention to the handling, storage and retail stages. Differences between supply chain typologies (specifically differences between informal and formal supply chains and differences between rural and urban situations) should be considered in order to generate an understanding of specific systems, so that the information is useful for intervention development.

For this purpose, WUR's EFFICIENT protocol can be used https://sites.google.com/iastate.edu/phlfwreduction/home/efficient-food-loss-waste-protocol?pli=1.

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Colophon and notes on this version

Carried out by:	The research that is documented in this study reports on work carried out by Wageningen Food & Biobased Research under Mitigate+ in 2022. It was conducted in an objective way by the researchers.
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Next steps:	An improved version of this note will be published in 2023 following engagement with various stakeholders and including additional parameters and data and improved matching between food categories from various sources. With respect to hotspots, no change in priority is expected.
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