



# Food wastage footprint & Climate Change

## Global food loss and waste

The 2011 FAO assessment of global food losses and waste (1) estimated that each year, one-third of all food produced in the world for human consumption never reached the consumer's table. This not only means a missed opportunity for the economy and food security, but also a waste of all the natural resources used for growing, processing, packaging, transporting and marketing food.

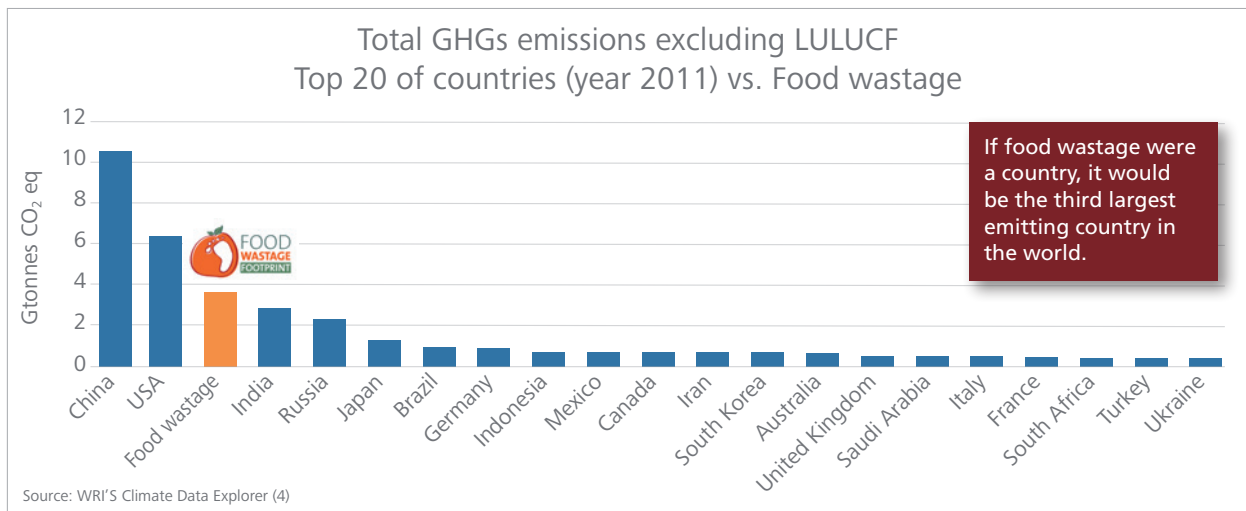
Through an extensive literature search, the 2011 assessment of food wastage volumes gathered weight ratios of food losses and waste for different regions of the world, different commodity groups and different steps of the supply chain. These ratios were applied to regional food mass flows of FAO's Food Balance Sheets for the year 2007.

Food wastage arises at all stages of the food supply chains for a variety of reasons that are very much dependent on the local conditions within each country. At a global level, a pattern is clearly visible; in high income regions, volumes of wasted food are higher in the processing, distribution and consumption stages, whereas in low-income countries, food losses occur in the production and post-harvesting phases.

In low income countries, the lack of infrastructure and lack of knowledge on proper storage and food handling, combined with unfavourable climatic conditions, favour food spoilage. In higher income countries, aesthetic preferences and arbitrary sell-by dates are factors that contribute to food waste.

## Carbon footprint of global food wastage

FAO quantified the food wastage footprint on natural resources (2), most notably its carbon footprint. Carbon footprint calculations – based on the 2011 assessment of food wastage volumes (1) and emissions factors taken from Life Cycle Assessment studies – were estimated at 3.3 GtCO<sub>2</sub> eq for 2007 (excluding land use change). Using the most recent Food Balance Sheets (2011) this figure is updated to 3.6 GtCO<sub>2</sub> eq (see figure below), which does not include the 0.8GtCO<sub>2</sub> eq of deforestation and managed organic soils associated with the food wastage (3). Thus the total carbon footprint of food wastage, including land use change, is around 4.4 GtCO<sub>2</sub> eq per year.



Global food loss and waste generate annually 4.4 GtCO<sub>2</sub> eq, or about 8% of total anthropogenic GHG emissions (5). This means that the contribution of food wastage emissions to global warming is almost equivalent (87%) to global road transport emissions (6).

The 2012 market value of food products lost or wasted was USD 936 billion; that is in the range of the GDP of countries such as Indonesia or the Netherlands. Using FAO methodology and estimates (3), the total cost of GHG emissions from global food wastage is USD 411 billion.

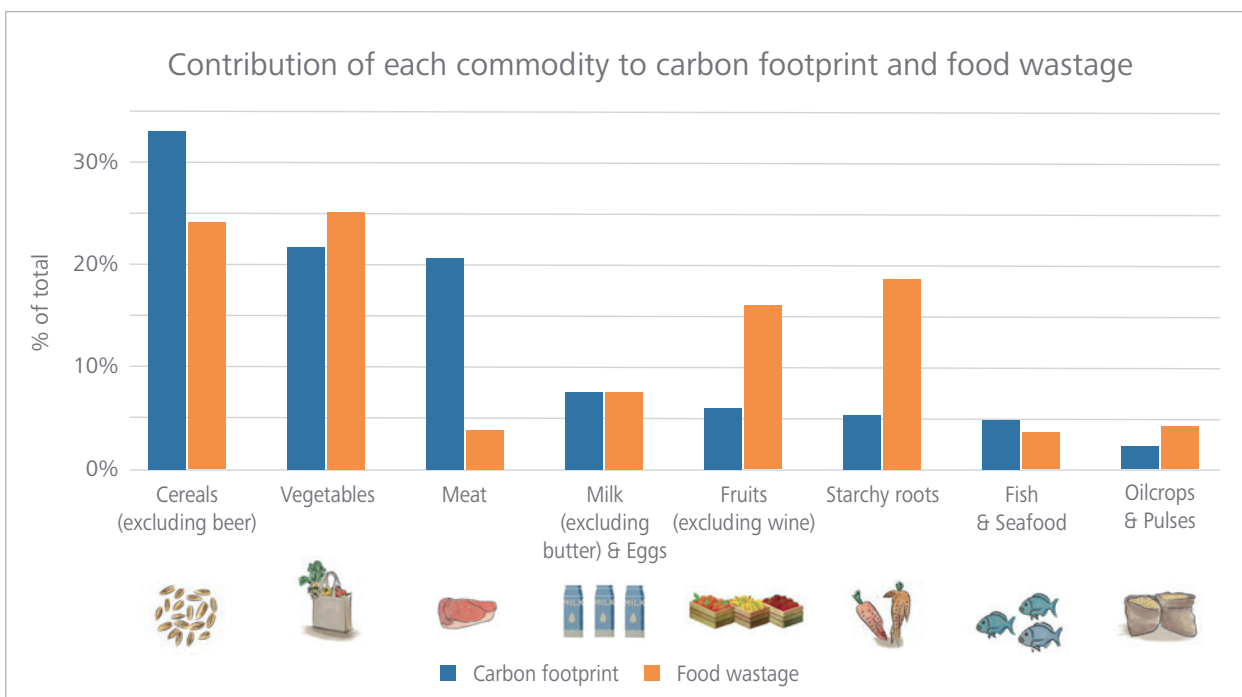
# Carbon footprint intensities

The carbon footprint of a food product is the total amount of GHG emitted throughout its lifecycle, expressed in kilograms of CO<sub>2</sub>-equivalents.

GHG emissions of the production phase (including all agricultural inputs, machinery, livestock, soils) and successive phases (such as processing, transportation, preparation of food, waste disposal) are all included in this calculation.

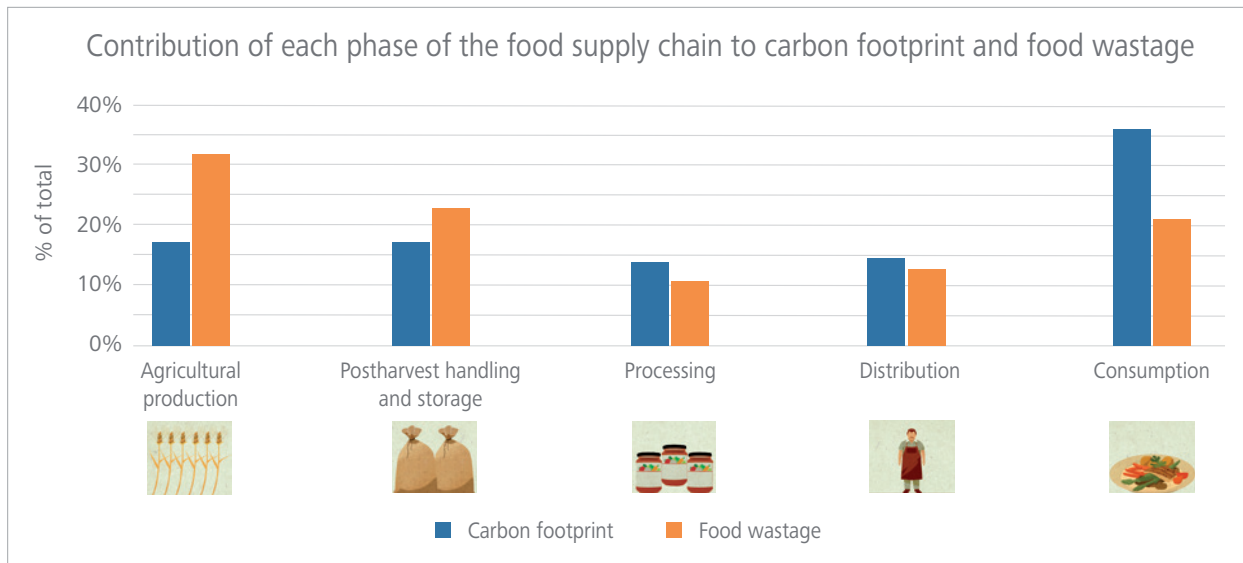
Thus, one kg of wheat, or one kg of beef, have different carbon footprints, since their life cycles are different, emitting specific types and varying amount of greenhouse gases.

Products hold different carbon intensities. For example, vegetable production in Europe is more carbon-intensive than vegetable production in Industrialized and Southeast Asia, as Europe uses more carbon-intensive means of production, such as artificially heated greenhouses. Inversely, cereal production in Asia is more carbon intensive than cereal production in Europe due to the difference in the type of cereal grown: rice on average has higher impact factors than wheat. Rice is a CH<sub>4</sub> emitting crop because of the decomposition of organic matter in paddy fields (1 kg of CH<sub>4</sub> is the equivalent of 25 kg of CO<sub>2</sub>).



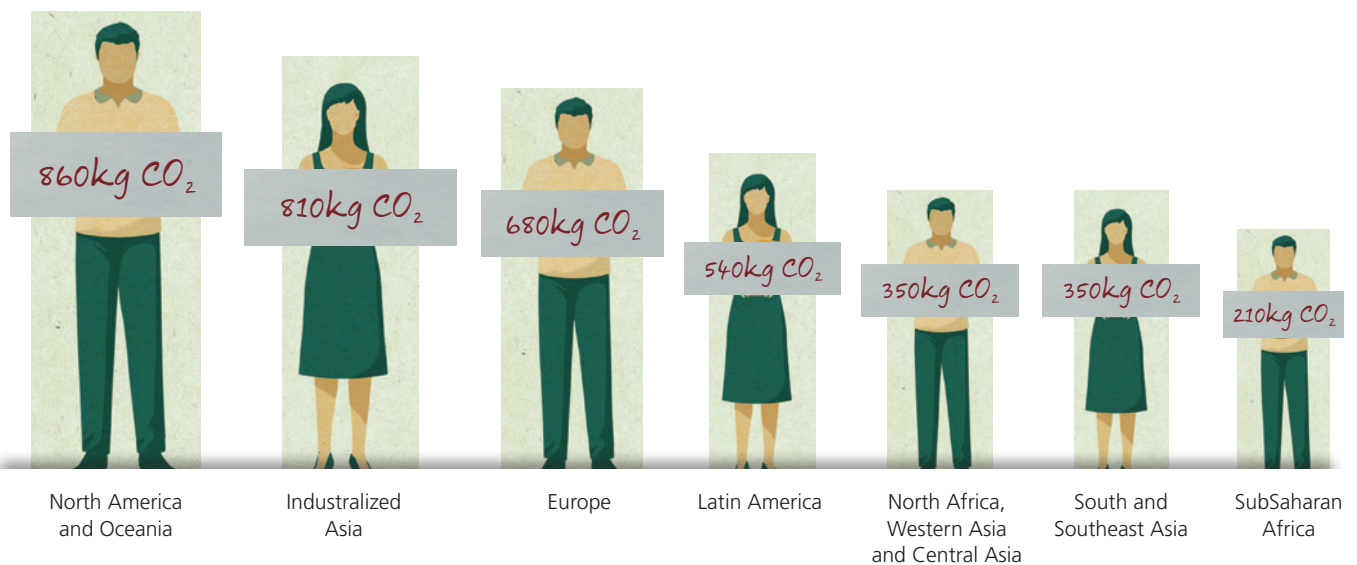
Despite meat being a relatively low contributor to global food wastage in terms of volumes (less than 5% of total food wastage) it has a significant impact on climate change, contributing to over 20% of the carbon footprint of total food waste (see chart above). This is because meat carbon footprint includes the emissions from producing a kilogram of meat (e.g. the methane emitted by ruminants), the emissions related to feed provision (e.g. the fertilizer used for the production of feed) and emissions from manure management. Thus, efforts to reduce GHG related to food wastage should focus on major climate hotspots commodities, such as meat and cereals.

The highest carbon footprint of wastage occurs at the consumption phase (37% of total), whereas consumption only accounts for 22% of total food wastage. This is because one kilogram of food that is wasted further along the supply chain will have a higher carbon intensity than at earlier stages.



The further along the chain the food loss occurs, the more carbon intensive is the wastage. For example, a single tomato spoiled at the harvesting stage will have a lower carbon footprint than tomato sauce wasted at the retail store, since the harvesting, transportation and processing accumulates additional greenhouse gases along the supply chain.

On a global average, per capita food wastage footprint on climate in high income countries is more than double that of low income countries, due to wasteful food distribution and consumption patterns in high income countries.



# Food wastage reduction scenario and climate change mitigation

United Nations Sustainable Development Goal 12 (SDG 12) on “Ensuring sustainable consumption and production patterns” includes a specific food waste reduction target: “by 2030, 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”.

The SDG 12 target of 50% food waste reduction is hereby combined with assumptions on feasible food loss reduction ratios, for each commodity group, in order to calculate a possible scenario.

## Assumptions for food wastage reduction ratios achievable by 2030

### Phases “Agricultural production” and “Processing”

- 5% reduction of 2011 food wastage in developed countries
- 15% reduction of 2011 food wastage in developing countries (a larger progress margin is assumed for developing countries)

### Phase “Post-harvest handling and storage”

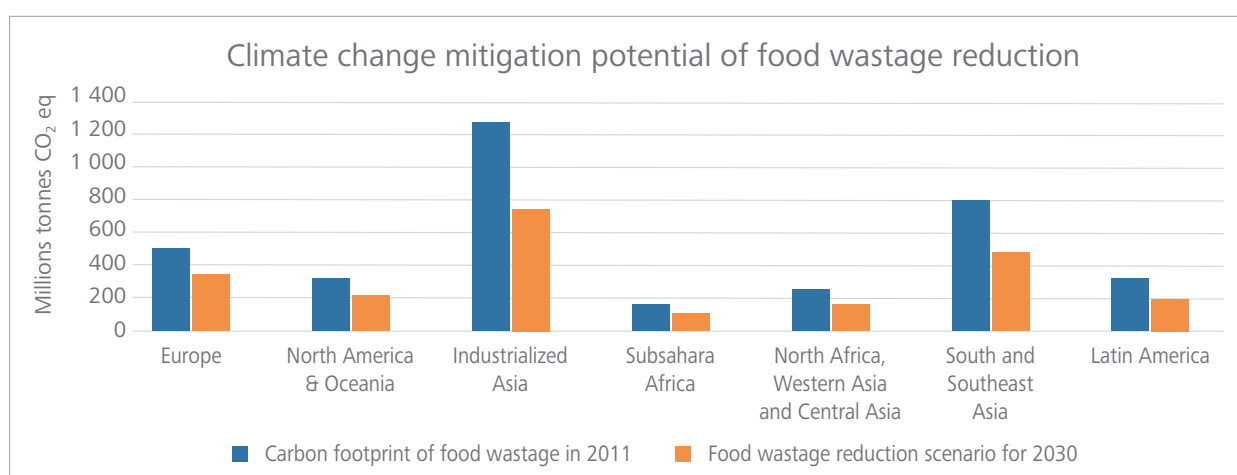
- 5% reduction of 2011 of food wastage in developed countries
- 54% reduction of 2011 food wastage in developing countries (reduction estimated to be needed to reach the average percentage of wastage observed in developed countries for most commodity groups)

### Phases “Distribution” and “Consumption”

- 50% reduction of 2011 food wastage amounts in all regions

The proposed scenario would lead to a reduction of the carbon footprint of food wastage by 38%, or 1.4 GtCO<sub>2</sub> eq per year (see chart below); this would be equivalent to the GHG emissions of the Japanese economy. Considering that post-harvest handling reductions are feasible in developing countries through improvements in their food systems (e.g. adopting improved technologies, better handling practices, efficient markets), investment in reducing post-harvest losses represent an important climate mitigation strategy.

Despite data and modelling uncertainties, the magnitude of the figures above suggest that a reduction of food losses and waste at global, regional and national levels would have a substantial positive effect on societal resources and in particular, climate change.



## References

- (1) FAO, 2011. Global Food Losses and Food Waste. Extent, Causes and Prevention.
- (2) FAO, 2013. Food Wastage Footprint: Impacts on Natural Resources, Summary Report.
- (3) FAO, 2014. Food Wastage Footprint: Full-Cost Accounting, Final Report.
- (4) CAIT, 2015. Climate Data Explorer. World Resources Institute.
- (5) EC, JRC/PBL, 2012 Emission Database for Global Atmospheric Research, version 4.2.
- (6) IPCC, 2014 Fifth Assessment Report. Chapter 8: Transportation.

