FOOD WASTAGE FOOTPRINT

AN ENVIRONMENTAL ACCOUNTING OF FOOD LOSS AND WASTE

Concept Note

Natural Resources Management and Environment Department
Food and Agriculture Organization of the United Nations
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Background

According to Graziano de Silva, FAO Director-General, “we cannot limit sustainability to food production, we need to also look at our food consumption and waste less. Wasteful food-consumption patterns across the world would lead to unsustainable demand for natural resources”. Because food waste was denounced by Ministers as almost 1 billion go hungry, the European Parliament passed a resolution that "urges the Commission to cooperate with the FAO in setting common targets to reduce global food waste"[1].

FAO Forecast for 2050 warns that under the current trends, global food production will need to increase by 70 percent. Yet, over one third of the food produced today is not eaten. That lost and wasted food is costly, as it represents a missed opportunity to feed the growing world population and comes at a steep environmental price. We need radically improved efficiency in food supply chains and different consumer behavior to decrease food wastage and reduce pressure on the environment, including cutting of the contribution of agriculture and deforestation to greenhouse gas emissions. So far, little attention is paid to the effect of uneaten food and to date, there has been no overarching study assessing the environmental footprint of food wastage.

Definitions

- ✓ Food loss: The decrease in edible food mass at the production, post-harvest, processing and distribution stages in the food supply chain. These losses are mainly caused by inefficiencies in the food supply chains, like poor infrastructure and logistics, lack of technology, insufficient skills, knowledge and management capacity of supply chain actors, no access to markets. In addition, natural disasters play a role.
- ✓ Food waste: Food which is fit for consumption being discarded, usually at retail and consumer level. This is a major problem in industrialized nations, where throwing away is often cheaper than using or re-using, and consumers can afford to waste food. Accordingly, food waste is usually avoidable.
- ✓ Food wastage: any food lost by wear or waste. Thus, the wastage is here used to cover both food loss and waste.

Objectives

This project of the Natural Resources Management and Environment Department will primarily focus on the environmental impacts of food losses and waste. In particular, it will analyze the embedded water, soil, biodiversity, greenhouse gases in food wastage at the global level in order to produce the first **global Food Wastage Footprint** (FWF). By creating a full environmental accounting of food wastage, the FWF will thus quantify the impact of the food grown, but not eaten, by modeling its environmental and economic “savings” effect through sparing further natural resources and climate change degradation and pollution.

In avoiding food wastage, there is actually more that would be gained by its reduction than a mere

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reduction in its 'footprint'. For instance, more efficient systems that reduce either losses or waste would likely result in additionally reduced GHG emissions, in part directly, since waste typically generates methane emissions during food disposal, as well as indirectly, given that reducing wastage may lead to critical redesign of supply chains and retail models, which may result in less energy use along the food chain, and thus associated GHG emissions. Generally, less wastage is associated with more efficiency and eventually more effective recycling of resources - all leading to savings in natural capital, less resource use and lower GHG emissions.

With regards increased food security, including availability, access and utilization, reducing food wastage can also be achieved by reducing certain loss factors, for instance, by increasing local supplies in Least Developed Countries or by promoting programmes where the food saved from an otherwise waste pathway in retailing is specifically accounted for and used as food aid. These opportunities will be investigated through specific case studies. The second part of this study will therefore identify and analyze the economic and environmental benefits of avoiding and reducing **FWF in selected contexts** at national, municipal and company level. A few countries and cities will be selected in both developed and developing countries, where more accurate data is available.

The ultimate objective of this project is to communicate that investments in food wastage reduction is the most logical step in the pursuit of sustainable production and consumption, including food security, climate change and other adverse environmental effects. Public awareness materials and a strategy will be developed to this effect.

Existing Studies and Data Sources

To date, no study has analyzed the environmental impacts of global food wastage. The studies listed below have either estimated global food wastage or its environmental effect on a specific country or area, including:

- ✓ FAO, *Global Food Losses and Food Waste* (May 2011). This is the most recent source of data on food wastage. The Swedish Institute for Food and Biotechnology performed this research on behalf of FAO and found that one-third of global food is lost or wasted.
- ✓ United Nations Environment Programme (UNEP), *The Environmental Food Crisis* (February 2009). This study contains a section on food waste that integrates research from other studies, including the 50% food loss/conversion/waste estimate from the Stockholm International Water Institute's 2008 study.
- ✓ The European Commission and BIO Intelligence Service, *Preparatory Study on Food Waste Across EU 27* (October 2010). This study projects growth in European GHG emissions from food waste through 2020 (including estimated population growth and income changes.)
- ✓ CleanMetrics, *The Climate Change Impact of US Food Waste* (September 2011). This technical brief calculates the environmental impact of food waste in the United States. CleanMetrics considers the waste impact of 20 commonly eaten foods for the Environmental Working Group's *Meat Eaters' Guide to Climate Change and Health*.
- ✓ Waste & Resources Action Programme and the World Wildlife Foundation, *The Water and Carbon Footprint of Household Food and Drink Waste in the UK* (March, 2011). This study provides a solid model for an ecological footprint of waste, albeit one in a specific country and for only a portion of the food wastage.
- ✓ The World Bank, *Missing Food: The Case of Postharvest Grain Losses in Sub-Saharan Africa* (SSA) (2011). This study provides another estimate on post-harvest losses (PHL) in Sub-Saharan Africa. Using the African Postharvest Losses Information System, it sets PHL at 10-20%. It also approximates 13.5% PHL for Eastern and Southern Africa.

- ✓ World Wildlife Fund and Food Climate Research Network, *How Low Can We Go?* (2009). This study reports that UK food system is responsible for 19% of UK GHG emissions. While there is some discussion of wastage, it does not focus on the topic.
- ✓ Stockholm International Water Institute (SIWI), *Saving Water: From Field to Fork* (2008). This study tallies the water loss embedded in food waste. Using Vaclav Smil's data, it also finds that more than 50 percent of available calories worldwide are not consumed. The study categorizes feeding grain to livestock as wasted of food energy.
- ✓ UNEP, *Waste: Investing in energy and resource efficiency* (2011). This study analyzes the benefits of an increased investment in waste management, including GHG reductions. Using UNFCCC estimates, the study notes that the waste sector produces an average 2.8% of national GHG emissions. But *Waste* never focuses on the food portion of the waste stream.
- ✓ African Post-harvest Losses Information System (APHLIS). Major data source on PHL specific to East and Southern Africa, managed by the European Commission Joint Research Centre, the Natural Resources Institute, and the ISICAD.
- ✓ Cuéllar A.D. And Webber M.E., *Wasted Food, Wasted Energy: The Embedded Eneregy in Food Waste in the United States* (2010) calculated the energy embedded in wasted food in 2007 using food loss data from the USDA for 1995.
- ✓ Hall K.D. et al, *The progressive Increase of Food Waste in America and Its Environmental Impact* (2009) quantified the evolution of food waste since 1974 and calculated the environmental impact of food waste in terms of total freshwater and oil consumption.

Data Gaps

There are several holes in the existing knowledge on the topic of global food wastage:

- ✓ The largest knowledge gap is simply the lack of available data on food wastage in most countries. For example, data on post-harvest losses does not exist for certain developing nations, whereas retail and household level food waste data is available only in very few developed countries.
- ✓ The exact causes of food losses vary throughout the world and are very much dependent on the specific conditions and local situation in a given country. Currently, the magnitude of food losses have been assessed, and most of the causes of food losses have been identified. However, the assessments are extremely rough, and still unknown are the quantifications of food losses per cause, making it difficult to prioritize and decide on interventions, to have the maximum effect.
- ✓ When decent data does exist in a country, it usually is on individual crops and does not synthesize overall national loss. There are very few food-chain-wide wastage studies.
- ✓ In general, there is better data available on food waste in developed countries than there is in developing countries. And, mostly, there is better intra-country data on food loss than food waste.
- ✓ Data on pre-harvest losses and un-harvested crops (acres planted versus harvested) can be difficult to attain in both developed and developing nations. Reasons why crops are not harvested include weather, disease or pests (loss) or price of a crop not justifying harvest (waste). While this kind of wastage occurs more in developing nations, it also happens in developed countries. For example, the most recent overarching US Department of Agriculture study on food waste—*Estimating and Addressing America's Food Losses*—does not include any farm level wastage in its totals, instead focusing on the retail and consumer level.
- ✓ There is a lack of data on food service and restaurant wastage. The 2011 FAO and UNEP waste studies do not address that segment of the food chain. This could be because the restaurant setting complicates the linear farm-to-fridge food chain. But restaurants, with their kitchen loss and customer plate waste, are a growing segment of the planet's food consumption. One notable exception is *The Composition of Waste Disposed of by the UK Hospitality Industry* (WRAP, 2011).

- ✓ The studies that do consider environmental impact of food wastage tend to focus on greenhouse gas emissions and ignore depleted natural resources, deforestation, and biodiversity loss.
- ✓ As described in BIO Intelligence Service (BIOIS), the environmental impacts of the life-cycle of only food products that constitute food waste should be assessed – this requires the knowledge of (a) the composition of food waste and (b) environmental data about those food products. However, even in the EU, only environmental data about the food and agriculture sector in general was available and used, further limiting the accuracy of results.

Data Inconsistencies

Estimates on the proportion of the global food supply grown but not consumed vary from one-third to one-half. The major difference between the estimates is whether grains fed to livestock and aquaculture are considered wastage. Some studies take the approach that this process - "conversion" of grains to produce animal protein and dairy - is an inefficient use of resources, and thus, a loss of food. Yet, most studies do not categorize that food as lost or wasted. This contradictory approach to conversion is the main difference between recent studies by UNEP and FAO. UNEP, in *The Environmental Food Crisis*, categorizes grains fed to animals as a loss. FAO's *Global Food Losses and Food Waste* does not. Similarly, just as converting grains can be interpreted as a net loss of agricultural output, the same might be said for growing crops for bioenergy and soil amelioration. In addition, pre-harvest losses are included in the UNEP study, but not in the most recent FAO study.

Furthermore, some studies consider only the edible part of wasted food as food waste, not inedible parts. WRAP further distinguishes edible food waste between avoidable and possibly avoidable food waste (that some people eat, others not). Waste at the consumer level should be adjusted to remove the unavoidable waste.

Also, the data that is available very often differs in their reference years and for a global analysis this will be an important limitation. For instance, the 2010 study by BIOIS uses data from 2006, since that is the most recent year for which data was available on EUROSTAT. FAO uses FAO Statistical Yearbook 2009 (except for oil crops and pulses FAO's Food Balance Sheets, 2007). CleanMetrics loss-adjusted food availability data series from USDA/ERS, 2009.

Even if available, there may be discrepancies due to the lack of standardization in definitions and allocation of data. Even in the EU, where most data on food waste exist, data in some countries' certain sectors is missing, other national studies only show data per capita, not total data.

Some studies take into account the disposal of food waste as environmental impact (CleanMetrics), others *(Wasted Food, Wasted Energy)* not – landfilling wasted food is a crucial source of methane. Most reports studying the environmental impacts of food waste only evaluate the climate change potential of food waste in a specific country (WRAP in the UK, CleanMetrics and Hall et al. in the U.S.A., etc). BIOIS in its Preparatory Study on Food Waste Across EU27 quantified the environmental impacts of the life cycle of food waste within EU, using available studies and own calculations.

Among the different sources available to assess the environmental impacts of food waste, few environmental issues were identified as relevant:

- ✓ *WRAP (2010) Waste arisings in the supply of food and drink in the UK.* The only indicator calculated in this study is the global warming potential.
- ✓ BIOIS (2010) *Technical support to identify product categories with significant environmental impact and with potential for improvement by making use of ecodesign measures.* Indicators used in

a cradle-to-gate approach (so excluding retail and household level): CO2-eq, euthrophication, abiotic resource depletion, human toxicity and ecotoxicity.

- ✓ JRC (2008) *IMPRO Meat & Dairy.* Focuses only on food waste from meat and dairy products and measures CO2-eq in the EU27.
- ✓ NAMEA (2009) *ETC/SCP working paper 1/2009.* Indicators used to account for environmental impacts of the whole food chain (excluding end-of-life impacts) with calculations based on EUROSTAT (2009): GHG emissions, acidification, photochemical oxidation, resource depletion.
- ✓ Sander (2008) *Climate protection potentials of EU recycling targets.* Again, only focuses on CO2-eq of municipal solid waste (including kitchen waste) in the EU relying on data from Lundie & Peters (2005).
- ✓ Impacts such as wasted water was only analyzed in two studies – WRAP/WWF, 2011 for the UK and Hall et al, 2009 for the U.S.A. – others, such as soil depletion has not been considered in any study.

The Work Ahead

This project will provide, as complete and accurate as possible, a picture of the environmental footprint of global food wastage, with a particular emphasis on impacts on soil, water, biodiversity, and climate change. The aim is to bring more precision to the debate on the environmental impacts of food waste and losses, by providing a more consistent knowledge base, which can be used to underpin future policy debate in this area.

At present, the best existing statistics come from using production amounts in the most recent FAO Statistical Yearbook and percentages of food wastage in the most recent FAO Food Balance Sheets. This combination of sources occurs in *Global Food Losses and Food Waste* and this study's data will be used as basic source for quantification of food wastage in different regions of the world. Further data must be consulted for the quantification of environmental impacts, including FAOSTAT data in relation to GHG emissions (the MAGHG project) and others.

We will start by calculating the global FWF – at least estimating the embedded water, soil, biodiversity, and greenhouse gases in food wastage – by using the best available data. In addition, we will illustrate how varying reductions in food wastage would reduce the pressure on natural resources and the climate environment. Specifically, we will forecast scenarios detailing how trimming wastage (e.g. by 25%, 50%, 75%) would affect the current global FWF and the estimated need to increase food production by 70% in 2050. We will analyze how specific food systems would need to be redesigned (marginally or drastically), depending on the desired wastage reduction targets. In parallel, we will undertake active research with interested partners for: (i) calculating FWF in selected case studies in a number of countries and cities (both developing and developed) and also companies; and (ii) modeling the environmental and economic benefits of avoided food wastage in specific settings. The choice of the countries will be based on the best available data.