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Carbon Footprint data of the IntoLife tool

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Contents

Summary

The IntoLife software tool developed by Will Nicholson. It is intended to give a measure of the environmental impact of food along the value chain from primary production, via processing, packing, wholesale, transports, etc. until the moment the food item reaches the restaurant. The full GHG (greenhouse gas) emissions of inputs used in these life cycle stages such as electricity, diesel, natural gas, packaging materials, fertilizers and pesticides are also included. In the same way, the GHG emissions associated with all outputs such as emissions to air, water and soil and emissions from waste handling are also included.

The tool can be used to assess the impact of a single food product, a meal, a complete menu and a restaurant. The tool contains data on CFP. It can also be used to calculate share of certified organic, ecolabelled and ethically produced products.

Østfoldforskning has been commissioned by IntoLife to evaluate the CFP data of the database. This is done by identifying best quality data and modifying data were data gaps have been found. Such modifications could be e.g. to add emissions from processing to restaurant delivery where no such data are available.

The CFP data are sometimes highly uncertain, which is caused by a combination of natural variation and variation in the way the LCA methodology has been applied in the studies from which the results have been collected. Care should thus be taken when using the tool, especially when making comparisons.

The functional unit used in this tool is mass for most food items and litres for beverages. Thus, there is no direct coupling of the FU to the actual function of the product. It is recommended that future versions of this tool use a functional unit more correlated with nutrition.
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1 Introduction

In recent years, there has been a growing awareness that food cause environmental problems. Previously the emphasis has been on local burdens from farming such as eutrophication caused by release of nutrients from fertilizer into water bodies and from toxic effects on flora and fauna caused by pesticides. However, in the recent 10 years a number of studies have shown, using holistic tools like Life Cycle Assessment, that when taking into account the whole life cycle of food from "farm to fork" the impact is significant and that there are many more impacts than eutrophication and toxic effects. One study of industrialized countries has shown that out of the total emissions approximately 25 % of all GHG emissions and 75 % of all eutrophication emissions stem from the food production chain[1].

Based on this knowledge, governments, organisations, industries and consumers have been looking at ways of reducing the impact of food. Simple solutions such as "reduce food miles, buy local" or "eat organic certified foods" have been proposed but studies have shown that this will not necessarily reduce environmental impacts. In order to give a full overview of environmental impacts a number of environmental effects must be considered and these can give conflicting results. For example, the toxic effects of organic agriculture is most often lower than that of conventional agriculture when comparing on a unit product basis. However, for land use the case is most often the opposite since yields in organic agriculture is usually lower than the conventional counterpart. This is the "trade-off" problem.

In order to simplify decision making, to address a major environmental problem and reduce assessment costs simplified procedures are sometimes used, e.g. looking at only one environmental problem. Carbon Footprint has often been used as a metric for comparing environmental impacts. The Carbon Footprint is the sum of all GHG emissions caused by a product or service. This is commonly abbreviated CFP, a term that will be used also in this study.

A number of general guidelines or standards have been developed for quantification of CFPs, e.g. ISO 14067, GHG Protocol Products Standard, PAS 2050. In addition, a number of product specific standards or guidelines have been developed but unfortunately these do not have the same worldwide acceptance as the general guidelines do. All guidelines now follow the Life Cycle Assessment (LCA) methodology.

It is necessary to use a product specific guideline in order to achieve results that are comparable for different products. In the absence of such harmonized procedures, the results of CFP and LCA studies are often not comparable. This also includes results from peer-reviewed studies. Unfortunately, many studies also lack information that is necessary to evaluate these results.

Another complicating factor concerning food is the high number of production units along the value chain especially at the beginning and the end (farmers and consumers) and the fact that farming involves biological processes, which are very variable in nature and in particular dependent on local factors such as soil quality, precipitation and temperature. This means that finding representative data to base the assessment on is difficult.

[1] Tukker, A., et al. 2006. Environmental Impacts of Products (EIPRO). EUR22284EN, EC Joint Research Centre, IPTS Sevilla

Despite these difficulties, the use of environmental impact data of food products can give large benefits. It gives information about the nature of impacts, their magnitude and distribution in the value chain that can help users identify the most efficient measures to reduce impacts. CFP does not give a measure of all impacts but are often well correlated with some other important issues such as energy use, depletion of non-renewable resources, acidification and photochemical oxidant formation.
CFP does not give information on effects from water pollution, water consumption, direct toxic effects or biodiversity impacts. Neither does measure economic or social effects. The use of CFP in isolation is thus not advisable but as a starting point, it can work well.

IntoLife is a calculation tool intended for the Horeca sector to enable calculation of environmental impact of e.g. ingredients, meals, entire menus or entire restaurants. See description in the following chapter. This report gives the criteria of the evaluation of the CFP database and some recommendations for further work. The CFP database is in the appendix.

2 IntoLife

The tool consists of a CFP database, a simple calculation algorithm and a user interface. The tool can also calculate the total amount of raw material from certified organic agriculture, amount of raw material with a Fair Trade certification and amount of MSC-certified (Marine Stewardship Council). This information is not contained in the databased and must be entered by the user for each ingredient.

The number of products with CFP results is 51. They comprise both products of animal origin (meat, fish, eggs and dairy) as well as those of plant origin (vegetables, fruits, berries, cereals, vegetable oils and sugar).

3 Evaluation procedure

IntoLife assigned the task of evaluating the CFP numbers in the database to Østfoldforskning in May 2014. The task was carried out between 16th of May and 30th of August 2014 by researcher Erik Svanes. The purpose of the evaluation of the database is to check that data and references used are credible and ensure that only data with optimal quality is used. The following evaluation parameters were used:

1. Reference
   Has the original reference been given? Is it available?

2. Modelling approach (attributional or consequential)
   Is the modelling based on assumptions about future market behaviour (consequential) or on past or current conditions (attributional)?

3. Functional unit
   What is the unit that the CFP number is based on? 1 kg is mostly used but there are other parameters, e.g. 1 kg eatable product or whole product.

4. System boundary
   What is the extent of the system studied? As a minimum, all farming activities are included in most studies but what further life cycle steps are included: processing, wholesale, retail/restaurant/etc., consumer, transports?

5. Inclusion of product loss
   Has the loss of eatable product in one or several life cycle stages been included in the calculations? E.g. if 5 % of the product is lost, then 1,05 kg must be produced for every 1 kg used.

6. Allocation
   How has impacts been partitioned between products in cases where one process gives several products? This can occur e.g., when rape seed processing gives both rape meal and rape oil or several fish species are caught in the same operation.

7. Electricity grid mix
   Electricity cannot be physically traced. In many cases electricity grids are connected and the electricity in the grids incurs different levels of GHG emissions due from the production. Which grid should be chosen as reference grid? It can be a regional, national or multinational grid.

8. Land Use Change
   In some cases agricultural land has been converted so recently to agricultural land so that carbon loss still occur from soil or biomass to air. This loss is called LUC (Land Use Change).

9. Land Use/Soil Carbon Change
   In some cases carbon is lost on a regular basis from soils to air, for other causes than change in land use. This loss can occur e.g., as a consequence of tillage.

10. Data quality

Data quality indicates how well the data reflects the reality, e.g. how representative and precise they are.

11. Guideline or Standard followed
    Does the calculation follow any accepted guideline or standard? Internationally accepted standards or guidelines are preferred.

The results of this evaluation is given in an Excel spreadsheet. The spreadsheet is not a part of this report. .

4 Description of evaluation work

Results are given in the spreadsheet. The spreadsheet contains information on the source of data and on how data are evaluated and, in some cases, recalculated to suit Norwegian conditions. As expected, it has not been possible to find data that are 100 % comparable, i.e. calculated in an identical manner based on data of similar quality. In this review, the focus has been on finding results of highest quality, rather than constructing averages from many different studies. One reason is that LCA methodology is progressing rapidly so that newer studies cover aspects that have not been included in previous studies. An example of that LUC (Land Use Change) comprising loss of carbon from soil and biomass (above and below ground) to air due to change in soil use (e.g. from rainforest to growing soya). Technological progress is another reason. Furthermore, as the number of studies for a food item increases (and the wealth of available LCI data increases) it has become more and more clear what factors must be included and what can be ignored. Thus, it is important to include only new studies. In addition, some studies use different approaches, which give incomparable results, e.g. the LCA Food DK results that are based on consequential modelling. For some products, it has not been possible to find new studies.

Some data includes an assessment of uncertainty, but in most cases, it has not been included in the evaluation. For some for products for which data is unavailable, assumptions can be made on product similarity, for example using a common CFP for root vegetables.

The common system border is Cradle to restaurant delivery, in many places the Cradle to Retail result is used to represent this result. Efforts have been made to add missing life cycle stages where no Cradle to Retail results where available.

The intention has been to examine primary references for all the studied products. This has been possible in most cases. Even when primary references have been obtained, it has often been impossible to find information on all quality parameters. It applies in particular for food loss, Soil Carbon Change/Land Use, infrastructure/capital goods, handling of electricity and whether or not any standard or guideline has been followed.

It has in many cases been impossible to determine exact methodology used. In some cases, this is not important. E.g. the input of electricity is often low, hence it is less important how the calculation of grid emissions has been done. However for products (tomatoes, cucumbers, different lettuce varieties) grown in greenhouses heated with electricity, as is often the case in Norway this is very important. If studies have not described methodological choices and assumptions that are important for the end result, the results from these studies have not used in the database. In cases where the methodological choices that are not shown the results have not been used.

Land Use/Soil Carbon Change is another factor that is seldom mentioned nor included in food LCAs. It signifies the loss or uptake of carbon from soil and biomass to air as a result of agriculture where no land use change has taken place. This factor has been mentioned in very few cases. The effect can be significant but due to the lack of internationally agreed calculation procedures and background data this effect has been largely ignored.

Product loss is another factor that is seldom mentioned in food LCAs. It can be very important for the end result not the least in the food service sector where losses are often high. It signifies emissions caused by production, processing, packing, transport, storage, etc. of new product needed to replace product that is wasted along the value chain. This factor is included in just a few of the studies in the database. The effect of including food waste is often an increase of 1-10 % of the CFP.

5 Conclusion and recommendations

Even though single results are not comparable, they indicate the magnitude of food items climate impact. This can be used as guidance for tool users.

The tool can be a good basis for decision making in restaurants and other food service companies. Care should be taken, however, not to draw conclusions for which there is no scientific basis. The uncertainty in CFP numbers is often high and should be taken into account when comparing meals, ingredients, menus, restaurants, etc.

Another problem is that function of the food products is not reflected. A high protein product such as beef should not be compared to carrot, because the latter has little protein. The carrot has many other nutrients, some in amounts exceeding that of beef, but in general beef is more “nutrient dense” than carrot per mass unit. When comparing ingredients or meals nutritional content should be taken into account

The most important thing to remember is that a Carbon Footprint does not cover everything. The use of amount of organic, MSC-certified and “ethically” sourced makes the scope broader but still the tool does not give a complete picture of the sustainability of food.

It is, however, a good starting point. It is recommended that the possible usage of the tool is explored by tool owner and potential users together to determine how it most likely will be used and the possible benefits and pitfalls of such usage. Provisional plans have been made to have a “review and development” project annually to develop the data and explore possibilities for including nutritional content.

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